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Australian tractor tests : report on test no. 34 : Fordson power major

G H. Vasey

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AUSTRALIAN TRACTOR TESTS

REPORT ON TEST No. 34
(Farmers' Edition)

FORDSON POWER MAJOR
( Tested for Ford Motor Co. of Australia Pty. Ltd., Geelong, Victoria)

THIS Report is taken from the full Technical Report No. 34 of this test; test results are shown here in briefer form: fuller explanations are added. Values quoted may be rounded out to two instead of three significant figures; to this extent the values may differ slightly but not significantly from those shown in the Technical Report. Some values are taken from graphs shown in the Technical Report, which are not shown here. The Technical Report is not available in large numbers, but it may be seen at, and copies of this farmers' report may be had from, the offices of the State Departments of Agriculture, the Bureau of Sugar Experiment Stations (Queensland), and the Commonwealth Department of Primary Industry.

1. THE TESTS

Special Note:—This is the first test carried out under a new procedure, in which the main tests of engine performance are done directly on the engine itself (removed from the tractor for the purpose), and not through the belt pulley as formerly.

The belt outlet has been abandoned as the main test at several overseas testing stations in favour of tests on the engine itself (Germany) or on the p.t.o. (Nebraska and British Standard tests).

After running-in, three types of tests were carried out, in order to measure the performance of the engine, as directly measured by the power in the engine crankshaft (shaft horse-power, s.h.p.), the performance of the power outlets, measured on the p.t.o. and belt pulley at their proper speeds, and the performance of the tractor as a whole, as measured by drawbar pull, tractor speed, wheel slip, and drawbar horse-power (d.b.h.p.), with the tractor running on a bitumen test track.

The main results of these tests are given in Sections 2 and 3. Other measurements and observations were made of various features of the tractor; these are given in Section 5.

The Australian Tractor Testing Committee is a joint body established between the Commonwealth, the States, and the University of Melbourne; under this agreement, the tests are carried out by the University of Melbourne. The address of the Tractor Testing Committee is: c/o Department of Primary Industry, 301 Flinders Lane, Melbourne.
2. SUMMARY OF POWER OUTPUT

Table A. (See note (a) below)

<table>
<thead>
<tr>
<th>Engine C/Shaft</th>
<th>P.T.O.</th>
<th>Belt Pulley</th>
<th>Draw Bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full power—h.p.</td>
<td>50-4</td>
<td>34-7</td>
<td>40-5</td>
</tr>
<tr>
<td>At engine speed—r.p.m.</td>
<td>1,700</td>
<td>(b)1,200</td>
<td>(c)1,400</td>
</tr>
<tr>
<td>Fuel economy—lb./h.p.—hr.</td>
<td>0-39</td>
<td>0-43</td>
<td>0-42</td>
</tr>
<tr>
<td>Fuel consumption—lb./hr.</td>
<td>19-6</td>
<td>14-8</td>
<td>16-9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Belt Pulley</th>
<th>Draw Bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-5</td>
<td>(e) 1,400</td>
</tr>
<tr>
<td>0-42</td>
<td>2-4</td>
</tr>
<tr>
<td>16-9</td>
<td>2-1</td>
</tr>
<tr>
<td>20-0</td>
<td>2-4</td>
</tr>
</tbody>
</table>

Rated Speed—1,700 r.p.m.

Fast Idling Speed required to give full power at rated engine speed—1,950 r.p.m.

Crankshaft Torque—at rated speed, 155 lb. ft.; maximum 165 lb. ft. at 1,200 r.p.m.

Best Economy—0.37 lb./s.h.p.—hr. at 2 load at about 1,400 r.p.m.

(a) Observed values, no atmospheric corrections applied to diesel engines.

(b) Engine speed required to give British Standard p.t.o. speed of 540 r.p.m.

(c) Engine speed required to give British Standard belt linear speed of 3,100 f.p.m.

3. DRAWBAR TESTS

(1) The following Tables B, C, and D, show the drawbar performance of the tractor, on the bitumen test track, on rear tyres 14 x 30, carrying maximum weight (1,980 lb. front, 6,220 lb. rear; total 8,200 lb.), working in the gears named in the tables. Height of drawbar 18 inches.

Drawbar tests, using standard weight of tractor (7,060 lb.), were carried out, but are not reported here.

Table B.—Maximum Power, Rated 3rd Gear.

<table>
<thead>
<tr>
<th>Rated engine speed, 1,700 r.p.m.</th>
<th>DBHP (d)</th>
<th>Pull lb.</th>
<th>Speed m.p.h.</th>
<th>Wheel Slip % (e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observe maximum d.b.h.p. at rated engine speed</td>
<td>42-1</td>
<td>4,300</td>
<td>3-67</td>
<td>8</td>
</tr>
</tbody>
</table>

Table C.—Pull at Maximum d.b.h.p.

<table>
<thead>
<tr>
<th>Gear</th>
<th>D.B.H.P.</th>
<th>Pull lb.</th>
<th>Speed m.p.h.</th>
<th>Wheel Slip %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32 (g)</td>
<td>6,000</td>
<td>2-0</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>41</td>
<td>5,550</td>
<td>2-8</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>42</td>
<td>4,300</td>
<td>3-7</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>43</td>
<td>3,025</td>
<td>5-3</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>44</td>
<td>2,150</td>
<td>7-6</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Road gear not tested</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table D.—Fuel Consumption, Various Loads, Rated (3rd) Gear.

<table>
<thead>
<tr>
<th>Fuel</th>
<th>IB/ hr.</th>
<th>lb./ d.b.h.p. hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,900</td>
<td>44</td>
<td>4-46</td>
</tr>
<tr>
<td>1,700</td>
<td>39</td>
<td>4-30</td>
</tr>
<tr>
<td>1,300</td>
<td>72</td>
<td>4-19</td>
</tr>
<tr>
<td>3,750</td>
<td>87</td>
<td>4-02</td>
</tr>
</tbody>
</table>

(d) D.B.H.P. is the product of pull (lb.) and speed (m.p.h.) divided by 375.

(e) Wheel slip can be measured by noting that, in travelling a given distance, the back wheels make more turns when working under load than when running with no load on the drawbar. The differences in these revolution counts divided by the former count gives the slip as a ratio, which can be written as a percentage (quoted in these tables to the nearest whole number.)

(f) There are not the maximum pulls available in the gears i.e., not the maximum sustained pulls, but the pulls at maximum d.b. power, i.e., at full-throttle at engine speed.

(g) Part throttle, maximum d.b.h.p. in first gear limited by wheel slip.

2. Tractor Weights (lb.).

<table>
<thead>
<tr>
<th>Weight Condition</th>
<th>Front</th>
<th>Rear</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard, unballasted (h)</td>
<td>1,980</td>
<td>5,080</td>
<td>7,060</td>
</tr>
<tr>
<td>Full weight, heaviest recommended (i)</td>
<td>1,980</td>
<td>6,220</td>
<td>8,200</td>
</tr>
<tr>
<td>Includes Water ballast (lb./wheel)</td>
<td>540</td>
<td>540</td>
<td></td>
</tr>
<tr>
<td>Solid ballast (lb./wheel)</td>
<td>30</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

(h) This weight, including driver and fuel, was used in finding centre of gravity.

(i) Weight of tractor in drawbar tests quoted in this report.

3. Wheels and Tyres.

<table>
<thead>
<tr>
<th>Tyres</th>
<th>Front</th>
<th>Rear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Rib</td>
<td>Open centre bar tread</td>
</tr>
<tr>
<td>Size</td>
<td>7-50 x 16, 6-ply</td>
<td>14 x 30, 6-ply</td>
</tr>
<tr>
<td>Pressure</td>
<td>28 p.s.i.</td>
<td>14 p.s.i.</td>
</tr>
</tbody>
</table>

4. THE TEST TRACTOR

(1) The test tractor was declared to have been chosen at random from the current run of production. It received no special attention during assembly; the standard pre-delivery checks usually carried out by the dealer were in this instance done by the Company's representatives at the Testing Station.

(2) Fuel Settings.—The engine of this tractor has only one fuel setting, at which all the tests were carried out.
Governor Control.—The engine was under the control of the governor set to give full throttle, and so maximum power at rated engine speed. See section 2 above, fast idling speed.

Fuel.—Distillate, Diesel Index 66, Specific Gravity 0.82; weight per Imperial gallon 8.15 lb.

Specification.—Engine No. 1524131. See also Section 7.

5. OTHER OBSERVATIONS
(1) Duration of Test.—Eighty hours, including running-in.

(2) Repairs and Adjustments.—The fuel pump and several injectors were serviced or replaced during preliminary running.

(3) Engine.—Fuel pump setting checked—within specified limits.
Radiator water used—none.
Lubricating oil—S.A.E., 20.
Weight to engine, 14.6 lb.;
Weight from engine after tests, 12.0 lb.

(4) Steering.—With track widths, front 54", rear 59", wheel base 80":
Turning circles: Without brakes 29’ L.H., 27’ 8” R.H.; with brakes, 20’ 9” L.H., 20’ R.H.
Comment: Easy to steer under load, sensitive to steering wheel; no power assistance.

(5) Centre of Gravity, with tractor in standard weight—level with and 22½” forward of rear axle.

(6) Driver’s Accommodation.—Access to seat, from either side forward of rear wheels. Foot-room and support, flat foot plates adequate.

Comfort: deep plough-type seat with rubber cushion and back rest. Seat folds up for weather protection, and has quick release adjustment for pushing back for stand-up working. Accessibility to controls, satisfactory.

Noise: sound pressure level measured 3 ft. above loaded seat, in open field—at full power, rated speed—103 units; at fast idling speed—94 units.

The special unit is the decibel (db) of pressure compared with a base level of virtual silence. The levels quoted above are typical of tractors, which generally are noisy by accepted industrial standards.

(7) Instruments.—All clearly visable, markings adequate. Indications were consistent throughout tests. Engine tachometer is marked for standard p.t.o. and belt speeds and road speeds in the gears.

(8) Inspection of Engine and Transmission after Test.—After testing, the tractor was partly dismantled and inspected and found to be in a satisfactory condition.

(9) Instruction Books.—Instructions for starting, running, and maintenance were satisfactory, and well illustrated.

6. INTERPRETATION OF TESTS
(1) Power at Outlets (p.t.o. and Belt).
P.t.o. and belt outlets should run at their recommended speeds, which in this instance conform to international standards. The figures shown in Table A represent the powers available at those speeds.

More power is available at higher engine speeds; for example, at greater engine speed (1,700 r.p.m.) belt power is 46 h.p., but belt linear speed would then be much above that recommended.

(2) Fuel Consumption—
Fuel consumption in galls./hour, though a simple unit often quoted, has little meaning unless the corresponding power output is also quoted. Specific fuel consumption (lb./h.p.-hr.), the weight of fuel consumed per unit of energy developed, is a better guide. The unit of energy here is the h.p.-hr. (similar to the electrical unit, the kilowatt-hr.). When specific fuel consumption is least, the engine is giving its best economy or efficiency.

Gallons per/hr. may be changed to lb./h.p./hr. as follows (referring to Table A above):—

\[
2.4 \text{ galls./hr. while developing } 50.4 \text{ h.p. means } 2.4 \div 50.4 \text{ galls./s.h.p./hr. } = 0.048 \text{ gal./s.h.p./hr.}
\]

\[
0.048 \text{ gal./s.h.p./hr. } \times 8.15 \text{ lb./gallon for this fuel } = 0.39 \text{ lb./s.h.p./hr., as shown.}
\]

(3) Drawbar Tests—
(i) Drawbar tests are carried out on a hard prepared surface. Most field conditions present higher resistance to the tractor’s motion, so that, in the field, the maximum drawbar pulls available in any gear will usually be less than those shown in the tables.

(ii) Wheel slip may also be greater in the field; to that extent tractor speeds in miles per hour in the field will be less than those shown in the tables.

(iii) Because of (i) and (ii) above, the drawbar horsepowers available in any gear in the field will usually be less than those shown in the tables.
7. BRIEF SPECIFICATIONS
Fordson Power Major
Based on Information Supplied by Manufacturers for standard drive model)

(1) Engine—No. 1524131,
4-stroke; 4 cylinders, vertical; crankshaft along tractor; direct injection diesel.
Rated speed: 1,700 r.p.m. (for drawbar work).
Other recommended speeds: for p.t.o. work, 1,200; for belt work, 1,400 r.p.m.
Fuel type: Distillate.
Fuel system: Simms 4-cyl. in-line pump, 4-hole spray type injectors.
Two replaceable-element filters in series. Tank capacity, 15 gallons.
Air Cleaner: Oil bath, perforated metal and fibre pre-cleaner.
Governor: Pneumatic, incorporated in fuel pump.
Electrical system: 12-volt battery and generator.
Starting: Electric, cold start.
Cooling: Water (pressure system), 2-blade fan, pump, and thermostat.
Exhaust: Vertical ahead of operator. Fordson spark arrester.
Lubrication: Oil pump, sump gauze filter, external replaceable-element filter.

(2) Chassis—
4-wheel; pneumatic tyres
Wheel base 80".
Track widths: Front 50½" x 4" steps to 74"; rear 59" not adjustable.
Tyre sizes: Front 7.50 x 16; rear 14 x 30.
Steering: Recirculatory ball drive.
Weight: Maximum, 8,200 lb.
(See Section 3 (2) above).

(3) Belt Pulley—
Right hand side, forward working, clockwise rotation.
Diameter 8½"; face width 6½".
2 speeds (at 1,400 r.p.m. engine speed),
high, 1,400 r.p.m.; low 1,779 r.p.m.
Belt speed (at 1,400 r.p.m. engine speed), high 3,115 ft./min. in accordance with overseas standards (namely, 3,100 ± 100 f.p.m.).

(4) Power Take-Off—
Centre rear; anti-clockwise; guarded.
Speeds: at 1,200 r.p.m. engine speed, 540 r.p.m., in accordance with overseas standards (namely, 536 ± 10 r.p.m.).
Dimensions: 6 spline, 13½" diameter.

(5) Drawbar—Swinging—9 positions across.
Height, as tested, 18" (adjustable 18", 20", 22").
Linkage mounted drawbar also available.

(6) Transmission—Conventional gears.
Clutch: Single dry plate; 11" diameter.
Gear ratios and road speeds (assuming no wheel slip) on 14 x 30 tyres, at rated engine speed, as advertised.

<table>
<thead>
<tr>
<th>Gear</th>
<th>Forward</th>
<th>Reverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio</td>
<td>123.0</td>
<td>87.3</td>
</tr>
<tr>
<td>Speed m.p.h.</td>
<td>2:2</td>
<td>3:1</td>
</tr>
</tbody>
</table>

(7) Hydraulics—Built in, gear pump in rear-axle housing.

(8) Three-point Linkage—Generally conforms to BS1841-1951, Category 2.

G. H. VASEY, Officer in Charge Tractor Testing.
W. F. BAILLIE, Tractor Testing Officer.
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