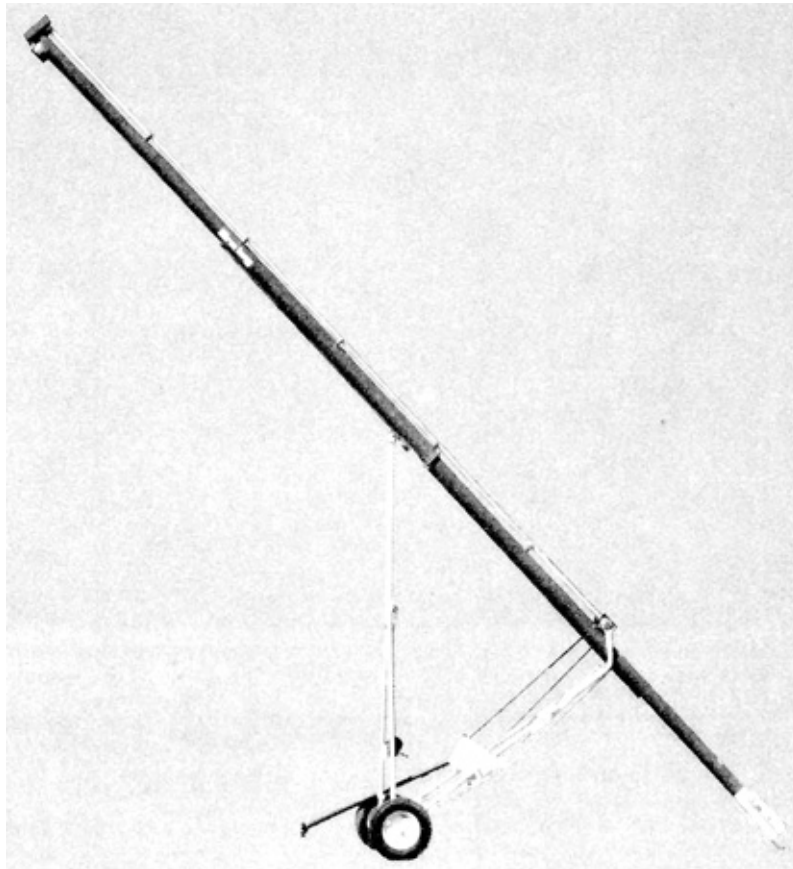


Evaluation Report

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Farm King 7 x 41A Grain Auger

A Co-operative Program Between



ALBERTA
FARM
MACHINERY
RESEARCH
CENTRE



PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

FARM KING 7 x 41A GRAIN AUGER

MANUFACTURER:
Farm King Ltd.
Box 1450
Morden, Manitoba.
R0G 1J0

DISTRIBUTORS:
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Farm King Ltd.
Box 1450
Morden, Manitoba
R0G 1J0

Alberta
Renn Sales Limited
12555 - 127 Avenue
Edmonton, Alberta
T5L 3E5

RETAIL PRICE: \$1,543.00 less tires (April 1981, f.o.b. Morden, Manitoba)

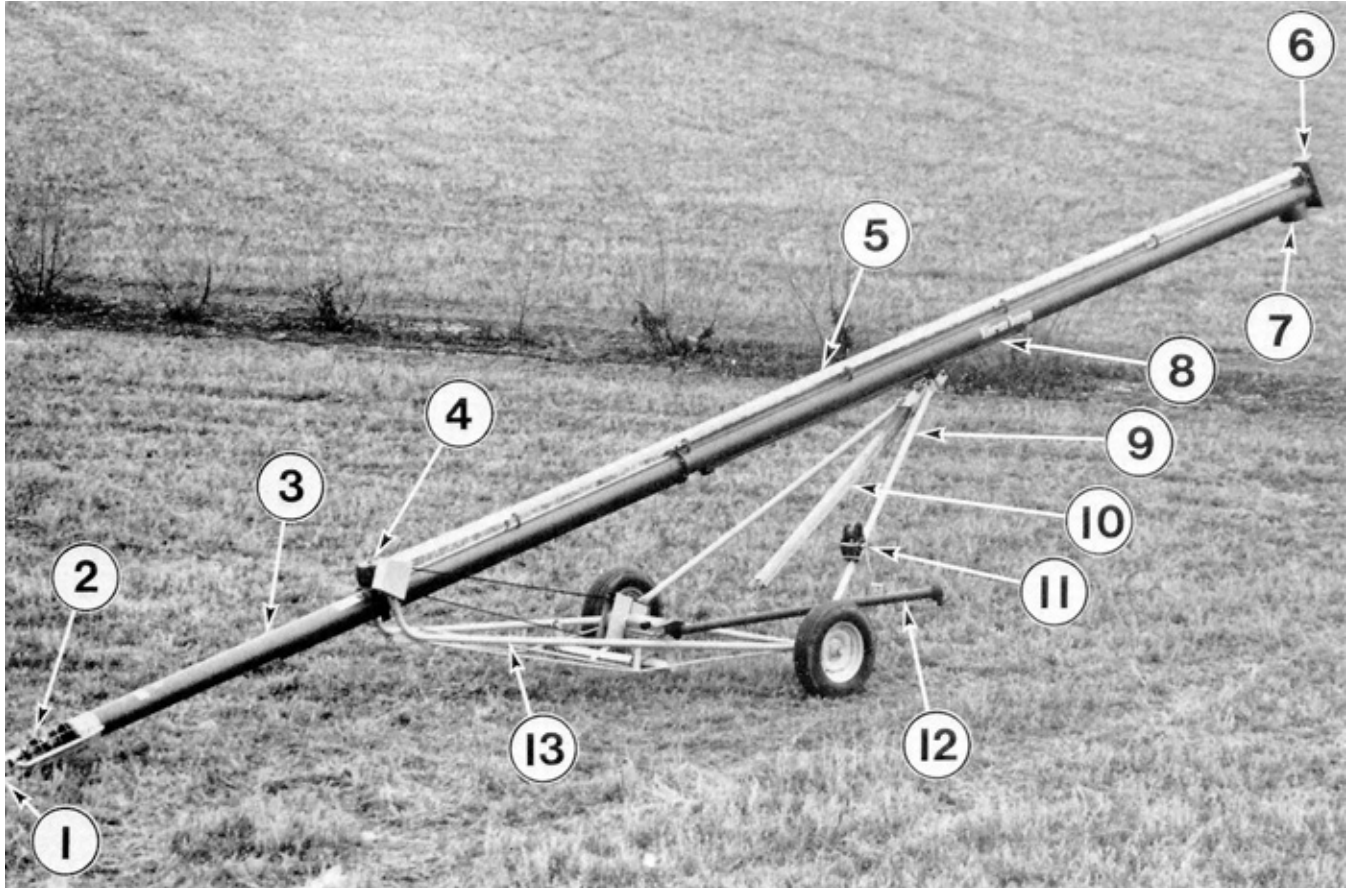


FIGURE 1. FARM KING 7 x 41A Grain Auger: (1) Tow Hitch, (2) Inlet, (3) Auger Tube, (4) Gear Box, (5) Drive Shaft, (6) Upper End Drive, (7) Discharge Spout (8) Elevating Track, (9) Lift Arms, (10) Telescoping Mast, (11) Cable Winch, (12) Power Take-off Drive Line, (13) Lower Arms.

SUMMARY AND CONCLUSIONS

At a flighting speed of 600 rpm and a 30° elevation angle corresponding to a discharge height of 6.3 m (21 ft), the capacity of the Farm King 7 x 41A was 43.7 t/h (1600 bu/h) in wheat, 32.9 t/h (2260 bu/h) in oats, 44.1 t/h (1730 bu/h) in corn and 41.6 t/h (1830 bu/h) in rapeseed. Maximum capacities were obtained at flighting speeds between 750 and 850 rpm.

Power requirements ranged from 3 to 11 kW (4 to 14 hp) in dry grain. Capacity and power depended on flighting speed, elevation angle, grain type and moisture content. A 15 kW (20 hp) power supply should have ample power reserve to operate the Farm King.

Grain damage in dry wheat was less than 0.2% for each pass through the auger.

The Farm King had a light hitch weight which made it easy to maneuver.

All pulleys, nip points, rotating drive shafts and intake flighting were guarded, in accordance with current safety standards.

A brief set of assembly instructions was provided. No operator manual was supplied.

No durability problems occurred during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Repositioning the mechanical stop on the elevating track to eliminate interference of the cable clamp with the cable pulley.
2. Providing a method of securing the power take-off drive line in its bracket during transport.
3. Providing an operator manual.

Chief Engineer -- E.O. Nyborg

Senior Engineer -- J. C. Thauberger

Project Engineer -- Carl W. Bolton

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Future production machines will have a changed pulley position which allows adequate clearance so the cable clamp does not contact the pulley.

2. Future production will incorporate a newly designed safety pin type latch for the power takeoff shaft holder.
3. Proper operator manuals have been included with Farm King augers since 1980.

Note: This report has been prepared using SI units of measurement. A conversion table is given in APPENDIX II.

GENERAL DESCRIPTION

The Farm King 7 x 41A Grain Auger (FIGURE 1) is a 180 mm (7 in) diameter, 12.8 m (42 ft) long portable screw conveyor. The auger tube is mounted on a tubular undercarriage with a telescoping mast arrangement. The undercarriage assembly is supported by a single axle with two wheels.

A hand-operated cable winch is used to adjust the auger angle which changes the discharge height. Bearings at the inlet and outlet ends support the auger flighting.

The Farm King may be powered with a tractor power take-off belt drive, power take-off direct drive, gasoline engine or electric motor. The drive shaft is mounted in bearings with a roller chain final drive.

The test machine was equipped with a 540 rpm tractor power take-off belt drive.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Farm King was operated for about 10 hours while conveying dry wheat, oats, corn and rapeseed. It was also operated in a standard test material (APPENDIX II) for about one hour. As well, it was transported over gravel and paved highways for a distance of 50 km (30 miles). It was evaluated for ease of operation and adjustment, rate of work, power requirements, quality of work, operator safety and suitability of the operator manual.

RESULTS AND DISCUSSION

EASE OF OPERATION AND ADJUSTMENT

Discharge Height: The discharge height could be varied from 2.9 to 9.2 m (9.5 to 30 ft) with the hand operated cable winch. Corresponding elevation angles varied from 14° to 47°. At 30° elevation, the point where the telescoping mast began to extend, the clamped cable end interfered with the cable pulley (FIGURE 2). When the auger was lowered past the point where the mast was fully retracted, the cable clamp sometimes jammed in the pulley causing momentary cable slack and shock loading due to a sudden short drop of the auger. It is recommended that the manufacturer modify the mechanical stop on the track to eliminate interference of the cable clamp and cable pulley.



FIGURE 2. Cable Interference at 30° elevation.

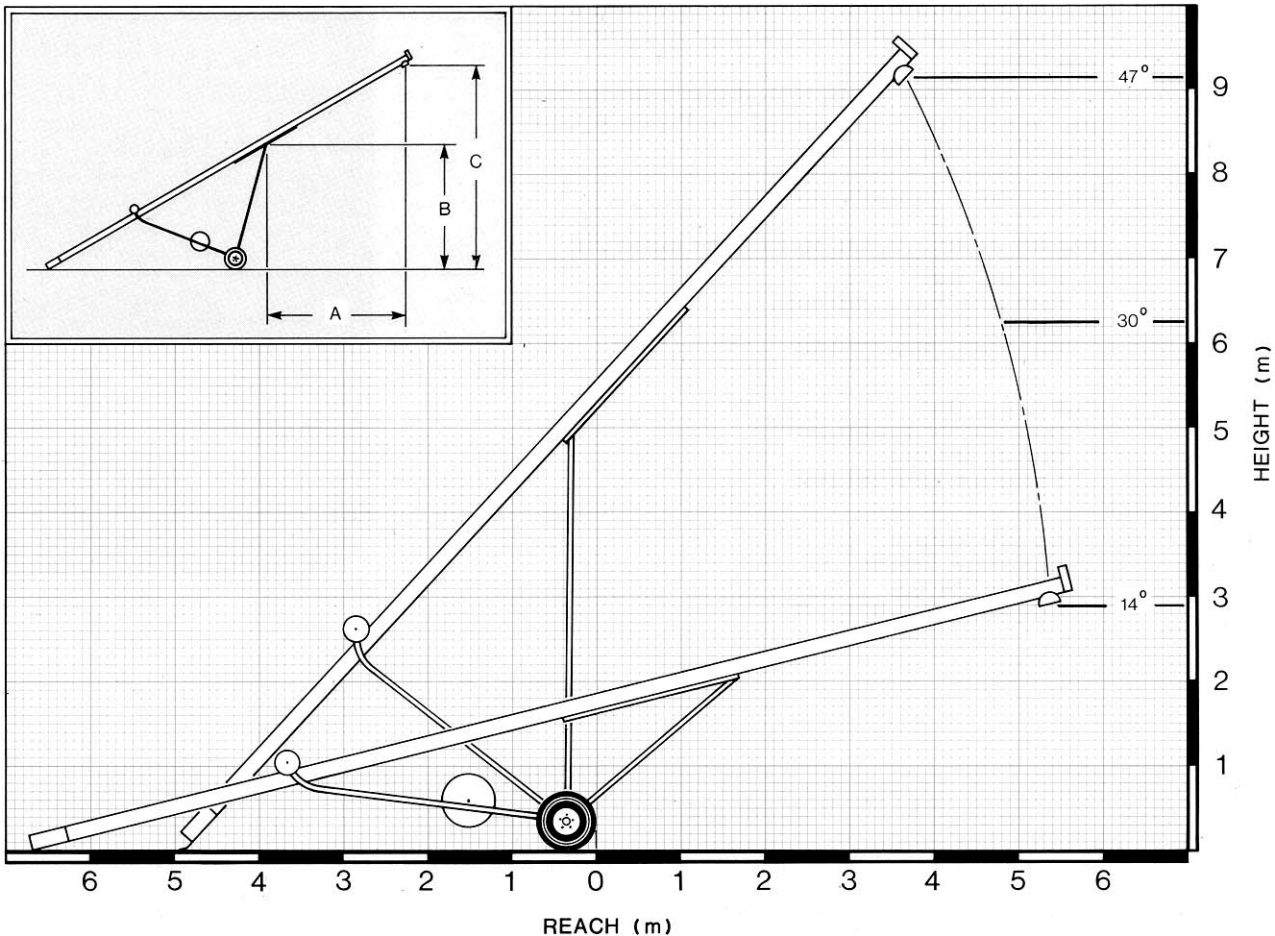


FIGURE 3. Reach and Clearance at Various Heights: (A) Reach, (B) Bin Eave Clearance, (C) Discharge Height.

With the auger empty, and the lift mechanism well lubricated, it took a maximum winch handle force of 165 N (33 lb) to raise the auger. When the winch drum was correctly aligned, perpendicular to the lift cable, the cable wrapped uniformly on the drum. The winch position changed as the auger was raised which resulted in some inconvenience at elevations greater than 30°. It took about 110 turns of the winch crank to fully raise or lower the auger.

Auger Reach: The bin eave clearance and horizontal reach of the Farm King 7 x 41A are shown in FIGURE 3. Bin eave clearance, measured from the ground to the foremost part of the undercarriage, varied from 2.1 m (6.9 ft) at 13° to 4.8 m (15.7 ft) at 47° elevation. The reach measured from the foremost part of the undercarriage to the centre of the discharge, was 3.8 m (12.5 ft) at both minimum and maximum elevations.

Hitch weight varied from 16 kg (35 lb) at minimum elevation to 30 kg (66 lb) at maximum elevation.

Adjustments: Drive belt tension was easily adjusted with a threaded rod to position the pivoting drive line frame.

Transporting: The Farm King transported well and was stable at speeds up to 100 km/h (60 mph) on paved highways and up to 50 km/h (30 mph) on gravel roads. The single tongue hitch provided a reliable coupling to the tow vehicle. The operator should use a suitable hitch pin and safety chain to prevent accidental unhitching when transporting on public roads. When travelling on rough roads, the power take-off drive line sometimes bounced out of the holding bracket. It is recommended that the manufacturer provide a method of securing the power take-off drive shaft in place.

Clearance under power lines was adequate. The transport height was 3.1 m (10 ft) when fully lowered.

RATE OF WORK

Capacity: FIGURE 4 shows the capacities of the Farm King 7 x 41A in dry wheat, oats, corn and rapeseed at a 30° elevation angle. Maximum capacities were 46.0, 34.8, 46.4 and 46.0 t/h (1690, 2400, 1820 and 2020 bu/h) in wheat, oats, corn and rapeseed respectively. Lower capacities can be expected for tough or damp grains. Maximum capacities occurred at flighting speeds ranging from 750 to 850 rpm.

Specific Capacity: The specific capacity, per metre of vertical lift, is a method of determining the efficiency of a grain auger. A low specific capacity indicates inefficient power use, while a high specific capacity indicates efficient operation. Specific capacities vary depending on grain type. In general, when the flighting speed is increased, the capacity increases at a lower rate than the increase in power requirements leading to an overall decrease in specific capacity.

As shown in FIGURE 4, the specific capacity¹ ranged from 0.67 to 1.55 t/kW-h per metre of vertical lift when operating at 30° elevation angle in dry wheat, oats, corn and rapeseed.

Critical Speeds: At certain critical flighting speeds, auger vibration becomes excessive. This phenomenon, known as resonance, is common to all augers and varies with grain type and operating conditions. Care should be taken not to operate at or near critical speeds.

POWER REQUIREMENTS

FIGURE 4 gives the power requirements for the Farm King in dry wheat, oats, corn and rapeseed at a 30° elevation angle. Power requirements ranged from 3 to 11 kW (4 to 14 hp). More power would be needed in high moisture grain. In general, a 15 kW (20 hp) power supply should have ample reserve power to operate the Farm King in most conditions.

QUALITY OF WORK

Grain Damage: Damage to dry wheat was less than 0.2% for each pass through the auger. This was insignificant as long as the same grain was not augered many times. Cracking would be lower with grain of higher moisture content.

¹Since the specific capacity is greatly dependent upon grain properties, such as varies and moisture content, FIG URE 5 should not be used for comparing efficiencies of different augers. The data presented in FIGURE 6, APPENDIX II, using a standard medium, may be used for comparisons of different augers.

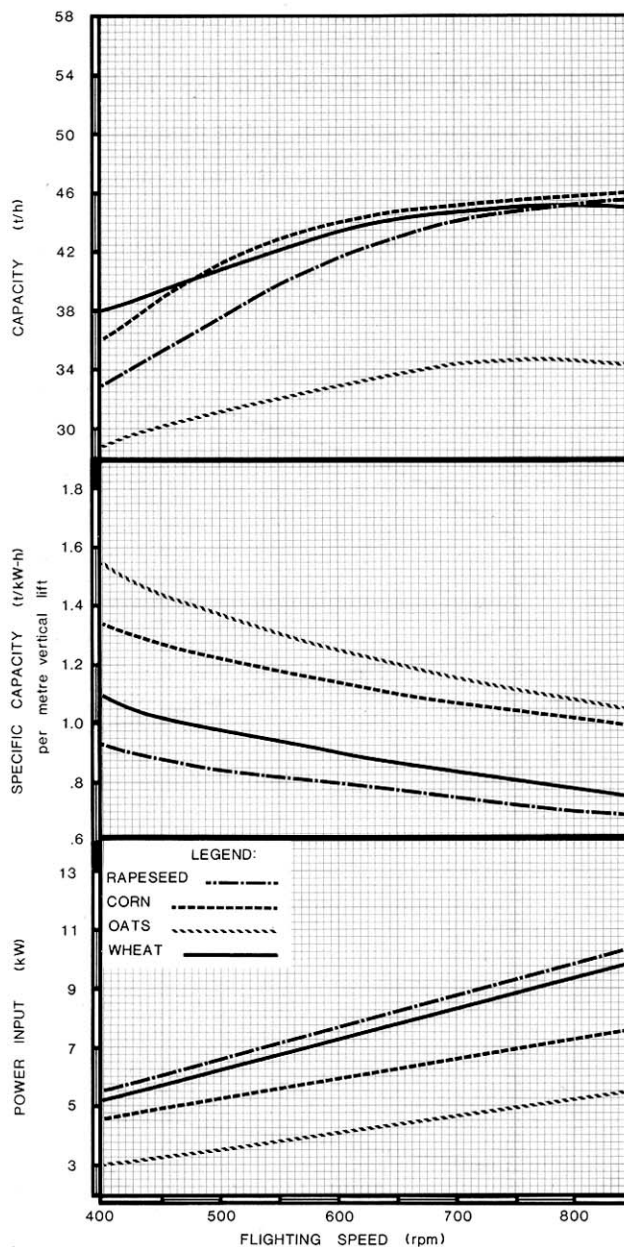


FIGURE 4. Capacity, Specific Capacity and Power input for Various Flighting Speeds at a 30° Elevation Angle.

OPERATOR SAFETY

The Farm King 7 x 41A met current safety standards² for grain augers. It was safe to operate if normal precautions were observed.

Shielding was provided for all rotating shafts, pulleys and pinch points. An adequate inlet safety guard (FIGURE 5) was provided. Appropriate warning and caution signs were placed on the auger.

Some caution had to be used in lowering the auger. The telescoping mast occasionally tended to bind momentarily, in its sleeve, allowing the cable to slacken if the operator continued to unwind the cable winch.

OPERATOR MANUAL

No operator manual was provided with the Farm King. It is recommended that a suitable operator manual, containing appropriate operating, servicing and safety instructions, be supplied. A step-by-step assembly manual was provided. Although it contained clearly written instructions, the line drawings were confusing.

²American Society of Agricultural Engineers Standard: ASAE S318.6, "Safety for Agricultural Equipment".

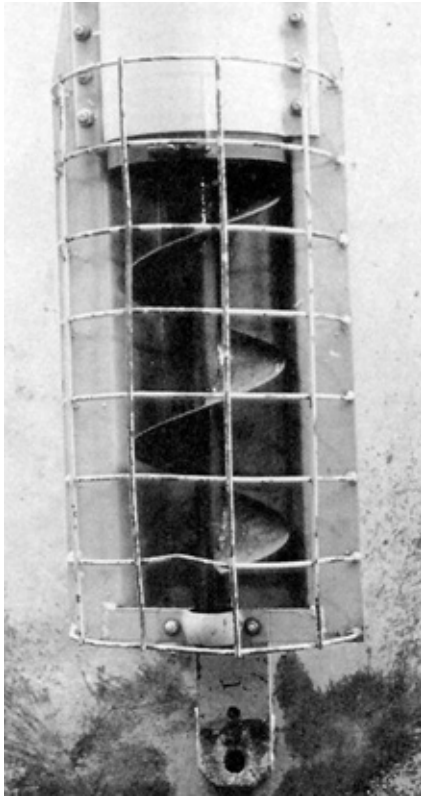


FIGURE 5. Inlet Safety Guard.

DURABILITY RESULTS

The Farm King was operated for about 10 hours. The intent of the test was evaluation of functional performance. An extended durability evaluation was not conducted. No mechanical problems occurred during the test.

APPENDIX I

SPECIFICATIONS

| | | |
|---|------------------------------|--------------------------|
| Serial Number: | 701199 | |
| Make: | Farm King | |
| Model: | 7 x 41A | |
| Overall Dimensions: | | |
| -- length | 12,755 mm | |
| -- width | 2290 mm | |
| Auger Tube: | | |
| -- inside diameter | 180 mm | |
| -- inlet length | 425 mm | |
| -- material thickness | 2.3 mm | |
| -- outlet size | elliptical 205 mm x 2t5 mm | |
| Fighting: | | |
| -- diameter | 155 mm | |
| -- pitch -- exposed (inlet) | 160 mm | |
| -- covered | 160 mm | |
| -- material thickness | 2.1 mm to 4.8 mm | |
| -- exposed length | 390 mm | |
| -- core diameter | 25.4 mm | |
| Elevating Height: | | |
| -- maximum (47°) | 9150 mm | |
| -- minimum (14°) | 2895 mm | |
| Lubrication Point: | | |
| -- pressure grease fittings | 2 | |
| -- sealed bearings | 10 | |
| -- wheel bearings (packed) | 2 | |
| Drive: | | |
| -- 540 rpm tractor power take-off | | |
| -- power take-off fighting speed ratio | 1:1.07 | |
| -- auxiliary drives | | |
| -- V-belt | 2 | |
| -- roller chain | 1 | |
| -- gear boxes | 1 | |
| Winch: | | |
| -- make and model | Work Winch K-1500 | |
| Bin Clearance @ maximum elevation: | 4800 mm | |
| Reach at maximum elevation: | 3800 mm | |
| Tires: | | |
| -- size | 6.70-15, 4 ply, L-1 tubeless | |
| -- tread width | 2120 mm | |
| Inlet Safety Shield: | | |
| -- type of grill | rod | |
| -- material dimensions | 5.1 mm dia | |
| -- grill openings | 72 mm x 82 mm | |
| -- maximum open area | 59 cm ² | |
| -- maximum open dimension | 82 mm | |
| -- overall size | 530 mm L x 280 mm dia. | |
| Weight: (PTO Drive) | | |
| | <u>maximum elevation</u> | <u>minimum elevation</u> |
| -- right wheel | 225 kg | 230 kg |
| -- left wheel | 190 kg | 200 kg |
| -- hitch point | 30 kg | 15 kg |
| Total | 445 kg | 445 kg |
| Optional Equipment: | | |
| -- various drives | | |
| -- discharge spouts | | |

APPENDIX II

PERFORMANCE WITH STANDARD TEST MATERIAL³

(a) Capacity and Power Requirements. FIGURE 6 gives the capacity, specific capacity and power requirements for the Farm King 7 x 41A in a standard test material. These data may be used for comparisons of different grain augers.

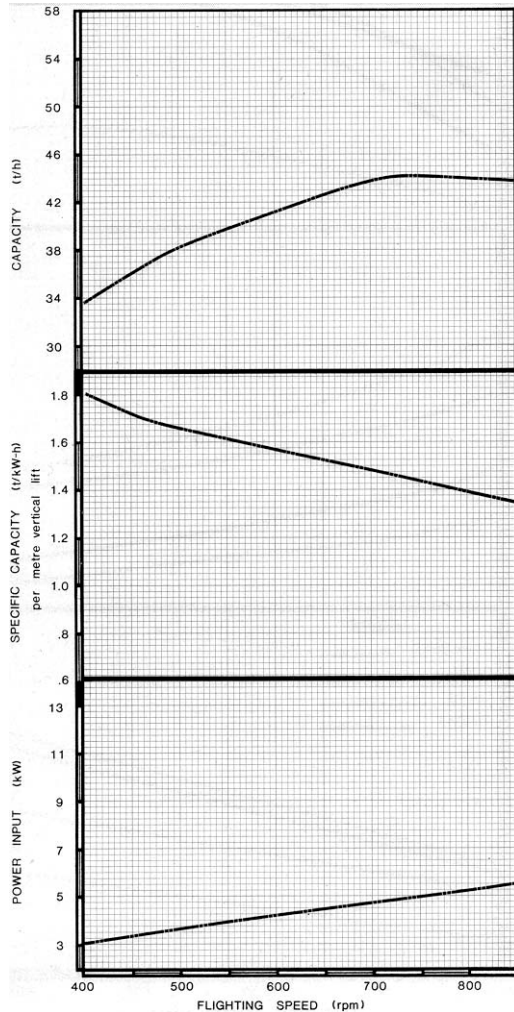


FIGURE 6. Capacity, Specific Capacity and Power Input with a Standard Test Material at a 30° Elevation Angle.

(b) Inlet Guard Index. This index is an indication of how freely grain flows through the inlet guard. The higher the index the less restrictive the guard. Free flow has a value of one. The Farm King guard had an index of 0.54, with the standard test material.

APPENDIX III

CONVERSION TABLE

| | |
|-----------------|-------------------------|
| 1 tonne (t) | = 2200 pounds mass (lb) |
| 1 metre (m) | = 3.3 feet (ft) |
| 1 kilowatt (kW) | = 1.3 horsepower (hp) |
| 1 kilogram (kg) | = 2.2 pounds mass (lb) |
| 1 newton (N) | = 0.2 pounds force (lb) |

³The standard test material is a high density granular polyethylene. The material is consistent and not subject to damage or changes in physical properties as are grains.



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