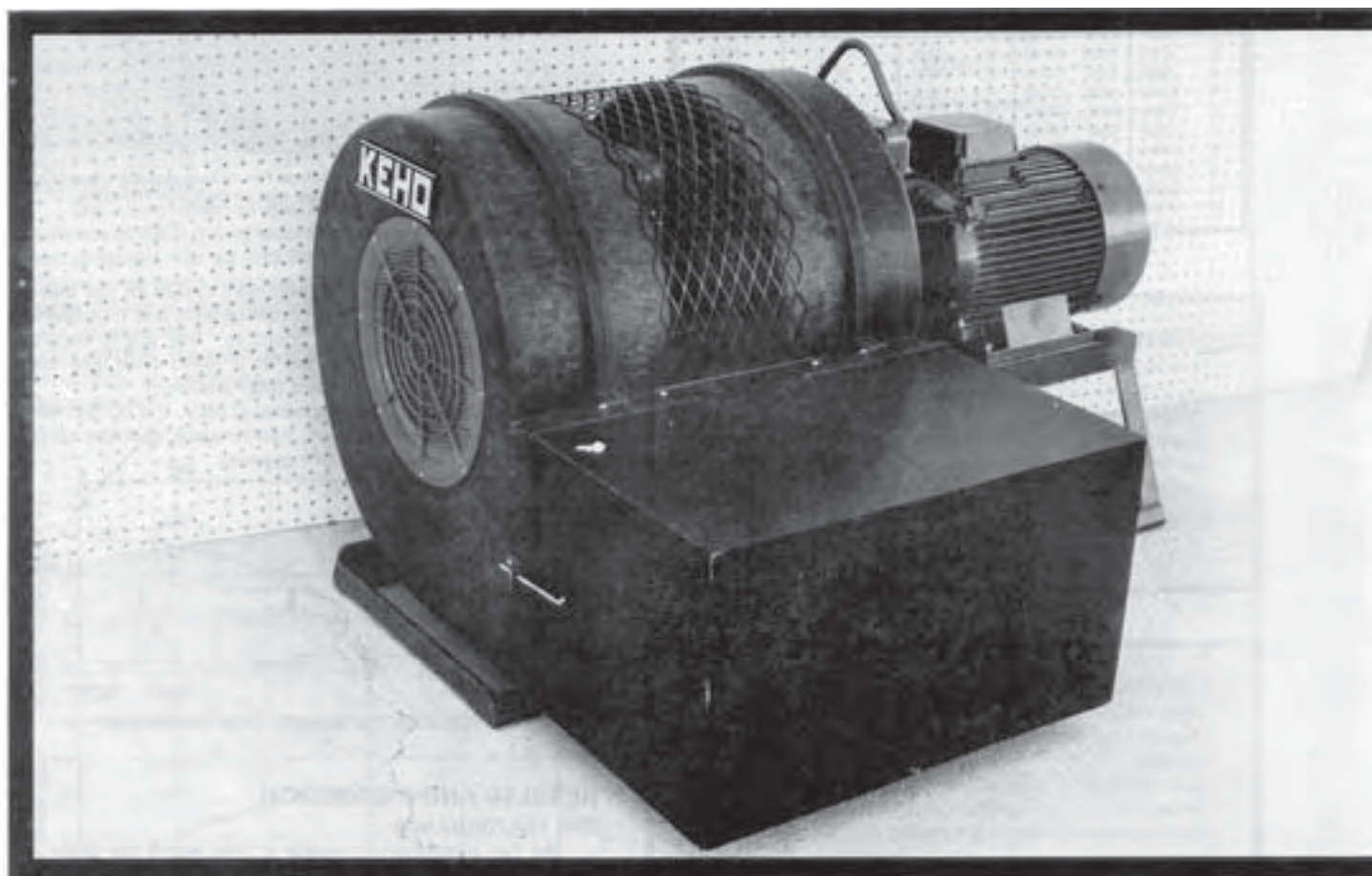


Evaluation Report

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Keho 10 HP Twin Blower Centrifugal Fan

A Co-operative Program Between



KEHO 10 HP TWIN BLOWER CENTRIFUGAL FAN

MANUFACTURER & DISTRIBUTOR:

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

RETAIL PRICE:

\$1,750.00 with three phase motor and \$1,900.00 with single phase motor (September, 1984, f.o.b. Lethbridge, Alberta).

SUMMARY OF RESULTS

TABLE 1. Keho 10 hp Twin Blower 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
1	249	8740	4120	15.7	11.7	15	3497
2	497	8170	3860	16.0	11.9	21	3491
3	747	7650	3610	16.1	12.0	25	3488
4	996	7140	3370	16.2	12.1	29	3486
5	1240	6630	3130	16.4	12.2	32	3485
6	1490	6100	2880	16.4	12.2	34	3485
7	1740	5540	2610	16.2	12.1	36	3487
8	1990	4910	2320	16.0	11.9	37	3489
9	2240	4170	1970	15.4	11.5	36	3493
10	2490	3200	1510	14.2	10.6	33	3501
11	2740	1880	889	12.0	8.92	25	3521

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 10 hp Twin Blower is made up of two 5 hp fans connected in parallel and driven by a single electric motor. The individual fans are 15 in (381 mm) in diameter, single speed, direct driven, centrifugal flow fans. The 10 hp fan is primarily used for grain aeration or grain drying systems.

The Keho 10 hp Twin Blower is equipped with a wire mesh guard grill for the outside blower, an expanded metal guard grill for the inside blower, 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 supported by a bearing. Coupled to the shaft is a 10 hp (7.46 kW), three phase, 208/230/460 V electric motor.

The blower housings are constructed of molded ABS plastic. The support frame and motor mounts 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 10 hp Twin Blower 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 460V. The fan was also evaluated for ease of operation, maintenance, operator safety and suitability of the operator's manual.

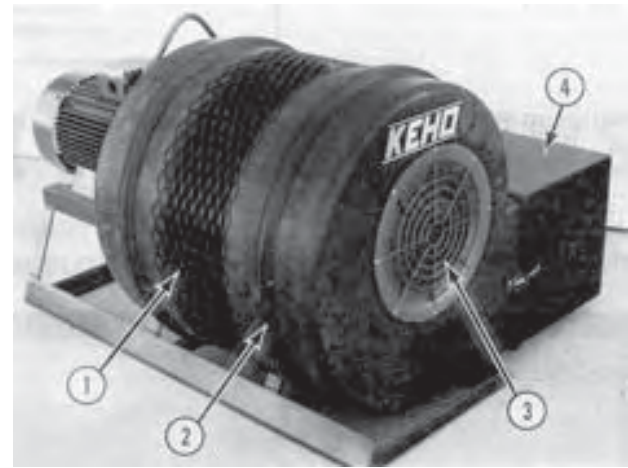


FIGURE 1. Keho 10 hp Twin Blower Centrifugal Fan: (1) Expanded Metal Guard Grill, (2) Fan Housing, (3) Wire Mesh Inlet Guard Grill, (4) Discharge Transition.

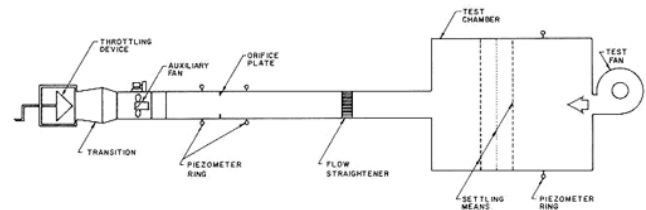


FIGURE 2. Schematic of Fan Test Apparatus - Outlet Chamber Setup.

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 1880 cfm (889 L/s) at 11 in wg (2740 Pa) to 8740 cfm (4120 L/s) at 1 in wg (249 Pa). FIGURE 3 illustrates the fan performance curves for the Keho 10 hp Twin Blower. 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 12.0 hp (8.92 kW) occurred at maximum static pressure and minimum air flow rate. The peak power input of 16.4 hp (12.2 kW) occurred at 5 in wg (1240 Pa) static pressure and an air flow rate of 6630 cfm (3130 L/s). The maximum amperage drawn by the motor was 12.6 amps, which was within the rated motor amperage of 12 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 15 to 37%. The maximum total efficiency of 37% occurred at 4950 cfm (2340 L/s) at a static pressure of 7.9 in wg (1970 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 such that no safety hazards were present. The Keho 10 hp Twin Blower was CSA approved.

The noise level³ of the Keho 10 hp Twin Blower, at a distance of 4.9 ft (1.5 m) from the centre of the fan inlet, while operating at a 1 in

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

wg (249 Pa) static pressure, was 94 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Keho 10 hp Twin Blower 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.

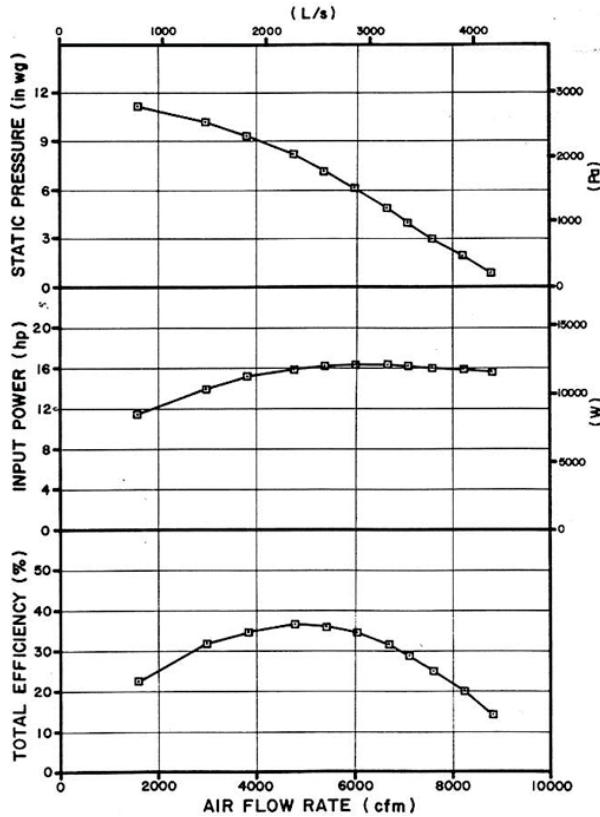


FIGURE 3. Keho 10 hp Twin Blower Fan Performance Curves. 3PAMI Test Procedure for Determining Fan Noise Level.

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.

³PAMI Test Procedure for Determining Fan Noise Level.

APPENDIX I SPECIFICATIONS	
MAKE:	Keho
MODEL:	10 hp Twin Blower
MANUFACTURER:	Keho Alta Products Ltd. Box 70 Barons, Alberta T0L 0G0

OVERALL DIMENSIONS:	
-- housing width	47 in (1194 mm)
-- housing depth	38.5 in (978 mm)
-- housing height	29.5 in (749 mm)
-- inlet bell diameter	9.75 in (248 mm)
-- guard grill diameter	13.5 in (343 mm)
-- grill opening	28 gauge (0.4 mm) wire on 0.25 in (6 mm) grid
-- discharge opening	13.75 x 24 in (349 x 610 mm)
IMPELLERS:	
-- diameter	15 in (381 mm)
-- inside flange diameter	10.5 in (267 mm)
-- number of blades	8
-- blade angle	60 degrees
WEIGHT: 292 lb (133 kg)	
MOTOR NAMEPLATE DATA:	
-- make	Elektrim
-- model	51940B
-- frame	215T
-- class	F
-- duty	continuous
-- rpm	3500
-- service factor	1.15
-- ambient temperature rise	40° C
-- volts	208/230/460
-- amps	26.3/24/12
-- phase	3
-- cycles	60 Hz
-- horsepower	10 hp (7.46 kW)

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 10 HP TWIN BLOWER	
RETAIL PRICE:	\$1,750.00 with three phase motor and \$1,900.00 with single phase motor (September, 1984, f.o.b. Lethbridge)
FAN DESCRIPTION:	2-15 in (381 mm) fans mounted in parallel, single speed, direct drive 10 hp (7.46 kW) electric motor.
FAN SPEED:	3485 to 3521 rpm
MAXIMUM EFFICIENCY:	37%
AIR FLOW RATE:	- range 1880 to 8740 cfm (889 to 4120 L/s) - at maximum efficiency 4950 cfm (2340 L/s) at a 7.9 in wg (1970 Pa) static pressure
INPUT POWER:	12.0 to 16.4 hp (8.92 to 12.2 kW)
OPERATOR SAFETY:	Guard grill provided CSA approved noise level = 94 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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