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6-22-1965

## Test 904: Allis-Chalmers Series II 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 904 - ALLIS-CHALMERS SERIES II D21 DIESEL

## 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

|        |      |       |       |       |     |    |    |        |
|--------|------|-------|-------|-------|-----|----|----|--------|
| 127.75 | 2200 | 7.667 | 0.416 | 16.66 | 182 | 62 | 75 | 29.057 |
|--------|------|-------|-------|-------|-----|----|----|--------|

### VARYING POWER AND FUEL CONSUMPTION—TWO HOURS

|          |      |       |       |       |     |    |    |        |
|----------|------|-------|-------|-------|-----|----|----|--------|
| 115.52   | 2341 | 7.404 | 0.445 | 15.60 | 181 | 63 | 76 | .....  |
| 0.00     | 2414 | 2.508 | ..... | ..... | 174 | 62 | 75 | .....  |
| 58.68    | 2377 | 4.999 | 0.591 | 11.74 | 177 | 62 | 74 | .....  |
| 129.47   | 2200 | 7.732 | 0.414 | 16.74 | 183 | 63 | 77 | .....  |
| 29.56    | 2397 | 3.827 | 0.898 | 7.72  | 175 | 62 | 75 | .....  |
| 87.25    | 2357 | 6.158 | 0.490 | 14.17 | 179 | 62 | 76 | .....  |
| Av 70.08 | 2348 | 5.438 | 0.538 | 12.89 | 178 | 62 | 75 | 29.057 |

## 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 Available Power—Two Hours—4th Gear

|        |      |      |      |      |       |       |       |     |    |    |        |
|--------|------|------|------|------|-------|-------|-------|-----|----|----|--------|
| 116.41 | 9740 | 4.48 | 2200 | 5.99 | 7.925 | 0.472 | 14.69 | 190 | 72 | 82 | 28.720 |
|--------|------|------|------|------|-------|-------|-------|-----|----|----|--------|

#### 75% of Pull at Maximum Power—Ten Hours—4th Gear

|       |      |      |      |      |       |       |       |     |    |    |        |
|-------|------|------|------|------|-------|-------|-------|-----|----|----|--------|
| 95.60 | 7373 | 4.86 | 2351 | 4.56 | 7.015 | 0.509 | 13.63 | 188 | 71 | 80 | 28.798 |
|-------|------|------|------|------|-------|-------|-------|-----|----|----|--------|

#### 50% of Pull at Maximum Power—Two Hours—4th Gear

|       |      |      |      |      |       |       |       |     |    |    |        |
|-------|------|------|------|------|-------|-------|-------|-----|----|----|--------|
| 64.65 | 4862 | 4.99 | 2369 | 2.86 | 5.496 | 0.590 | 11.76 | 181 | 66 | 78 | 28.970 |
|-------|------|------|------|------|-------|-------|-------|-----|----|----|--------|

### MAXIMUM POWER WITH BALLAST

|        |       |       |      |       |               |       |     |    |    |        |
|--------|-------|-------|------|-------|---------------|-------|-----|----|----|--------|
| 95.03  | 15261 | 2.34  | 2353 | 14.86 | 2nd Gear..... | ..... | 182 | 65 | 72 | 28.900 |
| 108.90 | 12116 | 3.37  | 2203 | 9.07  | 3rd Gear..... | ..... | 188 | 62 | 73 | 29.090 |
| 116.51 | 9771  | 4.47  | 2201 | 6.34  | 4th Gear..... | ..... | 188 | 62 | 73 | 29.090 |
| 117.57 | 7263  | 6.07  | 2203 | 4.71  | 5th Gear..... | ..... | 188 | 63 | 75 | 29.050 |
| 116.19 | 4739  | 9.19  | 2199 | 2.86  | 6th Gear..... | ..... | 188 | 63 | 75 | 29.050 |
| 111.81 | 3140  | 13.35 | 2195 | 2.03  | 7th Gear..... | ..... | 188 | 63 | 75 | 29.060 |

### MAXIMUM POWER WITHOUT BALLAST

|       |      |      |      |       |               |       |     |    |    |        |
|-------|------|------|------|-------|---------------|-------|-----|----|----|--------|
| 86.58 | 7186 | 4.52 | 2365 | 14.86 | 4th Gear..... | ..... | 189 | 66 | 70 | 29.100 |
|-------|------|------|------|-------|---------------|-------|-----|----|----|--------|

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

|                       |        |        |        |       |       |       |
|-----------------------|--------|--------|--------|-------|-------|-------|
| Pounds pull           | 9771   | 10810  | 11507  | 11744 | 11183 | 10696 |
| Horsepower            | 116.51 | 114.23 | 107.02 | 95.41 | 78.08 | 62.59 |
| Crankshaft speed, rpm | 2201   | 1980   | 1757   | 1542  | 1317  | 1097  |
| Miles per hour        | 4.47   | 3.96   | 3.49   | 3.05  | 2.62  | 2.19  |
| Slip of drivers, %    | 6.34   | 7.61   | 8.64   | 8.78  | 8.20  | 7.76  |

### TIRES, BALLAST and WEIGHT

|                            |                      | With Ballast        | Without Ballast     |
|----------------------------|----------------------|---------------------|---------------------|
| Rear tires                 | —No, size, ply & psi | Two 24.5-32; 10; 18 | Two 24.5-32; 10; 16 |
| Ballast                    | —Liquid              | 1705 lb each        | None                |
|                            | Cast iron            | 2250 lb each        | None                |
| Front tires                | —No, size, ply & psi | Two 11.00-16; 8; 36 | Two 11.00-16; 8; 36 |
| Ballast                    | —Liquid              | 190 lb each         | None                |
|                            | Cast iron            | None                | None                |
| Height of drawbar          |                      | 20½ inches          | 23½ inches          |
| Static weight              | —Rear                | 14690 lb            | 6780 lb             |
|                            | Front                | 4100 lb             | 3720 lb             |
| Total weight with operator |                      | 18965 lb            | 10675 lb            |

Department of Agricultural Engineering

Dates of Test: JUNE 22 TO JUNE 28, 1965

Manufacturer: ALLIS-CHALMERS MANUFACTURING COMPANY, MILWAUKEE, WISCONSIN

**FUEL, OIL and TIME** Fuel No 2 Diesel Cetane No 57.0 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8331 Weight per gallon 6.937 lb Oil SAE 30 API service classification MS, DS To motor 3.420 gal Drained from motor 1.594 gal Transmission and final-drive lubricant SAE 10W-30 Total time engine was operated 37½ hours.

**ENGINE** Make Allis-Chalmers diesel Type 6 cylinder vertical with turbo-charger Serial No 3D-02265 Crankshaft mounted lengthwise Rated rpm 2200 Bore and stroke 4¼" x 5" Compression ratio 16.0 to 1 Displacement 426 cu in Cranking system 12 volt electric 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 Oil cooler engine coolant heat exchanger for crank-case oil Fuel filter one dual media replaceable paper element Muffler was not used Cooling medium temperature control thermostat.

**CHASSIS** Type Standard Serial No D21-2109 Tread width rear 68" to 88" front 60" to 80" Wheel base 96¼" 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" Belt pulley none 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 904.

L. F. LARSEN

Engineer-in-Charge

G. W. STEINBRUEGGE, Chairman

J. J. SULEK

D. E. LANE

Board of Tractor Test Engineers

The University of Nebraska Agricultural Experiment Station  
E. F. Frolik, Dean; H. H. Kramer, Director, 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. 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 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 Series II D21 Diesel