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Australian tractor tests : report on test no. 32

G H. Vasey

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1.—THE TESTS
(1) After twelve hours of running-in, two types of tests were carried out, in order to measure the performance of the engine, as measured by the power in the belt driven by the belt pulley, 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, 3, and 4. Other measurements and observations were made of various features of the tractor; these are given in Section 5.

In this Test No. 32, for the first time, tests were included on the engine removed from the tractor. All normal auxiliaries were fitted and functioning; power output (shaft horse-power, s.h.p.) was measured at the crankshaft. See Section 2.

(2) Fuel Settings.—The engine of this tractor has only one fuel setting, at which all the tests were carried out.

(3) Governor Control.—The engine was under the control of the governor set to give full fuel delivery, and so full power at rated engine speed.

The Australian Tractor Testing Committee is a joint body established by agreement 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.
(4) **Fuel.**—Distillate, Diesel Index 54, Specific Gravity 0.84; weight per Imperial gallon 8.41 lb.

(5) **Specification.**—Engine No. 1416077. For a brief specification of this tractor see Section 6 at the end of this report.

2. **SUMMARY OF POWER OUTPUT**

<table>
<thead>
<tr>
<th>Table A</th>
<th>At the Belt</th>
<th>At the Drawbar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated engine speed, r.p.m.</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Maximum power (a)</td>
<td>30-0</td>
<td>26-9</td>
</tr>
</tbody>
</table>

Maximum shaft horse-power at 2,000 r.p.m.: 33-0.

Note.—Letters in brackets refer to explanatory footnotes.

(a) No atmospheric corrections are applied to diesel engines because there is no suitable formula; the values shown above are, therefore, the observed maximum powers.

(b) Engines are not expected to run indefinitely at full or maximum power output. But they can be expected to run continuously for some hours at rated output, which is less than maximum, defined as follows:

- (bl) Rated b.h.p. is defined as 85 per cent. of corrected maximum b.h.p.;
- (b2) Rated d.b.h.p. is defined as 75 per cent. of corrected maximum d.b.h.p.

3. **BELT TESTS**

The belt tests show the power (belt horse-power, b.h.p.) that the tractor may be expected to deliver when driving a machine by the belt.

<table>
<thead>
<tr>
<th>Table B—Belt Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rated engine speed, 2,000 r.p.m.</td>
</tr>
<tr>
<td>2. Fast idling speed 2,200 r.p.m.</td>
</tr>
<tr>
<td>3. Observed maximum b.h.p. at rated speed</td>
</tr>
<tr>
<td>4. Corrected maximum b.h.p. rated speed (a)</td>
</tr>
<tr>
<td>5. Calculated rated load (b1)</td>
</tr>
<tr>
<td>6. Test at approximately rated load (b2)</td>
</tr>
<tr>
<td>7. Average loading under governor (e)</td>
</tr>
<tr>
<td>8. Measured engine torque at full fuel delivery</td>
</tr>
<tr>
<td>9. Repeat of (3) above after 67 hours</td>
</tr>
</tbody>
</table>

4. **DRAWBAR TESTS**

(1) The following Tables C, D, and E, show the drawbar performance of the tractor, on the bitumen test track, wearing rear tyres 11 x 28, carrying maximum weight (1,500 lb. front, 3,310 lb. rear; total, 4,810 lb.), working in the gears named in the tables. Height of drawbar 16 inches.

Drawbar tests, using standard weight of tractor (3,370 lb.), were carried out, but are not reported here.

Table C—Maximum Power, Rated (2nd) Gear

<table>
<thead>
<tr>
<th>Gear</th>
<th>DBHP</th>
<th>Pull lb.</th>
<th>Speed m.p.h.</th>
<th>Wheel Slip %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rated engine speed, 2,000 r.p.m.</td>
<td>26•9</td>
<td>2,850</td>
<td>3•54</td>
<td>9</td>
</tr>
<tr>
<td>3. Corrected maximum d.b.h.p. at rated engine speed (a)</td>
<td>26•9</td>
<td>No correction made for diesel engines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Calculated rated load (b2)</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table D—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. 16 (i)</td>
<td>3,700</td>
<td>1•6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>2. 27</td>
<td>2,850</td>
<td>3•5</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>3. 28</td>
<td>2,200</td>
<td>4•7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>4. 28</td>
<td>1,725</td>
<td>6•0</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>5. 28</td>
<td>1,082</td>
<td>10•0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6. Road gear not tested</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

(g) 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 difference 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.)

(b) These 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 rated engine speed.

(i) Engine not fully loaded, maximum d.b.h.p. in first gear limited by wheel slip.

Table E—Fuel Consumption, Various Loads, Rated (2nd) Gear

<table>
<thead>
<tr>
<th>Pull lb.</th>
<th>Speed m.p.h.</th>
<th>DBHP</th>
<th>Percentage of Max. d.b.h.p.</th>
<th>Slip %</th>
<th>Gall./hr.</th>
<th>lb./d.b.h.p. hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,150</td>
<td>4.1</td>
<td>13</td>
<td>47</td>
<td>3</td>
<td>1.1</td>
<td>0.73</td>
</tr>
<tr>
<td>1,500</td>
<td>4.0</td>
<td>16</td>
<td>60</td>
<td>5</td>
<td>1.2</td>
<td>0.65</td>
</tr>
<tr>
<td>1,950</td>
<td>3.9</td>
<td>20</td>
<td>75</td>
<td>6</td>
<td>1.4</td>
<td>0.59</td>
</tr>
<tr>
<td>2,400</td>
<td>3.8</td>
<td>24</td>
<td>91</td>
<td>7</td>
<td>1.6</td>
<td>0.55</td>
</tr>
</tbody>
</table>

† Rated drawbar load.

(2) Interpretation of 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 horse-powers available in any gear in the field will usually be less than those shown in the tables.

5.—OTHER OBSERVATIONS

(1) Duration of Test.—67 hours, including running in.

(2) Repairs and Adjustments.—None.

(3) Engine—

Fuel settings—one, fuel pump calibration checked in accordance with specification.

Heat controls—radiator and four-blade fan, thermostat.

Radiator water used—none.

Lubricating oil—S.A.E. 20.

Weight to engine, 14.0 lb.;

Weight from engine after test, 13.0 lb.

(4) Tractor Weights (lb.).

<table>
<thead>
<tr>
<th>Weight condition</th>
<th>Front</th>
<th>Rear</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>*Standard, unballasted</td>
<td>1,340</td>
<td>2,030</td>
<td>3,370</td>
</tr>
<tr>
<td>†Maximum weight, heaviest recommended</td>
<td>1,500</td>
<td>3,310</td>
<td>4,810</td>
</tr>
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</table>

Includes—

Water ballast (lb./wheel) | 75 | 240 |

Solid ballast (lb./wheel) | 75 | 240 |

* This weight, including driver and fuel, was used in finding centre of gravity.

† Weight of tractor in drawbar tests quoted in this report.

5.—OTHER OBSERVATIONS

(1) Duration of Test.—67 hours, including running in.

(2) Repairs and Adjustments.—None.

(3) Engine—

Fuel settings—one, fuel pump calibration checked in accordance with specification.

Heat controls—radiator and four-blade fan, thermostat.

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Lubricating oil—S.A.E. 20.

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† Weight of tractor in drawbar tests quoted in this report.

5.—OTHER OBSERVATIONS

(1) Duration of Test.—67 hours, including running in.

(2) Repairs and Adjustments.—None.

(3) Engine—

Fuel settings—one, fuel pump calibration checked in accordance with specification.

Heat controls—radiator and four-blade fan, thermostat.

Radiator water used—none.

Lubricating oil—S.A.E. 20.

Weight to engine, 14.0 lb.;

Weight from engine after test, 13.0 lb.

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† Weight of tractor in drawbar tests quoted in this report.

5.—OTHER OBSERVATIONS

(1) Duration of Test.—67 hours, including running in.

(2) Repairs and Adjustments.—None.

(3) Engine—

Fuel settings—one, fuel pump calibration checked in accordance with specification.

Heat controls—radiator and four-blade fan, thermostat.

Radiator water used—none.

Lubricating oil—S.A.E. 20.

Weight to engine, 14.0 lb.;

Weight from engine after test, 13.0 lb.
Noise, sound pressure level measured 3 feet above loaded seat, in open field—
at full power rated speed—111 units.
at high idling speed—105 units.

The special unit is decibels 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.

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

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

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

6.—BRIEF SPECIFICATIONS

Fordson Dexta. (Based on Information Supplied by Manufacturers)

(1) Engine—No. 1416077.
4-stroke; 3 cylinders, vertical; crankshaft along tractor; diesel (indirect injection).
Bore, 3½"; stroke, 5"; compression ratio, 16.5 : 1.
Rated speeds: Belt and drawbar work, 2,000 r.p.m.
Fuel type: Distillate.
Air Cleaner: Oil bath.
Governor: Pneumatic, incorporated in fuel pump.
Electrical system: 12-volt battery and generator.
Starting: Electric, heater in manifold and fuel primer for cold starting.
Cooling: Water (pressure system), fan, pump, and thermostat.
Exhaust: Vertical, ahead of operator.
Lubrication: Oil pump and full-flow filter, replaceable element type.

(2) Chassis—
4-wheel; pneumatic tyres.
Wheel base 72".
Track widths: Front 48" x 4" steps to 76", rear 48" x 4" steps to 76".
Tyre sizes: Front 5.50 x 16; rear 11 x 28.
Steering: Two-start worm drive.
Weight: Maximum, 4,810 lb.

(3) Belt Pulley—
Rear working, direction of rotation as required.
Diameter 9"; face width 6½".
Speed (at rated engine speed), 1,290 r.p.m.
Belt speed (at rated engine speed), 3,040 ft./min., in accordance with overseas standards (namely, 3,100 ± 100 f.p.m.).

(4) Power Take-Off—
Centre rear; clockwise; guarded.
Speed: 690 r.p.m. at rated engine speed, not in accordance with overseas standards (namely, 536 ± 10 r.p.m.). At engine speed of 1,550 r.p.m., p.t.o. would be 536 r.p.m.
Dimensions: 6 spline, 1¾" diameter.

(5) Drawbar—Linkage mounted drawbar.
Height adjustable, 15"-26".

(6) Transmission—Conventional gears.
Clutch: Double dry plate, 9" diameter; second throw of pedal operates live drive.
Gear ratios and road speeds (assuming no wheel slip) on 11 x 28 tyres, at rated engine speed, as advertised.

<table>
<thead>
<tr>
<th>Gear</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>L</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio</td>
<td>152-2</td>
<td>71-1</td>
<td>54-6</td>
<td>43-5</td>
<td>25-5</td>
<td>15-5</td>
<td>98-4</td>
<td>35-2</td>
</tr>
<tr>
<td>Speed, m.p.h.</td>
<td>1-8</td>
<td>3-8</td>
<td>5-0</td>
<td>6-3</td>
<td>10-7</td>
<td>17-5</td>
<td>2-8</td>
<td>7-7</td>
</tr>
</tbody>
</table>

(7) Hydraulics—Built-in, gear pump in rear transmission housing. Live drive.

(8) Three-point Linkage—Generally conforms to BS1841-1951, Category 1.

G. H. VASEY, Officer in Charge Tractor Testing.
W. F. BAILLIE, Tractor Testing Officer.
September 1959.
University of Melbourne.