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# Evaluation Report

# 572



## Flexi-coil System 95 Harrow Packer Drawbar

A Co-operative Program Between



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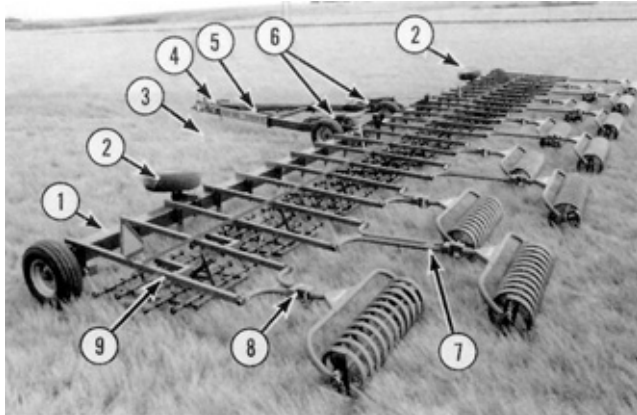
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

**FLEXI-COIL SYSTEM  
95 HARROW PACKER DRAWBAR**

**MANUFACTURER AND DISTRIBUTOR:**

Flexi-coil Ltd.  
P.O. Box 1928  
Saskatoon, Saskatchewan  
S7K 3S5

**RETAIL PRICE:** \$21,514.00 (March, 1988, f.o.b. Lethbridge, Alberta for a 60 ft (183 m) width unit complete with 5 ft. (1.5 m) five bar straight tire harrows, 1.5 in (38 mm) square bar coil packers, walking beam axles and tires and setup.)



**FIGURE 1.** Flexi-coil System 95 Harrow Packer Drawbar: (1) Boom, (2) Transport Wheels, (3) Wing Draw Cable, (4) Cable Pivot Arm Latch, (5) Wing Cable Pivot Arm, (6) Lift Cylinders, (7) Long Packer Draw, (8) Short Packer Draw, (9) Harrow Support Arm.

**Mechanical History:** Few mechanical problems occurred during the evaluation. The right wing transport wheel blew during transport, and one packer separated from the packer drawbar.

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*Project Engineer: K. Shimek*

**GENERAL DESCRIPTION**

The Flexi-coil System 95 is a 60.7 ft (18.5 m) wide harrow packer drawbar for use in seedbed preparation and soil finishing after seeding.

The System 95 consists of twelve 5 ft (1.5 m) harrows equipped with double straight tine teeth, and twelve 5 ft (1.5 m) steel coil packers that produce a packing force of 104 lb/ft (1550 N/m) of width. The harrow sections are hung from the harrow support arms by chains while the packer draws are attached to the ends of the lift arm with swivel connectors. The packers are in two rows of 6 each and are preceded by a gang of tine harrows. A U-joint connector is located between the drawbar and each packer to allow free movement of the packer sections. Dual hydraulic cylinders, mounted on the mainframe, raise the harrows and packers into transport position and release a latch mechanism on the wing cable pivot arm. Releasing the pivot arm allows the wings to fold rearward for transport position as the machine is driven forward.

The system 95 is available in 30, 40, 50, 60, 70 and 80 ft (9.1, 12.2, 15.2, 18.4, 21.3 and 24.4 m) widths. Additional optional equipment include single or walking beam axles, choice of harrows (five bar straight, five bar bent, four bar straight, four bar bent or parallel bar), 100 lb/ft (1490 N/m) or 130 lb/ft (1940 N/m) packer coils, spray attachments (choice of tank size, pumps, tips and nozzle bodies) and field sprayer conversion kit.

FIGURE 1 shows the location of major components while detailed specifications are given in APPENDIX 1.

**SUMMARY AND CONCLUSIONS**

**QUALITY OF WORK**

**Quality of Work:** The performance of the System 95 was very good under most conditions encountered when adjusted to spread trash and to level the soil surface. Performance of the harrows was very good. Plugging of the harrows occurred when operating in heavy trash conditions at steep harrow tine angles. The harrows levelled rough surfaces well, broke loose soil lumps, and trailed well on sharp turns.

The packers performance was very good in all field conditions. The packers trailed well during sharp turns. The packing force was suitable for creating a firm seedbed.

**Ease of Operation and Adjustment:** The transport stability and maneuverability of the Flexi-coil System 95 was very good. The unit was easily folded or unfolded. Hitching to the Flexi-coil System 95 was very good and convenient in both field and transport position if the jack stands provided were properly used.

Adjustment of the harrow tine angle was very good and could be performed without tools.

**Power Requirements:** A tractor with a maximum power take-off rating of 116 hp (86 kW) was required to operate the 60 ft (18.3 m) unit.

**Operator Safety:** Caution was required to ensure that the hitch jack stands were in place before unhooking from a tractor. The jack stands prevented the hitch from lifting up and causing possible injury to the operator.

**Operator's Manual:** The operator's manual was very good and included assembly, safety, lubrication and maintenance instructions, as well as a complete parts list.

**SCOPE OF TEST**

The Flexi-coil System 95 was operated in the field conditions shown in TABLE 1 for 119 hours while processing about 3190 ac (1276 ha). The 60 ft (18.3 m) System 95 was evaluated for quality of work, ease of operation and adjustment, power requirements and safety. The harrow packer drawbar was used predominantly for seedbed finishing after seeding with air seeders.

**TABLE 1.** Operating Conditions.

FIELD CONDITION	HOURS	FIELD AREA	
		Light Trash ac (ha)	Heavy Trash ac (ha)
Loam	41	610 (244)	530 (212)
Sandy Loam	33	930 (372)	
Clay Loam	24	600 (240)	160 (64)
Silty Loam	19	320 (128)	
Silty Clay Loam	2	40 (16)	
Totals			690 (276)

**RESULTS AND DISCUSSION**

**QUALITY OF WORK**

**Soil Finishing:** Performance of the System 95 harrow packer drawbar was very good. The five bar spring tine harrows were effective in smoothing surface ridges, spreading loose trash and breaking soil lumps. The steel coil packers further served to level the soil and break soil lumps. The harrows were effective in uprooting and exposing weeds loosened by a cultivator. Soil ridges formed by the packer coils ranged in depth from 1.3 in (33 mm) in soft soil conditions to 1 in (25 mm) in firmer soil.

Shown in FIGURE 2 is a stubble field seeded with an air seeder as the, first spring operation, both before and after soil finishing with the System 95 harrow packer drawbar. FIGURE 3 shows a summerfallow field seeded with an air seeder as a second operation both before and after soil finishing with the harrow packer drawbar.

Harrow and packer soil levelling effectiveness was increased when the System 95 was operated at an angle to the direction of seeding. Double packing cultivated fields in different directions from each other resulted in a very smooth field surface. The amount and direction of harrow packing depends on soil type and field conditions.



FIGURE 2. Stubble Field Seeded with an Air Seeder as the First Spring Operation. (Left: Before Soil Finishing, Right: After Soil Finishing).

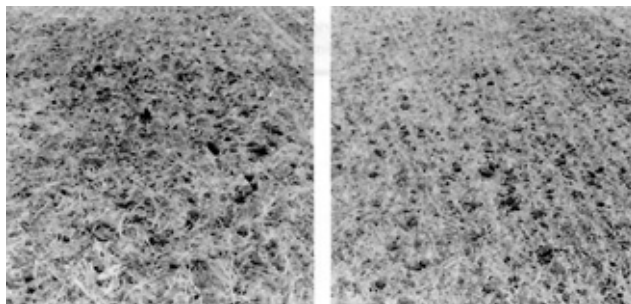


FIGURE 3. Summerfallow Field Seeded with an Air Seeder as a Second Operation (Left: Before Packing, Right: After Packing).

**Harrows:** Performance of the harrows was very good for most field conditions encountered. Although the straight spring tine teeth were less aggressive in soil finishing than forward bent tine teeth, they tended to collect less trash. The harrow tine angle was fully adjustable and the tines could be adjusted to clear the loose trash under most dry conditions. When fully plugged, the harrows could easily be cleaned by raising the harrows with the transport cylinders. The harrow sections were properly aligned and coverage was assured, even on sharp turns.

**Packing:** Performance of the packers was very good in the conditions encountered. Packing force of the 1.5 in (38.1 mm) square coil packers was approximately 104 lb/ft (1550 N/m). This packing force was adequate to form a firm seedbed for good crop emergence. Coverage by the coil packers was even and packer alignment was maintained when turning. In moist conditions, care had to be taken to avoid overpacking of the seedbed.

**Skewing and Stability:** Stability of the System 95 was very good. Sideways skewing was not a serious problem in normal field conditions. Normal allowance had to be made to maintain implement placement for consecutive passes in hilly conditions.

#### EASE OF OPERATION AND ADJUSTMENT

**Transporting:** The ease of folding, unfolding and transporting the System 95 was very good. The unit was placed into transport position (FIGURE 4), using the hydraulic cylinders provided, in about four minutes. The hydraulic cylinders rotated the boom

90 degrees, lifting the harrow support arms which raised both the harrows and packers off the ground. As the booms rotated, the transport wheels were lowered to the ground and the cable latch was disengaged. Driving the implement ahead slowly, caused the wing cable pivot arm to swing upwards, allowing the wings to fold rearward for transport position.

Changing from transport to field position with the System 95 was a simple matter of backing the unit while maintaining proper mainframe section alignment. This action allowed the wings to fold out into field position evenly. The wing cable pivot arm swung down automatically when the wings were completely folded out. The cable pivot arm latch locked as the hydraulic cylinders lowered the harrows and packers to the ground. Driving ahead slowly while lowering the unit was necessary to allow the packer sections to trail out behind the harrow sections. Failure to pull ahead while lowering the unit would cause packer sections to fold under the harrows.

Overall transport width was 13.3 ft (4.0 m) while transport height was 10.6 ft (3.2 m). The 60 ft (18.3 m) unit towed well at normal transport speeds. In transport position, a turning radius of 34 ft (11.2 m) permitted easy negotiation of most 90 degree corners encountered.



FIGURE 4. Flexi-coil System 95 in Transport Position.

#### QUALITY OF WORK

**Hitching:** Ease of hitching was very good. The System 95 had a negative hitch weight of 190 lb (846 N) in transport position and 270 lb (1202 N) in field position. A jack stand mounted at the front of each boom frame, allowed the unit to be conveniently hitched and unhitched in both field and transport positions. Hitching convenience was increased by the fact that the hitch link remained horizontal when unhitched from the tractor. Hitching also required the hook-up of two hydraulic lines to the tractor's remote outlets.

**Harrow Tine Angle Adjustment:** The harrow tine angle adjustment was very good and easily changed to one of six positions without the use of tools. The six positions provided adequate adjustment for all conditions encountered.

**Maintenance:** Ease of performing routine maintenance on the System 95 was very good. Operating instructions recommended daily lubrication of the 10 grease fittings on the boom. The 24 fittings on the packer draw swivels required greasing every 20 hours. The 24 grease fittings on the packer axle bearings as well as the wheel bearings required lubrication annually.

#### POWER REQUIREMENTS

**Draft:** Average draft for the 60 ft (18.3 m) System 95 harrow packer drawbar ranged from 2680 to 4310 lb (12 to 19 kN) at speeds ranging from 4.5 to 7.5 mph (7 to 12 km/h) in a preworked stubble field with average trash cover.

Maximum draft occurred at the steepest harrow angle setting and minimum draft occurred at the lowest harrow angle setting. This was due to a greater amount of trash being dragged by the harrows as well as increased tine aggressiveness at the steeper harrow angle setting.

**Tractor Size:** Field power measurements indicated that a tractor with a maximum power take-off rating of 116 hp (86 kW) was required to operate the 60 ft (18.3 m) harrow packer drawbar on level ground at normal field speeds for an intermediate

harrow angle setting. This tractor size has been adjusted to include tractive efficiency and the tractor operating at 80% of maximum power on a level field.

**OPERATOR SAFETY**

Caution was required when unhooking the System 95 from the tractor to ensure the rear hitch jacks were in position to hold the hitch down as the tractor pulled away. Failure to adjust the jacks to the proper height could result in the hitch lifting up, causing possible operator injury. Caution was also required when walking around the wing cables with the unit in field position. The cables were suspended 2.0 ft (0.7 m) above the ground and were difficult to see in poor light conditions. Mechanical transport locks for the lift cylinders were supplied.

The System 95 was 13.3 ft (4.0 m) wide in transport position. This necessitated caution when towing on public roads, over bridges and through gates.

**OPERATOR'S MANUAL**

The operator's manual was very good and included information on assembly, safety, operating instructions, lubrication, maintenance and complete parts list.

**MECHANICAL HISTORY**

TABLE 2 outlines the mechanical history of the Flexi-coil System 95 during 119 hrs of field operation. The intent of the test was evaluation of functional performance. An extended durability evaluation was not conducted.

TABLE 2. Mechanical History

ITEM	OPERATING HOURS	EQUIVALENT FIELD AREA	
		ac	(ha)
The pillow blocks on a packer axle broke and were replaced at	111	2755	(1110)
The jack stands were bent and repaired at	111	2755	(1110)
The right transport tire blew and was replaced at	119	2975	(1190)

**DISCUSSION OF MECHANICAL PROBLEMS**

**Tire Blowout:** The right boom frame had a 5 degree twist in it (FIGURE 5) causing the right transport wheel to have excessive camber. This in turn caused the tire to wear excessively (FIGURE 6) and eventually blowout. The problem was identified by the manufacturer as a misalignment during fabrication. Corrections were made to the jigs in the spring of 1987 to ensure future models would not have this problem. The manufacturer updated the machine at the end of the test.

**Packer Pillow Blocks:** The pillow blocks on one packer broke causing the packer to separate from the packer draw (FIGURE 7). This occurred just after completing a sharp turn on a slope. The problem may also have been compounded by loose pillow block mounting bolts.



FIGURE 6. Excessive Tire Wear.



FIGURE 7. Upper: Packer Separation from Packer Draw, Lower: Broken Pillow Block.

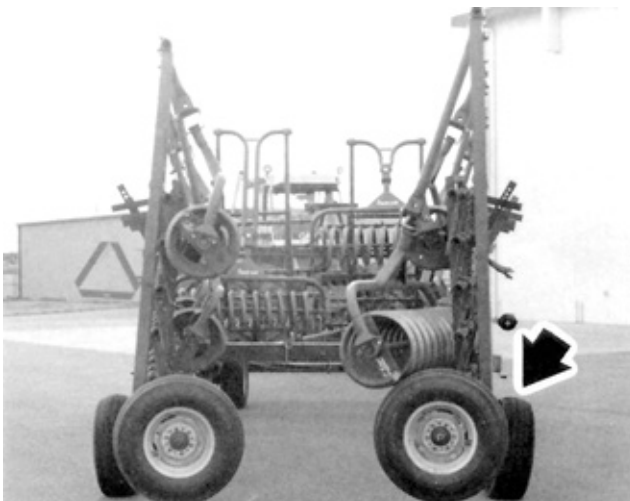


FIGURE 5. Excessive Camber in Right Transport Wheel.

**APPENDIX I**

**SPECIFICATIONS**

**MAKE:** Flexi-coil Harrow Packer Drawbar  
**MODEL:** System 95  
**SERIAL NUMBER:** S95-A000-H017002  
**MANUFACTURER:** Flexi-coil Ltd.  
 P.O. Box 1928  
 Saskatoon, Saskatchewan  
 S7K 3S5

	<u>FIELD POSITION</u>	<u>TRANSPORT POSITION</u>
- width	60.7 ft (18.5 m)	13.3 ft ( 4.1 m)
- length	36.2 ft (11.0 m)	46.2 ft (14.1 m)
- height	3.25 ft ( 1.0 m)	10.6 ft ( 3.23 m)
- minimum ground clearance		8.75 in (222 mm)
- wheel tread	59.5 ft (18.1 m)	10.4 ft (3.2m)

**PACKERS:**

- type coiled steel, 1.5 in (38 mm) square
- number 12
- width 5 ft (1.5 m)
- coil diameter 18.25 in (464 mm)
- coil pitch 5.5 in (140 mm)
- rows 2
- weight/unit 520 lb (234 kg)

**HARROWS:**

- type double tine straight tooth
- number 12
- rows of tines 5
- row spacing 11 in (280 mm)
- tine spacing 7.25 in (185 mm)
- tine length 14.5 in (368 mm)
- tine diameter 0.375 in (10 mm)

**HITCH:**

- vertical adjustable range 4.5 in (114 mm)

**FRAME:**

- main frame 4 x 8 in (102 x 203 mm)
- boom 8 x 8 in (203 x 203 mm)

**TIRES:** eight, 11L x 15, 8 ply

	<u>FIELD POSITION</u>	<u>TRANSPORT POSITION</u>
- right mainframe	2260 lb (1020 kg)	3210 lb (1460 kg)
- left mainframe	2390 lb (1080 kg)	3280 lb (1490 kg)
- right wing	950 lb (428 kg)	3460 lb (1560 kg)
- left wing	980 lb (441 kg)	3450 lb (1550 kg)
- hitch	-270 lb (-122 kg)	-190 lb (-85 kg)
Total	6310 lb (2850 kg)	13210 lb (6000 kg)

**SERVICING:**

- grease fittings 56
- wheel bearings 8

**SUMMARY CHART  
 FLEXI-COIL SYSTEM 95 HARROW PACKER  
 DRAWBAR**

<b>RETAIL PRICE:</b>	\$21,514.00 (March, 1988, f.o.b. Lethbridge for a 60 ft (18.3 m) width unit complete with five bar straight tine harrows, 1.5 in (38 mm) square bar coil packers, walking beam axles and tires)
<b>QUALITY OF WORK:</b>	
Soil Finishing	<b>very good;</b> effective smoothing levelling
Packing	<b>very good;</b> packing force of 104 lb/ft (1550 N/m)
Skewing and Stability	<b>very good;</b> packers and harrows tracked well
<b>EASE OF OPERATION AND ADJUSTMENT:</b>	
Transporting	<b>very good;</b> convenient to fold and unfold
Hitching	<b>very good;</b> negative hitch weight compensated by two jack stands
Tine Adjustment	<b>very good;</b> easily adjusted to one of six positions
<b>POWER REQUIREMENTS:</b>	116 PTO hp (86 kW) tractor
<b>OPERATOR SAFETY:</b>	safe; if normal precautions observed
<b>OPERATOR'S MANUAL:</b>	<b>very good;</b> contained useful information, parts list provided
<b>MECHANICAL HISTORY:</b>	right transport wheel blew due to improper camber on wheel

**APPENDIX II  
 MACHINE RATINGS**

The following rating scale is used in PAMI Evaluation Reports:

- Excellent
- Very Good
- Good
- Fair
- Poor
- Unsatisfactory



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