Australian tractor tests: International A554D: report on test no. 36 (farmers' edition)

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1. THE TESTS

Note: The tests are now carried out under a 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.

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 pto (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, shp), the performance of the power outlets, measured on the pto 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 (dbhp), with the tractor running on a bitumen test track.

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.
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.

2. SUMMARY OF POWER OUTPUT

Table A (See note (a) below)

<table>
<thead>
<tr>
<th>Engine C' Haupt</th>
<th>P.T.O.</th>
<th>Belt Pulley</th>
<th>Drawbar</th>
</tr>
</thead>
<tbody>
<tr>
<td>56-9</td>
<td>54-0</td>
<td>51-7</td>
<td>50-8</td>
</tr>
</tbody>
</table>

*Manufacturer's declared rating: 55 hp min.

Rated Speed—1,800 rpm.

Fast Idling Speed required to give full power at rated engine speed—1,920 rpm.

Crankshaft Torque—at rated speed, 166 lb ft; maximum 189 lb ft at 1,100 rpm.

Best Economy—0.44 lb/shp-hr at 85% load at about 1,200 rpm.

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

(b) Engine speed required to give British Standard pto speed of 540 rpm.

(c) See note in section 7 (3).

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 18.4 x 30, carrying maximum weight (2,530 lb. front, 7,290 lb. rear; total 9,820 lb.), working in the gears named in the tables. Height of drawbar 20 inches.

Drawbar tests, using unballasted weight of tractor (6,920 lb.), were carried out, but are not reported here.

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

<table>
<thead>
<tr>
<th>Gear</th>
<th>DBHP</th>
<th>Full lb</th>
<th>Speed m.p.h.</th>
<th>Wheel Slip %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45</td>
<td>7,610</td>
<td>2-23</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>5,350</td>
<td>3-46</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>51</td>
<td>4,140</td>
<td>4-80</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>51</td>
<td>3,410</td>
<td>5-64</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(d) DBHP is the product of pull (lb.) and speed (mph) 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) These are not the maximum pulls available in the gears (i.e., not the maximum sustained pulls), but the pulls at maximum db power, i.e., at full engine power at rated engine speed.

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 (h)</td>
<td>2,380</td>
<td>4,900</td>
<td>7,280</td>
</tr>
<tr>
<td>Full weight, heaviest recommended (i)</td>
<td>2,530</td>
<td>7,290</td>
<td>9,820</td>
</tr>
<tr>
<td>Includes—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water ballast (lb./wheel)</td>
<td>75</td>
<td>715</td>
<td>790</td>
</tr>
<tr>
<td>Solid ballast (lb./wheel)</td>
<td>40</td>
<td>620</td>
<td>660</td>
</tr>
</tbody>
</table>

(h) Weight as usually sold.

(1) 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></td>
<td>Open centre bar tread</td>
</tr>
<tr>
<td>Size</td>
<td>7-50 x 16</td>
<td>18-4 x 30, 6-ply</td>
</tr>
<tr>
<td>Pressure</td>
<td>36 p.s.i.</td>
<td>16 p.s.i.</td>
</tr>
</tbody>
</table>

4. THE TEST TRACTOR

(1) The test tractor was chosen at random from the current run of production by a representative of the Victorian
Wheat and Woolgrowers Association. The tractor was run-in for 12 hrs. 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.

(3) **Governor Control**.—The engine was under the control of the governor set to give full power at rated engine speed. (See Section 2 above, fast idling speed).

(4) **Fuel**.—Distillate, Diesel Index 66, Specific Gravity 0.82; weight per Imperial gallon 8.20 lb.

(5) **Specification**.—Engine No. AD264-12252. See also Section 7.

5. **OTHER OBSERVATIONS**

(1) **Duration of Test**.—65 hours, including running-in.

(2) **Repairs and Adjustments**.—As part of preliminary running and adjustment was made on the “torque control” setting of the fuel pump.

(3) **Engine**.—Fuel pump setting checked—within specified limits.

- **Radiator water used**—none.
- **Lubricating oil**—S.A.E., 30.
- Weight to engine, 19.8 lb.;
- Weight from engine after tests, 13.8 lb.

(4) **Steering**.—With track widths, front 54", rear 64½", wheel base 76½”:

- **Turning circles**: Without brakes, 29’ 0” L.H., 28’ 7” R.H.; with brakes, 22’ 9” L.H., 23’ 9” R.H.

- **Comment**: Easy to steer under load, sensitive to steering wheel; power assisted.

(5) **Centre of Gravity**, with tractor in standard weight condition but not including driver, 4½” above and 25¼” forward of rear axle.

(6) **Driver’s Accommodation**.—Access to seat, from rear, either side. With seat in most forward position steering wheel impedes access to seat. Footroom and support: flat top of transmission housing, foot plates either side; rear platform for stand-up working. Seat: permanently upholstered dish seat with fixed back rest, mounted on arm pivoted forward, and suspended on coil spring and damper. Seat can be tilted to alternative higher riding position or folded back for weather protection. Whole assembly can be set central or 15° to left or right. Accessibility to controls: all controls readily accessible. Pedals 25” apart and 6” below loaded seat. Reach for operation of pedals may be difficult for short people.

- **Noise**: sound pressure level measured at the driver’s head in open field (tractor fitted with prototype spark arrester/muffler now declared to be standard fitting)—
  - at full power, rated speed—102 units;
  - at fast idling speed—98 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**.—Indications were consistent throughout tests.

(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**.—Adequate.

6. **INTERPRETATION OF TESTS**

(1) **Power at Outlets (pto and Belt)**

Pto and belt outlets should run at their recommended speeds, which in this instance substantially conform to international standards. The figures shown in Table A represent the powers available at those speeds. (See also section 7 (3).)

(2) **Fuel Consumption**

Fuel consumption in gals./hour, though a simple unit often quoted has little meaning unless the corresponding power output is also quoted. **Specific fuel consumption** (lb./hp-hr), the weight of fuel consumed per unit of energy developed, is a
better guide. The unit of energy here is the hp-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/hp-hr as follows (referring to table A above):

3.2 gals/hr while developing 56.9 hp means 3.2 ÷ 56.9 gals/shp/hr = 0.056 gal./shp/hr.
0.056 gall./shp/hr × 8.20 lb/gallon for this fuel = 0.46 lb/shp/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
   International A554 D
   (Based on Information Supplied by Manufacturers)

   (1) Engine—No. AD264-12252.
   4-stroke; 4 cylinders, vertical; crankshaft along tractor; indirect injection diesel.
   Bore, 4"; stroke 5\(\frac{1}{4}\)"; compression ratio, 16.7 : 1.
   Rated speed: 1,800 rpm.
   Fuel type: Distillate.
   Fuel system: C.A.V. 4-cyl. in-line pump, single hole pintle type injectors. IHC replaceable-element full flow filter. Tank capacity, 17½ gallons.
   Air Cleaner: Oil bath, centrifugal pre-cleaner.
   Governor: Mechanical, centrifugal, incorporated in fuel pump.

   Electrical system: 12-volt battery and generator.
   Starting: Electric, glow plugs in pre-combustion chambers.
   Cooling: Water (pressure system), 6-blade fan, pump, and thermostat.
   Exhaust: Vertical, ahead of operator, effluent upwards.
   Lubrication: Oil pump, sump gauze filter, external full flow replaceable element by-pass filter.

   (2) Chassis—
   4-wheel; pneumatic tyres. Wheelbase 76\(\frac{1}{2}\)".
   Track widths: Front 54\(\frac{1}{2}\)"; rear 64\(\frac{1}{2}\)".
   Tyre sizes: Front 7.50 x 16; rear 18.4 x 30.
   Steering: Power assisted, worm drive.
   Weight: Maximum, 9,820 lb.
   (See Section 3 (2) above).

   (3) Belt Pulley—
   Right hand side, forward working.
   Diameter 11"; face width 7\(\frac{1}{2}\)".
   Speed (at 1,800 rpm engine speed), 1,115 rpm.
   Belt speed at 1,800 rpm engine speed is 3,212 ft./min.; this differs slightly from overseas standards (namely, 3,100±100 fpm). Belt speed would be 3,100 fpm at 1,740 rpm.

   (4) Power Take-Off—
   Centre rear; anti-clockwise; 29\(\frac{1}{2}\)" above ground; guarded.
   Speed: at 1,800 rpm engine speed, 543 rpm, in accordance with overseas standards (namely, 536 ± 10 rpm).
   Dimensions: 6 spline, 1\(\frac{3}{8}\)" diameter.
   Independent drive, hand operated over-centre clutch.

   (5) Drawbar—Swinging—9 positions across.
   Height, as tested, 20" adjustable, 16", 18", 20". Removal of swinging drawbar leaves fixed drawbar.
(6) **Transmission**—Conventional gears.
Clutch: 12" single dry plate.
Gear ratios and road speeds (assuming no wheel slip) on 18.4 x 30 tyres, at rated engine speed, as advertised (see table).

(7) **Hydraulics**—Optional, not fitted.

(8) **Three-point Linkage**—Optional, not fitted. Conforms to BS 1841-1951, Category 2.

<table>
<thead>
<tr>
<th>Gear Ratio*</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Reverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>114.7</td>
<td>80.5</td>
<td>61.9</td>
<td>51.1</td>
<td>18.3</td>
<td>63.3</td>
</tr>
<tr>
<td>m.p.h.</td>
<td>2.6</td>
<td>3.7</td>
<td>4.8</td>
<td>5.8</td>
<td>16.1</td>
<td>3.4</td>
</tr>
</tbody>
</table>

* Includes Differential 3.27, Final drive 5.62.

University of Melbourne
December 1961

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Officer in Charge Tractor Testing.

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Tractor Testing Officer,
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