

Evaluation Report

168



Bergen 40 Grain Auger

A Co-operative Program Between



BERGEN 40 GRAIN AUGER

MANUFACTURER AND DISTRIBUTOR

Bergen Manufacturing Limited
P.O. Box 1331
Drake, Saskatchewan
S0K 1H0

RETAIL PRICE:

\$3,860.00 (f.o.b. Drake, Saskatchewan), 50 foot length. Note: Auger in 40 foot length no longer available.

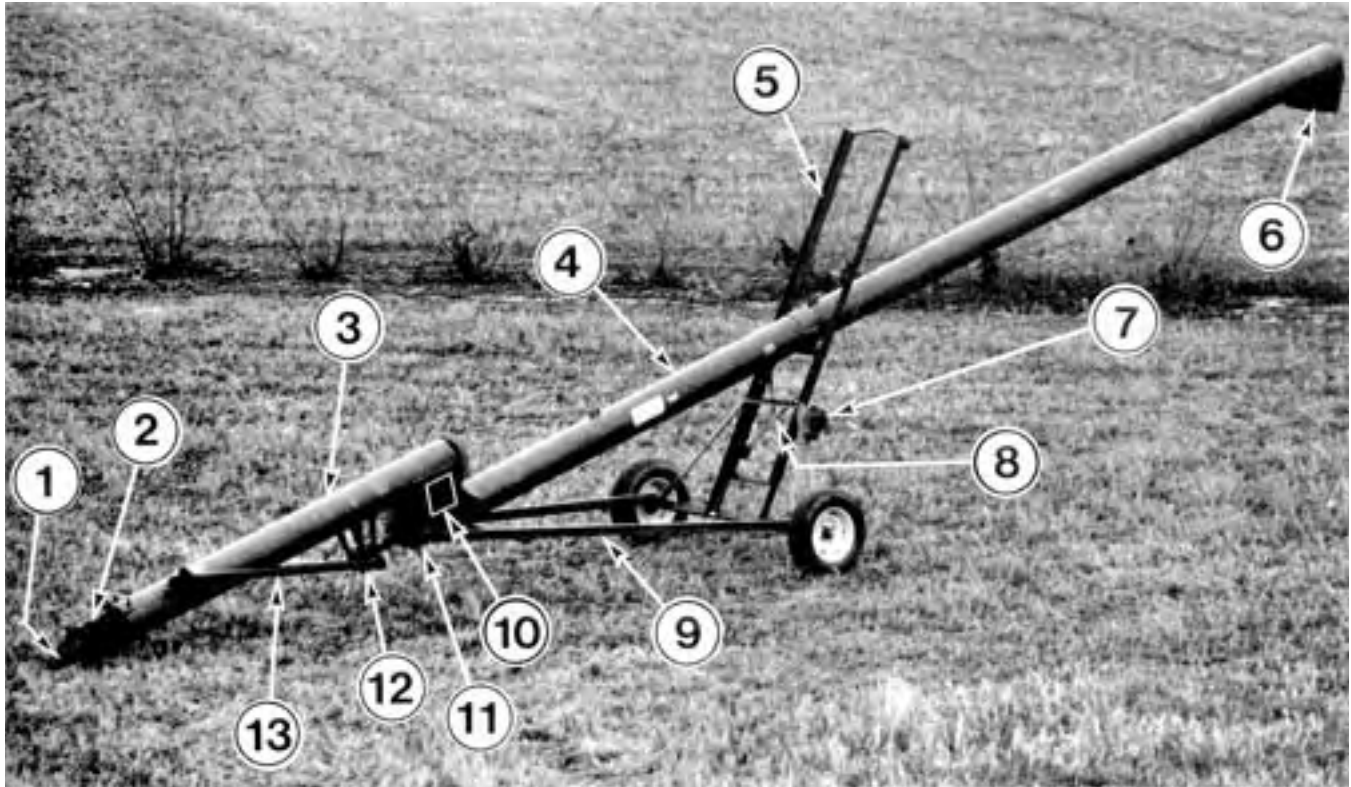


FIGURE 1. Bergen 40 Grain Auger: (1) Tow Hitch, (2) Inlet, (3) First Stage Auger Tube, (4) Second Stage Auger Tube, (5) Elevating Track, (6) Discharge Spout, (7) Cable Winch, (8) Elevating Carriage, (9) Lower Arms, (10) Service Panel, (11) Cleanout Panel, (12) Gear Box, (13) Power Take-Off Drive Line.

SUMMARY AND CONCLUSIONS

At a 30° elevation angle, corresponding to a discharge height of 5.4 m (17.7 ft) and at the manufacturer's recommended flying speed of 300 rpm, capacity of the Bergen 40 was 86.8 t/h (3180 bu/h) in wheat, 74.4 t/h (5120 bu/h) in oats, 85.0 t/h (3340 bu/h) in corn and 71.8 t/h (3160 bu/h) in rapeseed. Maximum capacities were obtained at flying speeds between 375 and 475 rpm.

The power requirements ranged from 3.5 to 20 kW (4 to 25 hp) in dry grain. Capacity and power depended on flying speed, elevation angle, grain type and moisture content. A 20 kW (25 hp) power supply should have ample reserve to operate the Bergen in most conditions.

Grain damage in dry wheat was less than 0.2% for each pass through the auger. Considerable effort was needed to maneuver the Bergen due to the heavy hitch weight.

The Bergen 40 had several potential safety hazards. The auger elevating mechanism did not operate smoothly due to spreading of the track members and jamming of the elevating carriage. As well, no guard was provided over the intake fighting, and the hand winch did not meet current standards.

No durability problems occurred during the test.

No operator manual was provided.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to eliminate spreading of the elevating tracks and to reduce the possibility of winch freewheeling.
2. Providing an auger inlet guard, which conforms to current safety recommendations.

3. Lengthening the raising cable to provide sufficient winch drum wrap in the fully lowered position to comply with current safety standards.

4. Providing a caution decal on the driveline advising on alignment practices and permissible extensions of the power take-off shaft and safety decals, which comply with current safety recommendations.

5. 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. We now have a completely new undercarriage and are using a K2500 Fulton winch without a ratchet.
2. A safety grate has always been supplied as standard equipment.
3. The cable has been lengthened.
4. We now use a Hayes-Dana power take-off driveline with lock features. A caution decal will be provided.
5. Assembly instructions now completed will be included in an operator manual.

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

GENERAL DESCRIPTION

The Bergen 40 grain auger (FIGURE 1) is a 270 mm (10.7 in)

diameter, two stage, portable screw conveyor, 12.1 m (40 ft) long. The auger tube is mounted on a frame supported by a single axle with two wheels. The first 455 mm (18 in) of the auger has double flighting. The remainder of the first stage and the second stage has single flighting.

Removable clean-out panels are located at the bottom of the second stage to allow cleaning when changing grains.

A hand-operated cable winch is used to adjust the auger angle, which varies the discharge height. Bearings at the intake and outlet ends support the auger flighting. The Bergen 40 is driven directly by a 540 rpm tractor power take-off. Power is transmitted through a gearbox and two roller chain drives to the flighting shafts.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Bergen was operated for about ten 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 60 km (40 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 2.3 to 5.4 m (7.4 to 17.7 ft) with the hand operated cable winch. Corresponding elevation angles ranged from 14° to 30°.

With the auger empty, and the lift mechanism well lubricated, it took a maximum winch handle force of 90N (18 lb). Raising the auger to maximum height posed a potential hazard since the carriage shifted to the side of one track and separated from the other track (FIGURE 2). As a precaution, the track was modified to prevent this separation.

When lowering, the elevating carriage sometimes momentarily jammed in the track causing hesitation and shock loading as the cable slack was abruptly taken up. Continuous winch handle control was needed when lowering to prevent the winch from freewheeling due to the design of the locking device. It is recommended that the manufacturer consider modifications to eliminate track binding and separation and also to reduce the possibility of winch freewheeling. It took about 160 turns of the winch crank to fully raise or lower the auger. The winch was conveniently located at all discharge heights.

Auger Reach: The bin eave clearance and horizontal reach of the Bergen 40 are shown in FIGURE 3. Bin eave clearance, measured from the ground to the foremost part of the undercarriage, varied from 1.1 m (3.7 ft) at 14° to 2.9 m (9.6 ft) at 30° elevation. The reach, measured from the foremost part of the undercarriage to the centre of the discharge varied from 5.3 m (17.3 ft) at 14° to 4.8 m (15.7 ft) at 30° elevation.

Hitch weight varied from 37 kg (80 lb) at minimum elevation, to 61 kg (135 lb) at maximum elevation.

Adjustments: There are two roller chain drives between the first and second stage flightings, which are easily adjusted. No other adjustments are needed.

Transporting: The Bergen transported well and was stable at speeds up to 100 km/h (60 mph) on paved highways, and 55 km/h (35 mph) on gravel roads. The hitch, on the inlet end, 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.

Clearance under power lines was adequate. The transport height was about 2.7 m (9 ft), when the auger was fully lowered.

When lowered to transport position, the winch drum had less than three complete wraps of cable, which did not comply with current standards¹. It is recommended that the cable be lengthened to provide sufficient contact with the drum.

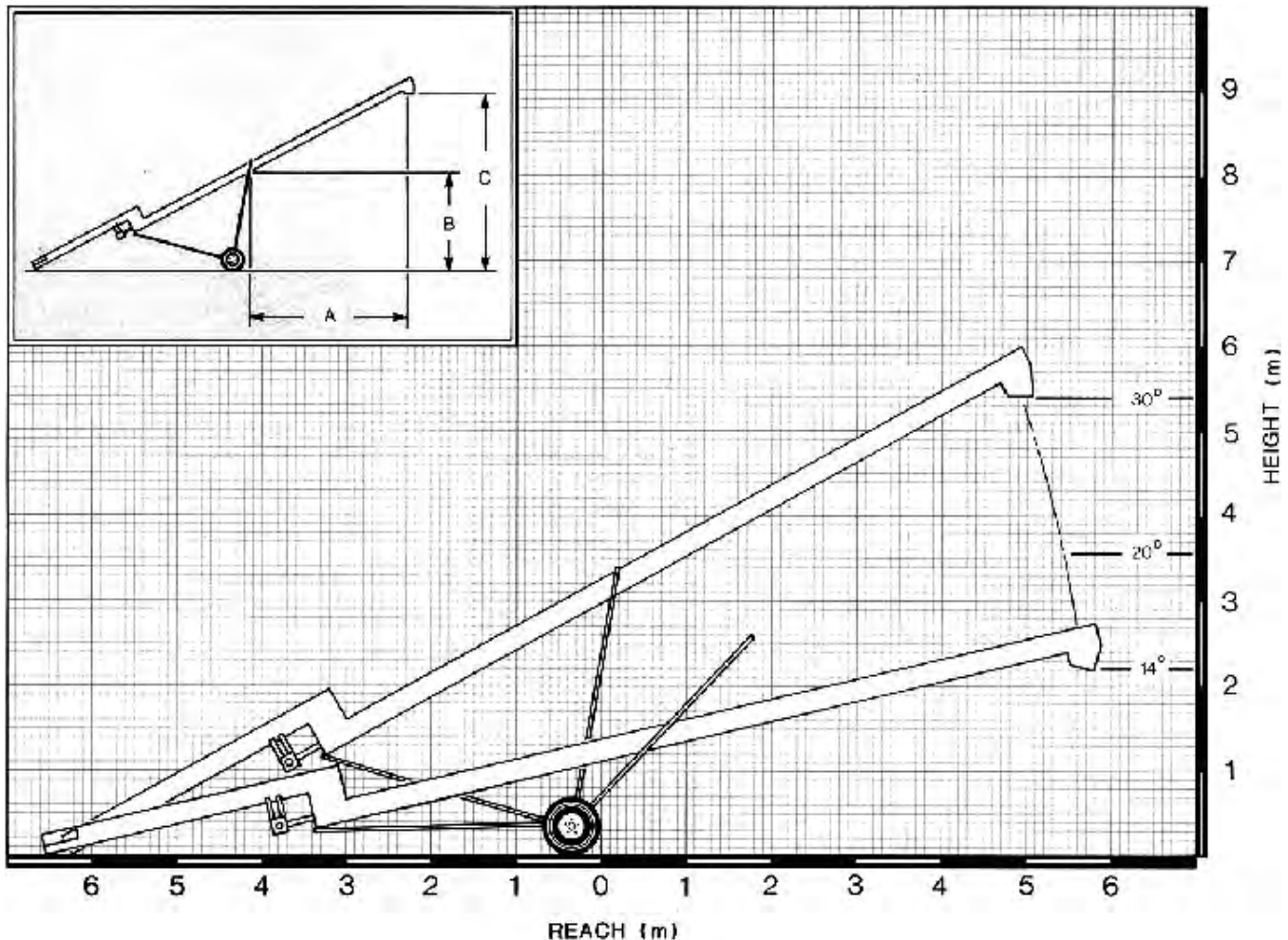


FIGURE 2. Carriage Separated from Track at Maximum Elevation.

¹American Society of Agricultural Engineers Tentative Standard: ASAE S 361.1T "Safety for Agricultural Auger Conveying Equipment", December 1979.

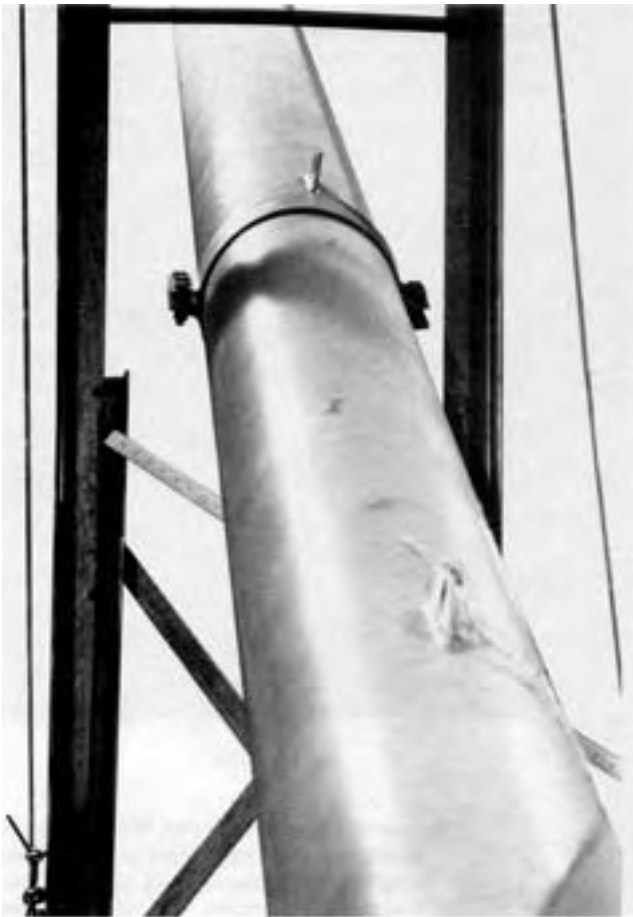


FIGURE 3. Reach and Clearance at Various Heights: (A) Reach, (B) Bin Eave Clearance, (C) Discharge Height.

RATE OF WORK

Capacity: FIGURE 4 shows the capacities of the Bergen 40 in dry wheat, oats, corn and rapeseed at a 30° elevation angle. Maximum capacities were 108, 94.4, 102 and 100 t/h (3960, 6490, 4010 and 4400 bu/h) in wheat, oats, corn and rapeseed respectively. Lower capacities can be expected in tough or damp grains. Maximum capacities were obtained at flying speeds ranging from 375 to 475 rpm, well above the manufacturer's recommended speed of 300 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 the grain type. In general, when the flying 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 is shown in FIGURE 4, the specific capacity² ranged from 0.95 to 2.27 t/kW-h per metre of vertical lift when operating at a 30° elevation angle in dry wheat, oats, corn and rapeseed.

Critical Speeds: At certain critical flying speeds, auger vibration becomes excessive. This phenomenon, known as resonance, is common to all augers and depends on 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 Bergen 40 in dry wheat, oats, corn and rapeseed at a 30° elevation angle. Power requirements ranged from 3.3 to 20.0 kW (4 to 25 hp). More power would be needed in high moisture grains. In general, a 20 kW (25 hp) power unit would have ample reserve power to operate the

Bergen in most conditions.

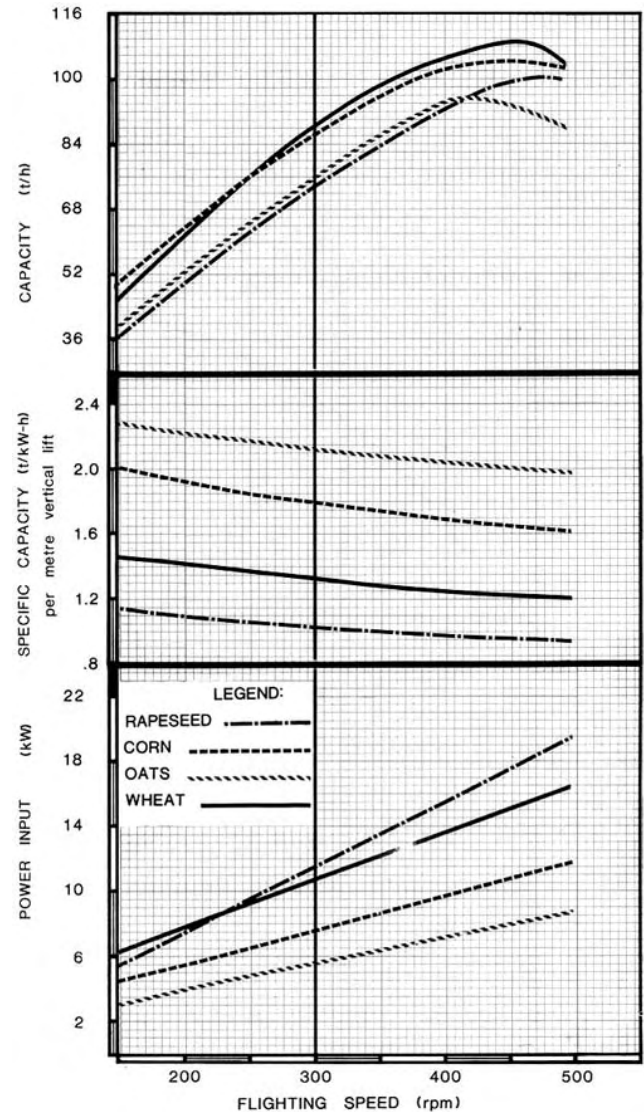


FIGURE 4. Capacity, Specific Capacity and Power Requirements for Various Flying Speeds at a 30° Elevation Angle.

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. Cragage would be lower with grain of higher moisture content.

OPERATOR SAFETY

Good shielding was provided around the PTO driveline and around the roller chain drives. The gearbox outlet shaft (FIGURE 5) was not shielded.



FIGURE 5. Unshielded Shaft.

²Since the specific capacity is greatly dependent upon grain properties such as variety and moisture content, FIGURE 4 should not be used for comparing efficiencies of different augers. The data presented in FIGURE 7, APPENDIX II, using a standard medium may be used for comparisons of different augers.

The power take-off driveline could separate if the tractor was placed too far away from the auger. It is recommended that a caution decal be placed on the driveline advising on alignment practices and permissible driveline extension.

The inlet was not provided with a guard meeting current standards (FIGURE 6). It is recommended that a guard be provided to conform with current safety recommendations.

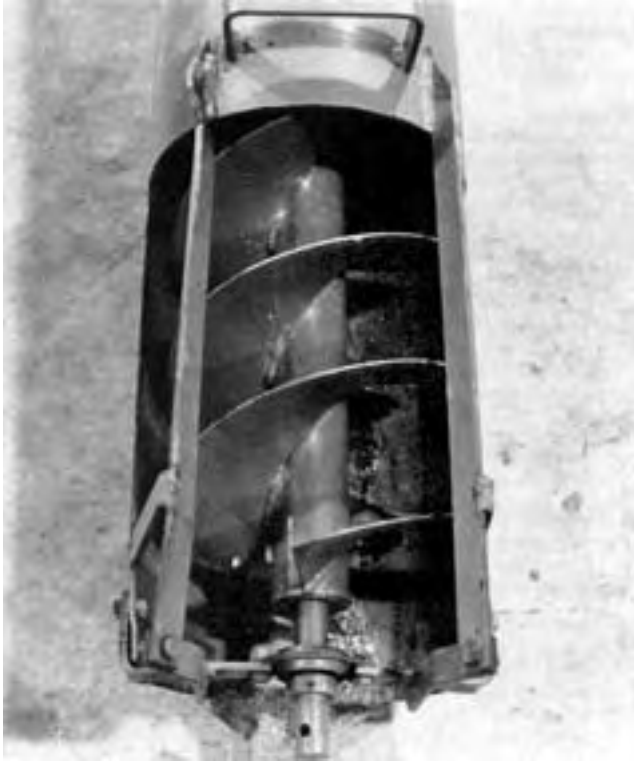


FIGURE 6. Auger Inlet.

Although several safety decals were provided, these did not comply with current standards³. Warning signs were not provided in several hazard areas. It is recommended that safety decals be provided to comply with current safety regulations.

OPERATOR MANUAL

No operator manual was provided. It is recommended that the manufacturer supply a manual outlining operating, maintenance and safety procedures.

DURABILITY RESULTS

The Bergen 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.

³American Society of Agricultural Engineers Standard: ASAE S318.6, "Safety for Agricultural Equipment", March 1978.

**APPENDIX I
SPECIFICATIONS**

Serial Number:	4010076	
Make:	Bergen	
Model:	40	
Dimensions:		
-- length	12,120 mm	
-- width	2180 mm	
Auger Tube:		
-- inside diameter	267 mm	
-- inlet length	405 mm	
-- material thickness	4.0 mm	
-- outlet size	square 280 mm x 280 mm	
Flighting:		
-- diameter	235 mm	
-- pitch		
--exposed (double flighting)	235 mm	
--covered	235 mm	
-- material thickness	3.0 mm	
-- exposed length	370 mm	
-- core diameter	62 mm	
Elevating Height:		
-- maximum (30°)	5380 mm	
-- minimum (14°)	2260 mm	
Lubrication:		
-- pressure grease fittings	5	
-- sealed bearings	4	
-- wheel bearings (packed)	2	
Drive:		
-- 540 rpm tractor power take-off		
-- power take-off flighting speed ratio	1:1	
-- auxiliary drive		
--roller chains	2 (60-43P)	
--gear boxes	1	
Winch:	Fulton 594	
Bin eave clearance @ maximum elevation:	2900 mm	
Reach at maximum elevation:	4750 mm	
Tires:		
-- size	F78-14, 2-ply.	
-- tread width	1980	
Inlet Safety Shield:		
-- type of grill	open flat bars	
-- material dimensions	6 mm x 24 mm	
-- grill openings	165 mm x 400 mm	
-- maximum open area	660 cm ²	
-- maximum open dimension	400 mm	
Weight:	Maximum Elevation	Minimum Elevation
-- right wheel	345 kg	355 kg
-- left wheel	315 kg	330 kg
-- hitch point	60 kg	35 kg
Total	720 kg	720 kg
Optional Equipment:		
-- hydraulic winch		

**APPENDIX II
PERFORMANCE WITH STANDARD TEST MATERIAL⁴**

(a) Capacity and Power Requirements. FIGURE 7 gives the capacity, specific capacity and power requirements for the Bergen 40 in a standard test material. These data may be used for comparisons of different grain augers.

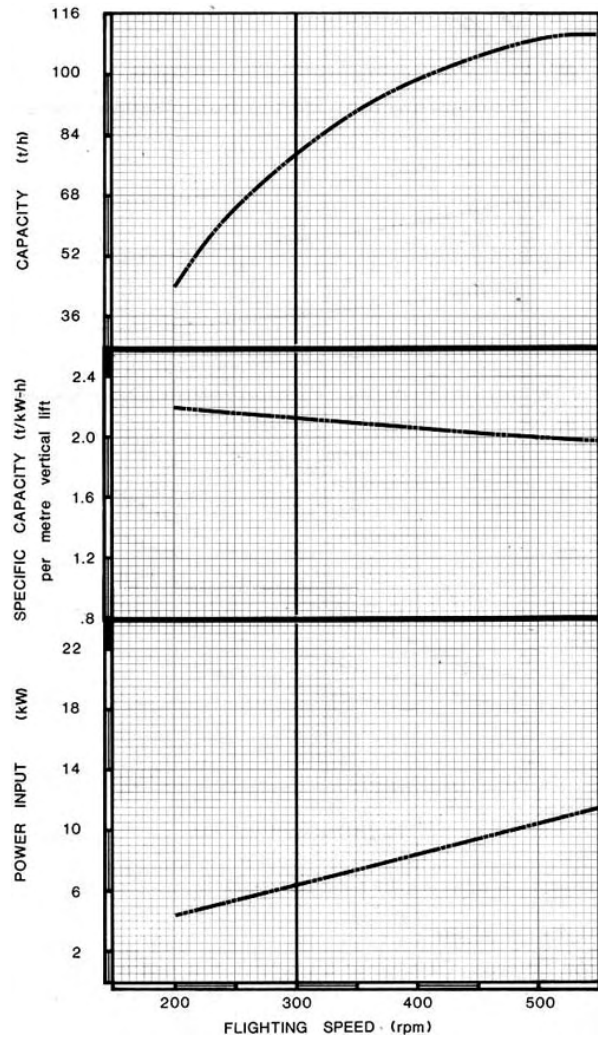


FIGURE 7. Capacity, Specific Capacity and Input Power with a Standard Test Material at a 30° Elevation Angle.

(b) Inlet Guard Flow Index. Since the Bergen had no inlet guard, no index could be determined.

⁴The standard test material is a high density granular polyethylene. This material is consistent and not subject to damage or changes in physical properties as are grains.

**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)



**ALBERTA
FARM
MACHINERY
RESEARCH
CENTRE**

3000 College Drive South
Lethbridge, Alberta, Canada T1K 1L6
Telephone: (403) 329-1212
FAX: (403) 329-5562
<http://www.agric.gov.ab.ca/navigation/engineering/afmrc/index.html>

Prairie Agricultural Machinery Institute

Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-2555

Test Stations:
P.O. Box 1060
Portage la Prairie, Manitoba, Canada R1N 3C5
Telephone: (204) 239-5445
Fax: (204) 239-7124

P.O. Box 1150
Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-5033
Fax: (306) 682-5080