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Test 960: Zetor 5511 Zetormatic (Diesel)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 960 – ZETOR 5511 ZETORMATIC DIESEL

The University of Nebraska Agricultural Experiment Station
E. F. Frolik, Dean; H. W. Ottoson, 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								
50.87	2200	3.391	0.465	15.00	181	59	75	29.107
Standard Power Take-off Speed (540 rpm)—One Hour								
47.79	1991	3.109	0.454	15.37	183	59	77	29.080
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
45.12	2295	3.033	0.469	14.88	177	60	79	.....
0.00	2385	0.895	.....	.....	138	61	81	.....
23.14	2354	1.859	0.560	12.45	146	60	80	.....
50.41	2203	3.382	0.468	14.91	183	61	82	.....
11.63	2368	1.351	0.810	8.61	146	61	83	.....
34.35	2330	2.353	0.478	14.60	164	62	84	.....
Av 27.44	2322	2.145	0.545	12.79	159	61	81	29.045

DRAWBAR PERFORMANCE

Hp	Draw- bar pull lbs	Speed miles per hr	Crank- shaft speed rpm	Slip of drivers %	Fuel Consumption			Temp Degrees F			Barom- eter 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—7th Gear (2nd Hi Range)												
44.00	4131	3.99	2203	10.57	3.267	0.518	13.47	180	48	66		29.195
75% of Pull at Maximum Power—Ten Hours—7th Gear (2nd Hi Range)												
34.97	3023	4.34	2308	7.35	2.605	0.519	13.42	155	51	67		29.029
50% of Pull at Maximum Power—Two Hours—7th Gear (2nd Hi Range)												
24.38	2032	4.50	2340	5.19	2.807	0.803	8.69	182	43	52		29.230

MAXIMUM POWER WITH BALLAST

37.23	5244	2.66	2298	14.96	5th Gear (1st Hi Range)			176	45	58		29.240
43.49	5057	3.23	2200	13.45	6th Gear (5th Lo Range)			176	45	58		29.240
44.93	4223	3.99	2201	10.59	7th Gear (2nd Hi Range)			186	45	58		29.240
45.28	2954	5.75	2200	7.65	8th Gear (3rd Hi Range)			172	46	60		29.220
44.55	1848	9.04	2202	5.10	9th Gear (4th Hi Range)			173	46	60		29.220

MAXIMUM PULL WITHOUT BALLAST

35.72	4127	3.25	2274	14.86	6th Gear (5th Lo Range)			181	58	71		29.060
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VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST 7th Gear (2nd Hi Range)

Pounds pull		4223	4400	4487	4485	4452	4309
Horsepower		44.93	41.72	37.60	32.94	28.03	22.72
Crankshaft speed, rpm		2201	1973	1750	1534	1314	1036
Miles per hour		3.99	3.56	3.14	2.75	2.36	1.98
Slip of drivers, %		10.59	11.12	11.32	11.53	11.43	10.91

TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 13-28, 8, 16	Two 13-28, 8, 14
	—Liquid	440 lb each	None
	Cast iron	313 lb each	None
Front tire	—No, size, ply & psi	Two 6.00-18, 6, 36	Two 6.00-18, 6, 32
	—Liquid	None	None
	Cast iron	60 lb each	None
Height of drawbar		23½ inches	23½ inches
Static weight with operator—	Rear	4945 lb	3440 lb
	Front	2045 lb	1925 lb
	Total	6990 lb	5365 lb

Department of Agricultural Engineering

Dates of Test: MAY 14 to MAY 22, 1967

Manufacturer: ZKL-BRNO, BRNO, CZECHO-SLOVAKIA

FUEL, OIL and TIME Fuel No 2 Diesel Cetane No 54.7 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8374 Weight per gallon 6.973 lb Oil SAE 20-20W API service classification MS, DG, DM, DS To motor 2.368 gal Drained from motor 2.273 gal Transmission and final-drive lubricant SAE 40 Total time engine was operated 54½ hours.

ENGINE Make Zetor Diesel Type 4 cylinder vertical Serial No 5101/1059 Crankshaft mounted lengthwise Rated rpm 2200 Bore and stroke 3.74" x 4.33" Compression ratio 17.9 to 1 Displacement 190.5 cu in Cranking system 12 volt electric (two 12 volt batteries) Lubrication pressure Air cleaner dry type with centrifugal pre-cleaner Oil filter centrifugal type Oil cooler not used Fuel filter two replaceable cellulose elements Muffler was used Cooling medium temperature control thermostat and radiator curtain.

CHASSIS Type standard Serial No 1089 Tread width rear 56.2" to 70.8" front 53.2" to 67.4" Wheel base 88.86" Center of gravity (without operator or ballast, with minimum tread, with fuel tank filled and tractor serviced for operation) Horizontal distance forward from centerline of rear wheels 31.1" Vertical distance above roadway 30" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive or transmission drive with throwout lever Transmission selective gear fixed ratio Advertised speeds mph first 0.74 second 1.10 third 1.53 fourth 2.35 fifth 3.93 sixth 3.16 seventh 4.70 eighth 6.55 ninth 10.05 tenth 16.79 reverse 0.96 and 4.12 Clutch double dry disc in combination with PTO clutch Brakes contracting bands operated by hand lever and internal expanding shoes operated hydraulically by two foot pedals that can be locked together Steering no power assistance Turning radius (on concrete surface with brake applied) right 128" left 128" (on concrete surface without brake) right 148" left 148" Turning space diameter (on concrete surface with brake applied) right 264" left 264" (on concrete surface without brake) right 303" left 303" Belt pulley 1152 rpm at 2000 engine rpm diam 9.84" face 5.90" Belt speed 2970 fpm Power take-off 542 rpm at 2000 engine rpm.

REPAIRS and ADJUSTMENTS During the 10 hour run the plastic section of the fuel return line failed and was replaced.

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

First, second, third, and fourth gears, low range, were not run as it was necessary to limit the pull in first gear, high range, to avoid excessive wheel slippage. Fifth gear, high range, was not run as it exceeded 15 mph.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 960.

L. F. LARSEN

Engineer-in-Charge

G. W. STEINBRUEGGE, Chairman

J. J. SULEK

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. 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.



ZETOR 5511 ZETOMATIC DIESEL