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# Test 531: Massey-Harris No. 16 Pacer

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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: November 10 to November 15, 1954
Manufacturer: MASSEY-HARRIS-FERGUSON LTD.,
TORONTO, CANADA
Manufacturer's rating: Not rated

# NEBRASKA TRACTOR TEST NO. 531

## MASSEY HARRIS NO. 16 PACER

### BELT HORSEPOWER TESTS

| Hp | Crank shaft speed rpm | Fuel Consumption | | | Water used gal per hour | Temp Deg F | | Barometer inches of mercury |
|---|---|---|---|---|---|---|---|---|
| | | Gal per hour | Hp-hr per gal | Lb per hp-hour | | Cooling med | Air | |
| **TEST B—100% MAXIMUM LOAD—TWO HOURS** | | | | | | | | |
| 18.87 | 1800 | 1.996 | 9.45 | 0.648 | 0.00 | 161 | 54 | 29.260 |
| **TEST C—OPERATING MAXIMUM LOAD—ONE HOUR** | | | | | | | | |
| 17.88 | 1800 | 1.696 | 10.54 | 0.582 | 0.00 | 154 | 44 | 29.250 |
| **TEST D—RATED LOAD—ONE HOUR** | | | | | | | | |
| 16.35 | 1800 | 1.574 | 10.39 | 0.590 | 0.00 | 156 | 54 | 29.250 |
| **TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)** | | | | | | | | |
| 16.31 | 1799 | 1.571 | 10.38 | 0.590 | ... | 156 | 54 | ..... |
| 1.73 | 1941 | 0.734 | 2.36 | 2.601 | ... | 149 | 53 | ..... |
| 8.56 | 1877 | 1.111 | 7.70 | 0.796 | ... | 151 | 52 | ..... |
| 16.55 | 1652 | 1.561 | 10.60 | 0.578 | ... | 158 | 52 | ..... |
| 4.34 | 1900 | 0.876 | 4.95 | 1.237 | ... | 150 | 52 | ..... |
| 12.51 | 1833 | 1.326 | 9.43 | 0.650 | ... | 153 | 54 | ..... |
| 10.00 | 1834 | 1.196 | 8.36 | 0.734 | 0.00 | 153 | 53 | 29.230 |
| **TORQUE (At Dynamometer)** | | | | | | | | |
| Eng rpm | 1798 | 1699 | 1600 | 1497 | 1399 | 1298 | 1205 | 1102 | 994 | 898 |
| Lb-ft | 108.5 | 110.3 | 112.0 | 113.1 | 115.2 | 117.3 | 119.0 | 120.4 | 117.3 | 114.1 |
| Dyn rpm | 849 | 802 | 752 | 668 | 615 | 567 | 520 | 493 | 468 | 424 |

### 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 F—100% MAXIMUM LOAD—2nd Gear** | | | | | | | | | | | |
| 17.05 | 1686 | 3.79 | 1803 | 6.76 | ..... Not Recorded ..... | | | | 160 | 49 | 29.160 |
| **TEST G—OPERATING MAXIMUM LOAD** | | | | | | | | | | | |
| 15.64 | 2118 | 2.77 | 1802 | 10.30 | ..... Not Recorded ..... | | | | 162 | 56 | 29.150 |
| 16.22 | 1607 | 3.79 | 1801 | 6.82 | ..... Not Recorded ..... | | | | 160 | 50 | 29.150 |
| 15.32 | 748 | 7.68 | 1807 | 3.09 | ..... Not Recorded ..... | | | | 162 | 56 | 29.150 |
| **TEST H—RATED LOAD—TEN HOURS—2nd Gear** | | | | | | | | | | | |
| 13.03 | 1269 | 3.85 | 1800 | 5.12 | 1.393 | 9.35 | 0.655 | 0.00 | 164 | 67 | 29.006 |
| **TEST J—OPERATING MAXIMUM LOAD—2nd Gear** | | | | | | | | | | | |
| 13.63 | 1484 | 3.44 | 1802 | 16.72 | ..... Not Recorded ..... | | | | 156 | 56 | 28.880 |
| **TEST K—OPERATING MAXIMUM LOAD—2nd Gear** | | | | | | | | | | | |
| 11.93 | 1340 | 3.34 | 1809 | 15.93 | ..... Not Recorded ..... | | | | 156 | 62 | 28.890 |

**FUEL, OIL and TIME** Gasoline Octane No. ASTM 79 Research 84.5 (rating taken from oil company's typical inspection data): **Weight per gallon** 6.131 lb **OIL** SAE 10; **to motor** 0.706 gal; **drained from motor** 0.678 gal **Total time motor was operated** 44 hrs.

**CHASSIS Type** standard **Serial No.** PGA50891 **Tread width** rear 45" to 69" front 44" to 68" **Wheel base** 72¼" **Hydraulic control system** direct engine drive **Advertised speeds mph** first 3.02 second 3.93 third 7.8 reverse 3.57 **Belt pulley diam** 6" face 5¼" **rpm** 1990 **Belt speed** 3125 fpm **Clutch** single plate clutch operated by foot pedal **Seat** upholstered seat with back rest **Brakes** wedge type brake operated by two foot pedals **Equalized** can be locked together **Power take-off** conventional type.

**ENGINE Make** Continental **Type** 4 cylinder vertical **Serial No.** F43664 **Crankshaft mounted** lengthwise **Head** I **Lubrication** pressure **Bore and stroke** 2⅞" x 3½" **Rated rpm** 1800 **Compression ratio** 6.1 to 1 **Displacement** 91 cu. in. **Port diameter valves** inlet 1.06" exhaust 0.78" **Governor** variable speed centrifugal **Carburetor size** ⅞" **Ignition system** battery **Starting system** 6 volt battery **Air cleaner** oil washed wire mesh **Muffler** was used **Oil filter** replaceable paper element **Cooling medium temperature control** thermostat.

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

**REMARKS** All test results were determined from observed data and without allowances, additions or deductions. Tests B and F were made with carburetor set for 100% maximum belt horsepower and data from these tests were used in determining the horsepower to be developed in tests D and H, respectively. Tests C, D, E, G, H, J and K were made with an operating setting of the carburetor (selected by the manufacturer) of 93.9% of maximum belt horsepower.

### TIRES, WHEELS AND WEIGHT

| | Tests F, G, & H | Test J | Test K |
|---|---|---|---|
| **Rear wheels** | | | |
| Type | Pressed steel | Pressed steel | Pressed steel |
| Liquid ballast | 193 lb each | None | None |
| Added cast iron | 392 lb each | None | None |
| **Rear tires** | | | |
| No. and size | Two 10-24 | Two 10-24 | Two 9-24 |
| Ply | 4 | 4 | 4 |
| Air pressure | 12 lb | 12 lb | 12 lb |
| **Front wheels** | | | |
| Type | Pressed steel | Pressed steel | Pressed steel |
| Liquid ballast | None | None | None |
| Added cast iron | 46 lb each | None | None |
| **Front tires** | | | |
| No. and size | Two 4.00-15 | Two 4.00-15 | Two 4.00-15 |
| Ply | 4 | 4 | 4 |
| Air pressure | 28 lb | 28 lb | 28 lb |
| **Height of drawbar** | 20½ inches | 21 inches | 20½ inches |
| **Static weight** | | | |
| Rear end | 2561 lb | 1390 lb | 1360 lb |
| Front end | 826 lb | 734 lb | 730 lb |
| **Total weight as tested with operator** | 3562 lb | 2299 lb | 2265 lb |

### HORSEPOWER SUMMARY

| | Drawbar | Belt |
|---|---|---|
| 1. Sea level (calculated) maximum horsepower (based on 60° F and 29.92" HG) | 17.31 | 19.19 |
| 2. Observed maximum horsepower (Tests F and B) | 17.05 | 18.87 |
| 3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (formerly ASAE and SAE ratings) | 12.98 | 16.31 |

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. 531.

L. F. LARSEN
Engineer-in-charge

C. W. SMITH
L. W. HURLBUT
F. D. YUNG
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, ½ rated load, maximum load at wide open throttle valve, ¼ and ¾ 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.