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Test 532: McCormick Farmall 400

Nebraska Tractor Test Lab
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The Experiment Station
University of Nebraska College of Agriculture
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Department of Agricultural Engineering
Dates of test: MARCH 28 to APRIL 4, 1955
Manufacturer: INTERNATIONAL HARVESTER COMPANY, CHICAGO, ILLINOIS
Manufacturer's rating: Drawbar 45 Hp Belt 51 Hp
(Corrected to standard conditions)

NEBRASKA TRACTOR TEST NO. 532

McCORMICK FARMALL 400

BELT HORSEPOWER TESTS

Hp	Crank shaft speed rpm	Fuel Consumption: Gal per hour	Fuel Consumption: Hp-hr per gal	Fuel Consumption: Lb per hp-hour	Water used gal per hour	Temp Deg F: Cooling med	Temp Deg F: Air	Barometer inches of mercury
TEST B—100% MAXIMUM LOAD—TWO HOURS								
50.78	1450	4.429	11.47	0.528	0.00	177	61	28.850
TEST C—OPERATING MAXIMUM LOAD—ONE HOUR								
48.70	1449	4.020	12.11	0.500	0.00	188	70	28.860
TEST D—RATED LOAD—ONE HOUR								
44.89	1450	3.848	11.67	0.519	0.00	190	74	28.860
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)								
45.06	1453	3.857	11.68	0.518	...	191	74	.....
1.37	1633	1.849	0.74	8.168	...	188	74	.....
24.02	1544	2.796	8.59	0.704	...	184	74	.....
46.16	1360	3.752	12.30	0.492	...	173	77	.....
12.47	1595	2.394	5.21	1.162	...	185	76	.....
34.73	1495	3.346	10.38	0.583	...	187	76	.....
27.30	1513	2.999	9.10	0.665	0.00	184	75	28.825

TORQUE (At dynamometer)										
Eng rpm	1450	1378	1300	1226	1150	1075	1002	924	856	775
Lb-ft	365.9	369.8	376.3	387.1	398.1	408.1	412.1	412.5	404.4	386.4
Dyn rpm	696	661	625	588	553	516	480	444	410	372

DRAWBAR HORSEPOWER TESTS

Hp	Draw bar pull lb	Speed miles per hr	Crank shaft speed rpm	Slip of drive wheels %	Fuel Consumption: Gal per hour	Fuel Consumption: Hp-hr per gal	Fuel Consumption: Lb per hp-hr	Water used gal per hour	Temp Deg F: Cooling med	Temp Deg F: Air	Barometer inches of mercury
TEST H—RATED LOAD—TEN HOURS—3rd GEAR											
35.60	2769	4.82	1450	4.80	3.736	9.53	0.635	0.00	190	65	28.926
TEST F—100% MAXIMUM LOAD											
45.34	3558	4.78	1454	5.98	..... 3rd Gear				170	64	28.765
TEST G—OPERATING MAXIMUM LOAD											
37.85	6508	2.18	1446	16.63	1st gear (Part Throttle) ...				178	64	28.800
43.26	4335	3.74	1451	7.41	2nd gear				182	64	28.775
43.47	3386	4.81	1456	5.35	3rd gear				183	64	28.760
43.38	2399	6.78	1449	3.70	4th gear				179	64	28.775
36.73	794	17.35	1452	1.08	5th gear				172	64	28.775
25.42	6447	1.48	1453	16.42	1st gear T. A. (Part Throttle)				173	64	28.800
39.20	6348	2.32	1447	14.84	2nd gear Torque Amplifier..				181	64	28.800
41.97	5073	3.10	1449	9.33	3rd gear Torque Amplifier..				182	64	28.800
42.21	3531	4.48	1450	5.77	4th gear Torque Amplifier				182	65	28.760
40.92	1318	11.64	1458	2.00	5th gear Torque Amplifier..				178	64	28.775
TEST J—OPERATING MAXIMUM LOAD											
41.87	3378	4.65	1453	8.90	..... 3rd Gear				178	64	28.560
TEST K—OPERATING MAXIMUM LOAD											
39.45	3672	4.03	1454	15.14	..... 3rd Gear				176	65	28.569

TIRES, WHEELS AND WEIGHT

	Tests F, G & H	Test J	Test K
Rear wheels (Type)	Cast iron	Cast iron	Cast iron
Liquid ballast	875 lb each	None	None
Added cast iron	700 lb each	None	None
Rear tires	Two 13-38	Two 13-38	Two 11-38
Ply	6	6	4
Air pressure	18 lb	12 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	Two 6.00-16	Two 6.00-16	Two 6.00-16
Ply	4	4	4
Air pressure	28 lb	28 lb	28 lb
Height of drawbar	22 inches	23 inches	20 inches
Static weight			
Rear end	7690 lb	4540 lb	4404 lb
Front end	1800 lb	1804 lb	1780 lb
Weight with operator	9665 lb	6519 lb	6359 lb

FUEL, OIL and TIME Gasoline Octane No. ASTM 80.8 (rating taken from oil company's typical inspection data); **weight per gallon** 6.052 lb **OIL** SAE 20; **to motor** 1.992 gal; **drained from motor** 1.781 gal **Total time motor was operated** 42 hours.

CHASSIS Type Tricycle **Serial No.** 4164 S **Tread width** rear 50" to 94" front 8⅜" to 17½" **Wheel base** 95¾" **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 2.27 **Belt pulley** diam 11" face 7½" **rpm** 899 **Belt speed** 2588 fpm **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 Harvester **Type** 4 cylinder vertical **Serial No.** 138509 **Crankshaft mounted** lengthwise **Head** I **Lubrication** pressure **Bore and stroke** 4" x 5¼" **Rated rpm** 1450 **Compression ratio** 6.3 to 1 **Displacement** 264 cu. in. **Port diameter valves** inlet 1 19/32" exhaust 1 7/16" **Governor** variable speed centrifugal **Carburetor size** 1¼" **Ignition system** battery **Starting system** 6 volt battery **Air cleaner** oil washed wire mesh **Muffler** was used **Oil filter** replaceable treated paper element **Cooling medium temperature control** thermostat and radiator shutter.

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 were made with an operating setting of the carburetor (selected by the manufacturer) of 96.7% of maximum belt horsepower.

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60° F and 29.92" HG)	47.34	52.71
2. Observed maximum horsepower (tests F and B)	45.34	50.78
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (formerly ASAE and SAE ratings)	35.51	44.80

We, the undersigned, certify that this is a true and correct report of official tractor test No. 532.

L. F. LARSEN
Engineer-in-Charge

C. W. SMITH
L. W. HURLBUT
F. D. YUNG
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 held 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 held 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, ½ rated load, maximum load at wide open throttle valve, ¼ and ¾ 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.

Torque, lb-ft at dynamometer, is obtained with wide open throttle and sufficient load is applied to give several readings.

DRAWBAR HORSEPOWER TESTS

In all drawbar tests the pull exerted by the tractor is transmitted by a hydraulic pressure cylinder to a recording instrument in the test car. All tests are made on the same 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.