

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

---

Nebraska Tractor Tests

Tractor Test and Power Museum, The Lester F. Larsen

---

11-10-1969

## Test 1030: Case 870 Power Shift Diesel

Nebraska Tractor Test Lab

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

Follow this and additional works at: <https://digitalcommons.unl.edu/tractormuseumlit>



Part of the [Energy Systems Commons](#), [History of Science, Technology, and Medicine Commons](#), [Other Mechanical Engineering Commons](#), [Physical Sciences and Mathematics Commons](#), [Science and Mathematics Education Commons](#), and the [United States History Commons](#)

---

Nebraska Tractor Test Lab, "Test 1030: Case 870 Power Shift Diesel" (1969). *Nebraska Tractor Tests*. 1367.

<https://digitalcommons.unl.edu/tractormuseumlit/1367>

This Article is brought to you for free and open access by the Tractor Test and Power Museum, The Lester F. Larsen at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Nebraska Tractor Tests by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

# NEBRASKA TRACTOR TEST 1030 - CASE 870 POWER SHIFT 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									
70.53	1900	4.662	0.458	15.13	196	56	75	28.887	
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS									
61.72	1955	4.066	0.456	15.18	193	55	75	.....	
0.00	2092	1.282	.....	.....	183	55	74	.....	
31.97	2027	2.572	0.557	12.43	189	56	75	.....	
70.95	1900	4.689	0.458	15.13	197	56	76	.....	
16.22	2055	1.922	0.821	8.44	184	55	74	.....	
47.22	1995	3.247	0.476	14.54	190	56	75	.....	
Av	38.01	2.963	0.540	12.83	189	55	75	28.895	

## DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank-shaft speed rpm	Slip of drivers %	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 POWER WITH BALLAST

59.28	8876	2.50	1916	14.96	1st Range High			185	47	51	28.700
63.59	6831	3.49	1898	9.24	2nd Range Intermed			185	46	51	28.700
64.23	6023	4.00	1900	7.92	3rd Range Low			185	47	51	28.700
63.80	5340	4.48	1901	6.90	2nd Range High			187	47	52	28.700
63.70	4364	5.47	1898	5.30	3rd Range Intermed			185	48	53	28.690
62.66	3375	6.96	1904	4.09	3rd Range High			180	48	52	28.680
60.51	2432	9.33	1901	2.98	4th Range Low			180	48	54	28.680
55.06	1646	12.54	1903	2.23	4th Range Intermed			180	47	51	28.680

## MAXIMUM PULL WITHOUT BALLAST

50.02	7253	2.59	1961	14.76	2nd Range High			185	27	29	29.210
-------	------	------	------	-------	----------------	--	--	-----	----	----	--------

## VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST

### 1st Range High

Pounds Pull	5340	5728	6043	6202	6042	6111
Horsepower	63.80	61.20	57.23	51.01	42.81	36.02
Crankshaft speed rpm	1901	1714	1524	1328	1141	952
Miles per hour	4.48	4.01	3.55	3.08	2.66	2.21
Slip of drivers, %	6.90	7.78	8.19	8.45	8.19	8.19

## TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No. size, ply & psi	Two 18.4-34; 8; 16	Two 18.4-34; 8; 16
Ballast	—Liquid	1003 lb each	None
	—Cast iron	280 lb each	None
Front tires	—No. size, ply & psi	Two 7.50-16; 6; 32	Two 7.50-16; 6; 32
Ballast	—Liquid	None	None
	—Cast iron	28 lb	None
Height of drawbar		16½ inches	17½ inches
Static weight with operator—Rear		9275 lb	6710 lb
Front		2735 lb	2680 lb
Total		12010 lb	9390 lb

## Department of Agricultural Engineering

Date of Test: November 10 to November 19, 1969

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

**FUEL, OIL and TIME** Fuel No 2 diesel Cetane 52.2 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8323 Weight per gallon 6.929 lb Oil SAE 20-20W API service classification MS DS To motor 2.031 gal Drained from motor 1.960 gal Transmission and final-drive lubricant Case TCH oil Total time engine was operated 43 hours.

**ENGINE** Make Case Diesel Type 4 cylinder vertical Serial No 2306917 Crankshaft mounted lengthwise Rated rpm 1900 Bore and stroke 4½ x 5" Compression ratio 16.5 to 1 Displacement 336 cu in Cranking system 12 volt electric (two 12-volt batteries) Lubrication pressure Air cleaner dry type with replaceable treated paper element with pre-cleaner Oil filter Full flow replaceable cartridge Fuel filter replaceable primary and secondary filter cartridges Muffler was used Cooling medium temperature control thermostat.

**CHASSIS** Type standard Serial No 8652187 Tread width rear 60" to 88" front 60" to 88" Wheel base 102" 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 29.3" Vertical distance above roadway 37.1" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive Transmission selective gear fixed ratio with partial range operator controlled power shifting Advertised speeds mph first 1.8 second 2.5 third 3.0 fourth 3.1 fifth 4.0 sixth 4.6 seventh 5.0 eighth 6.2 ninth 7.7 tenth 10.2 eleventh 13.7 twelfth 17.0 reverse 3.1, 5.0, 7.7, 17.0 Clutch multiple disc wet clutches within transmission hydraulically actuated Brakes dry double disc hydraulically power actuated with two foot pedals which can be locked together Steering hydrostatic Turning radius (on concrete surface with brake applied) right 137" left 137" (on concrete surface without brake) right 177" left 177" Turning space diameter (on concrete surface with brake applied) right 286" left 286" (on concrete surface without brake) right 356" left 356" Belt pulley 1108 rpm at 1900 engine rpm diam 10.5" face 7.25" Belt speed 3045 fpm Power take-off 538 rpm at 1900 engine rpm.

**REPAIRS and ADJUSTMENTS:** No repairs or adjustments.

**REMARKS:** The lower three travel speeds were not run as it was necessary to limit the pull in the fourth travel speed to avoid excessive slip. The twelfth travel speed was not run as it exceeded 15 miles per hour.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 1030.

L. F. LARSEN

Engineer-In-Charge

G. W. STEINBRUEGGE, Chairman

W. E. SPLINTER

D. E. LANE

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,  $\frac{1}{2}$  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.



CASE 870 POWER SHIFT DIESEL