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Test 579: Minneapolis-Moline 445 Utility

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 24, 1956 to July 2, 1956
Manufacturer: MINNEAPOLIS-MOLINE COMPANY, MINNEAPOLIS, MINNESOTA
Manufacturer's rating: Not rated

NEBRASKA TRACTOR TEST NO. 579

MINNEAPOLIS-MOLINE 445 UTILITY

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								
41.95	1550	4.025	10.42	0.591	158	67	75	28.810
TEST C—OPERATING MAXIMUM LOAD—ONE HOUR								
39.94	1549	3.295	12.12	0.508	158	68	75	28.785
TEST D—RATED LOAD—ONE HOUR								
37.70	1550	3.183	11.84	0.520	151	68	76	28.785
TEST E—VARYING LOAD—TWO HOURS—(20 minute runs; last line average)								
37.64	1550	3.187	11.81	0.521	153	68	76
2.06	1759	1.374	1.50	4.107	126	69	76
20.45	1678	2.261	9.04	0.681	138	69	76
37.03	1404	3.118	11.88	0.518	166	70	78
10.51	1720	1.798	5.85	1.503	135	70	78
29.75	1631	2.748	10.83	0.569	150	71	79
22.91	1624	2.414	9.49	0.649	144	69	77	28.792

TEST L—OPERATING MAXIMUM TORQUE

% of rated rpm (engine)	100	95	90	85	80	75	70	65	60	55
% of rated-speed torque	100	103	104	107	106	106	106	104	102	98

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	Cooling med	Air wet bulb	Air dry bulb	
TEST H—RATED LOAD—TEN HOURS—2nd Gear											
31.21	2952	3.96	1551	6.85	2.950	10.58	0.583	174	73	85	28.765
TEST F—100% MAXIMUM LOAD											
38.85	3751	3.88	1556	9.54	2nd gear			160	61	65	29.025
TEST G—OPERATING MAXIMUM LOAD											
25.68	4229	2.37	1550	14.78	1st gear (part throttle)			160	66	77	29.035
36.06	3492	3.87	1554	9.02	2nd gear			160	62	66	29.040
36.64	2249	6.11	1545	5.24	3rd gear			163	62	68	29.045
32.18	1251	9.65	1552	3.97	4th gear			167	70	82	29.010
28.58	713	15.03	1553	2.49	5th gear			170	70	82	29.010
13.88	4203	1.24	1557	15.37	1st gear A.T. (prt-thrtl)			157	70	82	29.010
21.14	4197	1.89	1552	15.33	2nd gear A.T. (prt-thrtl)			160	66	77	29.035
32.20	4101	2.94	1549	13.37	3rd gear ampli-torc . . .			169	62	73	29.040
34.71	2633	4.94	1551	6.09	4th gear ampli-torc . . .			162	62	73	29.040
32.17	1571	7.68	1546	4.79	5th gear ampli-torc . . .			165	70	82	29.010

TEST J—OPERATING MAXIMUM LOAD

28.87	2988	3.62	1545	14.14	2nd gear.....			176	78	90	28.585
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TEST K—OPERATING MAXIMUM LOAD

24.95	2672	3.50	1546	14.08	2nd gear.....			158	70	76	28.870
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TIRES, WHEELS AND WEIGHT

	Tests F, G, & H	Test J	Test K
Rear wheels			
Type	Pressed steel	Pressed steel	Pressed steel
Liquid ballast	476 lb each	None	None
Added cast iron	480 lb each	None	None
Rear tires			
No. and size	Two 12-28	Two 12-28	Two 11-28
Ply	4	4	4
Air pressure	14 lb	14 lb	12 lb
Front wheels			
Type	Pressed steel	Pressed steel	Pressed steel
Liquid ballast	None	None	None
Added cast iron	124 lb each	None	None
Front tires			
No. and size	Two 5.50-16	Two 5.50-16	Two 5.50-16
Ply	4	4	4
Air pressure	32 lb	32 lb	32 lb
Height of drawbar	18½ inches	19¼ inches	17½ inches
Static weight			
Rear end	4834 lb	2922 lb	2864 lb
Front end	1620 lb	1374 lb	1370 lb
Total weight as tested with operator	6692 lb	4471 lb	4409 lb

FUEL, OIL, WATER and TIME Fuel Gasoline Octane No. ASTM 82.0 Research 87.2 (rating taken from oil company's typical inspection data) Weight per gallon 6.157 lb Oil SAE 30 To motor 1.968 gal Drained from motor 1.248 gal Total time motor was operated 44½ hours.

CHASSIS Type Standard Serial No. 10200581 Tread width rear 56" to 84" front 50" to 78" Wheel base 81⅝" Hydraulic control system direct engine drive Advertised speeds mph first 2.61 second 3.99 third 6.08 fourth 9.42 fifth 14.44 reverse 3.99 Using ampli-torc first 1.37 second 2.09 third 3.19 fourth 4.95 fifth 7.58 reverse 2.09 Belt pulley diam 8⅝" face 6½" rpm 1468 Belt speed 3220 fpm Belt flat Length 71' Width 6" Thickness 0.215" Maximum slip 1.05% Clutch single plate dry disc operated by foot pedal Seat upholstered seat with back rest Brakes double disc operated by two foot pedals Equalized no Power take-off continuous running independently clutched.

ENGINE Make Minneapolis-Moline Type 4 cylinder vertical Serial No. 10002088 Crankshaft mounted lengthwise Head 1 Lubrication pressure Bore and stroke 3⅝" x 5" Rated rpm 1550 Compression ratio 7.3 to 1 Displacement 206 cu in Port diameter valves inlet 1¼" exhaust 1 11/64" Governor variable speed centrifugal Carburetor size 1" Ignition system battery Starting system 12 volt battery Air cleaner oil wash rolled screen Muffler was used Oil filter replaceable paper element Cooling medium temperature control thermostat.

REPAIRS AND ADJUSTMENTS Fuel gauge did not function during test.

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 and L were made with an operating setting of the carburetor (selected by the manufacturer) of 95.3% of maximum belt horsepower.

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60° F. and 29.92" Hg)	40.24	44.19
2. Observed maximum horsepower (tests F and B)	38.85	41.95
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (ASAE and SAE ratings)	30.18	37.56

We, the undersigned certify that this is a true and correct report of official Tractor Test No. 579.

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.

