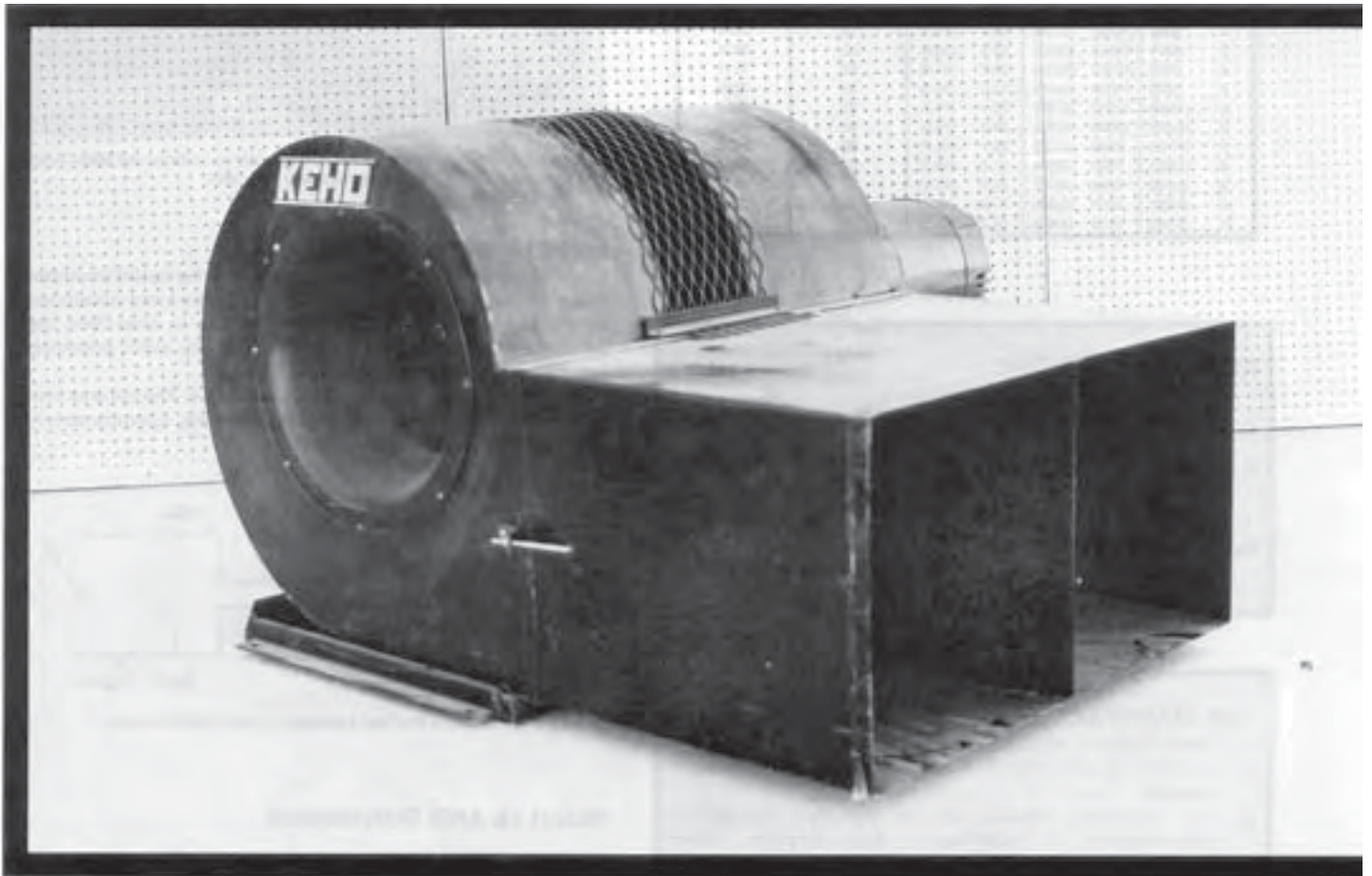


Evaluation Report

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Keho Model 15330 15 hp Twin Centrifugal Fan

A Co-operative Program Between



KEHO MODEL 15330 15 HP HI-FLOW CENTRIFUGAL FAN

MANUFACTURER & DISTRIBUTOR:

Keho Alta Products Ltd.
Box 70
Barons, Alberta
T0L 0G0

RETAIL PRICE:

\$2000.00 (November, 1984, f.o.b. Lethbridge, Alberta).

SUMMARY OF RESULTS

TABLE 1. Keho Model 15330 15 hp Twin 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	hp	W	%	rpm
1	249	14200	6700	20.3	15.1	13	3529	
2	497	13200	6230	22.3	16.6	20	3520	
3	747	12300	5810	23.7	17.6	26	3511	
4	996	11500	5430	24.5	18.3	30	3506	
5	1240	10800	5100	25.1	18.7	33	3502	
6	1490	10000	4720	25.3	18.8	35	3500	
7	1740	8950	4230	25.1	18.7	36	3499	
8	1990	7690	3630	24.2	18.1	37	3502	
9	2240	6290	2970	23.0	17.1	35	3509	
10	2490	5010	2360	21.6	16.1	32	3517	
11	2740	3010	1420	19.2	14.3	24	3531	

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.
2. Supplying a detailed operator's manual containing information on installation, maintenance, rated performance, safety aspects and trouble shooting.

Senior Engineer: E. H. Wiens

Project Engineer: R. P. Atkins

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. A performance curve or chart will be supplied with each blower.
2. An operator's manual will be included, containing information on installation, maintenance, rated performance, safety aspects and trouble shooting.

GENERAL DESCRIPTION

The Keho Model 15330 1 hp Twin Centrifugal fan is made up of two 7-1/2 hp fans connected in parallel, driven by a single electric motor. The individual fans are 16.5 in (419 mm) in diameter, single speed, direct driven, centrifugal flow fans. The fan is designed for use in high volume and high pressure grain aeration or grain drying systems.

The Keho Model 15330 is equipped with a wire mesh guard grill for the outside fan, an expanded metal guard grill for the inside fan, inlet bells and a discharge transition. The molded copolymer impellers consist of a hub-backplate, 8 backward curved air foil blades and a flange. Both impellers are mounted on a single shaft with one end supported by the motor and the other end by a bearing mounted on the main frame. Coupled to the shaft is a 15 hp (11.2 kW), three phase, 230/460 V electric motor. The support frame, motor mounts and housings are of steel construction and painted for corrosion protection.

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

SCOPE OF TEST

The Keho Model 15330 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 460 V. The fan was also evaluated for ease of operation, maintenance, operator safety and

suitability of the operator's manual.

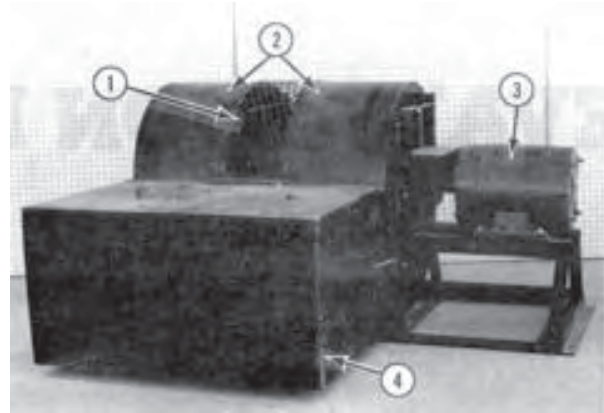


FIGURE 1. Keho Model 15330 15 hp Twin Centrifugal Fan: (1) Expanded Metal Guard Grill (2) Fan Housing, (3) Motor, (4) Discharge Transition.

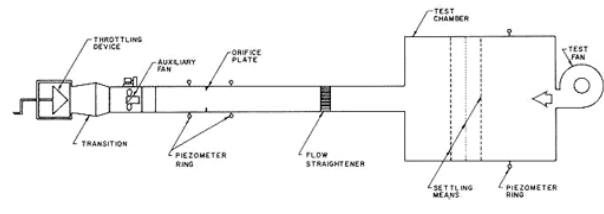


FIGURE 2. Schematic of Fan Test Apparatus - Outlet Chamber Setup.

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 3010 cfm (1420 L/s) at 11 in wg (2740 Pa) to 14,200 cfm (6700 L/s) at 1 in wg (249 Pa). FIGURE 3 illustrates the fan performance curves for the Keho Model 15330. There was no manufacturer's performance information provided. 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.

Power Requirements: The power required to run the fan depended upon the point of operation of the fan. The minimum input power of 19.2 hp (14.3 kW) occurred at maximum static pressure and minimum air flow rate. The peak power input of 25.7 hp (19.2 kW) occurred at 6.6 in wg (1640 Pa) static pressure and an air flow rate of 9460 cfm (4470 L/s). The maximum amperage drawn by the motor was 19.8 amps, which was within the rated motor amperage of 19 amps with a service factor of 1.15. Prolonged operation in excess of rated amperage could reduce motor life.

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 13 to 37%. The maximum total efficiency of 37% occurred at 8140 cfm (3840 L/s) at a static pressure of 7.7 in wg (1920 Pa).

OPERATOR SAFETY

The guard grills provided adequate protection from the fan blades. The motor was a totally enclosed unit and the motor/impeller shaft coupler was properly shielded so that no safety hazards were present. The Keho Model 15330 was CSA approved.

The noise level³ of the Keho Model 15330, at a distance of 4.9

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).

³PAMI Test Procedure for Determining Fan Noise Level.

ft (1.5 m) from the centre of the fan inlet, while operating at a 1 in wg (249 Pa) static pressure, was 93 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Keho Model 15330 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.

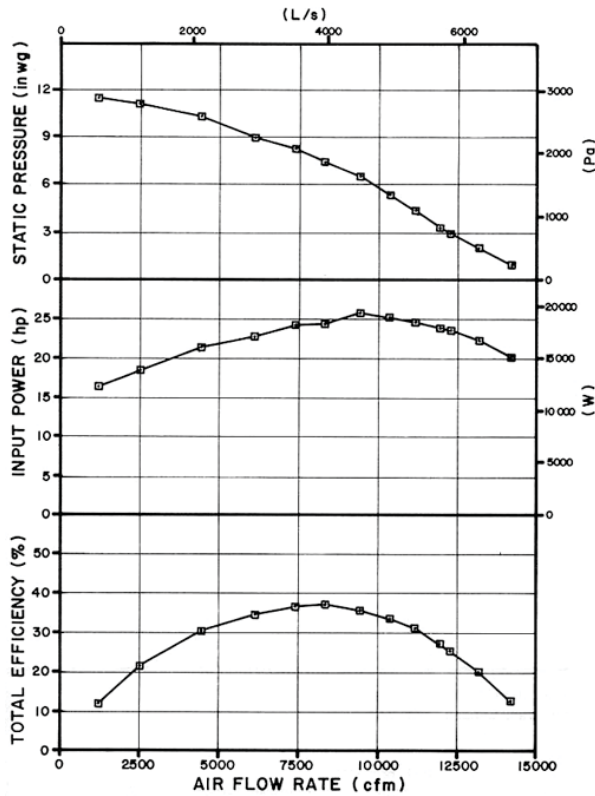


FIGURE 3. Keho Model 15330 Fan Performance Curves.

EASE OF OPERATION

Maintenance: No maintenance instructions were supplied.

OPERATOR'S MANUAL

The operator's manual contained very useful information on aeration and natural air drying, but had very little information on the fan itself. It is recommended that the manufacturer supply a detailed manual containing information on installation, maintenance, rated performance, safety aspects and trouble shooting.

APPENDIX I SPECIFICATIONS	
MAKE:	Keho
MODEL:	15330 15 hp Twin Blower
MANUFACTURER:	Keho Alta Products Ltd. Box 70 Barons, Alberta T0L 0G0

OVERALL DIMENSIONS:

- housing width 56.2 in (1429 mm)
- housing depth 48.5 in (1232 mm)
- housing height 29.5 in (749 mm)
- inlet bell diameter 10.8 in (273 mm)
- guard grill diameter 18.2 in (456 mm)
- grill opening 28 gauge (0.4 mm) wire on 0.25 in (6 mm) grid-discharge opening 17 x 325 in (432 x 826 mm)

IMPELLER:

- diameter 16.5 in (419 mm)
- inside flange diameter 12 in (305 mm)
- number of blades 8
- blade angle 45 degrees

WEIGHT:

380 lb (188 kg)

MOTOR NAMEPLATE DATA:

- make Canadian General Electric
- model 1F 1246 N
- frame 215T
- class B
- type K
- duty continuous
- rpm 3510
- ambient temperature rise 40°C
- volts 230/460 V
- amps 38119 A
- phase 3
- cycles 60 Hz
- horsepower 15 hp (11.2 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.

**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
KEHO MODEL 15330 15 HP TWIN CENTRIFUGAL FAN**

RETAIL PRICE:	\$2000.00 (November, 1984, f.o.b. Lethbridge)
FAN DESCRIPTION:	2-16.5 in (419 mm) fans mounted in parallel, single speed, direct drive 15 hp (11.2 kW) electric motor.
FAN SPEED:	3499 to 3531 rpm
MAXIMUM EFFICIENCY:	37%
AIR FLOW RATE:	-range 3010 to 14,200 cfm (1420 to 6700 L/s) -at maximum efficiency 8140 cfm (3840 L/s) at a 7.7 in wg (1920 Pa) static pressure
INPUT POWER:	19.2 to 25.7 hp (14.3 to 19.2 kW)
OPERATOR SAFETY:	Guard grill provided CSA approved Noise level = 93 dB(A) at 4.9 ft (1.5 m) from fan inlet
OPERATOR'S MANUAL:	Good general information but need more detail on the fan itself.



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