

Evaluation Report

585



Midwest 552 Pneumatic Grain Conveyor

A Co-operative Program Between



ALBERTA
FARM
MACHINERY
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CENTRE



PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

MIDWEST 552 PNEUMATIC GRAIN CONVEYOR

MANUFACTURER:

REM Manufacturing Ltd.
 P.O. Box 1207
 Swift Current, Saskatchewan
 S9H 3X4
 Telephone: (306) 773-0644

DISTRIBUTOR:

Manitoba - Co-op Implements
 Saskatchewan - Saskatchewan Wheat Pool
 Alberta - U.F.A. Farm Service

RETAIL PRICE: \$8,500.00 (Oct. 1988, f.o.b. Portage la Prairie, Manitoba)

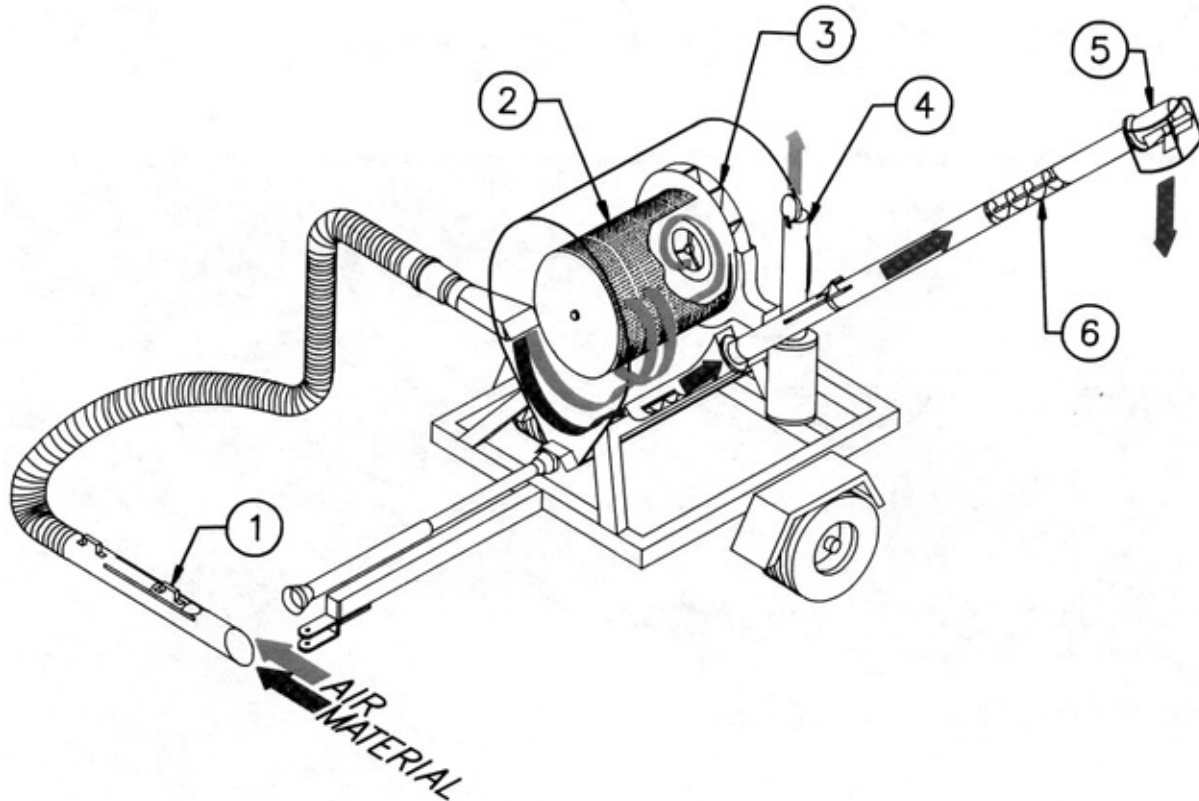


FIGURE 1. Midwest 552 (1) Intake Nozzle, (2) Rotating Screen, (3) Fan, (4) Exhaust, (5) Discharge Air Lock, (6) Discharge Auger.

SUMMARY AND CONCLUSIONS

Rate of Work: The maximum conveying rates for the Midwest 552 were 1719 bu/h (46.9 t/h) in wheat, 2149 bu/h (46.9 t/h) in barley, 1986 bu/h (50.6 t/h) in corn and 3006 bu/h (68.3 t/h) in canola.

Specific capacities were 1.43 ton/hp-h (1.73 t/kW-h) in wheat and 1.39 ton/hp-h (1.68 t/kW-h) in barley.

Quality of Work: Crackage in dry wheat was less than 0.2% for each pass through the Midwest 552. Crackage in canola could be kept to an acceptable level by reducing power-take-off speed.

Ease of Operation and Adjustment: The discharge auger was difficult to fold and unfold. Otherwise the machine was easy to operate and adjust during the test.

Power Requirements: A tractor with a minimum power-take-off rating of 70 hp (52 kW) would have sufficient power to operate the Midwest 552.

Operator Safety: Operator safety was very good. The machine was safe to operate and maintain. The operator should wear ear protection when working with the Midwest 552.

Operator's Manual: The operator's manual was very good. The manual was well written and illustrated and adequate for effective safe machine operation.

Mechanical History: A few minor mechanical problems occurred during the test.

RECOMMENDATIONS:

It is recommended that the manufacturer consider:

1. Modifications to allow easier folding and unfolding of the discharge auger.

Station Manager: G. M. Omichinski

Project Engineer: C. W. Chapman

THE MANUFACTURER STATES THAT:

With regard to the recommendation:

1. Folding and unfolding will be made easier on all future REM 552 grain vacuums by increasing the pull of the assist spring, and a more convenient mechanism to hold and release the auger from the field position. Locking the auger in the transport position was simplified earlier with a quick catch/release latch.

GENERAL DESCRIPTION

The Midwest 552 is a 540 rpm power-take-off driven pneumatic grain conveyor, mounted on a two wheel trailer. A centrifugal fan provides suction to convey grain into the machine.

The grain is separated from the air stream with a deflector and rotating screen. Discharge is provided with a folding 8 in (200 mm) auger.

The test machine was equipped with two, 6 in (150 mm) diameter 8 ft (2.4 m) long flexible steel hoses and one, 10 ft (3.0 m) long convoluted rubber intake hose. Also provided were one bin intake nozzle and one clean up nozzle.

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

SCOPE OF TEST

The Midwest 552 was tested for 28 hours while conveying the grains as shown in TABLE 1. It was evaluated for ease of operation and adjustment, rate of work, quality of work, power requirements, operator safety and suitability of the operator's manual.

TABLE 1. Operating Conditions

Material	Quantity Conveyed		Hours
	bu	(t)	
Wheat	10,371	(290.4)	12
Barley	4,702	(106.0)	5
Oats	1,947	(31.2)	3
Buckwheat	2,179	(47.5)	3
Canola	1,620	(37.7)	2
Corn	890	(23.3)	2
Standard Test Material	300	(6.2)	1
Total:	22,009	(542.3)	28

RESULTS AND DISCUSSION

RATE OF WORK

Maximum conveying rates for the Midwest 552 depended on the grain being conveyed, the air slide setting on the intake nozzle, and the length and type of intake hose used. The maximum conveying rates were obtained when using one section of flexible steel intake pipe, keeping the intake pipe as straight as possible, and totally submerging the intake nozzle in grain. Maximum conveying rates for various intake lengths are shown in TABLE 2.

TABLE 2. Maximum Conveying Rates

Material	Conveying Rates bu/h (t/h)		
	Intake Pipe Length		
	8 ft (2.4 m)	50 ft (15 m)	100 ft (30 m)
Wheat	1719 (46.9)	1535 (41.9)	1161 (31.7)
Barley	2149 (46.9)	2003 (43.7)	1452 (31.7)
Corn	1986 (50.6)	1700 (43.3)	1334 (34.6)
Canola	3006 (68.3)	2620 (60.0)	1910 (43.4)
Standard Test Material	1936 (38.7)	1721 (34.4)	1561 (31.2)

Air Slide Setting: The amount of air introduced at the intake nozzle was important in obtaining maximum conveying rates. Too little air caused the conveyor to surge and eventually plug, while too much air reduced intake nozzle suction and resulted in less than maximum conveying rates.

TABLE 3 indicates the air slide opening where maximum conveying rates were obtained.

TABLE 3. Air Slide Openings for Maximum Conveying Rates

Material	Air Slide Opening Inches (mm)		
	Intake Pipe Length		
	8 ft (2.4 m)	50 ft (15 m)	100 ft (30 m)
Wheat	3.0 in (75 mm)	5.0 in (125 mm)	4.5 in (113 mm)
Barley	3.0 in (75 mm)	3.5 in (88 mm)	4.0 in (100 mm)
Corn	2.5 in (63 mm)	4.0 in (100 mm)	5.0 in (125 mm)
Canola	3.5 in (88 mm)	4.5 in (113 mm)	5.0 in (125 mm)

SPECIFIC CAPACITY

Specific capacity measures the efficiency of the machine. Specific capacity for the Midwest 552 at maximum conveying rate, with the standard 8 ft (2.4 m) intake was 1.43 ton/hp-h (1.73 t/kW-h) in wheat and 1.39 ton/hp-h (1.68 t/kW-h) in barley. In comparison an 8 in (200 mm) diameter grain auger would have a specific capacity of 5.5 ton/hp-h (6.67 t/kW-h) in wheat at similar conveying rates.

QUALITY OF WORK

Grain Damage: In dry wheat (13% moisture content) total grain crackage increased less than 0.2% for each pass through the machine. In these tests the Midwest 552 was equipped with one steel intake pipe and the intake nozzle.

In dry canola (7% moisture content) total grain crackage was 1.2% for each pass through the machine. Grain crackage can be reduced to acceptable levels by reducing power take-off speed. Conveying rates are lower at reduced speeds.

EASE OF OPERATION AND ADJUSTMENT

Hitching: Ease of hitching was very good.

The Midwest 552, was easily hitched to all tractors used during the test, taking a minimal amount of time. A hitch jack was provided and convenient to use. The Midwest 552 requires a 540 rpm power-take-off.

Discharge Auger: The Midwest 552 was equipped with a folding 8 in (200 mm) diameter discharge auger. The auger was folded for transport and extended to field position for filling trucks, using a retractable handle. Placing the auger in transport or field position was difficult, due to the force required on the handle. To place the auger in transport position the operator had to hold a spring latch and operate the handle simultaneously. It is recommended the manufacturer consider modifications to allow easier folding and unfolding of the discharge auger.

The height and reach of the discharge auger are shown in FIGURE 2. The height and reach was sufficient for all grain trucks used during the test.

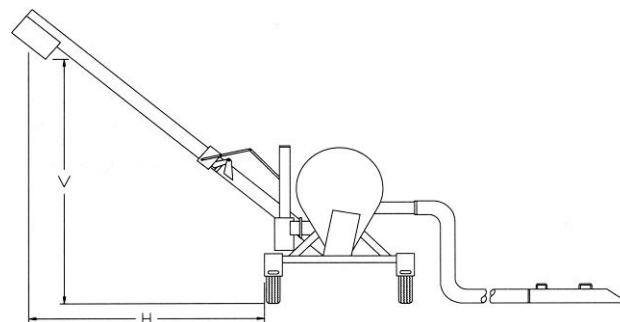


FIGURE 2. Height and Reach of the Discharge Auger; V= 12.0 ft (3.7 m) H= 8.2 ft (2.5 m).

Intake Pipes: Ease of operation of the intake pipes was very good. The Midwest 552 was equipped with two, 6 inch (150 mm) diameter, 8 ft (2.4 m) long flexible steel and one, 6 inch (150 mm) diameter, 10 ft (3.0 m) long convoluted rubber intake hose. All hoses were easy to connect together to the machine with minimal time and effort. One steel hose was used to empty full bins until the doors could be removed and then the two steel hoses used to further empty the bin. The convoluted rubber hose and clean-up nozzle were then used to completely remove all remaining grain.

All hoses could be conveniently stored and transported on the machine.

Nozzles: The Midwest 552 was equipped with an intake nozzle and a clean up nozzle as shown in FIGURE 3. The intake nozzle was used to remove all but 4 to 6 in (100 to 150 mm) of grain. It could be attached to any of the hoses supplied with the machine.

A slide gate on the intake nozzle varied the amount of intake air to the machine. Positioning the slide gate was easy. By the end of the test

period the slide gate would tend to close during machine operation. Bending the slide retaining brackets eliminated this problem.

The clean-up nozzle was used to remove all the grain remaining in the bin or grain on the ground. The clean-up nozzle was equipped with a handle and castor wheel which made it convenient to use on hard smooth surfaces. The clean-up nozzle was always used with the flexible rubber hose. Both nozzles could be stored and transported on the machine.

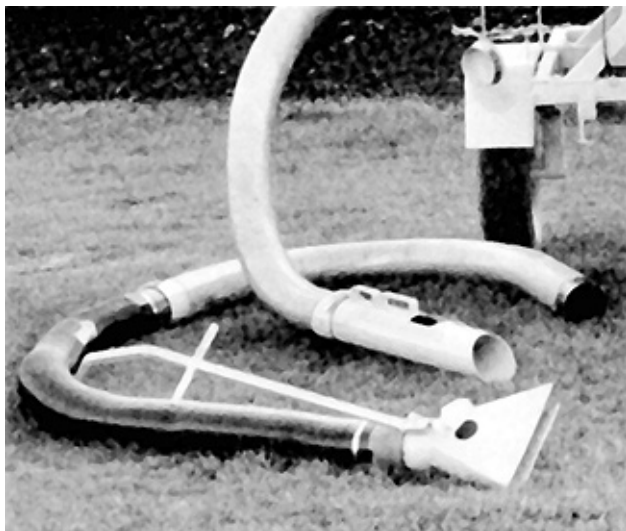


FIGURE 3. Intake and Clean-up Nozzles.

Deflector Plate/Rotary Screen: The deflector plate directs the incoming grain toward the discharge auger and the rotating screen removes fine material from the air flow before it enters the fan. Both worked effectively and required no adjustment during the test.

Unplugging: Ease of unplugging was very good.

Plugging would occur in the intake pipe if insufficient air entered the intake nozzle to convey the material. Proper adjustment of the air intake prevented plugging. Unplugging of the intake pipe was accomplished by fully opening the air intake or removing the intake nozzle from the grain, while continuing to operate the machine at full speed.

Plugging would occur in the rotary screen when conveying lighter grains such as oats or barley. Increasing air intake or reducing power-take-off speed (10 to 20%) prevented plugging.

The manufacturer does not recommend conveying very light grain such as grass seed, as this would cause plugging of the rotating screen. Unplugging of the rotating screen was accomplished by reducing power-take-off speed to idle, and removing the intake nozzle from the grain. On three occasions severe plugging caused the auger or rotating screen drive belt to burn out necessitating replacement. Severe plugging could be cleared by opening the clean out door at the bottom of the discharge auger, which allowed the grain to fall on the ground.

Transporting: Transporting was very good. All hoses and nozzles were conveniently stored and transported on the machine (FIGURE 4). The discharge auger was difficult to fold for transport.

The Midwest 552 was stable in transport and towed easily on both paved and unimproved road. Maximum recommended towing speed was 20 mph (32 Km/h).

Lubricating: The Midwest was equipped with 7 grease fittings all located on the power-take-off shaft. Complete lubrication could be accomplished in a few minutes.

POWER REQUIREMENTS

The maximum power-take-off power requirement was 62 hp (46 kW) which occurred when the machine was conveying air only. FIGURE 5

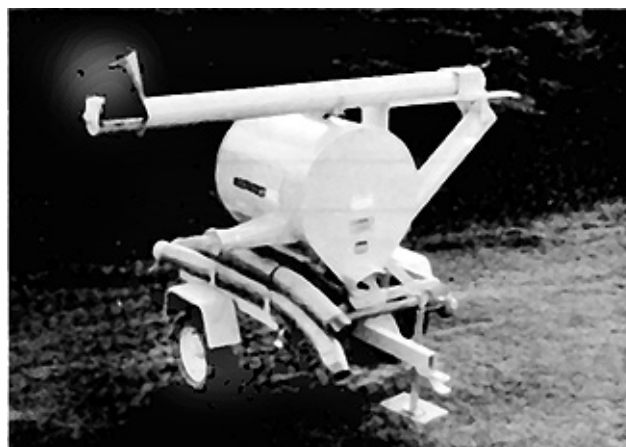


FIGURE 4. Transport Position

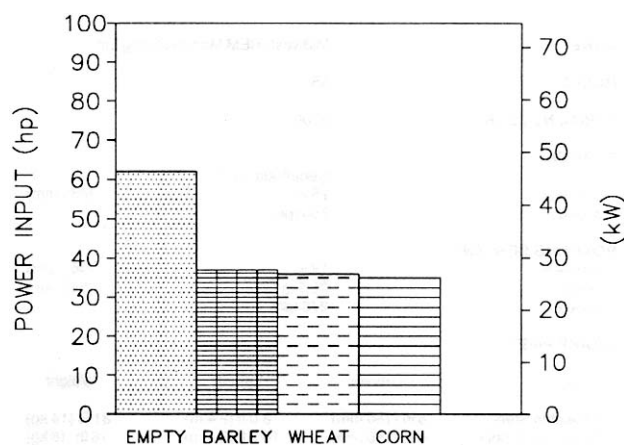


FIGURE 5. Power Requirements

shows the power requirements for various grains at maximum rates.

A tractor with a minimum power-take-off rating of 70 hp (52 kW) would have sufficient power to operate the Midwest 552.

OPERATOR SAFETY

Operator safety was very good. All rotating parts were well shielded and decals warned the operator of potential hazards.

Confined areas, such as grain bins, remained virtually dust free because most dust was removed by the machine. Areas around or downwind of the air exhaust could be very dusty depending on the material being conveyed.

Peak noise levels near the Midwest 552 was 101 dBA when operating beside metal grain bins. Operators should wear ear protection when working near the Midwest 552. The Midwest 552 was supplied with a Slow Moving Vehicle sign bracket but not a Slow Moving Vehicle sign.

OPERATOR'S MANUAL

The operator's manual was very good. The operator's manual was well written and illustrated and contained useful information on safety, operation, maintenance and trouble shooting. A parts list was also included.

MECHANICAL HISTORY

TABLE 4 outlines the mechanical history of the Midwest 552 during the 28 hours of operation. An extended durability evaluation was not conducted.

DISCUSSION OF MECHANICAL PROBLEMS

Drive Belts: The auger and rotating screen belts failed due to plugging of the machine. Plugging was caused by inexperienced operators.

TABLE 4. Mechanical History

<u>ITEM</u>	<u>HOURS</u>
The auger drive belt was burnt & replaced:	5, 9, 27
The rotating screen drive belt was worn and replaced at:	27
The auger drive belt idler pulley bearing failed and replaced at:	11
A flexible steel hose separated, and was repaired at:	21

APPENDIX II

MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

Excellent	Fair
Very Good	Poor
Good	Unsatisfactory

APPENDIX I

SPECIFICATIONS

MAKE:	Midwest (REM Manufacturing Ltd)		
MODEL:	552		
SERIAL NUMBER:	88001		
BLOWER:			
type-	Centrifugal Fan		
diameter-	25 in		(635 mm)
speed-	750 rpm		
ROTATING SCREEN:			
diameter-	18 in		(460 mm)
length-	21.5 in		(545 mm)
speed-	278 rpm		
INTAKE PIPE:			
Type	<u>Diameter</u>	<u>Length</u>	<u>Weight</u>
2 Flexible Steel	6 in (150 mm)	8.0 ft (2.4 m)	31 lb (14 kg)
1 Flexible Rubber	6 in (150 mm)	10.0 ft (3.0 m)	18 lb (8 kg)
DISCHARGE AUGER:			
diameter-	8 in		(200 mm)
length-	14.0 ft		(4.3 m)
speed-	620 rpm		
INTAKE NOZZLE:			
diameter-	6 in		(150 mm)
length-	35 in		(890 mm)
weight-	14.5 lb		(6.5 kg)
material-	Steel		
DRIVES:			
power-take-off-	540 rpm		
blower-	Oil bath chain and 3 V-belts		
auger-	1 V-belts		
rotating screen-	1 V-belts		
DIMENSIONS:	<u>Field Position</u>	<u>Transport Position</u>	
length-	8.2 ft (2.5 m)	9.5 ft (2.9 m)	
height-	13.3 ft (4.0 m)	8.6 ft (2.6 m)	
width-	16.1 ft (4.8 m)	11.1 ft (3.3 m)	
WEIGHT:			
right wheel-	431 lb (195 kg)	774 lb (351 kg)	
left wheel-	965 lb (438 kg)	726 lb (329 kg)	
hitch-	290 lb (132 kg)	317 lb (144 kg)	
total:	1686 lb (765 kg)	1817 lb (824 kg)	
TIRES:	P-215/75 R15 4 ply		
SERVICING:			
grease fittings-	2 (8 hrs)	3 (20 hrs)	2 (40 hrs)
gear boxes-	Check oil level 20-30 hours, 100 hours, or annually.		

SUMMARY CHART

MIDWEST 552 PNEUMATIC CONVEYOR

RETAIL PRICE:	\$8,500.00 (November 1988, f.o.b. Portage la Prairie)
RATE OF WORK:	1719 bu/h (46.9 t/h) wheat 2149 bu/h (46.9 t/h) barley
QUALITY OF WORK:	Little grain damage in wheat and barley. Crackage in canola can be reduced by reducing PTO speed.
EASE OF OPERATION:	Very Good , except for discharge auger latch.
POWER REQUIREMENTS:	Minimum 70 hp tractor recommended at 540 rpm PTO speed.
OPERATOR SAFETY:	Very Good , operator should wear ear protection.
OPERATOR'S MANUAL:	Very Good .
MECHANICAL HISTORY:	Only a few minor belt and drive failures.



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