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Test 576: Massey-Harris 444 (Diesel)

Nebraska Tractor Test Lab

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Department of Agricultural Engineering
Dates of test: June 2 to June 14, 1956
Manufacturer: MASSEY-HARRIS-FERGUSON
INC., RACINE, WISCONSIN
Manufacturer's rating: Not rated

NEBRASKA TRACTOR TEST NO. 576

MASSEY-HARRIS 444 DIESEL

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				
TESTS B & C—100% MAXIMUM LOAD—TWO HOURS											
48.21	1500	3.201	15.06	0.467	186	66	81	28.975			
TEST D—RATED LOAD—ONE HOUR											
43.29	1499	2.777	15.59	0.451	180	65	79	28.978			
TEST E—VARYING LOAD—TWO HOURS (20 minute runs;last line average)											
43.29	1499	2.770	15.63	0.450	180	65	79			
1.36	1591	0.832	1.63	4.301	166	64	78			
22.81	1573	1.758	12.97	0.542	176	64	77			
47.01	1442	3.103	15.15	0.464	186	65	79			
11.49	1587	1.319	8.71	0.807	172	65	79			
33.41	1544	2.232	14.97	0.470	179	67	80			
26.56	1539	2.002	13.27	0.530	176	65	79	28.993			
TEST L—OPERATING MAXIMUM TORQUE											
% of rated rpm (engine)		100	95	90	85	81	75	70	65	61	55
% of rated-speed torque		100	100	103	105	107	108	109	109	107	104

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 HIGH RANGE											
35.07	2591	5.08	1500	4.14	2.518	13.93	0.505	183	70	90	28.931
TEST F & G—100% MAXIMUM LOAD											
23.05	6463	1.34	1501	13.77	1st L.R. (part thrtl) .			140	50	58	29.030
34.51	6412	2.02	1502	13.88	2nd L.R. (part thrtl) .			143	50	58	29.030
41.60	5563	2.80	1500	9.53	3rd low range.			185	78	88	28.820
44.15	4432	3.74	1499	7.48	4th low range.			185	65	74	28.955
43.08	1932	8.36	1497	2.95	5th low range.			189	80	90	28.820
38.15	6282	2.28	1500	13.88	1st H.R. (part thrtl) .			140	50	58	29.030
43.06	4360	3.70	1497	6.94	2nd high range. . . .			181	76	86	28.820
43.84	3285	5.00	1500	5.32	3rd high range.			178	65	74	28.955
43.24	2454	6.61	1496	3.69	4th high range.			186	78	88	28.820
37.02	954	14.55	1503	1.37	5th high range.			188	83	93	28.820
TEST J—OPERATING MAXIMUM LOAD											
44.68	3391	4.94	1500	6.93	3rd gear high range. .			186	65	75	28.820
TEST K—OPERATING MAXIMUM LOAD											
44.15	3526	4.70	1501	8.23	3rd gear high range. .			185	62	72	28.820

TIRES, WHEELS AND WEIGHTS

	Tests F, G, & H	Test J	Test K
Rear wheels			
Type	Cast iron	Cast iron	Cast iron
Liquid ballast	413 lb each	None	None
Added cast iron	1120 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	20 inches	21½ inches	20 inches
Static weight			
Rear end	7520 lb	4454 lb	4282 lb
Front end	1904 lb	1870 lb	1880 lb
Total weight as tested with operator	9599 lb	6499 lb	6337 lb

FUEL, OIL, WATER and TIME Fuel Diesel Cetane No. 49 (rating taken from oil company's typical inspection data): **Weight per gallon** 7.029 lb **OIL** SAE 10-10W **To motor** 1.955 **Drained from motor** 1.049 gal **Water used none** **Total time motor was operated** 54½ hours.

CHASSIS Type Tricycle Serial No. 71402P **Tread** width rear 56" to 88" front 8.5" to 15.3" **Wheel base** 88½" **Hydraulic control system** direct engine drive **Advertised speed 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** 0.88% **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.

ENGINE Make Massey-Harris Type 4 cylinder vertical Diesel Serial No. 1132 **Crankshaft** mounted lengthwise **Head I Lubrication** pressure **Bore and stroke** 4" x 5½" **Rated rpm** 1500 **Compression ratio** 15.9 to 1 **Displacement** 277 cu. in. **Port Diameter** valves Inlet 1½" Exhaust 1¼" **Governor** centrifugal variable speed **Starting system** 12 volt battery **Air cleaner** oil washed wire mesh **Muffler** was used **Oil filter** replaceable treated paper element **Fuel filter** one fine mesh filter screen and water trap, one first stage filter with replaceable cotton waste element, one second stage filter with replaceable treated paper element, one final stage replaceable sealed filter **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 fuel pump set to develop approximately 50.7 corrected 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 the same setting (selected by the manufacturer).

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60° F and 29.92" Hg)	45.90	50.78
2. Observed maximum horsepower (tests F and B)	43.84	48.21
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (ASAE and SAE ratings)	34.43	43.16

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. 576.

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 highest wheels offered by the manufacturer are used.

