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Test 707: Fiat Model 411-R (Diesel)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 707 - FIAT 411-R 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								
36.75	2300	2.860	0.545	12.85	186	63	75	28.952
Standard Power Take-off Speed (540 rpm)—One Hour								
35.33	2159	2.678	0.531	13.19	187	63	75	28.977
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
32.69	2405	2.444	0.524	13.38	179	63	76	.....
1.06	2501	0.963	6.368	1.10	166	62	75	....
16.63	2447	1.605	0.676	10.36	171	63	76	.....
36.71	2303	2.872	0.548	12.78	188	62	75	.....
8.38	2471	1.263	1.056	6.63	169	63	76	.....
24.62	2414	1.952	0.556	12.61	173	62	76	....
Av 20.02	2423	1.850	0.648	10.82	174	62	75	28.983

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 WITH BALLAST											
Maximum Available Power—Two Hours—4th Gear											
32.37	2596	4.68	2293	3.66	2.806	0.608	11.54	191	79	87	28.880
75% of Pull at Maximum Power—Ten Hours—4th Gear											
26.39	2011	4.92	2389	2.70	2.171	0.577	12.16	177	64	84	29.122
50% of Pull at Maximum Power—Two Hours—4th Gear											
17.76	1332	5.00	2413	2.15	1.773	0.700	10.02	172	73	87	28.895
MAXIMUM POWER WITH BALLAST											
27.33	4526	2.26	2352	8.60	2nd Gear	.....	172	66	74	29.110	
32.66	3384	3.62	2295	4.98	3rd Gear	.....	176	66	74	29.110	
33.24	2674	4.66	2293	3.88	4th Gear	.....	175	66	74	29.110	
32.39	1409	8.62	2307	2.29	5th Gear	.....	174	69	76	29.110	
28.88	792	13.68	2310	1.59	6th Gear	.....	176	69	76	29.110	
MAXIMUM POWER WITHOUT BALLAST											
29.20	2590	4.23	2307	13.96	4th Gear	.....	191	68	85	28.980	
VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—4th Gear											
Pounds pull		2650	2750	2750	2800	2750	2600				
Horsepower		33.2	30.8	27.1	24.6	20.5	16.6				
Miles per hour		4.7	4.2	3.7	3.3	2.8	2.4				

TIRES, BALLAST and WEIGHT

	With Ballast	Without Ballast
Rear tires	—No, size, ply & psi Two 11-28;4;14	Two 11-28;4;12
Ballast	—Liquid 186 lb each	None
	—Cast iron 847 lb each	None
Front tires	—No, size, ply & psi Two 6.00-16;6;20	Two 6.00-16;6;20
Ballast	—Liquid None	None
	—Cast iron 77 lb each	None
Height of drawbar	18½ inches	19½ inches
Static weight	—Rear 4132 lb	2066 lb
	—Front 1484 lb	1324 lb
Total weight with operator	5791 lb	3565 lb

Department of Agricultural Engineering
 Dates of Test: June 29 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 2.033 gal Drained from motor 1.615 gal Transmission lubricant SAE No 90 Final-drive lubricant SAE 140 Total time motor was operated 46 hours.

ENGINE Make Fiat Type 4 cylinder vertical diesel Serial No 002996 Crankshaft mounted lengthwise 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 standard Serial No 402137 Tread width rear 47.2" to 74.8" front 50.4" to 77.7" Wheel base 71.8" Center of gravity (without operator ballast, with minimum tread, with fuel tank filled and tractor serviced for operation) Horizontal distance forward from center-line of rear wheels 30.8" Vertical distance above roadway 27.2" Horizontal distance from center of rear wheel tread 0" to the right or left Hydraulic control system direct engine drive Advertised speeds mph first 1.4 second 2.5 third 3.9 fourth 5.0 fifth 9.0 sixth 14.2 reverse 2.0 and 7.3 Belt pulley diam 9.84" face 5.91" rpm 1196 Belt speed 3090 fpm Clutch single plate dry disc operated by foot pedal Brakes contracting band operated by two independent foot pedals and a hand lever Power take-off 540 rpm at 2160 engine rpm Steering no power assistance Turning radius (on concrete surface with brake applied) right 114" left 114½" (on concrete surface without brake) right 124½" left 126" Turning space diameter (on concrete surface with brake applied) right 120" left 120½" (on concrete surface without brake) right 130" left 132".

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 gear was not run as pull was limited in second gear by stability formula. Oil pressure gauge locked at maximum position during the test.

We, the undersigned, certify that this is a true and correct report of official Tractor Test No 707.

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-R Diesel