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## Test 820: Farmall 504 (LPG)

Nebraska Tractor Test Lab

University of Nebraska-Lincoln, [tractortestlab@unl.edu](mailto:tractortestlab@unl.edu)

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# NEBRASKA TRACTOR TEST 820 - FARMALL 504 LPG

The University of Nebraska Agricultural Experiment Station

E. F. Frolik, Dean; H. H. Kramer, Director, Lincoln, Nebraska

## POWER TAKE-OFF PERFORMANCE

Hp	Crank- shaft speed rpm	Fuel Consumption		Hp-hr per gal	Temperature Degrees F			Barometer inches of Mercury	
		Gal per hr	Lb per hp-hr		Cooling medium	Air wet bulb	Air dry bulb		
MAXIMUM POWER AND FUEL CONSUMPTION									
Rated Engine Speed—Two Hours									
44.36	2200	4.933	0.473	8.99	202	65	75	28.893	
Standard Power Take-off Speed (540 rpm)—One Hour									
41.21	1969	4.381	0.452	9.41	199	65	75	28.948	
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS									
39.21	2287	4.327	0.469	9.06	192	66	76	.....	
0.00	2401	1.574	.....	.....	172	66	77	.....	
19.89	2320	2.831	0.605	7.03	178	66	77	.....	
45.27	2200	5.026	0.472	9.01	194	65	75	.....	
10.26	2396	2.153	0.892	4.77	172	65	75	.....	
29.50	2297	3.508	0.505	8.41	180	65	75	.....	
Av	24.02	2317	3.236	0.573	7.42	181	66	76	28.960

## DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank-shaft speed rpm	Slip of drivers %	Fuel Consumption			Temp Degrees F			Barometer inches of Mercury	
					Gal per hr	Lb per hp-hr	Hp-hr per gal	Cool-ing med	Air wet bulb	Air dry bulb		
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST												
Maximum Available Power—Two Hours—3rd Gear												
40.17	2793	5.39	2200	5.05	5.000	0.529	8.03	182	53	58	29.070	
75% of Pull at Maximum Power—Ten Hours—3rd Gear												
32.91	2164	5.70	2279	3.00	4.141	0.535	7.95	184	67	75	28.842	
50% of Pull at Maximum Power—Two Hours—3rd Gear												
22.25	1444	5.78	2293	2.37	3.235	0.618	6.88	173	55	62	29.033	
MAXIMUM POWER WITH BALLAST												
28.57	6178	1.73	2266	14.68	1st Gear .....			175	51	56	29.085	
40.92	3921	3.91	2204	7.26	2nd Gear .....			179	51	56	29.110	
41.32	2883	5.38	2197	5.22	3rd Gear .....			179	52	56	29.115	
41.23	1992	7.76	2206	3.78	4th Gear .....			179	52	56	29.115	
37.96	5704	2.50	2201	12.15	2nd Gear Torq. Amp.			179	51	56	29.085	
39.68	4212	3.53	2203	7.84	3rd Gear Torq. Amp.			179	51	56	29.110	
41.21	3008	5.14	2202	5.42	4th Gear Torq. Amp.			177	52	56	29.115	
40.08	1283	11.71	2204	2.23	5th Gear Torq. Amp.			178	52	53	29.100	
MAXIMUM POWER WITHOUT BALLAST												
39.55	2746	5.40	2202	6.81	3rd Gear .....			188	71	79	28.800	
VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—3rd Gear												
Pounds pull			2883		3017		2993		2902		2962	2826
Horsepower			41.32		39.00		34.41		29.08		25.27	20.22
Miles per hour			5.38		4.85		4.31		3.76		3.20	2.68
Slip of drivers, %			5.22		5.35		5.49		5.22		5.35	5.22

## TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 13.6-38; 6; 16	Two 13.6-38; 6; 14
	—Liquid	770 lb each	None
	—Cast iron	290 lb each	None
Front tires	—No, size, ply & psi	Two 6.00-16; 4; 28	Two 6.00-16; 4; 28
	—Liquid	None	None
	—Cast iron	195 lb each	None
Height of drawbar		19½ inches	21 inches
Static weight	—Rear	5940 lb	3820 lb
	—Front	1780 lb	1390 lb
Total weight with operator		7895 lb	5385 lb

Department of Agricultural Engineering

Dates of Test: May 17 to June 9, 1962

Manufacturer: INTERNATIONAL HARVESTER COMPANY, CHICAGO, ILLINOIS

Manufacturer's Power Rating: Not Rated

**FUEL, OIL and TIME** Fuel Commercial propane Specific gravity converted to 60°/60° 0.5103 Weight per gallon 4.25 lb Oil SAE 10W-30 API service classification MS To motor 1.467 gal Drained from motor 0.948 gal Transmission and final-drive lubricant IH Hy-Tran fluid Total time engine was operated 43½ hours.

**ENGINE** Make International LPG Type 4 cylinder vertical Serial No 2146 C Crankshaft mounted lengthwise Rated rpm 2200 Bore and stroke 3⅜" x 4¼" Compression ratio 8.0 to 1 Displacement 152.1 cu. in. Carburetor size 1¼" Ignition system battery Cranking system 12 volt electric Lubrication pressure Air cleaner oil washed wire mesh Oil filter replaceable treated paper element Oil cooler radiator for hydraulic and transmission oil Fuel filter felt pack in strainer Muffler was used Cooling medium temperature control thermostat.

**CHASSIS** Type tricycle Serial No 1309 S-Y Tread width rear 52" to 84" front 8" and 14" Wheel base 89" Center of gravity (without operator or ballast, with minimum tread, with fuel tank filled and tractor serviced for operation) Horizontal distance forward from center-line of rear wheels 23.1" Vertical distance above roadway 32.5" Horizontal distance from center of rear wheel tread 0.0" to the right/left Hydraulic control system direct engine drive Transmission selective gear fixed ratio plus partial range operator controlled power shifting Advertised speeds mph first 1.96 second 4.18 third 5.64 fourth 7.99 fifth 17.64 reverse 2.42 (Using T.A.) first 1.32 second 2.82 third 3.81 fourth 5.39 fifth 11.90 reverse 1.64 Clutch single plate dry disc operated by foot pedal Brakes disc brakes operated by two foot pedals that can be locked together Steering power assisted Turning radius (on concrete surface with brake applied) right 98.5" left 98.5" (on concrete surface without brake) right 100" left 100" Turning space diameter (on concrete surface with brake applied) right 206" left 206" (on concrete surface without brake) right 209.5" left 209.5" Belt pulley 1168 rpm at 2200 engine rpm diam 11" face 7.5" Belt speed 3363 fpm Power take-off 548 rpm at 2000 engine rpm.

**REPAIRS and ADJUSTMENTS** No repairs or adjustments.

**REMARKS** All test results were determined from observed data obtained in accordance with the SAE and ASAE test code.

First gear torque-amplifier was not run as it was necessary to limit the pull in first gear direct drive to avoid excessive wheel slippage.

Fifth gear direct drive was not run as it exceeded 15 mph.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 820.

L. F. LARSEN

Engineer-in-Charge

L. W. HURLBUT

G. W. STEINBRUEGGE

J. J. SULEK

Board of Tractor Test Engineers

# EXPLANATION OF TEST REPORT

## GENERAL CONDITIONS

Each tractor is a production model equipped for common usage. Power consuming accessories can be disconnected only when it is convenient for the operator to do so in practice. Additional weight can be added as ballast if the manufacturer regularly supplies it for sale. The static tire loads and the inflation pressures must conform to recommendations in the Tire Standards published by the Society of Automotive Engineers.

## PREPARATION FOR PERFORMANCE RUNS

The engine crankcase is drained and refilled with a measured amount of new oil conforming to specifications in the operators manual. The fuel used and the maintenance operations must also conform to the published information delivered with the tractor. The tractor is then limbered-up for 12 hours on drawbar work in accordance with the manufacturer's published recommendations. The manufacturer's representative is present to make appropriate decisions regarding mechanical adjustments.

The tractor is equipped with approximately the amount of added ballast that is used during maximum drawbar tests. The tire tread-bar height must be at least 65% of new tread height prior to the maximum power run.

## BELT OR POWER TAKE-OFF PERFORMANCE

**Maximum Power and Fuel Consumption.** The manufacturer's representative makes carburetor, fuel pump, ignition and governor control settings which remain unchanged throughout all subsequent runs. The governor and the manually operated governor control lever is set to provide the high-idle speed specified by the manufacturer for maximum power. Maximum power is measured by connecting the belt pulley or the power take-off to a dynamometer. The dynamometer load is then gradually increased until the engine is operating at the rated speed specified by the manufacturer for maximum power. The corresponding fuel consumption is measured.

**Varying Power and Fuel Consumption.** Six different horsepower levels are used to show corresponding fuel consumption rates and how the governor causes the engine to react to the following changes in dynamometer load: 85% of the dynamometer torque at maximum power; minimum dynamometer torque,  $\frac{1}{2}$  the 85% torque; maximum power,  $\frac{1}{4}$  and  $\frac{3}{4}$  of the 85% torque. Since a tractor is generally subjected to varying loads the average of the results in this test serve well for predicting the fuel consumption of a tractor in general usage.

## DRAWBAR PERFORMANCE

All engine adjustments are the same as those used in the belt or power take-off tests. If the manufacturer specifies a different rated crankshaft speed for drawbar operations, then the position of the manually operated governor control is changed to provide the high-idle speed specified by the manufacturer in the operating instructions.

**Varying Power and Fuel Consumption With Ballast.** The varying power runs are made to show the effect of speed-control devices (engine governor, automatic trans-

mission, etc.) on horsepower, speed and fuel consumption. These runs are made around the entire test course which has two 180 degree turns with a minimum radius of 50 feet. The drawbar pull is set at 3 different levels as follows: (1) as near to the pull at maximum power as possible and still have the tractor maintain the travel speed at maximum horsepower on the straight sections of the test course; (2) 75% of the pull at maximum power; and (3) 50% of the pull at maximum power. Prior to 1958, fuel consumption data (10 hour test) were shown only for the pull obtained at maximum power for tractors having torque converters and at 75% of the pull obtained at maximum power for gear-type tractors.

**Maximum Power with Ballast.** Maximum power is measured on straight level sections of the test course. Data are shown for not more than 12 different gears or travel speeds. Some gears or travel speeds may be omitted because of high slippage of the traction members or because the travel speed may exceed the safe-limit for the test course. The maximum safe speed for the Nebraska Test Course has been set at 15 miles per hour. The slippage limits have been set at 15% and 7% for pneumatic tires and steel tracks or lugs, respectively. Higher slippage gives widely varying results.

**Maximum Power Without Ballast.** All added ballast is removed from the tractor. The maximum drawbar power of the tractor is determined by the same procedure used for getting maximum power with ballast. The gear (or travel speed) is the same as that used in the 10-hour test.

**Varying Power and Travel Speed with Ballast.** Travel speeds corresponding to drawbar pulls beyond the maximum power range are obtained to show the "lugging ability" of the tractor. The run starts with the pull at maximum power; then additional drawbar pull is applied to cause decreasing speeds. The run is ended by one of three conditions: (1) maximum pull is obtained, (2) the maximum slippage limit is reached, or (3) some other operating limit is reached.

For additional information about the Nebraska Tractor Tests write to the Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska.



Farmall 504 LPG