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Test 577: Massey-Harris 333 (Diesel)

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: June 8 to June 13, 1956
Manufacturer: MASSEY-HARRIS-FERGUSON
INC., RACINE, WISCONSIN
Manufacturer's rating: Not rated

NEBRASKA TRACTOR TEST NO. 577

MASSEY-HARRIS 333 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	

BELT HORSEPOWER TESTS

TEST B & C—100% MAXIMUM LOAD—TWO HOURS

37.15	1500	2.638	14.08	0.499	180	60	67	29.018
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TEST D—RATED LOAD—ONE HOUR

32.79	1499	2.219	14.78	0.476	177	57	64	29.010
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TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)

32.65	1500	2.215	14.74	0.477	177	57	64
1.41	1635	0.828	1.70	4.128	167	57	63
17.38	1582	1.472	11.81	0.596	175	57	64
36.57	1453	2.595	14.09	0.499	185	58	65
8.91	1623	1.169	7.62	0.923	170	57	64
25.67	1562	1.831	14.02	0.501	180	58	66
20.43	1559	1.685	12.12	0.580	175	57	64	29.012

TEST L—OPERATING MAXIMUM TORQUE

% of rated rpm (engine)	100	94	89	85	80	75	69	64	60	54
% of rated-speed torque	100	102	104	104	105	106	105	104	101	97

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

26.53	2017	4.93	1499	3.70	2.003	13.26	0.531	183	67	83	28.997
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TEST F & G—100% MAXIMUM LOAD

18.15	5262	1.29	1496	13.48	1st L.R. (part thrtl)			178	61	64	29.050
27.35	5247	1.95	1496	13.48	2nd L.R. (part thrtl)			178	61	64	29.050
32.22	4465	2.71	1504	10.16	3rd low range.....			182	62	65	29.050
32.96	3393	3.64	1501	6.84	4th low range.....			178	64	68	29.050
31.10	1437	8.12	1501	2.98	5th low range.....			189	88	99	28.780
30.99	5247	2.21	1499	13.48	1st H.R. (part thrtl)			178	61	64	29.050
32.70	3422	3.58	1498	6.91	2nd hi range.....			185	68	74	29.050
33.34	2562	4.88	1498	4.68	3rd hi range.....			180	66	76	29.070
32.63	1908	6.41	1502	3.91	4th hi range.....			180	61	64	29.050
26.56	717	13.89	1493	1.90	5th hi range.....			180	66	73	29.050

TEST J—OPERATING MAXIMUM LOAD

33.52	2596	4.84	1503	5.56	3rd Gear high range.			180	68	79	28.830
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TEST K—OPERATING MAXIMUM LOAD

32.96	2705	4.57	1500	7.12	3rd gear high range..			180	67	76	28.860
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TIRES, WHEELS AND WEIGHT

	Tests F, G, & H	Test J	Test K
Rear wheels			
Type	Cast iron	Cast iron	Cast iron
Liquid ballast	438 lb each	None	None
Added cast iron	420 lb each	None	None
Rear tires			
No. and size	Two 12-38	Two 12-38	Two 11-38
Ply	6	6	4
Air pressure	18 lb	14 lb	12 lb
Front wheels			
Type	Pressed steel	Pressed steel	Pressed steel
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	20½ inches	19 inches
Static weight			
Rear end	6170 lb	4254 lb	4088 lb
Front end	1590 lb	1576 lb	1566 lb
Total weight as tested with operator	7935 lb	6005 lb	5829 lb

FUEL, OIL, WATER and TIME Fuel Diesel Ce-tane No. 49 (rating taken from oil company's typical inspection data): **Weight per gallon** 7.029 lb **OIL** SAE 10-10W: **To motor** 2.186 gal; **Drained from motor** 1.438 gal; **Water used** none; **Total time motor was operated** 45 hours.

CHASSIS Type Tricycle **Serial No.** 20848P **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 1.47 first Hi 2.51 second Lo 2.22 second Hi 3.79 third Lo 2.95 third Hi 5.03 fourth Lo 3.84 fourth Hi 6.55 fifth Lo 8.21 fifth Hi 14.00 reverse Lo 1.93 reverse Hi 3.30 **Belt pulley** 13½" face 6½" rpm 876 **Belt speed** 3097 fpm **Belt flat** Length 71' Width 6" Thickness 0.215" **Maximum slip** 0.57% **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.** 1321 **Crankshaft** mounted lengthwise **Head I** Lubrication pressure **Bore and stroke** 3 11/16" x 4½" **Rated rpm** 1500 **Compression ratio** 16.0 to 1 **Displacement** 208 cu. in. **Port diam valves** inlet 1 5/16" exhaust 1 3/16" **Governor** variable speed centrifugal **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 Following test "A" a leak developed at the hydraulic reservoir. This was repaired and the test continued.

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 38.5 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)	34.84	38.56
2. Observed maximum horsepower (tests F and B)	33.34	37.15
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (ASAE and SAE ratings)	26.13	32.78

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. 577.

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.

