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## Test 706: Ford Model 681-D (Diesel)

Nebraska Tractor Test Lab

University of Nebraska-Lincoln, [tractortestlab@unl.edu](mailto:tractortestlab@unl.edu)

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# NEBRASKA TRACTOR TEST 706 - FORD 681-D (DIESEL)

The University of Nebraska Agricultural Experiment Station

W. V. Lambert, 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								
31.56	2200	2.369	0.526	13.32	169	66	75	28.927
Standard Power Take-off Speed (1000 rpm)—One Hour								
26.30	1734	1.932	0.515	13.61	175	66	74	28.927
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
28.74	2353	2.170	0.529	13.24	165	66	74	.....
4.16	2424	0.937	1.579	4.44	138	66	76	.....
14.64	2397	1.391	0.666	10.52	152	66	75	.....
32.08	2232	2.397	0.524	13.38	172	66	75	.....
7.41	2420	1.083	1.024	6.84	143	66	76	.....
21.75	2373	1.742	0.561	12.49	159	67	76	.....
Av 18.13	2365	1.620	0.626	11.19	155	66	75	28.920

## DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank shaft speed rpm	% Slip of drive wheels	Fuel Consumption Gal per hr	Lb per hp-hr	Hp-hr per gal	Temp. Degrees F Cooling med	Air wet bulb	Air dry bulb	Barometer inches of mercury
<b>VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST</b>											
<b>Maximum Available Power—Two Hours—6th Gear</b>											
25.52	2162	4.43	1985	5.28	2.183	0.599	11.69	176	75	81	28.655
<b>75% of Pull at Maximum Power—Ten Hours—6th Gear</b>											
21.00	1629	4.84	2140	3.97	1.735	0.579	12.10	167	75	87	28.751
<b>50% of Pull at Maximum Power—Two Hours—6th Gear</b>											
14.48	1090	4.98	2170	2.48	1.340	0.648	10.81	155	76	87	28.650
<b>MAXIMUM POWER WITH BALLAST</b>											
23.29	4179	2.09	2112	13.61	4th Gear	.....	.....	164	63	70	28.870
25.90	2886	3.37	2002	8.09	5th Gear	.....	.....	173	66	73	28.875
25.61	2172	4.42	1998	5.89	6th Gear	.....	.....	173	68	74	28.880
24.80	1801	5.16	2005	4.92	7th Gear	.....	.....	172	72	80	28.850
24.08	1348	6.70	2000	3.87	8th Gear	.....	.....	171	72	81	28.840
23.16	784	11.08	2008	2.16	9th Gear	.....	.....	170	73	82	28.835
<b>MAXIMUM POWER WITHOUT BALLAST</b>											
24.96	2145	4.36	2005	9.29	6th Gear	.....	.....	176	77	93	28.650
<b>VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—6th Gear</b>											
Pounds pull	2150	2250	2250	2300	2350	2250					
Horsepower	25.6	24.0	21.0	19.0	16.3	13.2					
Miles per hour	4.4	4.0	3.5	3.1	2.6	2.2					

Department of Agricultural Engineering

Dates of Test: June 20 to June 26, 1959

Manufacturer: FORD MOTOR COMPANY, BIRMINGHAM, MICHIGAN

Manufacturer's Power Rating: Not rated

**FUEL, OIL and TIME** Fuel No 2 Diesel Cetane No 51 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8418 Weight per gallon 7.009 lb Oil SAE 30 API service classification DS to motor 1.457 gal Drained from motor 0.977 gal Transmission and final-drive lubricant Ford hydraulic oil M-2C-41 Total time motor was operated 45 hours.

**ENGINE** Make Ford Diesel Type 4 cylinder vertical Serial No 70858 Crankshaft mounted lengthwise Rated rpm 2200 PTO and belt 2000 drawbar Lubrication pressure Bore and stroke 3.562" x 3.600" Compression ratio 16.8 to 1 Displacement 144 cu in Cranking system 12 volt battery Air cleaner oil washed wire mesh Muffler was used Oil filter full flow with replaceable paper element Fuel filter one replaceable paper element Cooling medium temperature control thermostat.

**CHASSIS** Type standard Serial No 70858 Tread width rear 52" to 76" front 52" to 80" Wheel base 74.5" 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 32" Vertical distance above roadway 24" Horizontal distance from center of rear wheel tread 0" to the right or left Hydraulic control system direct engine drive Transmission manually controlled hydraulically actuated planetary gear Advertised speeds mph first 1.01 second 1.57 third 1.63 fourth 2.32 fifth 3.70 sixth 4.77 seventh 5.49 eighth 7.06 ninth 11.43 tenth 16.94 reverse 3.27 and 4.84 Belt pulley diam 9" face 6 1/2" rpm 1298 and 2382 Belt speed 3058 and 5613 fpm Clutch 3 multiple disc wet clutches hydraulically operated Brakes internal expanding shoes operated by two foot pedals on right side of tractor Power take-off 540 or 1000 rpm at 1750 engine rpm Steering power assisted Turning radius (on concrete surface with brake applied) right 107" left 107" (on concrete surface without brake) right 118" left 118" Turning space diameter (on concrete surface with brake applied) right 217" left 217" (on concrete surface without brake) right 246" left 246".

**REPAIRS AND ADJUSTMENTS** No repairs or adjustments.

**REMARKS** All test results were determined from observed data obtained in accordance with SAE and ASAE test code. First, second, and third gears were not run as the pull was limited in fourth gear by stability formula. Tenth gear was not run as it was over 15 mph.

This tractor is equipped with an operator-controlled power-shifting full range fixed-ratio transmission.

We, the undersigned, certify that this is a true and correct report of official Tractor Test No 706.

L. F. LARSEN  
Engineer-in-Charge

L. W. HURLBUT, Chairman  
G. W. STEINBRUEGGE  
J. J. SULEK  
Board of Tractor  
Test Engineers

## 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;14
Ballast	—Liquid 238 lb each —Cast iron 760 lb each	None None
Front tires	—No, size, ply & psi Two 5.50-16;4;28	Two 5.50-16;4;28
Ballast	—Liquid None —Cast iron None	None None
Height of drawbar	19 inches	20 1/2 inches
Static weight	—Rear 3930 lb —Front 1380 lb	1930 lb 1385 lb
Total weight with operator	5485 lb	3490 lb

## 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 transmissions, etc.) on horsepower, speed and fuel consumption. These runs are made around the entire test course which has two 180 degree

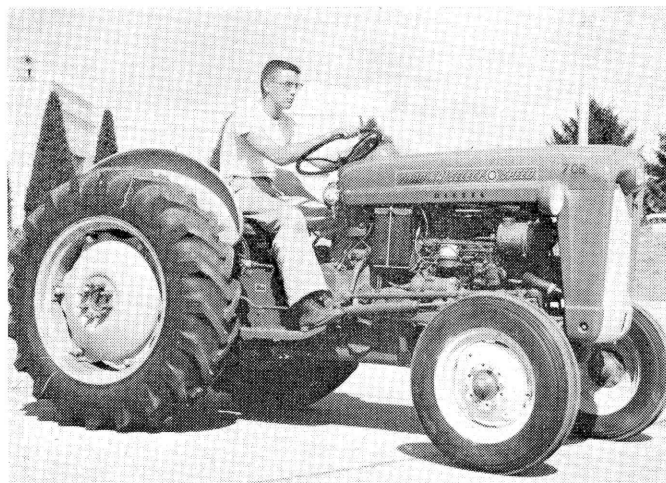
turns with a minimum radius of 50 feet. The drawbar pull is set at 3 different levels as follows: (1) as near to the pull at maximum power as possible and still have the tractor maintain the travel speed at maximum horsepower on the straight sections of the test course; (2) 75% of the pull at maximum 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.



Ford 681-D (Diesel)