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## Test 867: Zetor 4011 (Diesel)

Nebraska Tractor Test Lab

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# NEBRASKA TRACTOR TEST 867 - ZETOR 4011 DIESEL

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									
*	48.50	2000	2.978	0.429	16.29	192	60	75	29.077
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS									
	42.90	2083	2.644	0.431	16.23	181	59	75	.....
	0.00	2200	0.897	.....	.....	137	58	74	.....
	22.17	2152	1.700	0.536	13.04	154	58	73	.....
	48.16	2002	2.974	0.432	16.19	187	59	73	.....
	11.20	2173	1.279	0.798	8.76	143	58	72	.....
	32.79	2122	2.159	0.460	15.19	162	58	70	.....
Av	26.20	2122	1.942	0.518	13.49	161	58	73	29.070

## 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—2nd Gear High Range												
40.77	3715	4.12	2000	8.31	2.944	0.505	13.85	203	57	69	28.955	
75% of Pull at Maximum Power—Ten Hours—2nd Gear High Range												
33.71	2861	4.42	2094	6.02	2.403	0.498	14.03	198	59	71	28.790	
50% of Pull at Maximum Power—Two Hours—2nd Gear High Range												
24.28	1984	4.59	2144	4.59	1.934	0.557	12.55	193	48	52	28.880	
MAXIMUM POWER WITH BALLAST												
36.82	5184	2.66	2076	14.97	1st	Gear High Range	203	57	71	29.020		
40.69	4541	3.36	2002	10.50	5th	Gear Low Range	211	57	71	29.020		
41.84	3798	4.13	2001	8.06	2nd	Gear High Range	210	57	69	29.020		
41.78	2658	5.89	2003	5.89	3rd	Gear High Range	212	58	72	28.980		
40.95	1658	9.26	2005	3.68	4th	Gear High Range	208	58	72	28.980		
MAXIMUM POWER WITHOUT BALLAST												
40.14	3811	3.95	2013	12.83	2nd	Gear High Range	205	49	57	28.900		

## VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST 2nd Gear High Range

Pounds pull	3798	3928	3955	3966	3334	3732
Horsepower	41.84	38.63	34.84	30.45	25.81	20.36
Crankshaft Speed, rpm	2001	1794	1607	1404	1197	992
Miles per hour	4.13	3.69	3.30	2.88	2.46	2.05
Slip of drivers, %	8.06	8.39	8.39	8.62	8.51	8.28

## TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 13-28; 8; 14	Two 13-28; 8; 14
	—Liquid	430 lb each	None
	—Cast iron	297 lb each	None
Front tires	—No, size, ply & psi	Two 6.00-18; 6; 32	Two 6.00-18; 6; 24
	—Liquid	None	None
	—Cast iron	187 lb each	None
Height of drawbar		25 inches	25½ inches
Static weight	—Rear	4600 lb	3145 lb
	—Front	1965 lb	1590 lb
Total weight with operator		6740 lb	4910 lb

## Department of Agricultural Engineering

Dates of Test: October 10 to October 19, 1964

Manufacturer: ZKL-BRNO, BRNO, CZECHO-SLOVAKIA

**FUEL, OIL and TIME** Fuel No 2 Diesel Cetane No 57.0 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8394 Weight per gallon 6.990 lb Oil SAE 20-20W API service classification DS To motor 2.420 gal Drained from motor 2.172 gal Transmission and final-drive lubricant SAE 40 Total time engine was operated 39½ hours.

**ENGINE** Make Zetor Diesel Type 4 cylinder vertical Serial No 9975 Crankshaft mounted lengthwise Rated rpm 2000 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 oil bath with centrifugal pre-cleaner Oil filter one full-flow and one by-pass filter with fine mesh screen Fuel filter two replaceable cellulose elements Muffler was used Cooling medium temperature control thermostat and radiator curtain.

**CHASSIS** Type Standard Serial No 9755 Tread width rear 53.2" to 70.8" front 53.2" to 64.4" Wheel base 83.4" 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 (Low Range) first 0.7 second 1.04 third 1.45 fourth 2.23 fifth 3.72 reverse 0.91 (High Range) first 3.0 second 4.46 third 6.17 fourth 9.54 fifth 15.92 reverse 3.91 Clutch double dry disc in combination with PTO clutch operated by single foot pedal Brakes contracting band operated by hand lever and internal expanding shoe operated hydraulically by single foot pedal for both wheels or independently by use of hydraulic valve controlled by hand lever Steering no power assistance Turning radius (on concrete surface with brake applied) right 127.9" left 127.9" (on concrete surface without brake) right 147.6" left 147.6" Turning space diameter (on concrete surface with brake applied) right 263.8" left 263.8" (on concrete surface without brake) right 303.1" left 303.1" 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:** No repairs or adjustments.

**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 867.

L. F. LARSEN

Engineer-in-Charge

L. W. HURLBUT, Chairman

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.



Zetor 4011 Diesel