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Test 708: Fiat Model 411-C (Diesel)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 708 - FIAT 411-C 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								
37.33	2300	2.846	0.534	13.12	192	64	75	29.040
Standard Power Take-off Speed (540 rpm)—One Hour								
36.04	2160	2.846	0.524	13.38	193	64	75	29.018
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
33.96	2451	2.512	0.519	13.52	178	64	75
1.12	2605	0.989	6.188	1.13	153	63	73
17.45	2528	1.631	0.655	10.70	160	64	76
37.19	2300	2.846	0.536	13.07	193	64	75
8.91	2581	1.310	1.030	6.80	156	64	76
25.96	2509	2.050	0.554	12.66	160	64	75
Av 20.77	2496	1.890	0.638	10.99	166	64	75	28.995

DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank shaft speed rpm	% Slip of drive wheels	Fuel Consumption		Hp-hr per gal	Temp. Degrees F			Barometer inches of mercury
					Gal per hr	Lb per hp-hr		Cooling med	Air wet bulb	Air dry bulb	
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITHOUT BALLAST											
Maximum Available Power—Two Hours—4th Gear											
28.34	3230	3.29	2299	3.42	2.726	0.674	10.40	196	64	75	28.990
75% of Pull at Maximum Power—Ten Hours—4th Gear											
22.83	2476	3.46	2391	2.16	2.241	0.688	10.19	184	74	81	28.855
50% of Pull at Maximum Power—Two Hours—4th Gear											
15.31	1614	3.56	2446	1.66	1.818	0.832	8.42	180	88	94	28.793
MAXIMUM POWER WITHOUT BALLAST											
23.91	5147	1.74	2394	6.37	2nd Gear.....			187	74	89	28.840
28.28	4840	2.19	2299	5.76	3rd Gear.....			178	58	66	29.180
29.38	3325	3.31	2304	2.67	4th Gear.....			176	57	64	29.180
28.96	2636	4.12	2298	2.52	5th Gear.....			182	60	70	29.190
25.03	1542	6.09	2294	1.57	6th Gear.....			192	76	83	28.890
VARYING DRAWBAR PULL AND TRAVEL SPEED WITHOUT BALLAST—4th Gear											
Pounds pull		3350	3400	3550	3650	3550	3450				
Horsepower		29.4	27.2	24.6	22.4	18.9	15.6				
Miles per hour		3.3	3.0	2.6	2.3	2.0	1.7				

Department of Agricultural Engineering
 Dates of Test: June 30 to July 13, 1959
 Manufacturer: FIAT S.P.A., TURIN, ITALY
 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 MS and DG To motor 2.092 gal Drained from motor 1.715 gal Transmission lubricant SAE No 90 Final-drive lubricant SAE 140 Total time motor was operated 52½ hours.

ENGINE Make Fiat Type 4 cylinder vertical diesel Serial No 002526 Crankshaft mounted length-wise Rated rpm 2300 Lubrication pressure Bore and stroke 3.35" x 3.94" Compression ratio 21.5 to 1 Displacement 138.5 cu in Cranking system 24 volts (two-12 volt batteries) Air cleaner oil bath wire screen Muffler was used Oil filter one centrifugal filter and one replaceable cotton element Fuel filter one replaceable impregnated paper element Cooling medium temperature control thermostat.

CHASSIS Type track layer Serial No 000696 Tread width 43⁵/₁₆" Wheel base 51⁷/₈" Drawbar height 9" Measured length of track 14.77 feet Cleats integral with shoes Cleats per track 32 Size of cleats 10¹/₄" x 1³/₈" 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 27.3" Vertical distance above roadway 20.4" Horizontal distance from center of rear wheel tread 0" to the right or left Advertised speeds mph first 0.98 second 1.78 third 2.30 fourth 3.38 fifth 4.21 sixth 6.18 reverse 1.83 and 3.36 Belt pulley diam 9.84" face 5.91" rpm 1190 Belt speed 3070 fpm Clutch over-center single plate operated by hand lever Brakes contracting band operated by two independent foot pedals and a hand lever Power take-off 540 rpm at 2160 engine rpm Steering hand levers controlling multiple disc clutches Turning space diameter not available Total weight with operator 5385 lbs.

REPAIRS AND ADJUSTMENTS Gasket for the no. 4 cylinder injector was replaced and a new fuel filter was installed during maximum power runs.

REMARKS All test results were determined from observed data obtained in accordance with SAE and ASAE test code. First gear was not run as it was necessary to limit the pull in second gear to avoid excessive slippage.

We, the undersigned, certify that this is a true and correct report of official Tractor Test No 708.

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 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.



Fiat 411-C Diesel