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## Test 550: Allis-Chalmers Model HD-21 AC

Nebraska Tractor Test Lab

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

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The Experiment Station  
University of Nebraska College of Agriculture  
W. V. Lambert, Director, Lincoln, Nebraska

Department of Agricultural Engineering  
Dates of test: July 6 to July 18, 1955  
Manufacturer: ALLIS-CHALMERS MANUFACTURING COMPANY, SPRINGFIELD, ILLINOIS  
Manufacturer's rating: Not rated

NEBRASKA TRACTOR TEST NO. 550

ALLIS-CHALMERS HD-21 AC

**DRAWBAR HORSEPOWER TESTS**

Hp	Draw bar pull lb	Speed miles per hr	Crank shaft speed rpm	Slip of drive wheels %	Fuel Consumption			Water used gal per hour	Temp Deg F		Barometer inches of mercury
					Gal per hour	Hp-hr per gal	Lb per hp-hr		Cooling med	Air	
TEST H—RATED LOAD—TEN HOURS—LOW GEAR RANGE											
129.67	29,070	1.67	1790	2.76	13.974	9.28	0.756	0.00	183	96	28.934
TESTS F & G—100% MAXIMUM LOAD											
LOW GEAR RANGE											
132.26	40,563	1.22	1789	8.84	.....	Not Recorded	.....	.....	171	80	28.960
*135.12	29,067	1.74	1803	2.77	.....	Not Recorded	.....	.....	176	89	28.800
117.61	18,632	2.37	1816	1.79	.....	Not Recorded	.....	.....	168	75	28.870
HIGH GEAR RANGE											
121.45	18,729	2.43	1690	1.67	.....	Not Recorded	.....	.....	168	75	28.870
*123.93	12,897	3.60	1772	0.80	.....	Not Recorded	.....	.....	168	78	28.860
102.99	6,593	5.86	1823	0.68	.....	Not Recorded	.....	.....	170	80	28.860

\* Data shown on this line are for maximum horsepower in this gear range. Other data were obtained in the same gear range at loads selected by the manufacturer's representative.

**FUEL, OIL and TIME** Diesel fuel Cetane No. 50 (rating taken from oil company's typical inspection data) weight per gallon 7.015 lb Oil SAE 30 to motor 6.783 gal drained from motor 6.231 gal Total time motor was operated 29 hours.

**CHASSIS Type** tracklayer Serial No. HD 21A-7302 Tread width 84" Measured length of track 27.75 ft. Cleats integral with shoes Cleats per track 37 Size of cleats 28" x 2 3/4" Advertised speeds mph first 0 to 3.0 second 0 to 7.5 reverse 0 to 5.5 Clutch single plate over center operated by hand lever Seat upholstered Brakes contracting bands operated by two foot pedals Steering hydraulically controlled multiple disc clutches.

**ENGINE Make** Allis-Chalmers Diesel **Type** 4 cycle 6 cylinder vertical with super charger Serial No. 1643 Crankshaft mounted lengthwise Head I Lubrication pressure Bore and stroke 5 1/4" x 6 1/2" Rated rpm 1800 Compression ratio 13.3 to 1 Displacement 844 cu in Port diameter valves inlet 2" exhaust 1.812" Governor variable speed centrifugal Starting system 24 volt Air cleaner oil washed wire mesh with pre-cleaner Muffler was used Oil filter two replaceable pleated paper element Fuel filter two full flow replaceable wound cotton yarn elements in both primary and secondary filters Cooling medium temperature control thermostat.

**TOTAL WEIGHT AS TESTED** (With operator) 44,725 pounds.

**REPAIRS AND ADJUSTMENTS** No repairs or adjustments.

**REMARKS** All results were determined from observed data and without allowances, additions or deductions. Tests F, G, and H were made with fuel pumps as set by the manufacturer.

This tractor is equipped with a 3 stage hydraulic torque converter which automatically loads the engine by controlling the forward travel speed or the belt pulley speed of the tractor according to the load applied. Therefore, rated load and maximum load are approximately the same. No belt tests were made on this tractor due to the limited capacity of the dynamometer used for belt testing.

**HORSEPOWER SUMMARY**

	Drawbar
1. Sea level (calculated) maximum (based on 60° F. and 29.92" HG)	144.24
2. Observed maximum horsepower (test F)	135.12

We, the undersigned, certify that this is a true and correct report of official tractor test No. 550.

L. F. LARSEN  
Engineer-In-Charge

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



## EXPLANATION OF TEST REPORT

**TEST A:** The manufacturer's representative operates the tractor for a minimum of 12 hours using light to heavy drawbar loads in each gear.

This serves as a period for limber up, general observation and adjustments. Adjustments that are permissible include valve tappet clearance, breaker point gap, spark plug gaps, clutch and others of a similar nature. No new parts or accessories can be installed without having mention made of it in the report.

No data are recorded during this preliminary run except the time that the engine is operated.

### BELT HORSEPOWER TESTS

**TEST B:** The throttle valve is held wide open and the belt load on the dynamometer is adjusted so that the engine is at the rated speed recommended by the manufacturer. Carburetor, ignition timing and manifold adjustments are all set for maximum engine power.

This test is designed to determine maximum belt horsepower of the tractor at rated speed and to measure fuel consumption at the maximum power on the belt.

**TEST C:** For tractors with carburetors the best fuel economy does not always occur when the engine develops maximum power at rated speed. Test C is intended to allow the manufacturer's representative to select a more economical fuel setting even though there is a slight loss of power. *This more practical carburetor setting is used in all later tests except test F.* The throttle valve is held wide open and load adjusted to give rated rpm. Tests B and C are the same for diesel tractors, which have an altogether different fuel system.

**TEST D:** The throttle control lever is set so that the governor will maintain rated engine speed when rated load is applied. Rated load is 85% of 100% maximum, as obtained in test B, corrected to standard conditions.

This rating is somewhat less than the maximum belt horsepower in order that the operator may have a certain amount of reserve.

### TEST E:

**Varying load** serves to show the range of engine speeds when the engine is controlled by the governor during the following varied loads, of 20 minutes each: rated load, no load,  $\frac{1}{2}$  rated load, maximum load at wide open throttle valve,  $\frac{1}{4}$  and  $\frac{3}{4}$  rated load.

The average result of this test shows the average power and fuel consumption. Since the average tractor is subjected to varying loads, these data serve well in predicting fuel consumption and efficiency of a tractor in general use.

**Torque, lb-ft at dynamometer,** is obtained with wide open throttle and sufficient load is applied to give several readings.

### DRAWBAR HORSEPOWER TESTS

In all drawbar tests the pull exerted by the tractor is transmitted by a hydraulic pressure cylinder to a recording instrument in the test car. All tests are made on the same dirt test course which is maintained by grading, sprinkling and rolling so that it remains very nearly the same throughout the season. The same tires, wheels and weights are used for all tests except J and K.

**TEST F:** A drawbar test, the results of which are used to determine the rated drawbar horsepower in test H. The carburetor is set to develop maximum power as in test B. The rated gear recommended by manufacturer as plow gear is used in this test. The drawbar load is adjusted to give rated engine speed.

**TEST G:** Maximum drawbar horsepower is determined in each gear when the carburetor is set for fuel economy as in test C. The throttle valve is held wide open and the load is applied so that the engine runs at rated engine speed.

When operating in low gear it is not uncommon for the tractor to develop less drawbar horsepower than in rated gear because of excessive wheel slippage. When excessive wheel slippage occurs the load is reduced until slippage approaches 16%. When the load is reduced it is necessary to operate the tractor engine at part throttle and control engine speed by governor action.

**TEST H:** Intended to test the ability of the tractor to run continuously for 10 hours at rated drawbar horsepower and to determine the fuel consumption during that time. Rated drawbar horsepower is 75% of 100% maximum drawbar horsepower (Test F), corrected to standard conditions.

When operating at rated load the throttle control lever is set to maintain rated engine speed. This rating is less than maximum drawbar horsepower in order that the operator may have a certain amount of reserve.

**TEST J:** The tractor is operated in rated gear with all added weight removed. This test shows the effect of the removal of added weight on the performance of the tractor when compared with test G.

Removal of wheel weights generally increases wheel slippage and decreases drawbar horsepower.

**TEST K:** Similar to test J except that the **smallest tires** and lightest wheels offered by the manufacturer are used.