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Test 959: Ford 2000 8-Speed (Diesel)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 959 – FORD 2000 8-SPEED 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		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	
MAXIMUM POWER AND FUEL CONSUMPTION									
Rated Engine Speed—Two Hours									
31.19	2001	2.023	0.449	15.42	187	58	74	29.040	
Standard Power Take-off Speed (540 rpm)—One Hour									
30.32	1812	1.890	0.431	16.04	190	58	75	29.030	
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS									
27.37	2066	1.808	0.457	15.14	181	58	75	.....
0.00	2201	0.663	.....	.....	170	57	74	.....
14.14	2133	1.240	0.607	11.40	177	58	75	.....
31.56	2003	2.050	0.450	15.40	184	58	75	.....
7.13	2153	0.936	0.909	7.62	175	58	75	.....
20.90	2104	1.504	0.498	13.90	182	59	76	.....
Av	16.85	2110	1.367	0.561	12.33	178	58	75	29.000

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—4th Gear											
27.49	2246	4.59	2003	5.59	2.039	0.513	13.48	175	45	55	29.075
75% of Pull at Maximum Power—Ten Hours—4th Gear											
22.05	1693	4.88	2103	4.31	1.742	0.547	12.66	184	41	43	29.135
50% of Pull at Maximum Power—Two Hours—4th Gear											
15.86	1186	5.01	2127	2.86	1.482	0.647	10.70	170	41	44	28.960
MAXIMUM POWER WITH BALLAST											
21.40	4413	1.82	2093	14.53	2nd Gear		174	41	43		28.940
27.36	3141	3.27	1997	8.29	3rd Gear		169	44	52		29.100
27.76	2265	4.60	2002	5.35	4th Gear		178	41	49		29.040
28.21	1906	5.55	2002	4.70	5th Gear		174	41	49		29.040
27.47	1474	6.99	2000	3.72	6th Gear		168	44	52		29.100
25.42	759	12.56	2009	1.87	7th Gear		167	44	52		29.100
MAXIMUM PULL WITHOUT BALLAST											
25.72	3140	3.07	1997	14.81	3rd Gear		186	54	62		28.870

VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—4th Gear

Pounds pull	2265	2417	2564	2640	2666	2673	2547
Horsepower	27.76	26.40	24.96	22.34	19.24	16.22	12.37
Crankshaft speed, rpm	2002	1797	1607	1401	1197	1005	803
Miles per hour	4.60	4.10	3.65	3.17	2.71	2.28	1.82
Slip of drivers, %	5.35	6.19	6.50	6.71	6.92	6.81	6.71

TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 12.4-28; 4; 14	Two 12.4-28; 4; 12
	—Liquid	440 lb each	None
	Cast iron	490 lb each	None
Front tire	—No, size, ply & psi	Two 5.50-16; 4; 32	Two 5.50-16; 4; 32
	—Liquid	None	None
	Cast iron	None	None
Height of drawbar		23½ inches	24½ inches
Static weight with operator—Rear		4140 lb	2280 lb
	Front	1720 lb	1720 lb
	Total	5860 lb	4000 lb

Department of Agricultural Engineering

Dates of Test: APRIL 17 to APRIL 28, 1967

Manufacturer: FORD MOTOR COMPANY, BIRMINGHAM, MICHIGAN

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° 0.8313 Weight per gallon 6.921 lb Oil SAE 10W API service classification MS, DS To motor 1.453 gal Drained from motor 1.092 gal Transmission and final-drive lubricant Ford oil ESN-M2C77-A or M-4864-A Total time engine was operated 45½ hours.

ENGINE Make Ford Diesel **Type** 3 cylinder vertical **Serial No** LD-100813L155 **Crankshaft** mounted lengthwise **Rated rpm** 2000 **Bore and stroke** 4.2" x 3.8" **Compression ratio** 17.5 to 1 **Displacement** 158 cu in **Cranking system** 12 volt electric **Lubrication pressure** Air cleaner oil washed wire mesh **Oil filter** full flow replaceable paper element **Fuel filter** one filter with replaceable nylon gauze element and one filter with replaceable paper element **Muffler** was used **Cooling medium temperature control** thermostat.

CHASSIS Type standard **Serial No** 21013C **Tread width rear** 52" to 76" **front** 52" to 80" **Wheel base** 75.8" **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 32.8" Vertical distance above roadway 25.2" Horizontal distance from center of rear wheel tread 0" to the right/left **Hydraulic control system** direct engine drive **Transmission** selective gear fixed ratio **Advertised speeds mph** first 1.6 second 2.0 third 3.6 fourth 4.8 fifth 5.8 sixth 7.2 seventh 12.8 eighth 17.4 reverse 2.4 and 8.4 **Clutch** single plate dry disc operated by foot pedal **Brakes** internal expanding shoe operated by two foot pedals which can be locked **Steering** mechanical with power assist **Turning radius** (on concrete surface with brake applied) right 117" left 117" (on concrete surface without brake) right 129" left 129" **Turning space diameter** (on concrete surface with brake applied) right 240" left 240" (on concrete surface without brake) right 267" left 267" **Belt pulley** 1113 rpm at 2000 engine rpm diam 10.25" face 6.5" **Power take-off** 537 rpm at 1800 engine rpm **Belt speed** 2986 fpm.

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 the stability formula and to avoid excessive wheel slippage. Eighth gear was not run as it exceeded 15 mph.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 959.

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.



Ford 2000 8-Speed Diesel