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Test 602: Massey-Harris 444 LP

Nebraska Tractor Test Lab

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The Experiment Station
University of Nebraska College of Agriculture
W. V. Lambert, Director, Lincoln, Nebraska

Department of Agricultural Engineering
Dates of test: October 25, 1956 to November 3, 1956
Manufacturer: MASSEY-HARRIS-FERGUSON, INC.,
RACINE, WISCONSIN
Manufacturer's rating: Not rated

NEBRASKA TRACTOR TEST NO. 602

MASSEY-HARRIS 444 LP

BELT HORSEPOWER TESTS

Hp	Crank shaft speed rpm	Fuel Consumption			Temp. Deg. F.			Barometer inches of mercury			
		Gal per hr	Hp-hr per gal	Lb per hp-hr	Cooling medium	Air wet bulb	Air dry bulb				
TEST B—100% MAXIMUM LOAD—TWO HOURS											
49.24	1500	5.062	9.73	0.437	171	56	72	28.920			
TEST C—OPERATING MAXIMUM LOAD—ONE HOUR											
47.54	1500	4.774	9.96	0.427	163	47	52	28.800			
TEST D—RATED LOAD—ONE HOUR											
43.84	1500	4.504	9.73	0.437	162	46	52	28.808			
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)											
43.90	1501	4.567	9.61	0.442	162	45	51			
1.20	1653	1.602	0.75	5.675	153	46	52			
23.26	1586	3.169	7.34	0.579	159	45	51			
45.43	1351	4.405	10.31	0.412	162	44	49			
12.04	1637	2.442	4.93	0.862	156	44	50			
34.42	1568	3.953	8.71	0.488	160	42	48			
26.71	1549	3.356	7.96	0.534	159	44	50	28.817			
TEST L—OPERATING MAXIMUM TORQUE											
% of rated rpm (engine)		100	95	91	86	81	76	71	66	61	56
% of rated-speed torque		100	103	106	108	110	111	111	109	105	102

DRAWBAR HORSEPOWER TESTS

Hp	Draw bar pull lbs	Speed miles per hr	Crank shaft speed rpm	Slip of drive wheels %	Fuel Consumption			Temp. Deg. F.			Barometer inches of mercury
					Gal per hr	Hp-hr per gal	Lb per hp-hr	Cool- ing med	Air wet bulb	Air dry bulb	
TEST H—RATED LOAD—TEN HOURS—3rd Gear Hi Range											
35.11	2596	5.07	1500	3.96	4.221	8.32	0.511	163	54	61	28.633
TEST F—100% MAXIMUM LOAD											
45.26	3372	5.03	1500	4.77	3rd gear hi range			150	46	54	28.725
TEST G—OPERATING MAXIMUM LOAD											
23.17	6534	1.33	1501	14.04	1st l.r. (part throttle)			159	48	50	28.685
34.25	6529	1.97	1501	15.63	2nd l.r. (part throttle)			159	48	50	28.685
40.59	5388	2.83	1500	8.93	3rd low range			165	58	67	28.525
41.12	4074	3.79	1502	6.17	4th low range			164	58	66	28.530
39.58	1775	8.36	1499	2.88	5th low range			165	56	66	28.525
39.89	6472	2.31	1505	12.62	1st hi range			160	48	50	28.685
41.17	4148	3.72	1498	6.17	2nd hi range			165	58	66	28.530
41.49	3087	5.04	1502	4.63	3rd hi range			165	57	68	28.530
41.40	2343	6.63	1497	3.25	4th hi range			158	51	56	28.560
34.39	892	14.46	1499	1.53	5th hi range			165	52	67	28.530
TEST J—OPERATING MAXIMUM LOAD											
42.73	3236	4.95	1498	6.30	3rd hi range			165	35	40	28.990
TEST K—OPERATING MAXIMUM LOAD											
43.20	3393	4.78	1506	6.98	3rd hi range			158	42	52	29.050

TIRES, WHEELS AND WEIGHT

	Tests F, G, & H	Test J	Test K
Rear wheels			
Type	Cast iron	Cast iron	Cast iron
Liquid ballast	833 lb each	None	None
Added cast iron	725 lb each	None	None
Rear tires			
No. and size	Two 13-38	Two 13-38	Two 12-38
Ply	6	6	6
Air pressure	18 lb	14 lb	14 lb
Front wheels			
Type	Cast iron	Cast iron	Cast iron
Liquid ballast	None	None	None
Added cast iron	None	None	None
Front tires			
No. and size	Two 6.50-16	Two 6.50-16	Two 6.50-16
Ply	4	4	4
Air pressure	28 lb	28 lb	28 lb
Height of drawbar	20½ inches	21½ inches	20 inches
Static weight			
Rear end	7410 lb	4294 lb	4300 lb
Front end	1904 lb	1916 lb	1898 lb
Total weight as tested with operator	9489 lb	6385 lb	6373 lb

FUEL, OIL, WATER and TIME Fuel Commercial Propane Weight per gallon 4.25 lb Oil SAE 10 To motor 1.999 gal Drained from motor 1.255 gal Water used none Total time motor was operated 50½ hours.

CHASSIS Type Tricycle Serial No. 444-BIRF 72917 Tread width rear 56" to 88" front 8.5" to 15.3" Wheel base 88½" Hydraulic control system direct engine drive Advertised speeds mph first Lo 1.52 first Hi 2.59 second Lo 2.29 second Hi 3.91 third Lo 3.05 third Hi 5.19 fourth Lo 3.96 fourth Hi 6.75 fifth Lo 8.46 fifth Hi 14.40 reverse Lo 1.99 reverse Hi 3.40 Belt pulley diam 13½" face 6½" rpm 876 Belt speed 3097 fpm Belt flat Length 71' Width 6" Thickness 0.215" Maximum slip 0.90% Clutch foot operated single dry plate Seat pressed steel on conical spring with shock absorber Brakes internal expanding shoe operated by two foot pedals Equalized by locking together Power take-off direct engine drive with independent clutch Steering aided by hydraulic power steering.

ENGINE Make Massey-Harris Type 4 cylinder vertical Serial No. MHA 277B 9870 Crankshaft mounted lengthwise Head I Lubrication pressure Bore and stroke 4" x 5½" Rated rpm 1500 Compression ratio 8.98 to 1 Displacement 277 cu. in. Port diameter valves inlet 1 5/16" exhaust 1 5/16" Governor variable speed centrifugal Carburetor size 1¼" Ignition system battery Starting system 12 volt (two-6 volt batteries) Air cleaner oil washed wire mesh Muffler was used Oil filter replaceable treated paper element Cooling medium temperature control thermostat.

REPAIRS AND ADJUSTMENTS No repairs or adjustments.

REMARKS All test results were determined from observed data and without allowances, additions or deductions. Tests B and F were made with carburetor set for 100% maximum belt horsepower and data from these tests were used in determining the horsepower to be developed in tests D and H, respectively. Tests C, D, E, G, H, J, K & L were made with an operating setting of the carburetor (selected by the manufacturer) of 95.1% of maximum belt horsepower.

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60° F. and 29.92" Hg)	46.87	51.53
2. Observed maximum horsepower (tests F and B)	45.26	49.24
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (ASAE and SAE ratings)	35.15	43.80

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. 602.

L. F. LARSEN
Engineer-in-Charge

L. W. HURLBUT
G. W. STEINBRUEGGE
J. J. SULEK
Board of Tractor
Test Engineers

EXPLANATION OF TEST REPORT

TEST A: The manufacturer's representative operates the tractor for a minimum of 12 hours using light to heavy drawbar loads in each gear.

This serves as a period for limber up, general observation and adjustments. Adjustments that are permissible include valve tappet clearance, breaker point gap, spark plug gaps, clutch and others of a similar nature. No new parts or accessories can be installed without having mention made of it in the report.

No data are recorded during this preliminary run except the time that the engine is operated.

BELT HORSEPOWER TESTS

TEST B: The throttle valve is wide open and the belt load on the dynamometer is adjusted so that the engine is at the rated speed recommended by the manufacturer. Carburetor, ignition timing and manifold adjustments are all set for maximum engine power.

This test is designed to determine maximum belt horsepower of the tractor at rated speed and to measure fuel consumption at the maximum power on the belt.

TEST C: For tractors with carburetors the best fuel economy does not always occur when the engine develops maximum power at rated speed. Test C is intended to allow the manufacturer's representative to select a more economical fuel setting even though there is a slight loss of power. *This more practical carburetor setting is used in all later tests except test F.* The throttle valve is wide open and load adjusted to give rated rpm. Tests B and C are the same for diesel tractors which have an altogether different fuel system.

TEST D: The throttle control lever is set so that the governor will maintain rated engine speed when rated load is applied. Rated load is 85% of 100% maximum, as obtained in test B, corrected to standard conditions.

This rating is somewhat less than the maximum belt horsepower in order that the operator may have a certain amount of reserve.

TEST E:

Varying load serves to show the range of engine speeds when the engine is controlled by the governor during the following varied loads, of 20 minutes each; rated load, no load, $\frac{1}{2}$ rated load, maximum load at wide open throttle valve, $\frac{1}{4}$ and $\frac{3}{4}$ rated load.

The average result of this test shows the average power and fuel consumption. Since the average tractor is subjected to varying loads, these data serve well in predicting fuel consumption and efficiency of a tractor in general use.

TEST L: This torque test is run with wide open throttle. Loads are applied to reduce engine speed in approximately ten 5% increments. Rated speed equals 100%. The corresponding dynamometer torque is recorded as a per cent of torque at rated speed.

DRAWBAR HORSEPOWER TESTS

In all drawbar tests the pull exerted by the tractor is transmitted by a hydraulic pressure cylinder to a recording instru-

ment in the test car. When rubber tires are used, all tests are made on the concrete test course. All crawler type tractors are tested on a dirt test course which is maintained by grading, sprinkling and rolling so that it remains very nearly the same throughout the season. The same tires, wheels and weights are used for all tests except J and K.

TEST F: A drawbar test, the results of which are used to determine the rated drawbar horsepower in test H. The carburetor is set to develop maximum power as in test B. The rated gear recommended by manufacturer as plow gear is used in this test. The drawbar load is adjusted to give rated engine speed.

TEST G: Maximum drawbar horsepower is determined in each gear when the carburetor is set for fuel economy as in test C. The throttle valve is held wide open and the load is applied so that the engine runs at rated engine speed.

When operating in low gear it is not uncommon for the tractor to develop less drawbar horsepower than in rated gear because of excessive wheel slippage. When excessive wheel slippage occurs the load is reduced until slippage approaches 16%. When the load is reduced it is necessary to operate the tractor engine at part throttle and control engine speed by governor action.

TEST H: Intended to test the ability of the tractor to run continuously for 10 hours at rated drawbar horsepower and to determine the fuel consumption during that time. Rated drawbar horsepower is 75% of 100% maximum drawbar horsepower (Test F), corrected to standard conditions.

When operating at rated load the throttle control lever is set to maintain rated engine speed. This rating is less than maximum drawbar horsepower in order that the operator may have a certain amount of reserve.

TEST J: The tractor is operated in rated gear with all added weight removed. This test shows the effect of the removal of added weight on the performance of the tractor when compared with test G.

Removal of wheel weights generally increases wheel slippage and decreases drawbar horsepower.

TEST K: Similar to test J except that the smallest tires and lightest wheels offered by the manufacturer are used.

