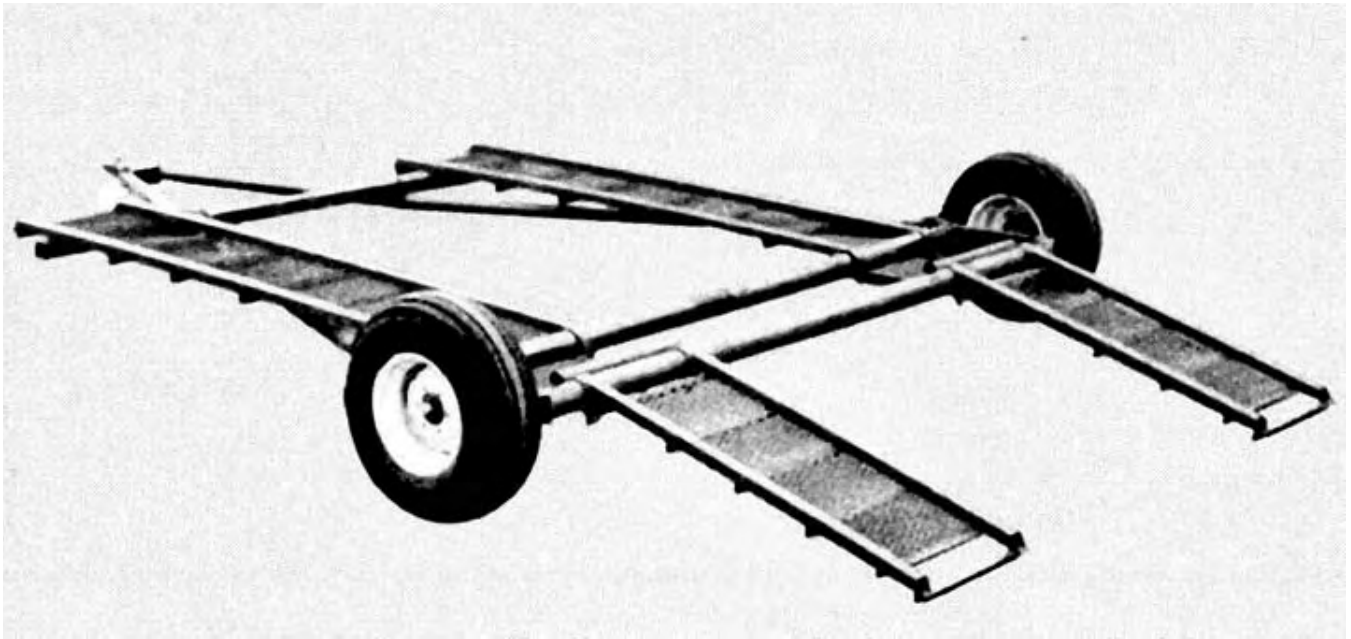


# Evaluation Report

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## Flexi-coil Windrower Transporter

A Co-operative Program Between



## FLEXI-COIL WINDROWER TRANSPORTER

### MANUFACTURER AND DISTRIBUTOR:

Flexi-coil Ltd.  
2326 Millar Avenue  
Saskatoon, Saskatchewan  
S7K 3R3

### RETAIL PRICE:

\$995.00 (January, 1978, f.o.b. Portage la Prairie with 11L x 15, 6-ply tires and double castor wheel beds).

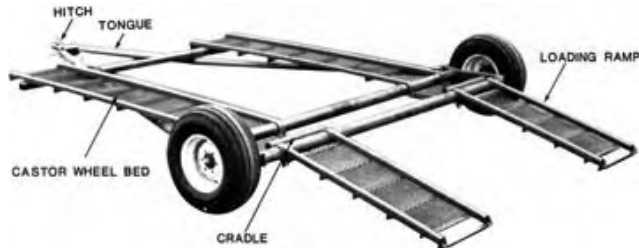


FIGURE 1. Flexi-coil Transporter.

### SUMMARY AND CONCLUSIONS

Overall functional performance of the Flexi-coil windrower transporter was excellent as a full carrying transporter and very good as a towing transporter. Maneuverability, ease of loading and ease of unloading were very good.

The Flexi-coil transporter was easily towed with a one-half ton truck in most conditions, however, a heavier towing vehicle with suitable brakes would be preferable.

When used as a carrying transporter, suitable speeds ranged up to 15 km/h (10 mph) on rough roads, 65 km/h (40 mph) on smooth gravel highways and 80 km/h (50 mph) on paved roads provided the machine was fitted with appropriate tires. When used as a towing transporter, speeds up to 40 km/h (25 mph) were possible without excessive sway or bounce, but speeds were usually limited from 15 to 30 km/h (10 to 20 mph) due to shimmy of the windrower castor wheels.

The Flexi-coil was compatible with all common self-propelled windrowers.

The tire load rating permitted safe transport of 1540 kg (3400 lb) of weight at speeds up to 30 km/h (20 mph). Agricultural implement tires are not recommended for speeds above 30 km/h (20 mph). This meant that most windrowers could be safely transported at speeds up to 15 km/h (10 mph) and some could be transported at speeds up to 30 km/h (20 mph). Tires were overloaded by 62% when transporting one large windrower at 30 km/h (20 mph).

The ball and socket hitch was rated for a gross weight less than 1590 kg (3500 lb). Depending upon windrower weight, the hitch was overloaded from 50 to 87% when transporting commonly used windrowers.

Rear visibility was obstructed when towing windrowers with a small truck. Transport width was determined by the windrower header width. As a result, the operator should install suitable signal devices when transporting on public roads.

Only minor mechanical problems occurred during functional evaluation and load testing.

### RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to eliminate permanent deformation of the tongue when used as a full carrying transporter.
2. Increasing the hitch connector load capacity and supplying approved hitch safety chains as standard equipment.
3. Supplying a hitch jack.
4. Supplying safety recommendations with the transporter, outlining items such as tire load ratings, tire pressures, maximum transport speeds, the use of slow moving vehicle signs and other pertinent safety considerations.

Chief Engineer -- E.O. Nyborg

Senior Engineer -- J.C. Thauberger

Project Engineer -- S.T. Enns

### THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. A stronger and stiffer A-frame hitch is planned for 1978 production.
2. A heavier coupling hitch and safety chains are included on the 1978 model.
3. A crank jack with swivel mount will be included on the 1978 production models.
4. Additional safety recommendations and operational considerations are to be added to the present safety decal. An increase in the tire load capacity is planned.

### GENERAL DESCRIPTION

The Flexi-coil (FIGURE 1) is designed for transporting self-propelled windrowers and may be used either as a towing or a full carrying transporter. The 3.2 m (10.5 ft) wide cradle is supported by two wheels and an A-frame hitch.

When used as a towing transporter, windrowers are driven forward, up self-raising ramps until the drive wheels rest in the cradle. They are then towed with the windrower castor wheels trailing on the ground. The loading ramps are adjustable to accommodate various windrower tread widths.

Two optional castor wheel beds may be attached to the frame to convert the Flexi-coil to a full carrying transporter. In full carrying mode, windrowers are backed onto the carrier with the castor wheels on the castor wheel beds and the drive wheels in the cradle.

Detailed specifications are given in APPENDIX I.

### SCOPE OF TEST

The Flexi-coil was operated over a wide range of conditions, from rough field trails to paved roads while transporting a variety of self-propelled windrowers over a distance of about 520 km (325 mi) as a full carrying transporter and 40 km (25 mi) as a towing transporter. It was evaluated for ease of operation, and operator safety. In addition, it was subjected to a dynamic load test<sup>1</sup> on an obstacle track.

### RESULTS AND DISCUSSION

#### EASE OF OPERATION

**Hitching:** The Flexi-coil was equipped with a ball and socket hitch. No hitch jack was provided. The unloaded hitch weight was 110 kg (212 lb) necessitating use of a jack.

**Towing Vehicle:** For most field and road conditions, the loaded transporter could readily be towed with a one-half ton truck when used either as a towing or full carrying transporter. Although a one-half ton truck may have adequate power to easily transport a windrower, it may not have adequate brakes or weight for emergency situations that may occur during high-speed transport or on hills.

**Loading:** It was easy to load a windrower on the Flexi-coil when used either as a trailing or carrying transporter. The transporter first had to be hitched to a suitable towing vehicle, the loading ramps lowered and the loading ramp and castor wheel bed spacing adjusted to match the windrower wheel tread. Loading ramps and castor wheel beds were easily positioned manually. No tools were needed.

When used as a towing transporter, windrowers are driven forward up the ramps until the drive wheels drop into the cradle, causing the ramps to automatically raise off the ground (FIGURE 2). All windrowers had ample table lift to clear the transporter wheels during loading.

When used as a full carrying transporter, windrowers are backed onto the carrier, with the castor wheels supported by the castor wheel beds, until the drive wheels drop into the cradle (FIGURE 3). Loading ramps automatically raise off the ground under the windrower header. It was important that the windrower drive train be in good condition when attempting to back onto the carrier. Poor handling windrowers might easily be backed off the castor wheel beds.

Windrower drive wheels seated firmly in the cradle with little possibility of them coming out during transport. It is recommended, especially for windrowers with large drive wheels, that the operator

<sup>1</sup>PAMI T771, Detailed Test Procedures for Windrower Transporters

secure the wheels to the cradle for transport on public roads. The cradle was wide enough to accommodate all conventional self-propelled windrowers.



FIGURE 2. Flexi-coil used as a Trailing Transporter.



FIGURE 3. Flexi-coil used as a Full Carrying Transporter.

No interference occurred between the windrowers and the raised loading ramps in either mode of use.

**Transporting:** When used as a full carrying transporter, the Flexi-coil transported well at speeds up to 15 km/h (10 mph) on rough roads, 65 km/h (40 mph) on smooth gravel highways and 80 km/h (50 mph) on paved roads. Transporter bounce and stability, in full carrying mode, depended upon the type of windrower transported. For most windrowers, transporter swaying was not a problem, as the hitch weight was substantial. For one windrower, which had an exceptionally heavy header, the transporter began to sway at speeds from 40 to 55 km/h (25 to 35 mph). Although high transport speeds are possible when used in the full carrying mode, the operator is cautioned that agricultural implement tires are not recommended for speeds above 30 km/h (20 mph).

When used as a trailing transporter, the Flexi-coil transported well at speeds up to 15 km/h (10 mph) on rough roads and 40 km/h (25 mph) on smooth roads. On rough roads, transport speed was limited by machine bounce while on smooth roads transporter swaying sometimes occurred at speeds above 40 km/h (25 mph). In most instances, transport speed was limited by shimmy of the windrower castor wheels.

No trailing problems occurred while towing the unloaded transporter at high speeds. The loading ramps remained folded and did not bounce excessively.

**Maneuverability:** The loaded transporter was very maneuverable in both modes of use. Sharp turns and backing were easy. The width of the windrower table established the transport width. As a result, passing vehicles on narrow roads with sharp ditches created problems due both to the overhang of the windrower header and the wide wheel tread of the transporter. Ground clearance was adequate.

**Unloading:** Unloading windrowers, when transported in either mode was usually easy. The loading ramps automatically dropped to the ground as the windrower was driven out of the cradle. Windrowers equipped with 7.50 x 16 drive wheels, or smaller, had difficulty in driving out of the cradle if the cradle was wet with dew or rain. The drive wheels tended to spin rather than climb out of the cradle.

#### OPERATOR SAFETY

The Flexi-coil windrower transporter was safe to operate if normal safety precautions were observed.

Since the transporter is not equipped with brakes, the towing vehicle must have adequate brakes and be heavy enough to be able

to stop safely in emergency situations.

A slow moving vehicle sign is required at the rear of the transporter before transport on public roads. The windrower header obstructs rear visibility when towing with a small truck. Truck brake lights and rear signal lights are obscured by the windrower. It is not practical to recommend to the manufacturer that brake lights, signal lights, or a slow moving vehicle sign be installed on the transporter since these would probably be obscured by the windrower. It must be the operator's responsibility to ensure that adequate signal devices are installed for use on public roads.

The Flexi-coil was equipped with two, 11L x 15, 6-ply agricultural implement tires. Tire manufacturer specifications indicate that the transporter is capable of carrying a 1540 kg (3400 lb) load at a maximum speed of 30 km/h (20 mph). The largest windrower used in the evaluation placed a load of 2500 kg (5510 lb) on the tires resulting in a tire overload of 62% at 30 km/h (20 mph). Tire overloads with smaller windrowers, or at lower transport speeds, were reduced accordingly.

The ball and socket hitch on the Flexi-coil was a SAE Class 2 hitch rated for trailers with a gross weight less than 1590 kg (3500 lb). Depending upon windrower weight, the hitch was overloaded from 50 to 87% when the transporter was used in either mode. No safety chains were provided. It is recommended that the manufacturer consider supplying a heavier hitch coupling and equipping the transporter with approved hitch safety chains.

The unloaded hitch weight was 110 kg (243 lb). It is recommended that the manufacturer supply a hitch jack to improve hitching safety and convenience.

No operating instructions were provided with the Flexi-coil transporter and due to the simplicity of the machine, there may be little need for them. It is however, recommended that safety instructions be supplied to the purchaser. These should include tire and wheel load ratings, maximum transport speeds, tire pressures, recommended size of towing vehicle, attachment of a slow moving vehicle sign and other pertinent safety considerations.

#### DURABILITY RESULTS

TABLE 1 outlines the mechanical history of the Flexi-coil windrower transporter during functional evaluation and dynamic load testing. Since the intent of the test was functional evaluation, an extended durability evaluation was not conducted.

Table 1. Mechanical History

Item	Time of Occurrence
FRAME -the tongue pipe members bowed downward about 40 mm (1.5 in)	during initial use as a full carrying transporter
RAMPS -individual welds attaching the expanded metal grating to the bottom of the loading ramps and castor wheel beds failed causing the grating to stretch	progressively throughout the test

#### DISCUSSION OF MECHANICAL PROBLEMS TONGUE

Permanent deformation of the tongue (FIGURE 4) occurred during initial use as a full carrying transport. No further deformation occurred with continued use or during dynamic load testing. Deformation was caused by inadequate strength of the hitch members to support the loaded castor wheel beds. It is recommended that modifications be considered to eliminate this problem.

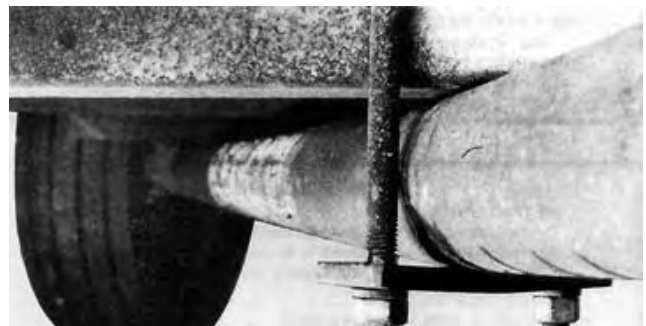


FIGURE 4. Permanent Deformation of Hitch Tongue.

## LOADING RAMPS

Some individual welds attaching the expanded metal grating to the bottom of the loading ramps failed progressively (FIGURE 5) as windrowers were loaded and unloaded.

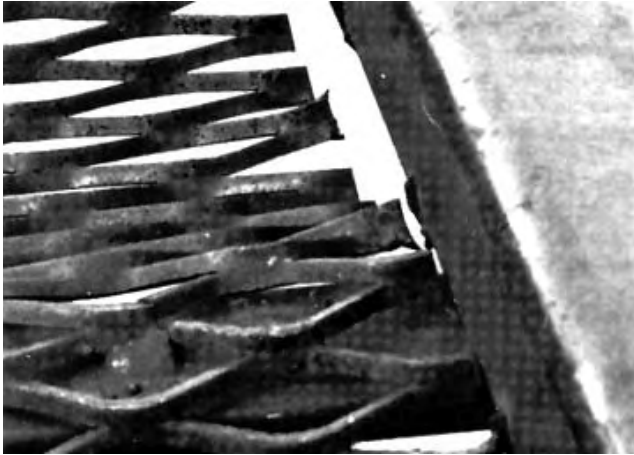


FIGURE 5. Failure of Welds on Loading Ramp Grating.

### APPENDIX I SPECIFICATIONS

<b>Make:</b>	Flexi-coil Windrower Transporter
<b>Serial Number:</b>	0241ST6
<b>Load Rating (based on tires):</b>	1540 kg at 30 km/h (3400 lb. at 20 mph)
<b>Overall Dimensions:</b>	
-- length	4715 mm (186 in)
-- width	3890 mm (153 in)
-- height	780 mm (31 in)
-- ground clearance	250 mm (10 in)
-- wheel tread	3610 mm (142 in)
<b>Cradle:</b>	
-- width	3200 mm (126 in)
-- opening	520 mm (20.5 in)
-- height	430 mm (17 in)
-- material	101 mm (4 in) round tubing
<b>Loading Ramps:</b>	
-- length	1610 mm (63 in)
-- width	585 mm (23 in)
-- angle	14°
<b>Castor Wheel Support Beds (optional):</b>	
-- length	2845 mm (112 in)
-- width	585 mm (23 in)
<b>Tires:</b>	
-- Size	2, 11L x 15, 6-ply
-- load rating (Tire & Rim Assoc.)	950 kg at 30 km/h - 190 kPa (2100 lb at 20 mph - 28 psi)
<b>Hitch:</b>	
-- type	SAE Class 2, 51 mm (2 in) ball and socket
-- gross trailer load rating	1590 kg (3500 lb)
<b>Weight:</b>	
-- hitch point	110 kg (243 lb)
-- wheels	<u>2,360 kg (794 lb)</u>
Total	470 kg (1037 lb)

### APPENDIX II MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

- |              |                   |
|--------------|-------------------|
| a) excellent | b) very good      |
| c) good      | e) poor           |
| d) fair      | f) unsatisfactory |

### APPENDIX III METRIC UNITS

In keeping with the Canadian metric conversion program this report has been prepared in SI units. For comparative purposes, the following conversions may be used:

1 kilometre/hour (km/h)	= 0.62 miles/hour (mph)
1 metre (m) = 1000 millimetres (mm)	= 39.37 inches (in)
1 kilogram (kg)	= 2.2 pounds (lb)
1 kilopascal (kPa)	= 0.15 pounds/inch <sup>2</sup> (psi)



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