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January 1969

## Test 1014: John Deere 4520 Power Shift

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# NEBRASKA TRACTOR TEST 1014 - JOHN DEERE 4520 POWER SHIFT DIESEL

## POWER TAKE-OFF PERFORMANCE

Hp	Crank-shaft speed rpm	Fuel Consumption		Temperature Degrees F				
		Gal per hr	Lb per hp-hr	Hp-hr per gal	Cooling medium	Air wet bulb	Air dry bulb	Barometer inches of Mercury
<b>MAXIMUM POWER AND FUEL CONSUMPTION</b>								
<b>Rated Engine Speed—Two Hours</b>								
122.36	2200	8.113	0.458	15.08	184	65	75	28.775
<b>Standard Power Take-off Speed (1000 rpm)—One Hour</b>								
115.44	1905	7.381	0.442	15.64	187	66	75	28.775
<b>VARYING POWER AND FUEL CONSUMPTION—TWO HOURS</b>								
106.97	2264	7.372	0.476	14.51	182	67	76	.....
0.00	2418	2.640	.....	.....	183	66	75	.....
55.19	2336	4.993	0.625	11.05	167	66	75	.....
124.03	2200	8.210	0.457	15.11	187	66	76	.....
28.12	2368	3.847	0.945	7.31	165	66	74	.....
81.48	2295	6.182	0.524	13.18	169	66	75	.....
Av 65.97	2313	5.541	0.580	11.91	176	66	75	28.778

## 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	Cooling med	Air wet bulb		Air dry bulb
<b>VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST</b>											
<b>Maximum Available Power—Two Hours—4th Gear</b>											
107.76	8427	4.80	2202	6.62	8.042	0.516	13.40	191	61	77	28.820
<b>75% of Pull at Maximum Power—Ten Hours—4th Gear</b>											
89.36	6673	5.02	2269	5.09	7.104	0.549	12.58	183	66	83	28.782
<b>50% of Pull at Maximum Power—Two Hours—4th Gear</b>											
60.51	4342	5.23	2322	3.43	5.737	0.655	10.55	175	63	78	28.943
<b>MAXIMUM POWER WITH BALLAST</b>											
82.32	13790	2.24	2290	14.71	2nd Gear	.....	178	67	80	28.770	
109.51	11587	3.54	2200	10.18	3rd Gear	.....	190	66	82	28.770	
111.41	8714	4.79	2203	6.54	4th Gear	.....	198	61	77	28.820	
109.74	6490	6.34	2201	5.05	5th Gear	.....	193	69	86	28.770	
108.52	4863	8.37	2206	3.84	6th Gear	.....	186	68	84	28.770	
108.16	3730	10.87	2201	2.93	7th Gear	.....	180	69	90	28.770	

## MAXIMUM PULL WITHOUT BALLAST

90.22	9761	3.47	2281	14.95	3rd Gear	.....	189	63	72	28.560
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## VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—4th Gear

Pounds Pull	8714	9395	10079	10001	9689	9135
Horsepower	111.41	106.62	100.09	87.58	73.11	57.66
Crankshaft speed rpm	2203	1978	1755	1535	1318	1098
Miles per hour	4.79	4.26	3.72	3.28	2.83	2.37
Slip of drivers, %	6.54	7.68	8.28	8.13	7.83	7.53

## TIRES, BALLAST and WEIGHT

	With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 20.8-38; 10; 20
Ballast	—Liquid	1360 lb each
	Cast iron	528 lb each
Front tires	—No, size, ply & psi	Two 10.00-16; 6; 28
Ballast	—Liquid	None
	Cast iron	23 lb each
Height of drawbar		23 inches
Static weight with operator—Rear		13760 lb
Front		4235 lb
Total		17995 lb

Department of Agricultural Engineering

Date of Test: June 3 to June 10, 1969

Manufacturer: JOHN DEERE WATERLOO TRACTOR WORKS, WATERLOO, IOWA

**FUEL, OIL and TIME** Fuel No 2 Diesel Cetane No 52.2 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8299 Weight per gallon 6.910 lb Oil SAE 30 API service classification MS-DS To motor 3.646 gal Drained from motor 3.055 gal Transmission and final-drive lubricant John Deere special 303 oil Total time engine was operated 45½ hours.

**ENGINE** Make John Deere diesel Type 6 cylinder vertical with turbo-charger Serial No M25R0235976R Crankshaft mounted lengthwise Rated rpm 2200 Bore and stroke 4¼" x 4¾" Compression ratio 15.7 to 1 Displacement 404 cu in Cranking system 12 volt electric (two 6 volt batteries) Lubrication pressure Air cleaner pre-cleaner and 2 dry type in parallel with replaceable treated paper elements Oil filter full flow replaceable paper cartridge Oil cooler engine coolant heat exchanger for crankcase oil and radiator for transmission and hydraulic system Fuel filter sediment bowl and screen and replaceable paper primary and secondary filter elements Muffler was used Cooling medium temperature control thermostat.

**CHASSIS** Type standard Serial No T813-P006692R Tread width rear 70" to 100" front 56" to 84.8" Wheel base 106.5" 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 33.02" Vertical distance above roadway 39.36" Horizontal distance from center of rear wheel tread 0.11" to the left Hydraulic control system direct engine drive Transmission selective gear fixed ratio with operator controlled full range power shifting Advertised speeds mph first 1.72 second 2.46 third 3.83 fourth 4.99 fifth 6.50 sixth 8.45 seventh 10.92 eighth 18.47 reverse 2.11 and 3.02 Clutch multiple disc wet clutches within transmission hydraulically operated Brakes wet disc hydraulically power actuated and operated by two foot pedals which can be locked together Steering hydrostatic power Turning radius (on concrete surface with brake applied) right 151" left 151" (on concrete surface without brake) right 171" left 171" Turning space diameter (on concrete surface with brake applied) right 302" left 302" (on concrete surface without brake) right 342" left 342" Power take-off 998 rpm at 1900 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 was not run as it was necessary to limit the pull in second gear to avoid excessive wheel slippage. Eighth gear was not run as it exceeded 15 miles per hour.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 1014.

L. F. LARSEN

Engineer-In-Charge

G. W. STEINBRUEGGE, Chairman

W. E. SPLINTER

D. E. LANE

Board of Tractor Test Engineers

The University of Nebraska Agricultural Experiment Station

E. F. Frolik, Dean; H. W. Ottoson, Director; Lincoln, Nebraska

# 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,  $\frac{1}{2}$  of 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 transmission, 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 Pull without Ballast.** All added ballast is removed from the tractor. The drawbar pull is determined at slip limits of 15% for pneumatic tires or 7% for steel tracks or lugs. The tractor is operated at the fastest possible travel speed.

**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.



JOHN DEERE 4520 POWER SHIFT DIESEL