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Test 772: Case 531 (Diesel)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 772 - CASE 531 DIESEL

The University of Nebraska Agricultural Experiment Station

(ALSO CASE 570 DIESEL)

E. F. Frolik, Dean and Acting Director, Lincoln, Nebraska

POWER TAKE-OFF PERFORMANCE

Hp	Crank shaft speed rpm	Fuel Consumption		Hp-hr per gal	Temp Degrees F			Barometer inches of mercury
		Gal per hr	Lb per hp-hr		Cool- ing med	Air wet bulb	Air dry bulb	
MAXIMUM POWER AND FUEL CONSUMPTION								
Rated Engine Speed—Two Hours								
41.2%	1900	2.521	0.434	16.37	184	58	75	29.013
Standard Power Take-off Speed (540 rpm)—One Hour								
39.41	1772	2.381	0.429	16.55	184	58	75	29.005
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
35.63	1930	2.188	0.436	16.28	181	58	75	.....
0.00	2033	0.617	.....	.....	156	57	73	.....
18.30	1981	1.348	0.523	13.58	150	56	73	.....
41.11	1900	2.459	0.425	16.72	184	58	75	.....
9.28	2009	0.959	0.734	9.68	155	57	73	.....
27.10	1958	1.715	0.449	15.80	169	57	72	.....
Av 21.90	1965	1.548	0.502	14.15	167	57	74	29.020

DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank shaft speed rpm	Slip of drivers %	Fuel Consumption		Hp-hr per gal	Temperature Degrees F		Barometer inches of mercury	
					Gal per hr	Lb hp hr		Cooling medium	Air wet bulb		Air dry bulb
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours—5th Gear											
37.03	3205	4.33	1903	5.01	2.407	0.462	15.38	180	54	65	28.790
75% of Pull at Maximum Power—Ten Hours—5th Gear											
29.36	2422	4.55	1961	3.28	1.996	0.483	14.71	163	54	64	28.808
50% of Pull at Maximum Power—Two Hours—5th Gear											
20.41	1643	4.66	1989	2.23	1.578	0.549	12.93	140	37	38	28.920
MAXIMUM POWER WITH BALLAST											
26.78	6124	1.64	1958	14.51	1st Gear.....		180	59	61		28.680
35.22	5401	2.45	1904	10.80	2nd Gear.....		185	59	61		28.680
36.16	4804	2.82	1898	8.93	3rd Gear.....		187	54	60		28.750
35.98	4041	3.34	1900	7.15	4th Gear.....		188	54	60		28.750
37.20	3241	4.30	1901	5.54	5th Gear.....		180	54	60		28.750
35.53	2703	4.93	1898	4.47	6th Gear.....		180	54	60		28.750
36.34	2377	5.73	1895	4.11	7th Gear.....		180	54	60		28.750
34.60	1763	7.36	1902	3.26	8th Gear.....		180	54	60		28.750
34.43	1492	8.65	1901	2.52	9th Gear.....		180	54	60		28.750
33.26	1270	9.82	1908	1.89	10th Gear.....		180	54	60		28.750
30.15	774	14.61	1902	1.19	11th Gear.....		180	54	60		28.750
MAXIMUM POWER WITHOUT BALLAST											
29.71	2706	4.12	1944	14.27	5th Gear.....		180	52	57		28.760
VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—5th Gear											
Pounds pull			3250	3250	3350	3450	3400	3300			
Horsepower			37.2	33.8	30.4	27.6	23.6	18.5			
Miles per hour			4.3	3.9	3.4	3.0	2.6	2.1			

TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 14.9-28;6;18	Two 14.9-28;6;14
Ballast	—Liquid	540 lb each	None
	—Cast iron	1491 lb each	None
Front tires	—No, size, ply & psi	Two 5.50-16;4;28	Two 5.50-16;4;24
Ballast	—Liquid	None	None
	—Cast iron	None	None
Height of drawbar		15 inches	17 inches
Static weight	—Rear	6630 lb	2568 lb
	—Front	1400 lb	1374 lb
Total weight with operator		8205 lb	4117 lb

Department of Agricultural Engineering

Dates of Test: October 12 to October 27, 1960

Manufacturer: J. I. CASE COMPANY, RACINE, WISCONSIN

Manufacturer's Power Rating: 40 Belt horsepower (corrected to standard conditions)

FUEL, OIL and TIME Fuel No 2 Diesel Cetane No 47 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8528 Weight per gallon 7.101 lb Oil SAE 20-20W API service classification ML, MM, MS, DG To motor 1.098 gal Drained from motor 0.946 gal Transmission and final-drive lubricant SAE 90 Type multi-purpose gear lubricant (E.P.) Total time engine was operated 37 hours.

ENGINE Make Case Diesel Type 4 cylinder vertical Serial No 517-SO-4331 Crankshaft mounted lengthwise Rated rpm 1900 Bore and stroke 3¹³/₁₆" x 4¹/₈" Compression ratio 17.5 to 1 Displacement 188.4 cu in Cranking system 12 volt electric (two 6 volt batteries) Lubrication pressure Air cleaner oil washed wire mesh Oil filter replaceable treated paper element Fuel filter replaceable treated paper element Muffler was used Cooling medium temperature control thermostats.

CHASSIS Type tricycle Serial No 6153312 Tread width rear 48" to 88" front 6¹/₂" to 11¹/₂" Wheel base 86¹/₄" 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 32.6" Vertical distance above roadway 32.4" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive with throwout lever Transmission selective gear fixed ratio Advertised speeds mph first 1.60 second 2.48 third 2.81 fourth 3.26 fifth 4.13 sixth 4.69 seventh 5.44 eighth 6.89 ninth 8.06 tenth 9.07 eleventh 13.43 twelfth 22.38 reverse 2.01 and 3.35 Clutch single plate dry disc operated by foot pedal Brakes double disc operated by two foot pedals Steering power assisted Turning radius (on concrete surface with brake applied) right 95" left 95" (on concrete surface without brake) right 95" left 95" Turning space diameter (on concrete surface with brake applied) right 205" left 205" (on concrete surface without brake) right 205" left 205" Belt pulley 1290 rpm at 1900 engine rpm diam 9¹/₄" face 6³/₈" Belt speed 3125 fpm Power take-off 533 rpm at 1750 engine rpm.

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.

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 772.

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.



Case 531 Diesel