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## Test 785: Case 431 (Diesel)

Nebraska Tractor Test Lab

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

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# NEBRASKA TRACTOR TEST 785 - CASE 431 DIESEL

(ALSO CASE 470 DIESEL)

The University of Nebraska Agricultural Experiment Station

E. F. Frolik, Dean; A. W. Epp, 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									
34.38	1750	2.031	0.408	16.93	185	57	75	29.067	
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS									
29.90	1790	1.833	0.423	16.31	180	57	75	.....	
0.00	1865	0.512	....	....	143	56	74	.....	
15.27	1827	1.116	0.505	13.68	158	56	74	.....	
34.38	1750	2.050	0.412	16.77	185	56	74	.....	
7.71	1845	0.782	0.700	9.86	155	56	74	.....	
22.64	1808	1.450	0.443	15.61	176	55	73	.....	
Av	18.32	1814	1.291	0.487	14.19	166	56	74	29.070

## DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank shaft speed rpm	Slip of driv- ers %	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
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours—3rd Gear											
30.33	2282	4.98	1746	5.08	2.092	0.476	14.50	168	47	54	28.835
75% of Pull at Maximum Power—Ten Hours—3rd Gear											
24.80	1768	5.26	1816	3.54	1.752	0.488	14.16	158	39	42	28.810
50% of Pull at Maximum Power—Two Hours—3rd Gear											
16.56	1147	5.41	1848	2.62	1.314	0.548	12.60	157	49	55	28.783
MAXIMUM POWER WITH BALLAST											
28.72	4506	2.39	1802	14.81	1st Gear	.....	164	40	43		28.920
31.19	3151	3.71	1752	7.29	2nd Gear	.....	166	40	43		28.920
31.33	2364	4.97	1746	5.30	3rd Gear	.....	164	42	45		28.895
26.51	782	12.71	1749	2.05	4th Gear	.....	166	45	50		28.865
MAXIMUM POWER WITHOUT BALLAST											
30.29	2378	4.78	1752	12.22	3rd Gear	.....	165	34	41		28.915
VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—3rd Gear											
Pounds pull			2350		2450		2600		2650		2550
Horsepower			31.3		28.7		27.7		24.7		16.3
Miles per hour			5.0		4.4		4.0		3.5		2.4

Department of Agricultural Engineering

Dates of Test: April 6 to April 15, 1961

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

Manufacturer's Power Rating: 35 Belt Horsepower (corrected to Standard Conditions)

**FUEL, OIL and TIME** Fuel No 2 Diesel Cetane No 54 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8297 Weight per gallon 6.908 lb Oil SAE 20-20W API service classification DS To motor 1.242 gal Drained from motor 0.950 gal Transmission and final-drive lubricant SAE 90 Type multi-purpose gear lubricant (E.P.) Total time engine was operated 39½ hours.

**ENGINE** Make Case Diesel Type 4 cylinder vertical Serial No 511-50-7360 Crankshaft mounted lengthwise Rated rpm 1750 Bore and stroke 3<sup>13</sup>/<sub>16</sub>" x 4½" 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 thermostat.

**CHASSIS** Type tricycle Serial No 6155427 Tread width rear 48" to 88" front 6¼" to 11½" Wheel base 86¼" 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 39.3" Vertical distance above roadway 32.3" 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 2.49 second 3.66 third 4.81 fourth 11.88 reverse 2.96 Clutch single plate dry disc operated by foot pedal Brakes double disc operated by two foot pedals Steering no power assistance 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 1190 rpm at 1750 engine rpm diam 10¼" face 6" Belt speed 3193 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.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 785.

L. F. LARSEN

Engineer-in-Charge

L. W. HURLBUT  
G. W. STEINBRUEGGE  
J. J. SULEK  
Board of Tractor  
Test Engineers

## TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 13.6-28;4;14	Two 13.6-28;4;14
Ballast	—Liquid	450 lb each	None
	—Cast iron	792 lb each	None
Front tires	—No, size, ply & psi	Two 5.00-15;4;28	Two 5.00-15;4;28
Ballast	—Liquid	None	None
	—Cast iron	None	None
Height of Drawbar		14½ inches	16 inches
Static weight	—Rear	4858 lb	2374 lb
	—Front	1322 lb	1290 lb
Total weight with operator		6355 lb	3839 lb



# 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 431 Diesel