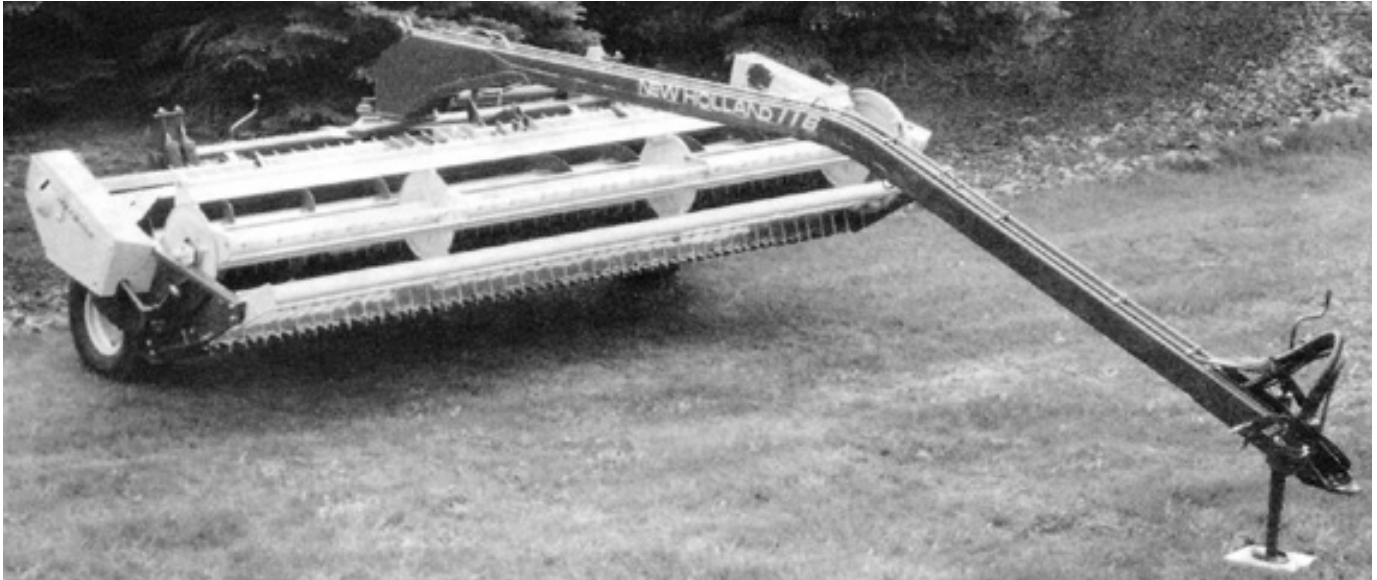


Evaluation Report

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New Holland 116 Mower Conditioner

A Co-operative Program Between



NEW HOLLAND 116 MOWER CONDITIONER

MANUFACTURER:

Ford New Holland
500 Diller Avenue
New Holland, Penn.
17557

DISTRIBUTOR:

New Holland of Canada Ltd.
1055 Mackay Street
Regina, Saskatchewan
S4N 4X9

New Holland of Canada Ltd.
P.O. Box 1616
Calgary, Alberta
T2P 2M7

RETAIL PRICE: \$25,730.00 (December 1987 f.o.b. Portage la Prairie, Manitoba)

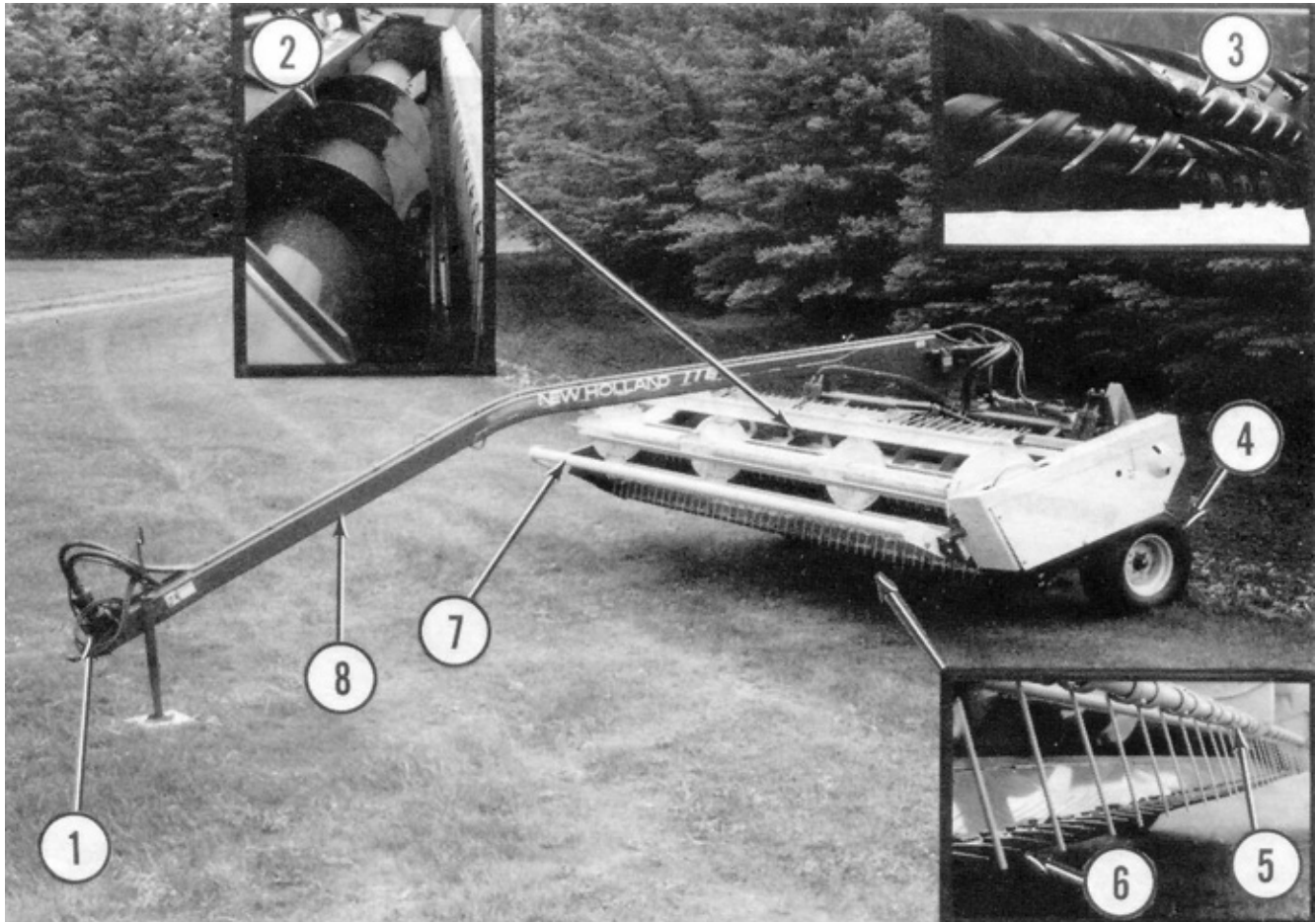


FIGURE 1. (1) Hydraulic Pump, (2) Feed Auger, (3) Conditioning Rolls, (4) Floatation Tires, (5) Bat Reel, (6) Cutter Bar, (7) Push Bar, (8) Pivot Tongue.

SUMMARY

Rate of Work: The average continuous groundspeed for the New Holland 116 mower conditioner in all crops tested was excellent. The cutterbar performance was excellent cutting alfalfa, native grasses, brome, timothy and clover. Performance of the conditioning rolls was very good in all crops and the windrow formation was very good. After initial adjustment, flotation was very good. Leaf loss was minimal.

Quality of Work: The performance of the New Holland 116 mower conditioner in all crops tested was excellent. The cutterbar performance was excellent cutting alfalfa, native grasses, brome, timothy and clover. Performance of the conditioning rolls was very good in all crops and the windrow formation was very good. After initial adjustment, flotation was very good. Leaf loss was minimal.

Ease of Operation: Hitching, hydraulic controls, transporting and field operation were all rated as very good. Lubrication was rated as good. The New Holland 116 was easy to operate and required little operator practice. Daily service took about 20 minutes.

Ease of Adjustment: The New Holland 116 was easy to adjust if procedures outlined in the operator's manual were followed. It allowed nine separate settings controlling cutting and condi-

tioning performance. PAMI's ratings for adjustments ranged from good to very good. Auger speed was not adjustable.

Operator Safety: The New Holland 116 was safe to operate if normal safety precautions were followed. It complied with all applicable ASAE standards for safety.

Operator's Manual: The operator's manual was very good. It contained useful and accurate information.

Mechanical History: Feed auger drive sprocket and chain wore out at 135 hours. Wheel and rim had to be replaced at 68 hours. Push bar mounts required repair at 193 and 212 hours.

RECOMMENDATIONS:

It is recommended that the manufacturer consider:

1. Supplying a heavier anti-torque chain that prevents the hydraulic pump from rotating with the tractor PTO shaft.
2. Providing a modification to prevent oil leakage when the hydraulic filter is removed for replacement.

3. Providing a method of continually lubricating the roller chain and sprocket that drive the feed auger.
4. Strengthening the push bar mounts.

Station Manager- G.M. Omichinski

Project Technologist: R.K. Harris

THE MANUFACTURER STATES THAT:

With regard to recommendations (1-4):

1. The intended use of the chain is not to prevent pump rotation. The pump vertical torque arm when properly adjusted with relation to the tractor drawbar (in compliance to ASAE standards) prevents pump rotation. The chain is intended to insure the torque arm maintains close contact with the drawbar. Operator's Manuals have been revised to include this information.
2. The oil filter was purposely located at the highest point on the hydraulic circuit to minimize oil losses when changing filters. No plans to modify the filter placement are being considered.
3. Work is currently in process to develop methods to improve roller chain life.
4. Work is currently in process to improve pushbar and pushbar mount area.

MANUFACTURER'S ADDITIONAL COMMENTS:

1. **Transporting section:** "The 116 towed well at 30 mph..." please note, this speed is not recommended by the tire manufacturer. Based on tire rating, 25 mph is the maximum speed.
2. **Operator Safety Section:** New Holland is investigating if the IH 1086 PTO shield is in compliance with ASAE standards.

GENERAL DESCRIPTION

The New Holland 116 mower conditioner is designed to cut, condition, and windrow forage and hay crops. It is powered by an integral hydraulic pump, which derives its rotary power input from the PTO of a tractor. The New Holland 116 requires either 540 or 1000 rpm PTO shaft speed. It is capable of cutting a 16 ft (4.9 m) swath in a single pass. Cutting is accomplished with two opposing sickle knife bars, which are driven from both sides of the machine. Crop is forced against the knives by a cam operated four bat finger reel, then into the centre delivery auger. From the auger, crop is fed to the 8.5 ft (2.6 m) rubber conditioning rolls. The New Holland 116 has a centre mounted pivoting hitch, which is also used as an oil storage reservoir for the hydraulic drives. The pivoting hitch allows operation of the mower conditioner from both sides of the towing tractor.

It is supported on either side by floatation tires. The height of the machine is hydraulically adjustable for transport. Complete specifications are given in APPENDIX I and FIGURE 1 shows the location of the major components.

SCOPE OF TEST

The New Holland 116 mower conditioner was operated in the crops shown in TABLE 1 for 275 hours while harvesting 2500 ac (1011 ha). It was evaluated for quality of work, rate of work, ease of operation and adjustment, power requirements, operator safety, and suitability of the operator's manual. In addition, mechanical problems were monitored throughout the test.

TABLE 1. Operating Conditions

CROP	HOURS	EQUIVALENT FIELD AREA	
		ac	(ha)
Alfalfa	104	1050	(425)
Alsike Clover & Timothy	44	450	(182)
Timothy & Brome	51	500	(202)
Native Grasses	76	500	(202)
Total:	275	2500	(1011)

RESULTS AND DISCUSSION

RATE OF WORK

The rate of work was dependent on field roughness, crop density and operator experience. The average continuous groundspeed was 6 mph (9.6 km/h) and the average workrate was 10 ac/h (4.1 ha/h). Due to the long hitch length, considerable distance was required to turn 180 degrees at the completion of a row. This reduced the rate of work.

QUALITY OF WORK

Windrow Formation: The New Holland 116 produced good quality windrows in all crops tested (FIGURE 2). The width and height of the windrows were controlled by two adjustable baffles situated to the rear of the conditioning rolls. The centre delivery or discharge allowed a continuous windrow to be formed around tight corners.



FIGURE 2. Typical Windrow.

Cutterbar Performance: Cutting ability of the two opposing knife bars was excellent in all crops. The New Holland 116 was very effective when cutting native grasses (june grass, etc) due to the high cyclic rate of the knives. Damp and fine stemmed crops did not affect cutting ability. In damp field conditions, especially new alfalfa fields, dirt would build up on the skid shoes and eventually plug the cutter bar. If forward speed was excessive, the ability of the crop to flow through the rest of the machine was impaired and would eventually result in a plug.

The New Holland 116 produced ideal stubble in most crops. In areas that were trampled or lodged, stubble was ragged. Stubble height was controlled by the adjustable skid shoes beneath the cutter bar.

Floatation: Four large tension springs provided header floatation on the New Holland 116. Four skid shoes allowed the cutter bar to follow ground contours. After initial adjustment, header floatation was very good.

Conditioner Performance: The New Holland 116 was equipped with two counter rotating rubber conditioning rolls. The 8.5 ft (2.6 m) rolls mesh together in a chevron design. As the crop is pulled through the rotating rolls the stems are crushed or broken allowing more rapid moisture evaporation. The performance of the conditioning rolls was good in most crops. Native grasses did not appear to be crimped as thoroughly. FIGURE 3 shows the difference of drying or curing time between a conditioned crop and an unconditioned crop. The tests were carried out in the same crop, on the same day in parallel windrows. Relative humidity during the test period was unusually high. Other conditions that affect curing time are, stubble height, ambient temperature and wind velocity. Generally, the advantages of a conditioned hay crop is 1/2 to 1 day advance in start of baling. PAMI's rating was very good.

Leaf Loss: Some leaf loss was observed in crops that were quite heavy and did not allow sunlight to penetrate to the bottom of the plant. After the mower passed, yellowed leaves could be found on the ground. Leaf loss was considered to be minimal. PAMI rated the leaf loss of the New Holland 116 as very good.

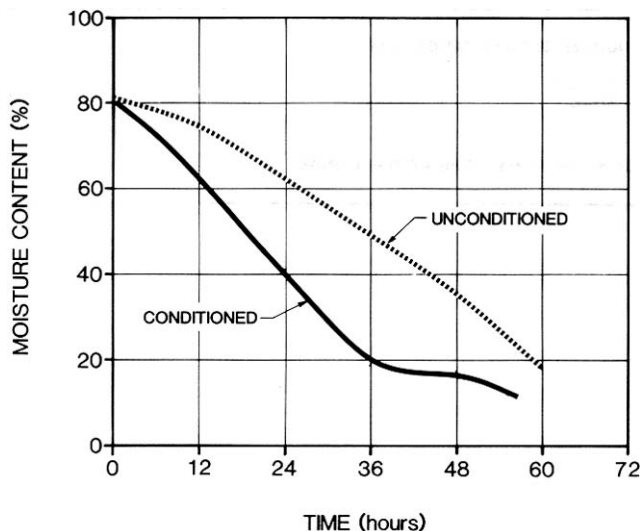


FIGURE 3. The effect of conditioning in alfalfa 3.5 ton/acre (1.5 t/ha) for the New Holland 116.

EASE OF OPERATION

Hitching: The New Holland 116 was supplied with a hitch extension which when attached to the tractor's drawbar provided additional room to attach the hydraulic pump to the tractor PTO shaft. In order to place the hydraulic pump on the PTO shaft of an International 1086 tractor, the guard that surrounds the power shaft had to be removed. A 1 inch (25.4 mm) bolt and compatible nut attached the New Holland 116 to the tractor. The hydraulic pump was attached to the 540 or 1000 RPM power shaft of the tractor and an anti-torque chain, which prevented the hydraulic pump from rotating with the power shaft, was wrapped around the drawbar and fastened to the pump. The attachment of four hydraulic hoses to the tractor's remote hydraulic connectors completed the hookup. Hitching was easy and took one person about 10 minutes. PAMI's rating was very good.

Hydraulic Controls: The New Holland 116 was equipped with two separate control circuits. Mower height was controlled by cylinders attached to each of the ground wheels. These cylinders also lifted the mower conditioner high enough to remove or engage the transport up-locks. The second circuit was used to power the cylinder which swung the hitch to the desired cutting side. The cylinder allowed 45 degrees of deflection on either side of centre. PAMI's rating was very good.

Transporting: The New Holland 116 was transported by moving the hitch to the centre position and engaging the hitch lock pin. The mower was then raised to its maximum height and the transport lock bars were swung into place. Spring loaded retaining pins prevented the lock bars from dislocating. The 18 ft (5.4 m) overall width made meeting oncoming traffic difficult and required caution. The New Holland 116 towed well at 30 mph (50 km/h) and had sufficient clearance. The two 31 x 13.5 -- 15 NHS tires provided very good floatation and met the requirements of the Tire and Rim Associations Standard for the weight of the machine. PAMI's rating was very good.

Lubrication: The hitch of the New Holland 116 also served as the hydraulic fluid reservoir and contained about 25 gal (94.6 L) of hydraulic oil. The reservoir was equipped with a dipstick for checking the level of the oil. The hitch had to be level when checking oil level or an erroneous reading would result. The hitch was also used to mount the replaceable hydraulic filter. When the filter was removed for replacement, oil poured from the filter mount and a considerable amount was lost before it could be stopped. It is recommended that the manufacturer consider a modification to prevent oil leaking from the filter mount when changing filters. Normal daily lubrication took one person about 20 minutes. The pressure fittings in the universal joints were difficult to get at with the grease gun and sometimes the shafts had to be rotated manually. The roller chain and sprocket which drives the feed auger wore out due to a lack of lubrication. It is recommended that the manufacturer consider a method of permanently lubricating this chain and sprocket. PAMI's rating was good.

Field Operation: The New Holland 116 was placed in field position by first raising the mower to its maximum height, and remov-

ing the transport lock rods. The pin which held the hitch in the centre position for transporting was disengaged by lifting the overcentre lever connected to the pin. The hitch was then moved to the full deflection position, the PTO engaged, and the mower conditioner moved into the crop to initiate cutting.

Due to the length of the hitch, at least five outside rounds had to be cut to allow enough room for the mower conditioner to safely turn around within the confines of the field, when back and forth cutting began. The New Holland 116 was easy to turn at the completion of a row and swung easily from one side of the tractor to the other. PAMI's rating was good.

EASE OF ADJUSTMENTS:

Push Bar: Adjustments for changing the height of the push bar allowed 8 in (203 mm) of height movement. The adjustment was quick and easy, and took one person about 3 or 4 minutes. PAMI's rating was good.

Cutter Bar: The adjustment for changing the angle of the cutter bars and guards consisted of either lengthening or shortening the turnbuckle link located in the centre of the machine. The tips of the guards were adjustable 6 to 12 degrees from horizontal. A proper sized wrench was required to loosen and then retighten the jam nuts. PAMI's rating was very good.

Reel: Reel height adjustment was a little more time consuming and consisted of loosening 7 nuts and bolts, pulling the reel to the desired location and retightening the nuts and bolts. It took 2 persons about 15 minutes. Reel height was adjustable through a range of 0 to 3 in (0 to 75 mm). PAMI's rating was good.

The reel speed was adjustable to 45, 49, 52.9, 53.9, 62.3, 66.2, 70.2 and 74.1 rpm. Reel speed adjustment rated very good, and was easy if directions in the operator's manual were followed.

Auger: The auger speed was not adjustable, nor was there a need for such adjustment throughout the test.

Conditioning Rolls: Changing the conditioner roll pressure was easy and consisted of turning the hand crank located at the rear of the machine, until desired degree of conditioning was reached. PAMI's rating was very good.

Conditioning roll clearance was adjustable and accomplished by the addition of shims between the rolls bearing mount plates. The minimum clearance of the rubber rolls was 0.15 inch (3.8 mm) when the shims were removed. The New Holland 116 was equipped with six shims, with 4 installed at the factory. Adjustment ranged from 0.15 to .36 in (3.8 to 9.1 mm). Adjustment of the conditioning roll clearance was not attempted during the test as the factory setting was adequate for conditions of the evaluation.

Floatation: Four large tension springs provided header floatation on the New Holland 116. Four skid shoes allowed the cutterbar to follow ground contours. Header floatation adjustments were required to prevent the cutterbar from plugging in soft fields. The floatation was adjusted so that it took about 50 lbs (23 kg) of force to lift each side of the header, clear of the ground. PAMI's rating was good.

The skid shoes on the bottom of the table were hinged at the front, and held at the desired height position with a pin. All four shoes were individually adjustable and provided an adjustment range of 6 in (152 mm) with 4 pin holes spaced 1.5 in (38 mm) apart. PAMI's rating was good.

Swath: Adjustable swath gate offered nine settings from 3.2 ft (1.0 m) to 8.5 ft (2.6 m) swath width. It was easy to adjust and consisted of moving the lever into the desired position. PAMI's rating was very good.

Knives: Changing the dual knives took one person about half an hour. Routine maintenance such as drive chain and belt tensioning was easy. PAMI's rating was good.

POWER REQUIREMENTS

Average power and peak power take-off requirement for the New Holland 116 were 28.3 hp (27 kW) and 46 hp (34.5 kW) respectively. Average drawbar pull at 4 mph (6.4 km/h) was 432 lbs (1921 N) for a crop yielding 3 ton/ac (1.3 t/ha). PAMI originally used a 85 hp (63 kW) tractor to operate the New Holland 116 mower conditioner, but found it marginally acceptable in heavy crop conditions and high side draft loads. To handle all crop conditions, a 100 hp (75 kW) tractor was required. In addition, the tractor required two remote hydraulic outlets capable of 1750 psi (12 MPa). A 540 or 1,000 rpm power-take-off was required as well.

OPERATOR SAFETY

The New Holland 116 was safe to operate if normal safety precautions were followed. The guard which surrounded the PTO shaft of an International 1086 tractor had to be removed in order to slide the hydraulic pump on the power shaft. Otherwise, the New Holland 116 conformed with ASAE standards for safety. All pulleys, sprockets and other potentially dangerous devices were adequately guarded and labelled. It was equipped with a slow moving vehicle sign. PAMI's rating was very good.

OPERATOR'S MANUAL

The operator's manual was very good, and contained useful information on servicing, operation, safety, and maintenance. All information was found to be factual and accurate. The book was well written and illustrated.

MECHANICAL HISTORY

Table 2 outlines the mechanical history of the New Holland 116. The intent of this project was a functional evaluation of the machine and an extended durability evaluation was not conducted.

TABLE 2. Mechanical History

ITEM	HOURS	EQUIVALENT FIELD AREA	
		ac	(ha)
Hydraulic pump chain broke at:	40	405	164
Wheel mount bolts broke at:	60	590	239
Wheel centre section developed cracks at:	68	675	273
Auger drive chain and sprocket wore out at:	135	1325	537
Push bar mounts failed at:	193	1925	780
	212	2200	891

The chain that prevents the hydraulic pump from rotating with the PTO shaft failed after 40 hrs, resulting in the pressure and suction hoses for the PTO mounted hydraulic pump being destroyed. The cost of effecting repairs were as follows: Pressure hose: \$109.00, Suction hose: \$30.00, and 25 gallons (113.6 L) of hydraulic oil at a cost of \$173.00. It took 2 persons 3 hrs to complete repairs. It is recommended that the manufacturers consider supplying a stronger chain to restrain the hydraulic pump.

The roller chain and driven sprocket that drive the feed auger wore out at 135 hours due to lack of lubrication, although the chain was lubricated with motor oil at the start of each work day. It took 2 persons about 1 hour to complete the replacement of the sprocket and chain. Both were replaced on warranty and no further problem was encountered.

When PAMI received the New Holland 116, it was noticed that the left ground wheel was bent and was wobbling slightly. After 60 hours of operation, 3 wheel mounting bolts broke off (FIGURE 4). The bolts were replaced, and at 68 hours cracks appeared in the wheel rim in the area of the bolt holes (FIGURE 5). The rim was replaced on warranty and no further problem occurred.

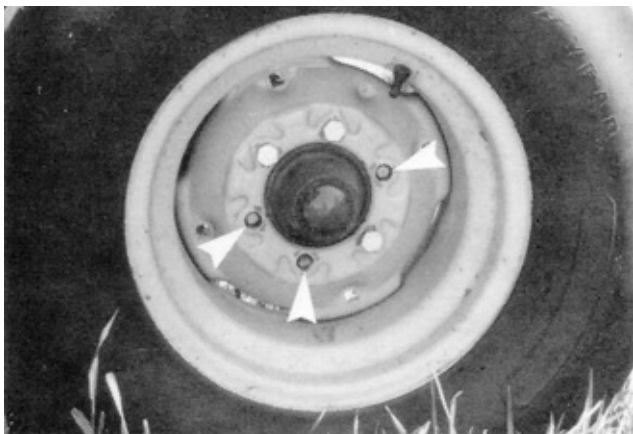


FIGURE 4. Broken Wheel Bolts.

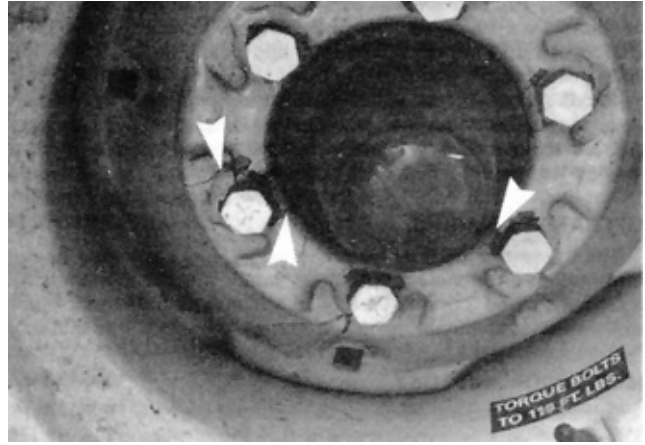


FIGURE 5. Cracked Wheel.

The push bar on the front of the mower conditioner separated from its mounting bracket at 193 hours due to metal fatigue in the area of the attaching weld. It was repositioned and rewelded, at a cost of \$30.00. At 212 hours the push bar broke away on the opposite side of the machine at the same location. It was repositioned and rewelded. No further problems were encountered (FIGURE 6). It is recommended that the manufacturer consider strengthening the pushbar mount brackets.

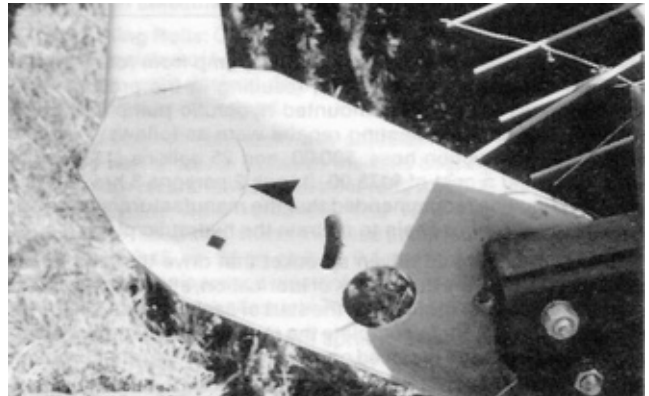


FIGURE 6. Cracks in Push Bar Mount Before Failure.

Several times during the evaluation, the hydraulic circuit used to lift the New Holland 116 to its maximum height to remove the transport locks, required several cyclings before lifting high enough to release the locks.

APPENDIX I

SPECIFICATIONS:

MAKE: New Holland

MODEL: 116 Mower Conditioner

SERIAL NUMBER: 520672

HEADER:

- effective width of cut 16.25 ft (4.9 m)
- range of cutting height 1.25 in to 5.5 in (30 to 140 mm)
- guard angle 6° to 12° below horizontal
- guard type twin forged steel
- guard spacing 3 in (75 mm)
- knife stroke 2.75 in (70 mm)
- knife speed 875 cycles per minute
- knife section under serrated
- length of knife bar 8.1 ft (2.5 m)
 - 2 cutterbars

REEL:

- number of bats 4 standard, 5 or 6 optional
- diameter 30 in (760 mm)
- number of teeth per bat 45
- bat teeth spacing 4.25 in (110 mm)
- reel speed range 45 - 74 rpm

AUGER:

- speed 241 rpm
- length of auger 16 ft (4.9 m)
- outside diameter 20 in (510 mm)
- inside diameter 12 in (300 mm)
- auger flighting pitch 21 in (530 mm)

CONDITIONER ROLLS:

- number of rolls 2
- roll construction Molded rubber with meshing lugs
- roll length 8.5 ft (2.6 m)
- roll diameter 10.4 in (260 mm)
- roll speed 673 rpm
- roll pressure control screw crank

OVERALL DIMENSIONS:

	<u>Transport Position</u>		<u>Field Position</u>	
- length	25.8 ft	(7.9 m)	20.6 ft	(6.3 m)
- width	18.0 ft	(5.5 m)	24.5 ft	(7.5 m)
- height	6.3 ft	(1.9 m)	5.7 ft	(1.7 m)

WEIGHT:

- left wheel 2627 lb (1192 kg)
- right wheel 2556 lb (1159 kg)
- hitch 933 lb (423 kg)
- total weight 6116 lb (2774 kg)

TIRES:

- Number/size Two, 31 x 13.5-15 NHS

NUMBER OF CHAIN DRIVES: Four

NUMBER OF BELT DRIVES: One

HYDRAULIC CONTROLS:

- header lift: two double acting cylinders (one per wheel)
- pivot hitch: one double acting cylinder

NUMBER OF LUBRICATION POINTS:

- 10 hours 13
- 50 hours 11

NUMBER OF PRELUBRICATED BEARINGS: 12

SUMMARY CHART

NEW HOLLAND 116 MOWER CONDITIONER

RETAIL PRICE:	\$25,730.00 (December, 1987, f.o.b. Portage la Prairie, Manitoba)
RATE OF WORK:	Average continuous workrate was 10 ac/h (4.1 ha/h)
QUALITY OF WORK:	
- Windrow Formation	Good; width & height controlled with baffles.
- Cutterbar Performance	Excellent; some dirt buildup in damp conditions.
- Floatation	Very Good; followed ground contours on skid shoes
- Conditioner Performance	Very Good; less effective on native grasses
- Leaf Loss	Very Good; minimal
EASE OF OPERATION:	
- Hitching	Very Good; straight forward; 10 minutes
- Hydraulic Controls	Very Good; adequate for effective operation
- Transporting	Very Good; wide width required caution.
- Lubrication	Good; lost oil when changing hydraulic filter.
- Field Operation	Good; long hitch length required wide turning radius.
EASE OF ADJUSTMENTS:	
- Push Bar Height	Good; 3 or 4 minutes: $\pm 4"$
- Cutterbar Angle	Very Good; 6-12° from horizontal
- Reel Height	Good; 2 persons 15 minutes
- Reel Speed	Very Good; incremental 45-74.1 rpm
- Auger Speed	Not adjustable
- Conditioner Roll Pressure	Very Good; adjusting crank.
- Roll Clearance	Shim adjustable 0.15-0.36 in (3.8-9.1 mm)
- Skid Shoes	Good; 4 pin holes, 1.5 in (38 mm) apart
- Header Floatation	Good; soft fields required adjustment
- Swath Gate	Very Good; nine settings from 3.2-8.5 ft (1.0-2.6 m).
- Knife Change	Good; 30 minutes.
POWER REQUIREMENTS:	PAMI suggests a tractor of 100 hp (75 kW), with a 540 or 1000 rpm power-take-off and two remote hydraulic outlets capable of 1750 psi (12 mpa).
OPERATOR SAFETY:	Very Good; The 116 was safe to use if normal safety precautions were followed. Complied with ASAE Standards for safety.
OPERATOR'S MANUAL:	Very Good; contained much useful and accurate data.
MECHANICAL HISTORY:	Problems occurred with the auger drive sprocket and chain, wheel and rim, and push bar mounts.



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