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## Test 855: Allis-Chalmers D-21 (Diesel)

Nebraska Tractor Test Lab

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

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# NEBRASKA TRACTOR TEST 855 - ALLIS - CHALMERS D 21 DIESEL

The University of Nebraska Agricultural Experiment Station  
E. F. Frolik, Dean; H. H. Kramer, 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								
103.06	2200	7.135	0.478	14.44	185	64	75	28.930
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
91.06	2287	6.108	0.463	14.91	179	66	76	.....
0.00	2396	2.185	.....	.....	172	66	75	.....
46.69	2345	3.957	0.585	11.80	175	67	76	.....
105.00	2200	7.137	0.469	14.71	186	66	75	.....
23.63	2373	3.149	0.920	7.50	173	66	74	.....
69.18	2317	4.952	0.494	13.97	177	66	75	.....
Av 55.93	2320	4.582	0.566	12.21	177	66	75	28.930

## DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank-shaft speed rpm	Slip of drivers %	Fuel Consumption			Temp Degrees F			Barometer inches of Mercury
					Gal per hr	Lb per hp-hr	Hp-hr per gal	Cool-ing med	Air wet bulb	Air dry bulb	
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours—4th Gear											
93.09	7738	4.51	2205	4.91	7.113	0.528	13.09	189	62	68	28.890
75% of Pull at Maximum Power—Ten Hours—4th Gear											
74.94	5848	4.81	2311	3.37	5.653	0.521	13.26	183	62	69	28.877
50% of Pull at Maximum Power—Two Hours—4th Gear											
52.32	3952	4.96	2351	1.98	4.912	0.648	10.65	191	65	74	28.840
MAXIMUM POWER WITH BALLAST											
87.87	14840	2.22	2246	14.64	2nd Gear .....			186	53	54	28.850
92.15	10140	3.41	2199	7.27	3rd Gear .....			192	65	73	28.920
94.05	7861	4.49	2199	5.30	4th Gear .....			192	65	72	28.880
95.38	5902	6.06	2194	3.81	5th Gear .....			189	65	72	28.880
92.38	3771	9.19	2200	2.35	6th Gear .....			189	65	72	28.880
85.72	2396	13.42	2203	1.10	7th Gear .....			191	65	72	28.880
MAXIMUM POWER WITHOUT BALLAST											
82.25	7135	4.32	2257	14.47	4th Gear .....			193	68	78	28.860

## VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—4th Gear

Pounds pull	7861	8565	8881	9109	9039	8936
Horsepower	94.05	91.46	84.05	75.38	64.15	53.02
Crankshaft speed rpm	2199	1974	1753	1537	1317	1101
Miler per hour	4.49	4.00	3.55	3.10	2.66	2.23
Slip of drivers %	5.30	5.76	5.91	6.22	6.07	6.07

## TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 24.5-32; 10; 16	Two 24.5-32; 10; 16
	Ballast	1665 lb each	None
	Cast iron	2000 lb each	None
Front tires	—No, size, ply & psi	Two 11.00-16; 8; 36	Two 11.00-16; 8; 36
	Ballast	220 lb each	None
	Cast iron	None	None
Height of drawbar		20 inches	23½ inches
Static weight	—Rear	14190 lb	6860 lb
	Front	4150 lb	3710 lb
Total weight with operator		18515 lb	10745 lb

Department of Agricultural Engineering

Dates of Test: October 15 to October 21, 1963

Manufacturer: ALLIS-CHALMERS MANUFACTURING COMPANY, MILWAUKEE, WISCONSIN

Manufacturer's Power Rating: Not rated

**FUEL, OIL and TIME** Fuel No 2 diesel Cetane No 57.2 (rating taken from oil company's typical inspection data) **Specific gravity converted to 60°/60°** 0.8294 **Weight per gallon** 6.906 lb **Oil SAE 20-20W API service classification DS To motor** 3.899 gal **Drained from motor** 2.309 gal **Transmission and final-drive lubricant** SAE 10W-30 **Total time engine was operated** 37 hours.

**ENGINE** Make Allis-Chalmers Diesel Type 6 cylinder vertical Serial No 3D01046 **Crankshaft mounted lengthwise** **Rated rpm** 2200 **Bore and stroke** 4¼" x 5" **Compression ratio** 16 to 1 **Displacement** 426 cu in **Cranking system** 12 volt electric (four 12 volt batteries) **Lubrication pressure** Air cleaner dry type with built-in pre-cleaner using a replaceable pleated paper element **Oil filter** full flow replaceable pleated paper element **Fuel filter** one dual media replaceable paper element **Muffler** was used **Cooling medium temperature control** thermostat.

**CHASSIS** Type standard Serial No D21-1012D **Tread width rear** 70" to 82" front 64" to 84" **Wheel base** 96½" **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 33½" Vertical distance above roadway 36" Horizontal distance from center of rear wheel tread 0" to the right/left **Hydraulic control system** direct engine drive **Transmission** selective gear fixed ratio **Advertised speeds mph** first 1.6 second 2.4 third 3.4 fourth 4.4 fifth 5.8 sixth 8.7 seventh 12.5 eighth 16.2 **Reverse** 1.8 and 6.8 **Clutch** single plate dry disc operated by foot pedal **Brakes** contracting band and disc operated by two foot pedals which can be locked **Steering** hydraulic with power assist **Turning radius** (on concrete surface with brake applied) right 130" left 130" (on concrete surface without brake) right 150" left 150" **Turning space diameter** (on concrete surface with brake applied) right 280" left 280" (on concrete surface without brake) right 310" left 310" **Power take-off** 1000 rpm at 2200 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.

First gear was not run as it was necessary to limit the pull in second gear to avoid excessive wheel slippage. Eighth 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 855.

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 trans-

mission, 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.



Allis-Chalmers D21 Diesel