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January 1970

## Test 1050: John Deere 4320 Syncro Range

Nebraska Tractor Test Lab

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# NEBRASKA TRACTOR TEST 1050 – JOHN DEERE 4320 SYNCRO RANGE DIESEL

## POWER TAKE-OFF PERFORMANCE

Hp	Crank-shaft speed rpm	Fuel Consumption Gal per hr	Lb per hp-hr	Hp-hr per gal	Temperature Degrees F			Barometer inches of Mercury
					Cooling medium	Air wet bulb	Air dry bulb	
<b>MAXIMUM POWER AND FUEL CONSUMPTION</b>								
<b>Rated Engine Speed—Two Hours (PTO Speed—1161 rpm)</b>								
116.55	2200	7.953	0.472	14.65	196	60	75	28.900
<b>Standard Power Take-off Speed (1000 rpm)—One Hour</b>								
108.02	1894	7.036	0.450	15.35	195	60	75	28.895
<b>VARYING POWER AND FUEL CONSUMPTION—Two Hours</b>								
103.22	2295	7.520	0.504	13.73	196	60	74	.....
0.00	2391	2.686	.....	.....	185	60	76	.....
52.85	2350	5.189	0.679	10.19	190	59	74	.....
116.51	2200	7.945	0.471	14.66	198	59	74	.....
26.80	2370	3.979	1.026	6.74	187	60	76	.....
78.52	2322	6.326	0.557	12.41	194	60	75	.....
Av 62.98	2321	5.607	0.731	9.46	192	60	75	28.890

## DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank-shaft speed rpm	Slip of drivers %	Fuel Consumption		Hp-hr per gal	Temp Degrees F			Barometer inches of Mercury
					Gal per hr	Lb per hp-hr		Cooling med	Air wet bulb	Air dry bulb	

### VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST

<b>Maximum Available Power—Two Hours—4th Gear</b>											
101.71	7475	5.10	2196	6.62	7.989	0.543	12.73	188	51	60	29.120
<b>75% of Pull at Maximum Power—Ten Hours—4th Gear</b>											
83.78	5784	5.43	2297	4.94	7.119	0.587	11.77	184	53	57	29.026
<b>50% of Pull at Maximum Power—Two Hours—4th Gear</b>											
57.21	3816	5.62	2340	3.45	5.870	0.709	9.75	183	61	70	28.730

### MAXIMUM POWER WITH BALLAST

89.09	11783	2.84	2277	14.78	2nd Gear	.....	186	52	56	28.730
101.28	9921	3.83	2201	10.15	3rd Gear	.....	189	52	55	28.730
104.40	7718	5.07	2199	7.19	4th Gear	.....	185	52	55	28.730
104.49	6076	6.45	2204	5.52	5th Gear	.....	183	54	59	28.730
103.69	4561	8.52	2201	4.25	6th Gear	.....	183	55	60	28.730

### MAXIMUM PULL WITHOUT BALLAST

88.46	8758	3.79	2287	14.99	3rd Gear	.....	194	53	66	29.200
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### VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—4th Gear

Pounds Pull	7718	8323	8680	8831	8643	8192
Horsepower	104.40	100.00	92.56	82.45	69.30	55.01
Crankshaft Speed rpm	2199	1967	1756	1540	1322	1100
Miles Per Hour	5.07	4.51	4.00	3.50	3.01	2.52
Slip of Drivers %	7.19	7.96	8.66	8.66	8.66	7.96

### TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No. size, ply & psi	Two 18.4-38; 8; 20	Two 18.4-38; 8; 16
Ballast	—Liquid	863 lb each	None
	Cast iron	980 lb each	None
Front tires	—No. size, ply & psi	Two 11L-15; 6; 28	Two 11L-15; 6; 28
Ballast	—Liquid	None	None
	Cast iron	10 lb each	None
Height of drawbar		21 inches	21 inches
Static weight with operator—	Rear	11340 lb	7655 lb
	Front	3040 lb	3020 lb
	Total	14380 lb	10675 lb

The University of Nebraska Agricultural Experiment Station  
E. F. Frolik, Dean; H. W. Ottoson, Director; Lincoln, Nebraska

Department of Agricultural Engineering

Dates of Test: September 21 to September 26, 1970

Manufacturer: John Deere Waterloo Tractor Works, Waterloo, Iowa

**FUEL, OIL and TIME** Fuel No 2 Diesel Cetane No 53.5 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8304 Weight per gallon 6.914 lb Oil SAE 30 API service classification MS, DG, DM, DS To motor 3.676 gal Drained from motor 3.096 gal Transmission and final-drive lubricant John Deere Special 303 Oil Total time engine was operated 47 hours.

**ENGINE** Make John Deere Diesel Type 6 cylinder vertical with turbo-charger Serial No 6404TR-03-282590R Crankshaft mounted length-wise Rated rpm 2200 Bore and stroke 4¼" x 4¾" Compression ratio 15.7 to 1 Displacement 404 cu in Cranking system 12 volt electric Lubrication pressure Air cleaner dry type with primary and secondary replaceable paper elements Oil filter full flow with replaceable paper cartridge Oil cooler engine coolant heat exchanger for crankcase oil and radiator for transmission and hydraulic system Fuel filter single replaceable paper element with two stages in series Muffler was used Cooling medium temperature control thermostat.

**CHASSIS** Type standard Serial No T613-R006568 Tread width rear 60" to 91" front 53" to 78" 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 31.3" Vertical distance above roadway 40.2" Horizontal distance from center of rear wheel tread 0.1" to the left Hydraulic control system direct engine drive Transmission selective gear fixed ratio with partial range syncro-mesh Advertised speeds mph first 2.01 second 3.21 third 4.26 fourth 5.47 fifth 6.82 sixth 8.89 seventh 11.61 eighth 18.87 reverse 4.12 & 6.60 Clutch single plate dry disc operated by foot pedal Brakes wet disc hydraulically power actuated operated by two foot pedals that can be locked together Steering hydrostatic power Turning radius (on concrete surface with brake applied) right 136" left 136" (on concrete surface without brake) right 157" left 157" Turning space diameter (on concrete surface with brake applied) right 286" left 286" (on concrete surface without brake) right 328" left 328" Power take-off 1003 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 because of excessive slippage. Seventh and eighth gears were not run as test procedure permits only one gear over eight miles per hour.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 1050.

L. F. LARSEN  
Engineer-in-Charge

G. W. STEINBRUEGGE  
W. E. SPLINTER  
D. E. LANE

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. Prior to the maximum power run the tire tread-bar height must be at least 65% of new tread height.

## 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.

**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.

**Maximum Power with Ballast.** Maximum power is measured on straight level sections of the test course. Data are shown for not more than 8 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 manufacturer's representative has the option of selecting one gear or speed over eight miles per hour. 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 Drawbar Pull 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 68503.



JOHN DEERE 4320 SYNCRO RANGE DIESEL