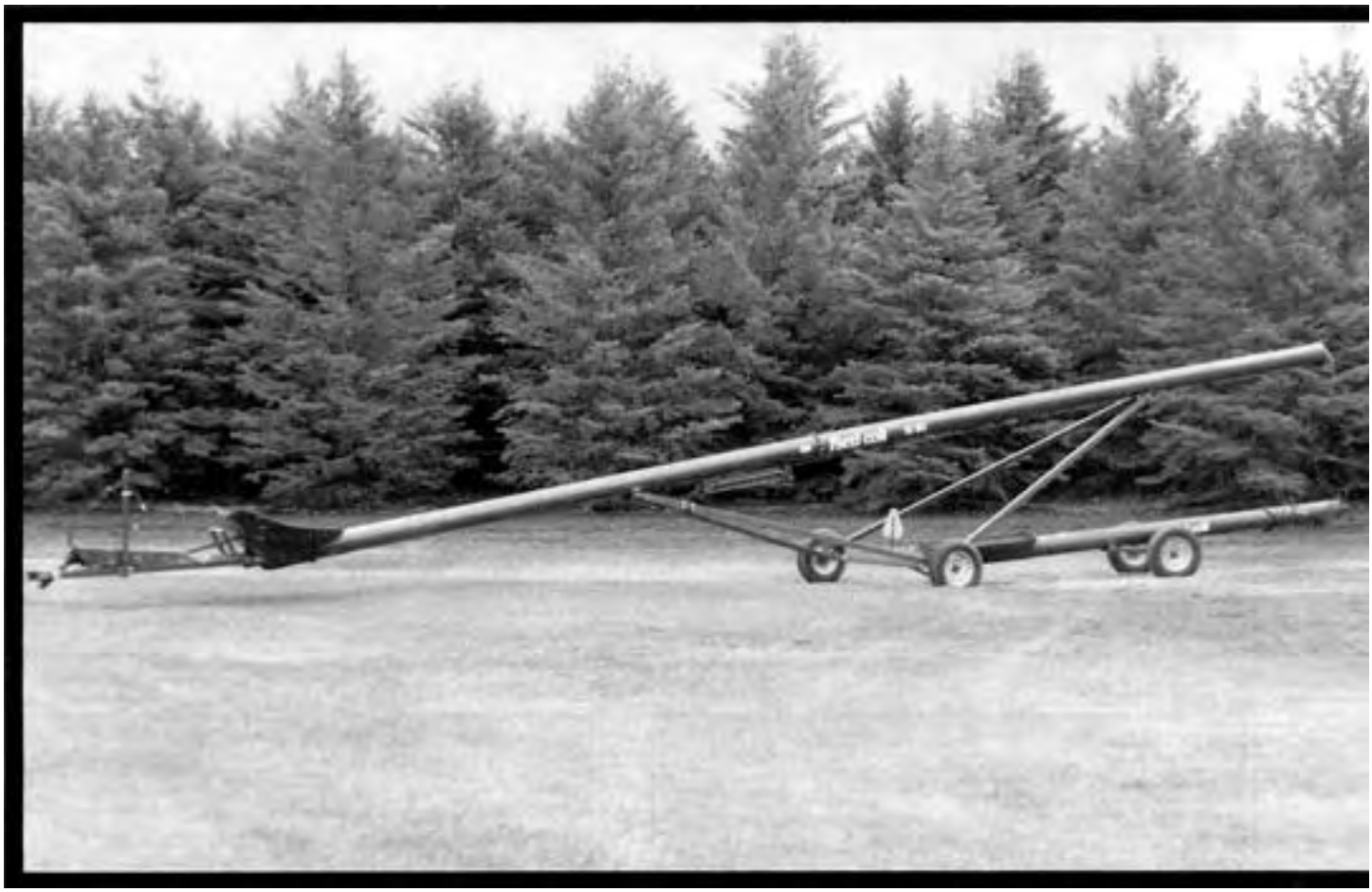
Printed: December, 1992
Tested at: Portage la Prairie
ISSN 0383-3445

Evaluation Report 689



Flexi-coil 10-50 Grain Auger

A Co-operative Program Between
ALBERTA FARM MACHINERY RESEARCH CENTRE
PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

FLEXI-COIL 10-50 GRAIN AUGER

MANUFACTURER AND DISTRIBUTOR:

Flexi-coil Ltd.
1000-71 St. E.
Saskatoon, Sask.
S7K 3S5
Tel: (306) 934-3500

RETAIL PRICE:

$5,518.00 (June 1991, f.o.b. Portage la Prairie, MB) Optional reverser $262.00 and transfer auger $1,779.00.

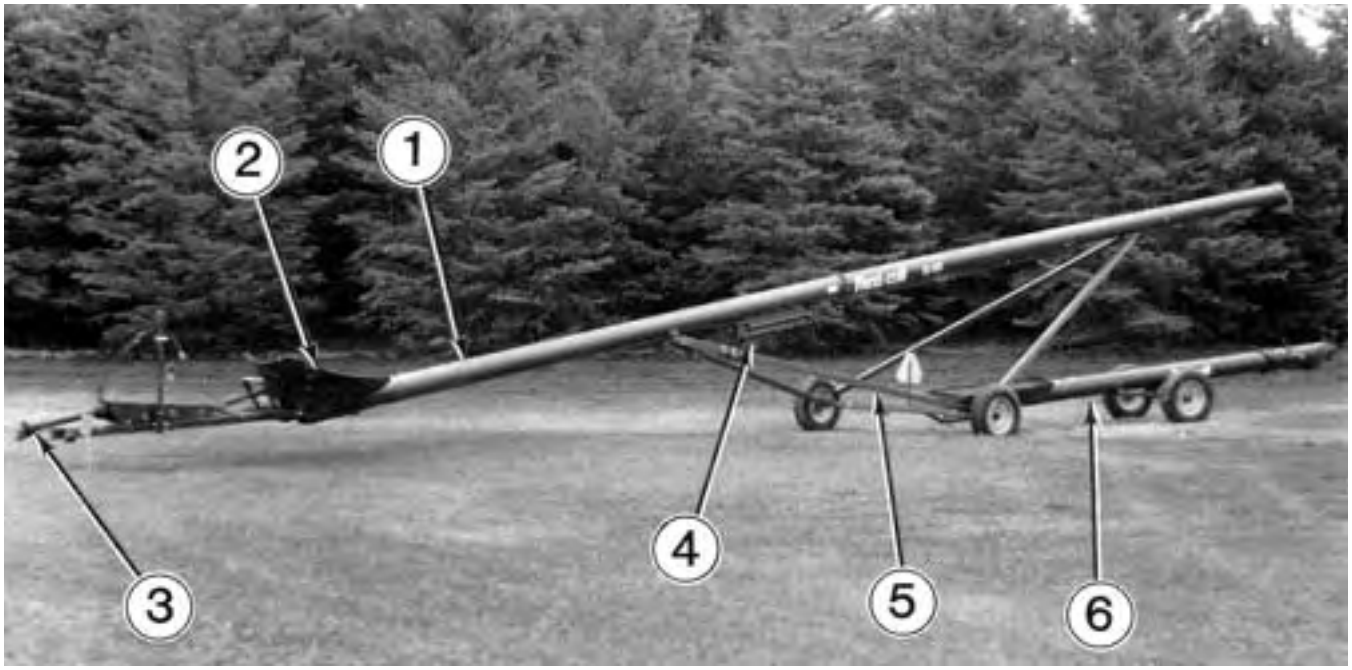


FIGURE 1. Flexi-coil 10-50: (1) Main Auger Tube, (2) Inlet Hopper, (3) PTO Drive, (4) Lift Cylinder, (5) Undercarriage, (6) Optional Transfer Auger (in transport position).

SUMMARY

Rate of Work: At the 30° elevation angle, corresponding to a discharge height of 25.2 ft (7.7 m), maximum capacities were 5720, 5300, 6010 and 5090 bu/h (149, 92,144 and 102 t/h) in wheat, oats, canola, and standard material respectively. Maximum capacities were usually obtained at flighting speeds between 490 and 600 rpm.

Quality of Work: Quality of work was very good. In dry wheat, damage was less than 0.2% for each pass through the auger.

Ease of Operation and Adjustment: The discharge height could be varied from 11.0 to 32.1 ft (3.4 to 9.8 m). Bin eave clearance varied from 8.5 to 15.8 ft (2.6 to 4.8 m) and reach varied from 10.7 to 21.1 ft (3.3 to 6.4 m) at elevation angles of 11.5° to 40° respectively.

Ease of operation was very good. The auger was easily positioned at the loading/unloading site from the tractor seat.

Ease of hitching the auger was very good. It utilized a 540 rpm PTO shaft and two hydraulic circuits.

Ease of manoeuvring was very good. The large hitch weight of 370 lbs (184 kg) made moving the auger by hand impractical. However, it could be transported, raised, positioned and operated from the tractor seat.

Ease of transporting was very good. It was stable at speeds up to 30 mph (50 km/h) on paved highways and gravel roads.

Ease of operating the optional transfer auger was very good. It was not attached to the main auger and was useful for unloading hopper bottom bins or trucks with belly dumps. Ease of lubrication was very good. The auger had six grease pressure nipples that were easy to get at.

Power Requirements: Power requirements for the main auger in dry grain ranged from 8 to 28 hp (6 to 21 kW). The Flexi-coil 10-50 required a tractor with a PTO shaft capable of 540 rpm and dual remote hydraulics capable of 1500 psi (10.3 MPa).

Operator Safety: The safety of the Flexi-coil t0-50 was very good. All pinch points, rotating drive shafts, and inlet flighting were guarded in accordance with ASAE standards for safety.

Operator's Manual: The operator's manual was excellent. The manual was clearly written and illustrated.

Mechanical History: No mechanical problems were encountered during the test period.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying a safety chain for the hitch of the main auger and the optional transfer auger.

Station Manager: B. H. Allen

Project Manager: R.K. Harris

THE MANUFACTURER STATES THAT:

1. The proper operation of the available safety chains is covered in the operator's manual. Consideration is being given to offering the safety chains as standard equipment.

GENERAL DESCRIPTION

The Flexi-coil 10-50 Grain Auger (FIGURE 1) is a 10 in (250 mm) diameter, 50 ft (15.2 m) long portable screw conveyor with a fixed hopper section at the inlet.

The main auger tube is mounted on a square tubular undercarriage and is raised or lowered hydraulically. The hitch portion, located forward of the inlet hopper is also raised or lowered hydraulically. The auger utilizes a direct drive 540 rpm, PTO drive shaft to the auger flighting, connected at the inlet end of the auger.

The test machine was equipped with an optional direction of rotation reversing device to aid in cleaning and emptying the auger tube. The Flexi-coil 10-50 is compatible with an optional transfer auger that is not an integral part of the main auger.

The transfer auger is 18 ft (5.5 m) in length, 10 in (250 mm) diameter and is powered by a hydraulic motor. The transfer auger is equipped with a wheeled undercarriage and is used to unload hopper bins, trailers or trucks.

Detailed specifications are presented in APPENDIX I.

SCOPE OF TEST

The machine evaluated by PAMI was configured as described in the General Description, FIGURE 1 and the Specifications section of this report. The manufacturer may have built different configurations of this machine before or after PAMI tests. Therefore. when using this report, check that the machine under consideration is the same as the one reported here. If differences exist, assistance can be obtained from PAMI or the manufacturer to determine changes in performance.

The Flexi-coil 10-50 grain auger was run 15 hours, loading canola into rail cars prior to capacity and power tests. During this 15 hour period, the auger moved 66,000 bu (174 t) of canola.

Capacity tests consisted of operating the auger in wheat, oats, canola and standard material. The auger was operated in each crop at a range of speeds from idle up to a maximum of 540 rpm. The auger was tested at 200, 300 and 400 or maximum height. All capacity tests were conducted with the inlet hopper adjusted so it was in contact with the ground.

The Flexi-coil was transported over gravel roads and paved highways for a distance of 50 mi (80 km). It was evaluated for rate of work, quality of work, ease of operation and adjustment, power requirements, and suitability of the operator's manual. Mechanical history and problems were also noted and recorded.

RESULTS AND DISCUSSION

RATE OF WORK

Capacity: FIGURE 2 shows the capacities of the Flexi-coil 10-50 in various dry grains at 30° elevation angle. Maximum capacities at this angle were 5720, 5300, 6010, 5090 bu/h (149, 92, 144, 102 t/h) in dry wheat, oats, canola, and standard material respectively. As flighting speeds are increased, the capacity of screw conveyors increases to a peak, then levels off or decreases. Maximum or peak capacities for the Flexi-coil 10-50 occurred at flighting speeds (PTO speeds) ranging from 490 to 600 rpm. Capacities at 20° of elevation were significantly higher. At 540 rpm in dry wheat, the Flexi-coil produced a maximum capacity of 6210 bu/h (162 t/h).

The effect of elevation angle on capacity is illustrated in TABLE 1. Peak capacities in wheat dropped 23.5% from 6210 bu/h (162 t/h) at 20° elevation to 4750 bu/h (124 t/h) at the maximum 40° elevation.

The Flexi-coil 10-50 was operated in dry wheat at 20°, using the optional 18 ft (5.5 m) x 10 in (250 mm) diameter transfer auger to feed the inlet hopper of the 10-50. With the inlet hopper of the transfer auger flooded, and the main auger operating at 540 rpm, the capacity of the main auger was reduced by about 25%. Maximum obtainable capacity with the transfer auger was 4700 bu/hr (123 t/h).

TABLE 1. Peak Capacity, Specific Capacity and Power Requirements Vs Elevation Angle (dry wheat)

Elevation Angle	Discharge Height		Peak Capacity		Specific Capacity		Power Input	
Degrees	ft	m	bu/h	t/h	ton/hp-h	t/kW-h	hp	kW
20	17.0	5.2	6210	162	7.4	9.0	24	18
30	25.2	7.7	5720	149	6.0	7.3	28	21
40	32.1	9.8	4750	124	5.3	6.5	26	19
20*	17.0	5.2	4700	123	6.3	10.1	16	12

**Main auger performance utilizing transfer auger.*

Specific Capacity: Specific capacity is the amount of grain moved per unit of power in a specific time. A high specific capacity indicates efficient use of power. In general, specific capacity decreases (less grain is moved per horsepower hour) with increasing flighting speeds and elevation angle). Specific capacity at 30° ranged from 6.0 to 9.0 ton/hp-h (7.3 to 11.0 t/kW-h), in dry wheat, oats, canola, and standard material (FIGURE 2).

Critical Speeds: At certain critical flighting speeds auger vibration may become excessive. This phenomenon, known as resonance, is common to all augers. It would appear that this critical speed is outside the operating speed range of the Flexi-coil 10-50 as it did not appear within the range of speeds the auger was operated at during the evaluation.

QUALITY OF WORK

Grain Damage: Quality of work was very good. Damage in dry wheat (13% moisture content) was less than 0.2% for each pass through the auger. This was considered to be normal in comparison to other makes of augers. Grain damage would not be significantly reduced when moving crops of higher moisture content.

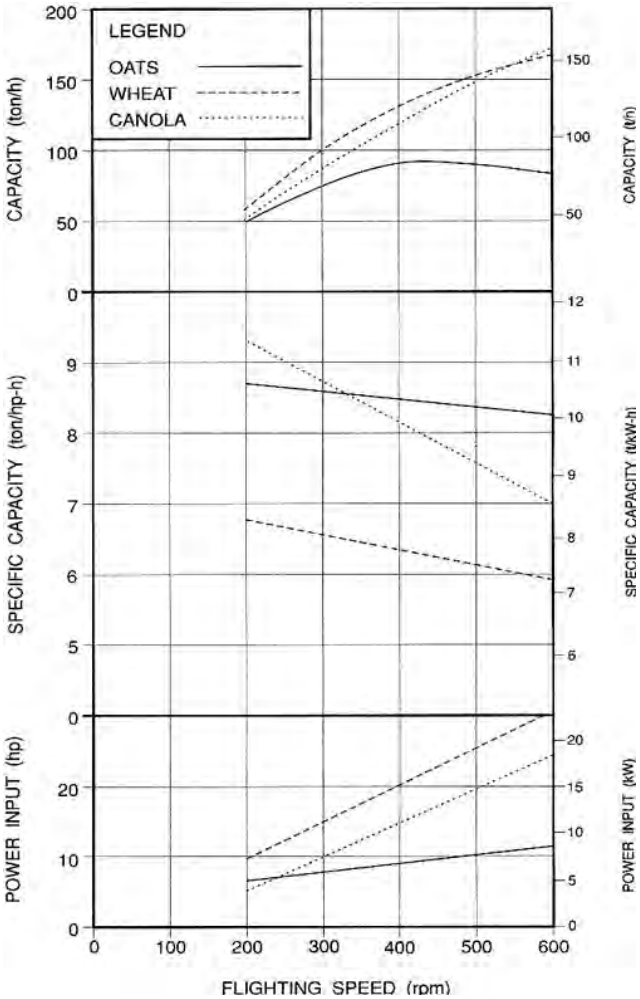


FIGURE 2. Capacity, Specific Capacity and Power Requirements for various flighting speeds at 30° elevation angle (dry grain).

EASE OF OPERATION AND ADJUSTMENT

Discharge Height: The discharge height (FIGURE 3) could be varied from 11.0 to 32.1 ft (3.4 to 9.8 m) with the hydraulic lift mechanism. Corresponding elevation angles varied from 11.5° to 40°. See TABLE 2.

The auger discharge height could be easily adjusted from the tractor seat. An in line ball valve was provided in the hydraulic hose feeding the cylinder to lock the auger tube at the desired elevation.

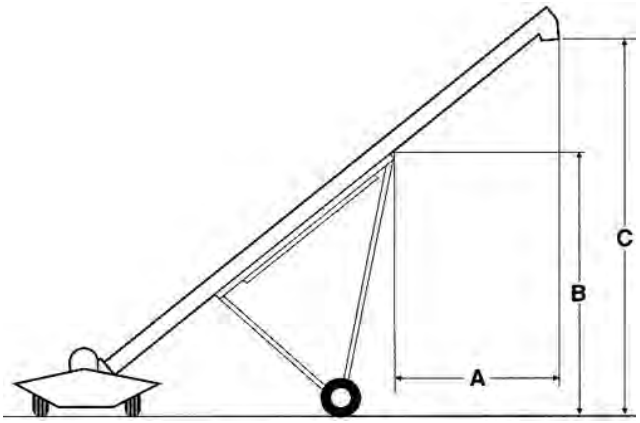


FIGURE 3. Dimensions: (A) Horizontal Reach (B) Bin Eave Clearance (C) Discharge Height.

Auger Reach: The bin eave clearance and horizontal reach (FIGURE 3) of the Flexi-coil 10-50 are shown in TABLE 2. Bin eave

clearance, measured from the ground to the auger tube at the foremost part of the undercarriage, varied from 8.5 ft (2.6 m) at 11.5° to 15.8 ft (4.8 m) at 40°. The reach, measured from the foremost part of the undercarriage to the centre of the discharge, varied from 10.7 ft (3.3 m) at 11.5° to 21.1 ft (6.4 m) at 40°.

TABLE 2. Reach, Clearance, and Discharge Height at Various Elevations

Angle	A Horizontal Reach		B Bin Eave Clearance		C Discharge Height	
Degrees	ft	m	ft	m	ft	m
11.5 (min)	10.7	3.3	8.5	2.6	11.0	3.4
20	13.0	4.0	12.5	3.8	17.0	5.2
30	17.5	5.3	15.4	4.7	25.2	7.7
40 (max)	21.1	6.4	15.8	4.8	32.1	9.8

Operation: Ease of operation was very good. The Flexi-coil 10-50 was easily manoeuvred and positioned at the loading/unloading site.

The hydraulically powered auger tube adjustment for height was very easy to operate. The adjustments for auger tube height were carried out from the operator's station on the tractor.

The Flexi-coil was equipped with an optional reverse mechanism that reversed the direction of rotation of the flighting so the auger tube could be cleaned out completely.

The Flexi-coil 10-50 was equipped with a large inlet hopper. The hopper was equipped with a clean out door on the bottom of the hopper to allow thorough clean out.

Hitching: Ease of hitching the Flexi-coil 10-50 was very good. Hitching consisted of lifting the inlet end of the auger to correspond with the drawbar of the tractor and inserting a suitably sized pin. Once the auger was connected to the drawbar the implement jack was removed. The power shaft on the auger was connected to the PTO shaft of the tractor and two hydraulic hoses were connected to the remote couplers of the tractor to complete hitching. The Flexi-coil 10-50 was not supplied with a safety chain for the hitch.

Manoeuvrability: Ease of manoeuvring was very good. The Flexicoil 10-50 was designed as a tractor implement. It could be transported, raised, positioned and operated from the tractor seat. The large hitch weight of 370 lbs (184 kg) made moving the auger by hand impractical. It was difficult to judge the distances between the auger outlet and obstructions due to the auger's length.

Transportability: Ease of transporting the Flexi-coil 10-50 was very good. The auger transported well and was stable at normal agricultural implement speeds. The auger was equipped with 10 mph (16 km/h) rated tires.

The inlet end of the auger could be raised and lowered hydraulically for transport. The auger was prepared for transport by hydraulically lifting the auger inlet and installing the safety lock on the hitch hydraulic cylinder.

The auger was supplied with an adjustable, hydraulically controlled hitch. The operator should use a suitable hitch pin and safety chain to prevent accidental unhitching when travelling on public roads. The optional transfer auger was attached to the axle spreader bar of the main auger for transporting (FIGURE 4). The transfer auger towed true to the main auger but tended to bounce on rough roads.

Clearance under power lines was ample when fully lowered. The transport height was 10.7 ft (3.3 m).

Figure 4. Transport position for transfer auger.

Transfer Auger: Ease of operating the optional transfer auger was very good. The optional transfer auger was adjustable for height and offered adjustments that ranged from horizontal to 8 inches (200 mm) above horizontal. The transfer auger was not attached to the main auger and allowed a large degree of latitude for auger set-up. The transfer auger was useful for unloading hopper bottom bins or trucks with belly dumps.

Lubrication and Maintenance: Ease of lubrication was very good. The six grease pressure nipples were easy to get at. The operator's manual provided a maintenance schedule and lubrication chart.

POWER REQUIREMENTS

Power requirements for the main auger in dry wheat (FIGURE 2) ranged from 8 to 28 hp (6 to 21 kW). The Flexi-coil 10-50 required a tractor with a PTO shaft capable of 540 rpm and dual remote hydraulics capable of 1500 psi (10.3 MPa). The Flexi-coil required a tractor with a PTO shaft capable of 540 rpm and at least 40 hp (30 kW).

Damp Grain: No specific testing of damp grain was carried out for the Flexi-coil 10-50. However, tests with similar augers of this size generally show that power requirements increase and capacities decrease as moisture content rises. These tests are summarized in TABLE 3. If augers are used to move damp grain the power source should be sized accordingly.

TABLE 3. Capacity and Power Requirements in Damp Grain for Grain Augers (300 elevation)

Grain (Moisture Content)	Peak Capicity as % of Capacity in Dry Grain	Power Requirements as % of Power Required in Dry Grain
Wheat (20% MC)	65	150
Corn (30% MC)	70	130
Canola (15% MC)	90	105

OPERATOR SAFETY

Operator safety was very good. The Flexi-Coil 10-50 met current standards for safety in respect to grain augers. It was safe to operate if normal precautions were observed. Safety decals were provided, alerting the operator to potentially dangerous areas. Shielding was provided for all rotating shafts. An adequate inlet safety guard was provided. All capacities were measured with this inlet safety guard in place.

OPERATOR'S MANUAL

The operator's manual was excellent. It contained information on: safety, general information, operation, maintenance, trouble shooting, adjustments, specifications, assembly, options, and parts. The manual was well written, organized, and illustrated.

MECHANICAL HISTORY

The Flexi-coil 10-50 auger was operated for about 30 hours. No mechanical problems arose during the test.

APPENDIX I
SPECIFICATIONS

MAKE:	Flexi-coil
MODEL:	10-50
SERIAL NUMBER:	GAIO ADO-V031447
OVERALL DIMENSIONS:	
-- Transport Length	58.3 ft (17.8 m)
-- Field Width	9.9 ft (3.0 m)
-- Transport Width	9.9 ft (3.0 m)
-- Transport Height	10.7 ft (3.3 m)
DRIVE:	
Main Auger:	
-- 540 rpm Tractor Power Take-Off	
-- Direct Drive	
-- Power Take - off to Flighting	
-- Speed Ratio	1:1
Intake Feed Auger (Optional):	
-- Hydraulic Motor Displacement	4.3 in^3 (70.5 cm^3) per rev
-- Motor to Flighting Speed Ratio	1:1
LUBRICATION:	
-- Pressure Grease Fittings	6
-- Sealed Bearings	3
-- Packed Wheel Bearings	2 Sets (1 set per wheel)
-- Gearboxes	1 reverse gear
-- Universal Joints	1 double cardan (constant velocity)
AUGER TUBE:	
-- Inside Diameter	9.8 in (250 mm)
-- Material Thickness	0.12 in (3 mm)
-- Discharge Spout Diameter	9.8 in (250 mm)
FLIGHTING:	
-- Diameter	9.0 in (230 mm)
-- Pitch	Double cupped in hopper
-- Exposed Length	19 in (483 mm)
-- Thickness	
-Inner	0.196 in (5.0 mm)
-Outer	0.098 in (2.5 mm)
INLET SAFETY GUARD:	
-- Material Dimensions	0.25 in (6.3 mm)
-- Overall Size	27 x 16 in (691 x 425 mm)
-- Grill Openings	2.8 x 2.6 in (70 x 66 mm)
-- Maximum Open Area	7.2 in^2 (4620 mm^2)
-- Maximum Open Dimension	3.8 in (97 mm)
LIFT MECHANISM:	
-- Type	Hydraulic Cylinder and Cables
-- Cylinder Size	4 in (100 mm) diameter 32 in (813 mm) stroke
WEIGHT:	
-- Minimum Elevation	
-Right Wheel	692 lb (314 kg)
-Left Wheel	797 lb (362 kg)
-Hitch	406 lb (184 kg)
TOTAL	1895 lb (860 kg)
TIRES:	
-- Size	6.70 - 15
-- Number	2
TRANSFER AUGER:	
-- Size	6.70 - 15
-- Number	2

APPENDIX II
PERFORMANCE WITH STANDARD TEST MATERIAL

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

FIGURE 5 gives the capacity, specific capacity and power requirements for the Flexi-coil 10-50 in a standard test material. This data may be used for comparison of different grain augers.

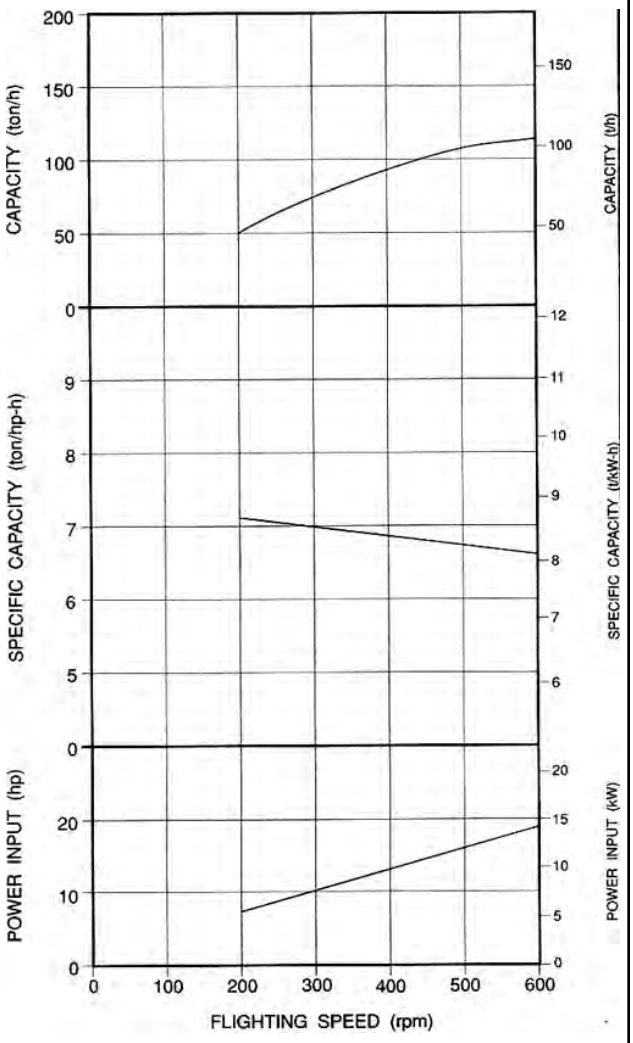


FIGURE 5. Capacity, Specific Capacity and Power Requirements with a standard test material at 30° elevation angle.

APPENDIX III
MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

Excellent	Fair
Very Good	Poor
Good	Unsatisfactory

SUMMARY CHART

FLEXI-COIL 10-50 GRAIN AUGER

RETAIL PRICE	$5518.00 (July 1991, f.o.b. Portage la Prairie, MB)
RATE OF WORK	
Capacity at 300	
- Dry Wheat (13% MC)	5720 bu/h (149 t/h)
- Standard Material	5090 bu/h (102 t/h)
QUALITY OF WORK	**Very Good;** less than 0.2% damage for each pass through
EASE OF OPERATION AND ADJUSTMENT	
Discharge Height	11.0 to 32.1 ft (3.4 to 9.8 m)
Auger Reach	
- Bin Eave Clearance	8.5 to 15.8 ft (2.6 to 4.8 m)
- Reach	10.7 to 21.1 ft (3.3 to 6.4 m)
Operation	**Very Good;** easily positioned
Manoeuvrability	**Very Good;** raised, positioned and operated from tractor seat
Transportability	**Very Good;** stable at speeds of 30 mph (50 km/h) on paved highways and gravel roads
Transfer Auger	Useful for unloading hopper bins or trucks with belly dumps
Lubrication and Maintenance	**Very Good;** six grease fittings
POWER REQUIREMENTS	8 to 28 hp (6 to 21 kW)
OPERATOR SAFETY	**Very Good;** was safe to operate
OPERATOR'S MANUAL	**Excellent;** well written & organized
MECHANICAL HISTORY	No problems during test

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