

# Evaluation Report

391



## **Keho Model 15400 1 hp Hi-Flow Centrifugal Fan**

A Co-operative Program Between



# KEHO MODEL 15400 1 HP HI-FLOW CENTRIFUGAL FAN

## MANUFACTURER & DISTRIBUTOR:

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

## RETAIL PRICE:

\$550.00 (November, 1984, f.o.b. Lethbridge, Alberta).

## SUMMARY OF RESULTS

TABLE 1. Keho Model 15400 1 hp Performance at Typical Levels of Operation

Static Pressure		Air Flow Rate		Input Power		Total Efficiency	Fan Speed
in wg	a	cfm	L/s	hp	W	%	rpm
0.5	(125)	1250	591	2.20	1640	11	3501
1.0	(249)	1180	558	2.19	1630	13	3499
1.5	(374)	1110	523	2.18	1630	15	3498
2.0	(497)	1020	483	2.17	1620	17	3499
2.5	(823)	935	441	2.15	1610	18	3500
3.0	(747)	846	399	2.12	1580	19	3501
3.5	(872)	756	357	2.07	1540	19	3503
4.0	(996)	656	310	2.00	1490	19	3507
4.5	(1120)	532	251	1.89	1410	18	3514
5.0	(1240)	379	179	1.74	1290	15	3526
5.5	(1370)	273	129	1.62	1210	12	3535
6.0	(1490)	182	86	1.51	1130	9	3541

## 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 15400 1 hp Hi-Flow fan is a 13.5 in (343 mm) diameter, single speed, direct drive, centrifugal flow fan. It is primarily used for grain aeration or grain drying systems.

The Keho Model 15400 is equipped with a plastic guard grill, duct mounting flange and weatherproof switch. The molded copolymer impeller consists of a hub-backplate, 4 backward curved airfoil blades and a flange. The impeller is directly mounted on the 1 hp (746 W) single phase, 115/230 V electric motor. The motor is mounted in the inlet sleeve of the fan. The fan housing and the perforated inlet sleeve 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 Keho Model 15400 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.

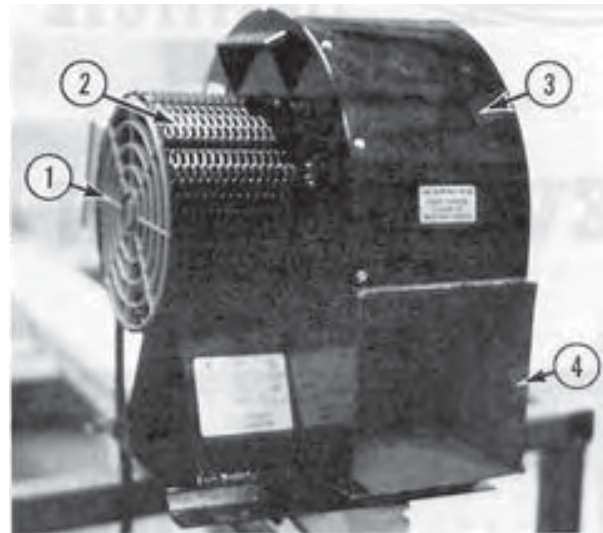


FIGURE 1. Keho Model 15400 1 hp Hi-Flow Centrifugal Fan: (1) Guard Grill, (2) Perforated Inlet Sleeve, (3) Fan Housing, (4) Duct Mounting Flange.

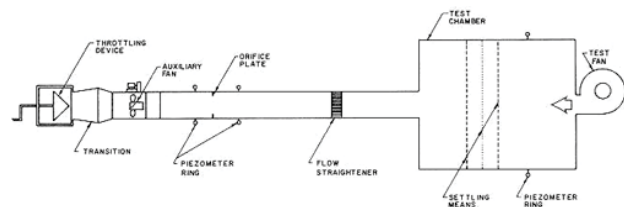


FIGURE 2. Schematic of Fan Test Apparatus - Outlet Chamber Setup.

## RESULTS AND DISCUSSION

### FAN PERFORMANCE

All fan performance results in this report are given at standard 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 levels of operation (i.e. static pressure<sup>2</sup> are given in TABLE 1. The air flow rate ranged from 182 cfm (86 L/s) at 6 in wg (1490 Pa) to 1250 cfm (591 L/s) at 0.5 in wg (125 Pa). FIGURE 3 illustrates the fan performance curves for the Keho Model 15400 1 hp Hi-Flow 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 1.51 hp (1130 W) at maximum static pressure and minimum air flow rate to 2.20 hp (1640 W) at 0.5 in wg (125 Pa) static pressure and an air flow rate of 1250 cfm (591 L/s). The maximum amperage drawn by the motor was 7.5 amps, which exceeded the rated motor amperage of 7.2 amps. The shaded zone in FIGURE 3 illustrates operation levels where the rated motor amperage was exceeded. 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 11 to 19%. The maximum total efficiency of 19% occurred at a static pressure of 3.75 in wg (934 Pa) and an air flow rate of 705 cfm (333 L/s).

### OPERATOR SAFETY

The guard grill provided adequate protection from the fan blades. The motor was a totally enclosed unit and presented no safety

<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).

hazards. The Keho Model 15400 was CSA approved.

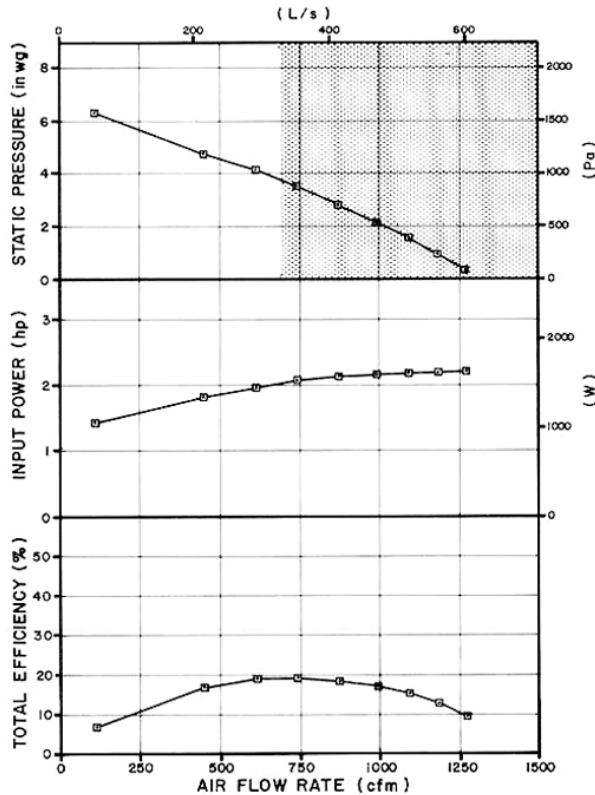


FIGURE 3. Keho Model 15400 Fan Performance Curves. 3PAMI Test Procedure for Determining Fan Noise Level.

The noise level<sup>3</sup> of the Keho Model 15400, 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 88 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Keho Model 15400 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 blower for prolonged periods.

#### 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.

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

APPENDIX I SPECIFICATIONS	
<b>MAKE:</b>	Keho
<b>MODEL:</b>	15400 1 hp Hi-Flow Fan
<b>MANUFACTURER:</b>	Keho Alta Products Ltd. Box 70 Barons, Alberta T0L 0G0
<b>OVERALL DIMENSIONS:</b>	<ul style="list-style-type: none"> <li>-- housing width 12.5 in (318 mm)</li> <li>-- housing height 17.5 in (444 mm)</li> <li>-- housing depth 16 in (406 mm)</li> <li>-- inlet sleeve diameter 8.75 in (222 mm)</li> <li>-- guard grill diameter 8.75 in (222 mm)</li> <li>-- grill opening 0.125 in (3 mm) plastic rings on 0.75 in (19 mm) spacing discharge 7.1 in (181 mm) by 7 in (178 mm)</li> </ul>
<b>IMPELLER:</b>	<ul style="list-style-type: none"> <li>-- diameter 13.5 in (343 mm)</li> <li>-- width 4.1 in (105 mm)</li> <li>-- inside flange diameter 9.5 in (241 mm)</li> <li>-- number of blades 4</li> <li>-- blade angle 35 degrees</li> </ul>
<b>WEIGHT:</b>	40 lb (18 kg)
<b>MOTOR NAMEPLATE DATA:</b>	<ul style="list-style-type: none"> <li>-- make Franklin Electric</li> <li>-- model 1104 360 438</li> <li>-- frame 56</li> <li>-- class B</li> <li>-- duty continuous</li> <li>-- rpm 3450</li> <li>-- service factor 1</li> <li>-- ambient temperature rise 40°C</li> <li>-- volts 115/230 V</li> <li>-- amps 14.4/7.2 A</li> <li>-- phase 1</li> <li>-- cycles 60 Hz</li> <li>-- horsepower 1 hp (746 W)</li> </ul>

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 KEHO MODEL 15400 1 HP HI-FLOW CENTRIFUGAL FAN	
<b>RETAIL PRICE:</b>	\$550.00 (November, 1984, f.o.b. Lethbridge)
<b>FAN DESCRIPTION:</b>	13.5 in (343 mm) single speed, direct drive, 1 hp (746 W) electric motor.
<b>FAN SPEED:</b>	3498 to 3541 rpm
<b>MAXIMUM EFFICIENCY:</b>	19%
<b>AIR FLOW RATE:</b>	<ul style="list-style-type: none"> <li>-range 182 to 1250 cfm (88 to 591 L/s)</li> <li>-at maximum efficiency 705 cfm (333 L/s) at a 3.75 in wg (934 Pa) static pressure</li> </ul>
<b>INPUT POWER:</b>	1.51 to 2.2 hp (1130 to 1 640 W)
<b>OPERATOR SAFETY:</b>	Guard grill provided CSA approved Noise level = 88 dB(A) at 4.9 ft (1.5 m) from fan inlet
<b>OPERATOR'S MANUAL:</b>	Good general information but need more detail on the fan itself.

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