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Test 571: McCormick Farmall Model 400 (Diesel)

Nebraska Tractor Test Lab

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Department of Agricultural Engineering
Dates of test: May 7 to May 28, 1956
Manufacturer: INTERNATIONAL HARVESTER
COMPANY, CHICAGO, ILLINOIS
Manufacturer's rating: Not rated

NEBRASKA TRACTOR TEST NO. 571

MCCORMICK FARMALL 400 LPG

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										
52.36	1450	5.820	9.00	0.472	170	53	58	28.893		
TEST C—OPERATING MAXIMUM LOAD—ONE HOUR										
49.69	1450	5.082	9.78	0.435	169	51	55	28.925		
TEST D—RATED LOAD—ONE HOUR										
46.36	1450	4.786	9.69	0.439	168	51	55	28.920		
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)										
46.38	1448	4.786	9.69	0.439	168	52	57		
1.26	1585	1.631	0.77	5.500	147	51	56		
24.20	1515	3.311	7.31	0.581	161	51	56		
48.13	1401	4.878	9.87	0.431	169	54	58		
12.45	1560	2.435	5.11	0.831	158	55	60		
35.67	1495	4.108	8.68	0.489	166	56	62		
28.02	1500	3.525	7.95	0.535	161	53	58	28.960		
TEST L—OPERATING MAXIMUM TORQUE										
% of rated rpm (engine)	100	95	90	84	80	75	70	65	60	55
% of rated speed torque	100	100	99	100	101	103	105	107	106	103

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											
37.21	2892	4.83	1449	4.90	4.371	8.51	0.499	170	57	77	29.072
TEST F—100% MAXIMUM LOAD											
48.12	3813	4.73	1450	6.56	3rd gear.....	158		53	61		29.085
TEST G—OPERATING MAXIMUM LOAD											
38.17	6374	2.25	1448	14.43	1st gear (part throttle)			167	67	76	28.870
44.93	4489	3.75	1450	7.38	2nd gear.....			171	57	67	28.990
45.36	3537	4.81	1453	5.38	3rd gear.....			169	66	76	28.820
44.67	2472	6.78	1448	3.37	4th gear.....			171	67	76	28.820
39.26	855	17.22	1442	1.34	5th gear.....			170	74	82	28.870
27.10	6663	1.53	1445	13.79	1st gear T.A. (prt-thrtl)			157	57	67	28.990
40.70	6464	2.36	1453	13.56	2nd gear torque amp..			158	57	67	29.085
43.16	5229	3.10	1448	9.56	3rd gear torque amp..			169	69	80	28.840
43.66	3645	4.49	1449	5.59	4th gear torque amp..			169	67	76	28.820
41.84	1353	11.60	1447	1.80	5th gear torque amp..			170	74	82	28.870
TEST J—OPERATING MAXIMUM LOAD											
44.81	3571	4.71	1448	7.97	3rd gear.....			155	63	71	28.935
TEST K— OPERATING MAXIMUM LOAD											
42.84	3831	4.19	1446	10.76	3rd gear.....			161	72	80	28.950

TIRES, WHEELS AND WEIGHTS

	Tests F, G, & H	Test J	Test K
Rear wheels			
Type	Cast iron	Cast iron	Cast iron
Liquid ballast	780 lb each	None	None
Added cast iron	700 lb each	None	None
Rear tires			
No. and size	Two 13-38	Two 13-38	Two 11-38
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	6	6	6
Air pressure	28 lb	28 lb	28 lb
Height of drawbar	22 inches	23 inches	20 inches
Static weight			
Rear end	7720 lb	4760 lb	4610 lb
Front end	1860 lb	1862 lb	1840 lb
Total weight as tested with operator	9755 lb	6797 lb	6625 lb

FUEL, OIL, WATER and TIME Fuel Commercial Propane Weight per gallon 4.25 lb OIL SAE 20-20W To motor 2.202 gal Drained from motor 1.688 gal Water used none Total time motor was operated 49 hours.

CHASSIS Type Tricycle Serial No. 25458S Tread width rear 50" to 94" front 8 3/8" to 17 1/2" Wheel base 95 3/4" Hydraulic control system direct engine drive Advertised speeds mph first 2.50 second 3.85 third 4.83 fourth 6.71 fifth 16.70 reverse 3.33 Using torque amplifier (planetary underdrive) first 1.69 second 2.60 third 3.26 fourth 4.53 fifth 11.27 reverse 2.25 Belt pulley diam 11" face 7 1/2" rpm 899 Belt speed 2588 fpm Belt flat Length 72' Width 7" Thickness 0.216" Maximum slip 0.76% Clutch single plate dry disc operated by foot pedal Seat upholstered seat on conical spring with shock absorber Brakes double disc brakes operated by two foot pedals Equalized by locking pedals together Power take-off direct engine drive with independent clutch.

ENGINE Make INTERNATIONAL Type 4 cylinder vertical Serial No. 159094E Crankshaft mounted lengthwise Head I Lubrication pressure Bore and stroke 4" x 5 1/4" Rated rpm 1450 Compression ratio 8.35 to 1 Displacement 264 cu. in. Port diameter valves inlet 1 19/32" exhaust 1 7/16" Governor variable speed centrifugal Carburetor size 1 1/4" Ignition system battery Starting system 12 volt battery 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 B and F, respectively. Tests C, D, E, L, G, H, J & K were made with an operating setting of the carburetor (selected by the manufacturer) of 94.5% of maximum belt horsepower.

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60 F and 29.92" Hg)	49.54	54.11
2. Observed maximum horsepower (tests F and B)	48.12	52.36
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (ASAE and SAE ratings)	37.16	45.99

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. 571.

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.

