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Test 958: Ford 2000 4-Speed (Diesel)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 958 – FORD 2000 4-SPEED DIESEL

POWER TAKE-OFF PERFORMANCE

Hp	Crank- shaft speed rpm	Fuel Consumption		Temperature Degrees F					Barometer inches of Mercury
		Gal per hr	Lb per hp-hr	Hp-hr per gal	Cooling medium	Air wet bulb	Air dry bulb		
MAXIMUM POWER AND FUEL CONSUMPTION									
Rated Engine Speed—Two Hours									
32.09	2000	2.255	0.486	14.23	195	57	75	29.020	
Standard Power Take-off Speed (540 rpm)—One Hour									
26.64	1486	1.761	0.458	15.13	200	58	76	29.000	
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS									
28.16	2066	1.899	0.467	14.83	197	58	74	.....
0.00	2211	0.681	.....	.....	180	57	73	.....
14.48	2125	1.222	0.584	11.85	184	55	73	.....
32.33	2000	2.276	0.487	14.20	198	58	75	.....
7.33	2154	0.936	0.884	7.83	182	57	74	.....
21.45	2097	1.552	0.501	13.82	188	58	74	.....
Av	17.29	2109	1.428	0.571	12.11	188	57	74	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—5th Gear (2nd direct)											
28.10	2303	4.58	2013	6.24	2.179	0.537	12.90	200	51	64	29.105
75% of Pull at Maximum Power—Ten Hours—5th Gear (2nd direct)											
22.75	1769	4.82	2090	4.84	1.816	0.552	12.53	194	38	46	28.517
50% of Pull at Maximum Power—Two Hours—5th Gear (2nd direct)											
15.71	1186	4.97	2117	3.27	1.475	0.650	10.65	194	41	49	28.585
MAXIMUM POWER WITH BALLAST											
27.45	4402	2.34	2044	13.22	1st Gear (1st under)			193	47	54	29.270
28.12	3668	2.88	1999	10.20	2nd Gear (2nd under)			193	47	54	29.270
28.95	2959	3.67	2000	8.09	3rd Gear (1st direct)			198	48	57	29.240
28.03	2417	4.35	1998	6.71	4th Gear (3rd under)			197	48	57	29.240
28.27	2334	4.54	2002	6.40	5th Gear (2nd direct)			196	48	57	29.240
27.84	1852	5.64	1997	5.39	6th Gear (1st over)			198	51	63	29.160
28.02	1557	6.75	2004	4.64	7th Gear (3rd direct)			197	51	63	29.160
27.46	1488	6.92	1998	4.37	8th Gear (2nd direct)			197	51	63	29.160
26.98	1079	9.38	1998	3.55	9th Gear (4th under)			196	51	63	29.160
25.87	951	10.20	2000	3.22	10th Gear (3rd over)			196	51	63	29.160
24.20	630	14.40	2003	2.43	11th Gear (4th direct)			196	51	63	29.160
MAXIMUM PULL WITHOUT BALLAST											
23.97	3178	2.83	2063	14.87	2nd Gear (2nd under)			193	45	57	28.990
VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—5th Gear											
Pounds pull				2334	2398	2485	2540	2605	2547		
Horsepower				28.27	25.83	24.03	21.47	18.80	15.33		
Crankshaft speed, rpm				2002	1786	1606	1407	1204	1002		
Miles per hour				4.54	4.04	3.63	3.17	2.71	2.26		
Slip of drivers, %				6.40	6.71	6.91	7.12	7.33	7.12		

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	460 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	30 lb each	None
Height of drawbar		23½ inches	24½ inches
Static weight with operator—Rear		4140 lb	2240 lb
	Front	1710 lb	1650 lb
	Total	5850 lb	3890 lb

Department of Agricultural Engineering

Dates of Test: APRIL 14 to MAY 2, 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** 1.757 gal **Drained from motor** 1.432 gal **Transmission and final-drive lubricant** SAE Ford oil ESN-M2C77-A or M-4864-A **Total time engine was operated** 64½ hours.

ENGINE Make Ford Diesel **Type** 3 cylinder vertical **Serial No** LD229825-M16 **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** 21012A **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 2.7 second 3.2 third 4.0 fourth 4.6 fifth 4.8 sixth 6 seventh 7.0 eighth 7.2 ninth 9.4 tenth 10.5 eleventh 14.8 reverse 2.8 and 4.2 **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** 1323 rpm at 1950 engine rpm diam 9.00" face 6.5" **Power take-off** 546 rpm at 1500 engine rpm **Belt Speed** 3117 fpm.

REPAIRS and ADJUSTMENTS Before starting the PTO runs the fuel injectors were replaced.

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

It was necessary to limit the pull in first gear because of the stability formula and to avoid excessive slippage. Twelfth 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 958.

L. F. LARSEN

Engineer-in-Charge

G. W. STEINBRUEGGE, Chairman

J. J. SULEK

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.



Ford 2000 4-Speed Diesel