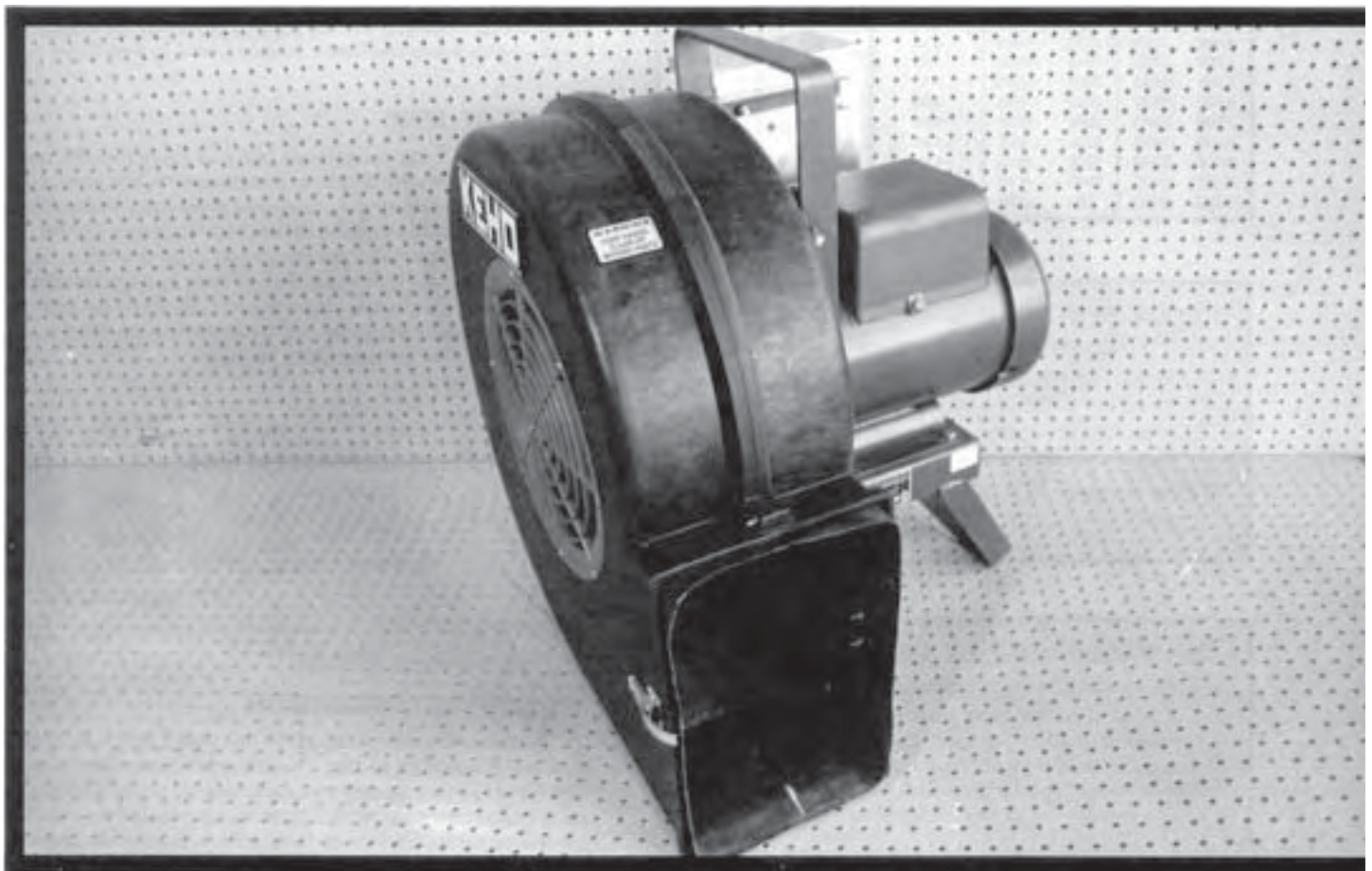


Evaluation Report

602



Keho Model 15150 5 HP Centrifugal Fan

A Co-operative Program Between



KEHO MODEL 15150 5 HP CENTRIFUGAL FAN

MANUFACTURER AND DISTRIBUTOR:

Keho Alta Products Ltd.
Box 70
Barons, Alberta
T0L 0G0
Phone (403) 757-2444

RETAIL PRICE: \$1,300.00 (June, 1989, f.o.b. Lethbridge, Alberta).

SUMMARY OF RESULTS

TABLE 1. Keho Model 15150 5 HP 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) | kW | % | rpm |
| 0.540 | (134) | 4440 | (2100) | 5.22 | 22 | 3420 |
| 1.000 | (249) | 4310 | (2040) | 5.25 | 25 | 3404 |
| 2.000 | (498) | 4030 | (1900) | 5.31 | 30 | 3378 |
| 3.000 | (747) | 3770 | (1780) | 5.33 | 35 | 3370 |
| 4.000 | (996) | 3510 | (1660) | 5.29 | 39 | 3366 |
| 5.000 | (1250) | 3220 | (1520) | 5.18 | 42 | 3368 |
| 6.000 | (1500) | 2930 | (1360) | 5.08 | 45 | 3374 |
| 7.000 | (1740) | 2600 | (1230) | 4.96 | 46 | 3378 |
| 8.000 | (1990) | 2260 | (1070) | 4.81 | 46 | 3390 |
| 9.000 | (2240) | 1930 | (910) | 4.69 | 44 | 3400 |
| 10.000 | (2490) | 1500 | (709) | 4.29 | 40 | 3420 |
| 10.650 | (2650) | 988 | (466) | 3.77 | 32 | 3450 |

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. Improving the operator's manual to contain information on safety and maintenance.

Station Manager: R. P. Atkins

Project Engineer: K. Shimek

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. A table of airflow rates is included with our sales information, which is made available to dealers and customers before the point of purchase.
2. Additional information will be supplied with the owner's manual on safety and maintenance.

GENERAL DESCRIPTION

The Keho Model 15150 5 hp 3450 rpm centrifugal fan is a 15 in (381 mm) diameter, single speed, direct drive, centrifugal fan. It is primarily used for grain aeration or grain drying systems.

The Keho 5 hp centrifugal fan is equipped with a plastic guard grill, an inlet bell and weather proof motor control switch. The molded copolymer impeller consists of a hub backplate, 8 backward curves blades and a flange. The impeller is directly mounted on the 5.0 hp (3.73 kW), single phase, 3450 rpm, 230 volt electric motor. The fan housing is constructed of molded ABS plastic. Motor mounts, and supports 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 5 hp centrifugal fan was tested in the outlet chamber setup (FIGURE 2) in accordance with test procedures developed by the Prairie Agricultural Machinery Institute and adopted by the Alberta Farm Machinery Research Centre. 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

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.

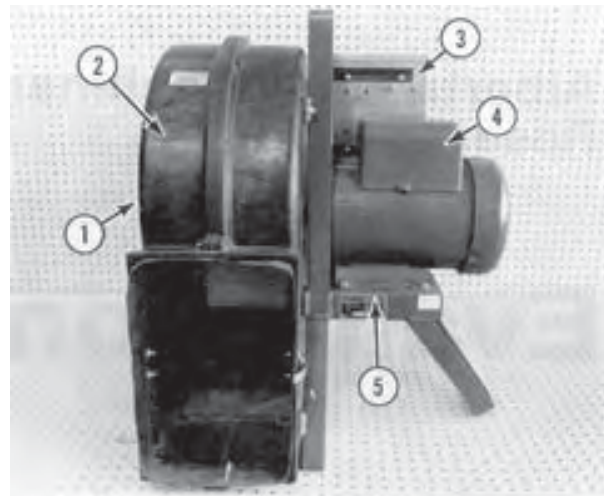


FIGURE 1. Keho Model 15150 5 hp Centrifugal Fan: (1) Inlet Bell and Guard Grill, (2) Fan Housing, (3) Weatherproof Switch, (4) Motor Control, (5) Motor Mount.

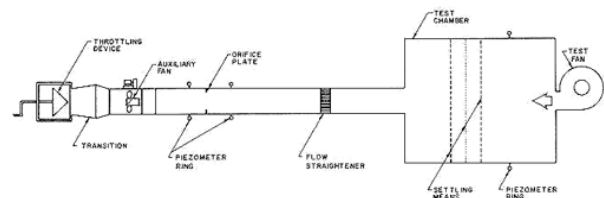


FIGURE 2. Schematic of Fan Test Apparatus - Outlet Chamber Setup.

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 4440 cfm (2100 L/s) at 0.54 in wg (134 Pa) to 988 cfm (466 L/s) at 10.65 in wg (2650 Pa). FIGURE 3 illustrates the fan performance curves for the Keho Model 15150 5 hp centrifugal 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.

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 3.77 kW at maximum static pressure and minimum air flow to 5.33 kW at 3.0 in wg (747 Pa) static pressure and an air flow rate of 3770 cfm (1780 L/s). The maximum amperage drawn by the motor was 24.2 amps, which was less than the rated motor amperage of 23 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 22 to 46%. The maximum total efficiency of 46% occurred between 2600 cfm (1230 L/s) and 2260 cfm (1070 L/s) at a static pressures of 7 in wg (1740 Pa) to 8 in wg (1990 Pa).

EASE OF OPERATION

Maintenance: No maintenance instructions were supplied. However, the inlet screen was easily removed which allowed for

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).

cleaning of the wheel and fan housing.

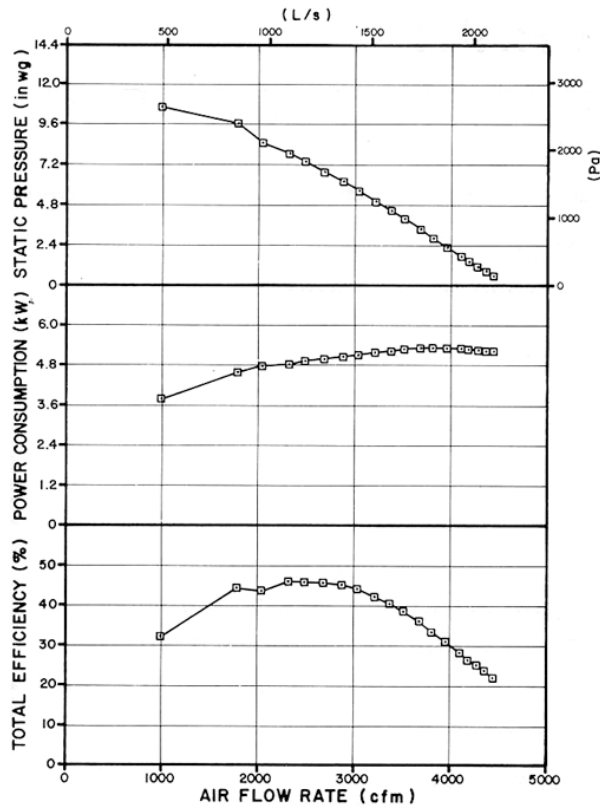


FIGURE 3. Keho Model 15150 5 hp Centrifugal Fan Performance Curves.

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 Keho Model 15150 5 hp, single phase fan was CSA approved.

The noise level of the Keho Model 15150 5 hp centrifugal 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 94 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Keho Model 15150 5 hp centrifugal fan falls within range 4 of the Alberta Farm Machinery Research Centre 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

The operator's manual contained very useful information on aeration and natural air drying. However, the operator's manual contained little information on installation and trouble shooting. No information was given on rated performance, safety or maintenance. It is recommended that the operator's manual be improved to contained information on safety and maintenance.

APPENDIX I SPECIFICATIONS

| | |
|------------------------------|---|
| MAKE: | Keho |
| MODEL: | 15150 5 hp Centrifugal |
| SERIAL NUMBER: | H5 03516 |
| MANUFACTURER: | Keho Alta Products Ltd. Box 70 Barons, Alberta T0L 0G0 |
| OVERALL DIMENSIONS: | |
| -- housing width | 23.0 in (584 mm) |
| -- housing depth | 24.5 in (622 mm) |
| -- housing height | 28.5 in (724 mm) |
| -- inlet bell diameter | 9.6 in (244 mm) |
| -- guard grill diameter | 10.0 in (254 mm) |
| -- grill opening | 0.13 in (3.2 mm) diameter plastic spaced at 0.81 in (20.6 mm) |
| -- discharge opening | 8.9 in (226 mm) by 13.9 in (352 mm) |
| IMPELLER: | |
| -- diameter | 15.16 in (385 mm) |
| -- width | 5.88 in (149 mm) |
| -- inside flange diameter | 10.9 in (276 mm) |
| -- number of blades | 8 |
| -- blade angle | 31 degrees |
| WEIGHT: | 120 lb (55 kg) |
| MOTOR NAMEPLATE DATA: | |
| -- make | Baldor |
| -- serial number | F887 |
| -- specification | 36F181W25 |
| -- frame | 184T |
| -- class | B |
| -- design | L |
| -- code | F |
| -- full load efficiency | 75% |
| -- power factor | 88% |
| -- rpm | 3450 |
| -- service factor | 1.15 |
| -- ambient temperature rise | 40°C |
| -- volts | 230 V |
| -- amps | 23 A |
| -- phase | single |
| -- cycles | 60 Hz |
| -- horsepower | 5 hp (3.73 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. |

SUMMARY CHART KEHO MODEL 15150 5 HP CENTRIFUGAL FAN

| | |
|---------------------------|--|
| RETAIL PRICE: | \$1,300.00 (June, 1989, f.o.b. Lethbridge) |
| FAN DESCRIPTION: | 15 in (381 mm) single speed, direct drive, 5.0 hp (3.73 W) 230 volt electric motor |
| FAN PERFORMANCE: | |
| Air Flow Rate: | |
| --range | 988 to 4440 cfm (466 to 2100 L/s) |
| --at maximum efficiency | 2600 cfm (1230 L/s) at a 7 in wg (1740 Pa) static pressure to 2260 cfm (1070 L/s) at a 8 in wg (1990 Pa) static pressure |
| Power Consumption: | 3.77 to 5.33 kW |
| Total Efficiency: | maximum 46% |
| OPERATOR SAFETY: | guard grill provided CSA approved motor noise level = 94 dB(A) at 4.9 ft (1.5 m) from fan inlet |
| OPERATOR'S MANUAL: | Good general information but more detail on rated fan performance, safety and maintenance is needed. |



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