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Test 1150: Case 870 Power Shift Diesel

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NEBRASKA TRACTOR TEST 1150 – CASE 870 POWER SHIFT DIESEL

POWER TAKE-OFF PERFORMANCE

Hp	Crankshaft speed rpm	Fuel Consumption Gal per hr	Fuel Consumption Lb per hp-hr	Hp-hr per gal	Temperature Degrees F Cooling medium	Temperature Degrees F Air wet bulb	Temperature Degrees F Air dry bulb	Barometer inches of Mercury
MAXIMUM POWER AND FUEL CONSUMPTION								
Rated Engine Speed—Two Hours (PTO Speed—1123 rpm)								
80.49	2100	6.040	0.519	13.33	208	68	75	28.920
Standard Power Take-off Speed (1000 rpm)—One Hour								
76.52	1870	5.610	0.507	13.64	209	70	75	28.890
VARYING POWER AND FUEL CONSUMPTION—Two Hours								
71.34	2191	5.120	0.497	13.93	193	70	75	.....
0.00	2286	1.652	.....	.....	178	70	74	.....
36.35	2230	3.113	0.593	11.68	184	73	78	.....
80.11	2100	6.100	0.527	13.13	205	72	75	.....
18.34	2252	2.397	0.905	7.65	179	70	74	.....
54.05	2213	4.049	0.518	13.35	186	70	74	.....
Av 43.37	**2212**	**3.738**	**0.596**	**11.60**	**187**	**71**	**75**	**28.857**

DRAWBAR PERFORMANCE

Hp	Drawbar pull lbs	Speed miles per hr	Crankshaft speed rpm	Slip of drivers %	Fuel Consumption Gal per hr	Fuel Consumption Lb per hp-hr	Hp-hr per gal	Temp Degrees F Cooling med	Temp Degrees F Air wet bulb	Temp Degrees F Air dry bulb	Barometer inches of Mercury
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours—6th Gear (3 Lo)											
68.90	5840	4.42	2100	7.25	5.997	0.602	11.49	189	45	51	28.540
75% of Pull at Maximum Power—Ten Hours—6th Gear (3 Lo)											
57.65	4558	4.74	2211	5.51	4.790	0.575	12.04	184	44	51	28.570
50% of Pull at Maximum Power—Two Hours—6th Gear (3 Lo)											
39.82	3052	4.89	2235	3.67	3.757	0.653	10.60	182	43	49	28.530
50% of Pull at Reduced Engine Speed—Two Hours—8th Gear (3 Int)											
39.09	2996	4.89	1673	3.45	3.106	0.549	12.58	181	45	52	28.480
MAXIMUM POWER WITH BALLAST											
61.15	10030	2.29	2198	14.98	2nd Gear (1 Int)			184	41	44	28.590
70.32	6864	3.84	2101	9.29	5th Gear (2 Int)			192	48	55	28.640
71.04	6072	4.39	2098	7.98	6th Gear (3 Lo)			191	48	55	28.640
68.36	5202	4.93	2099	6.63	7th Gear (2 Hi)			192	48	55	28.640
70.26	4394	6.00	2099	5.60	8th Gear (3 Int)			192	47	53	28.650
66.28	2432	10.22	2099	3.08	10th Gear (4 Lo)			192	47	53	28.650

VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST
6th Gear (3 Lo)

Pounds Pull	6072	6482	6809	6983	6998	6894
Horsepower	71.04	67.87	62.90	56.54	48.13	39.23
Crankshaft Speed rpm	2098	1891	1681	1479	1257	1039
Miles Per Hour	4.39	3.93	3.46	3.04	2.58	2.13
Slip of Drivers %	7.98	8.71	9.23	9.61	9.61	9.61

TRACTOR SOUND LEVEL	dB (A)
Maximum Available Power 2 Hours	82.0
75% of Pull at Max. Power 10 Hours	84.0
50% of Pull at Max. Power 2 Hours	83.5
50% of Pull at Reduced Engine Speed 2 Hours	82.0
Bystander 12th Gear (4-Hi)	86.5

TIRES, BALLAST AND WEIGHT		With Ballast	Without Ballast
Rear Tires	—No., size, ply & psi	Two 18.4-34;8;20	Two 18.4-34;8;20
Ballast	—Liquid	998 lb each	None
	Cast Iron	720 lb each	None
Front Tires	—No., size, ply & psi	Two 10.00-16;6;28	Two 10.00-16;6;28
Ballast	—Liquid	None	None
	Cast Iron	115 lb each	None
Height of drawbar		20½ inches	21½ inches
Static weight with operator	—rear	10630 lb	7195 lb
	front	3130 lb	2900 lb
	total	13760 lb	10095 lb

Department of Agricultural Engineering
Dates of Test: October 26th to November 6, 1973
Manufacturer: J. I. CASE COMPANY, RACINE, WISCONSIN

FUEL, OIL AND TIME **Fuel No** 2 Diesel **Cetane No** 50.1 (rating taken from oil company's typical inspection data) **Specific gravity converted to 60°/60°** 0.8311 **Weight per gallon** 6.920 lb **Oil SAE** 30 **API service classification** (Case HDM Oil) **To motor** 1.920 gal **Drained from motor** 1.626 gal **Transmission and final drive lubricant** Case TFD Oil **Total time engine was operated** 48 hours.

ENGINE **Make** J. I. Case Diesel **Type** 4 cylinder vertical **Serial No** 2531468 **Crankshaft Mounted** lengthwise **Rated rpm** 2100 **Bore and stroke** 4⅝" x 5" **Compression ratio** 16.5 to 1 **Displacement** 336 cu in **Cranking system** 12 volt electric **Lubrication** pressure **Air cleaner** dry type with replaceable pleated paper element and precleaner **Oil filter** Full flow replaceable cartridge **Oil cooler** engine coolant heat exchanger for engine oil and radiator for transmission and hydraulic oil **Fuel filter** replaceable primary and secondary filter cartridges **Muffler** was used **Cooling medium temperature control** thermostat.

CHASSIS **Type** standard **Serial No** 8728083 **Tread width** rear 62" to 88" front 62" to 90" **Wheel base** 101" **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 29.5" Vertical distance above roadway 39.1" 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 **Clutch** multiple disc wet clutches within transmission actuated hydraulically **Brakes** dry double disc hydraulically power actuated by two foot pedals that can be locked together **Steering** hydrostatic **Turning radius** (on concrete surface with brake applied) right 156" left 156" (on concrete surface without brake) right 182" left 182" **Turning space diameter** (on concrete surface with brake applied) right 320" left 320" (on concrete surface without brake) right 373" left 373" **Belt pulley** 1107 rpm at 1900 engine rpm diam 10.5" face 7.25" **Belt speed** fpm 3045 **Power take-off** 538 rpm at 1900 engine rpm and 1016 rpm at 1900 engine rpm.

REPAIRS AND ADJUSTMENTS No repairs or adjustments.

REMARKS: All test results were determined from observed data optained in accordance with SAE and ASAE test code or official Nebraska test procedure.

First gear was not run as it was necessary to limit the pull in second gear to avoid excessive wheel slippage. Third, fourth, ninth, eleventh and twelfth gears were not run as test procedure permits a maximum of six travel speeds.

We, the undersigned, certify that this is a true and correct report of official Tractor Test **1150.**

L. F. LARSEN
Engineer-in-Charge
G. W. STEINBRUEGGE, Chairman
W. E. SPLINTER
D. E. LANE
Board of Tractor Test Engineers

The University of Nebraska Agricultural Experiment Station
H. W. Ottoson, Director & Acting Dean; Lincoln, Nebraska

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. Prior to the maximum power run the tire tread-bar height must be at least 65% of new tread height.

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 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, ½ of the 85% torque; maximum power, ¼ and ¾ 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.

Varying Power and Fuel Consumption With Ballast. The varying power runs are made to show the effects 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 4 different runs 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; (3) 50% of the pull at maximum power; and (4) maintaining the same load and travel speed as in (3) by shifting to a higher gear and reducing the engine rpm.

Maximum Power with Ballast. Maximum power is measured on straight level sections of the test course. Data are shown for not more than 6 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 manufacturer's representative has the option of selecting one gear or speed over eight miles per hour. 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.

Varying Drawbar Pull 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.

SOUND MEASUREMENT

Sound is recorded during each of the Varying Power and Fuel Consumption runs as the tractor travels on a straight section of the test course. The dB(A) sound level is obtained with the microphone located near the right ear of the operator. Bystander sound readings are taken with the microphone placed 25 feet from the line of travel of the tractor.

An increase of 10 dB(A) will approximately double the loudness to the human ear.

For additional information about the **Nebraska Tractor Tests** write to the **Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska 68503.**

CASE 870 POWER SHIFT DIESEL