



Report 608/O.E.C.D.
September 1969

REPORT ON TEST IN ACCORDANCE WITH O.E.C.D. TEST CODE FOR
AGRICULTURAL TRACTORS

JOHN DEERE MODEL 2120 TRACTOR (8-SPEED TRANSMISSION)

Manufactured by: John Deere Werke Mannheim,
Mannheim, German Federal Republic



Test No.: R.69/5510/O.E.C.D.

*This report has been approved by the O.E.C.D.
Coordinating Centre (C.N.E.E.M.A., France) as being
in accordance with the O.E.C.D. Tractor Test Code
Date of Approval: 3rd December 1969 Serial No.: 284*

NATIONAL INSTITUTE OF AGRICULTURAL ENGINEERING
WREST PARK SILSOE BEDFORD

This Bulletin is based on engineering tests in accordance with the O.E.C.D. Tractor Code. It does not contain an evaluation of the performance of the tractor on practical farm work

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SPECIFICATION OF TRACTOR

Manufacturer: John Deere Werke Mannheim,
Mannheim, German Federal Republic

Selected and submitted
for test by: John Deere Limited,
Langer, Nottingham

Place of running-in: John Deere Werke Mannheim

Duration of running-in: Engine 189 hours
Transmission 51 hours

Tractor

Make: John Deere
Model: 2120
Type: Four wheel, rear wheel driven
Serial No: T5 HBC 023602L

Engine

Make: John Deere (made in France)
Model: M5 BL4
Type: 4 stroke, direct injection diesel
Serial No: 044941 CD

Cylinders: 4 cylinders, vertical, in-line, 4.02 in
(102 mm) bore x 4.33 in (110 mm) stroke,
capacity 219.8 in³ (3.602 l),
compression ratio 16.7:1, overhead
valves, replaceable wet cylinder liners

Fuel system: AC diaphragm type, Model 6440324 fuel
feed pump, Roto-Diesel dual paper
cartridge fuel filters with water and
dirt separators in series, fuel tank
capacity 16.3 UKgal (74.1 l); C.A.V.
Roto-Diesel type DPA R3442 810
injection pump, Serial No. 22747 ZK.
Manufacturer's production setting for
injection pump: 51+ 1.5 mm³ per
stroke at 1250 rev/min pump speed
(test bench figures); Roosa-master
5-hole pencil type injector nozzles,
injection pressure 2800 lb/in²
(197 kg/cm²)

Governor: Roto-Diesel mechanical, incorporated
in fuel injection pump. Governed
range of engine speed 650 to
2725 rev/min, rated engine speed
2500 rev/min

Air cleaner: Donaldson, dry, paper element

Lubrication system:	Forced feed from gear type pump with metal strainer in sump; Purolator full flow paper element oil filter Oil capacity 10.0 pt (5.68 l) Recommended oil change period 150 h						
Cooling system:	Liquid cooled, impeller assisted with 16½ in (419 mm) dia 6-blade, belt driven fan; thermostat for temperature control; pressurized at 4 lb/in² (0.3 kg/cm²), cooling liquid capacity 2½ UKgal (11.4 l)						
Starting system:	Electrical, 12V Bosch JD 4PS solenoid engaged starter motor; C.A.V. Thermostart cold starting aid						
Electrical system	<table border="0"> <tr> <td>Voltage:</td> <td>12, negative earth</td> </tr> <tr> <td>Generator:</td> <td>Bosch EH 14V 11A 19</td> </tr> <tr> <td>Batteries:</td> <td>Bosch, two 12V, in parallel, 110 Ah total capacity</td> </tr> </table>	Voltage:	12, negative earth	Generator:	Bosch EH 14V 11A 19	Batteries:	Bosch, two 12V, in parallel, 110 Ah total capacity
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Transmission

Clutch:	Fichtel and Sachs dual, dry clutch, 11.02 in (280 mm) and 8.86 in (225 mm) dia plates for gearbox and p.t.o. drives respectively, pedal operated
Gearbox:	Own make constant mesh type with 8 forward speeds and 4 reverse
Rear axle and final drive:	Own make, crown wheel and pinion with differential and planetary reduction gears on final drive shafts Combined pedal and hand lever operated differential lock
Oil capacity:	67.0 pt (38.1 l). Recommended oil change period 1000 h

Gear	Number of engine revolutions for 1 revolution of driving wheel	Nominal travelling speed for 2500 rev/min rated speed of engine, mile/h (km/h)	
Forward			
1	300.0	1.42	(2.28)
2	210.0	2.02	(3.25)
3	141.5	3.00	(4.83)
4	101.2	4.19	(6.74)
5	76.4	5.56	(8.95)
6	53.5	7.93	(12.76)
7	36.1	11.75	(18.92)
8	25.8	16.45	(26.47)
Reverse			
1	258.1	1.64	(2.64)
2	180.7	2.35	(3.78)
3	121.8	3.49	(5.62)
4	87.1	4.87	(7.84)

Power take-off

Main:

At rear of tractor, $1\frac{3}{8}$ in (34.9 mm) dia, optional 6-spline and 21-spline stub shafts, when stub shaft is bolted in position correct speed ratio is selected; 6-spline proportional engine speed giving 651 rev/min at 2500 rev/min rated engine speed, 540 rev/min (standard p.t.o. speed) at 2075 rev/min engine speed; 21-spline proportional engine speed giving 1209 rev/min at 2500 rev/min rated engine speed, 1000 rev/min (standard p.t.o. speed) at 2067 rev/min engine speed. Height above ground 26 in (660 mm), direction of rotation clockwise viewed from driving end

Secondary:

21-spline mid-mounted (on front of transmission housing), speeds as for 21-spline rear. Height above ground 26 in (660 mm), direction of rotation anti-clockwise viewed from driving end

Belt pulley

Not fitted for test

Power lift

Live hydraulic, gear pump in transmission casing supplies oil to radial piston pump driven from front of crankshaft supplying oil to ram cylinder and spool valve for external supply. Hydraulic oil cooler adjacent to radiator. Category 2 implement linkage with lower link sensing, variable proportion draught and position controls. John Deere type JDM J14B special purpose oil

Drawbar

Swinging drawbar, height above ground to centre of clevis, maximum $20\frac{1}{4}$ in (514 mm), minimum 19 in (483 mm), changed by inverting drawbar; distance from rear axle centre $32\frac{1}{4}$ in (819 mm), $30\frac{5}{8}$ in (778 mm) and $24\frac{3}{4}$ in (629 mm); position relative to 540 rev/min p.t.o. $15\frac{5}{8}$ in (397 mm), 14 in (356 mm) and $8\frac{1}{8}$ in (206 mm) to rear. Lateral adjustment $16\frac{1}{4}$ in (413 mm), $15\frac{1}{2}$ in (394 mm) and $7\frac{1}{2}$ in (191 mm). Pivot position relative to rear wheel centre 2 in (51 mm) forward

Hitch

Not fitted

Steering

Power assisted with single drop arm and drag link

Brakes

Hydraulically operated wet disc brakes on final drive shafts, independent or combined pedal operated. Left-hand gear range shift lever operates transmission lock for parking

Wheels

Steering wheels:

Two at front, Continental 7.50 - 16 A.S. - Front tyres, 6 ply rating, maximum permissible weight on each tyre 1565 lb (710 kg) at 37 lb/in² (2.58 kg/cm^2), track width $49\frac{5}{8}$ in (1260 mm) by 2 in (51 mm) steps to $75\frac{3}{8}$ in (1920 mm) changed by extending front axle. The track can be extended to $80\frac{3}{4}$ in (2050 mm) by reversing the wheels

Driving wheels: Two at rear, Continental 15.5 - 38 A.S. tyres, 6 ply rating, mounted on W.14 rims with cast centres. Maximum permissible weight on each tyre 3726 lb (1690 kg) at 19 lb/in² (1.34 kg/cm²). Track width 59 in (1500 mm) to 84½ in (2145 mm) changed by rack and pinion axle and clamps on offset lugs on rims

Wheelbase: 7 ft 1¾ in (2178 mm)

Tractor and ballast weights (without driver but with tanks full)

Weight without ballast	Front:	1880 lb (853 kg)
	Rear:	4485 lb (2034 kg)
	Total:	6365 lb (2887 kg)
Ballast	Front:	9 frame weights and frame, total 1027 lb (466 kg)
	Rear:	Weights - 5 per wheel, total 1449 lb (657 kg)
		Liquid - 1384 lb (628 kg)
Weight with full ballast	Front:	3104 lb (1408 kg)
	Rear:	7121 lb (3230 kg)
	Total:	10 225 lb (4638 kg)

Seat John Deere, upholstered cushion seat with matching backrest. Linkage mounted, helical coil spring suspension, adjustable for driver's weight, oil filled shock absorber. Range of adjustment 3⅜ in (86 mm) fore and aft and ¾ in (19 mm) vertical

Number of grease points

Whole tractor: 9

Overall dimensions

Overall length:	11 ft 9¾ in (3.60 m) without ballast weights, 12 ft 8½ in (3.87 m) with front ballast weights fitted
Overall width:	89¼ in (2267 mm) to ends of rack and pinion axle; 97¼ in (2470 mm) at 62 in (1575 mm) track with 5 weights per wheel
Overall height:	62¼ in (1581 mm) to top of steering wheel, 86⅜ in (2194 mm) to top of exhaust pipe
Minimum ground clearance:	17 in (432 mm) to underside of drawbar frame

Lighting

	Height above ground of centre, in (cm)	Diameter in (cm)	Distance from outside edge of tractor at 62 in (1575 mm) wheel track, to centre, in (cm)
Headlights	$39\frac{1}{4}$ (99.7)	$4\frac{1}{8}$ (10.5)	$29\frac{5}{8}$ (75.2)
Side lights	61 (154.9)	3 (7.6)	$18\frac{7}{8}$ (47.9)
Rear lights	$61\frac{3}{4}$ (156.8)	$3\frac{1}{2}$ (8.9)	$19\frac{1}{8}$ (50.5)
Reflectors	$58\frac{1}{2}$ (148.6)	3 (7.6)	$19\frac{1}{8}$ (50.5)

Unrestricted beam angle of headlight in plan view 24°

FUELS AND LUBRICANTS USED IN TESTS

Laboratory tests

Fuel: Diesel oil, density 0.841 at 60°F
(15.6°C), Cetane No. 51, to Class A,
B.S.2869:1957

Engine oil: Shell Multi-purpose 20W/30

Transmission oil: JDM J 14 B John Deere special purpose

Track tests

Fuel: Diesel oil, density 0.8295 at 60°F
(15.6°C), Cetane No. 53, to Class A,
B.S.2869:1957

Engine oil: Shell Multi-purpose 20W/30

Transmission oil: JDM J 14 B John Deere special purpose

COMPULSORY TESTS

1. MAIN POWER TAKE-OFF PERFORMANCE

Date and location of tests: 10th March 1969; N.I.A.E., Silsoe,
Bedford, U.K.

Type of dynamometer: Water brake, Heenan and Froude

Horsepower (Metric hp)	Speeds, rev/min		Fuel consumption,		
	Engine	P.t.o.	UKgal/h (l/h)	lb/hp h (g/metric hp h)	hp h/UKgal (metric hp h/l)
Maximum power - 2 hour test					
64.9 (65.8)	2570	669	3.48 (15.82)	0.451 (202)	18.6 (4.15)
Standard p.t.o. speed (540 rev/min)					
57.0 (57.8)	2075	540	2.85 (12.96)	0.421 (188)	20.0 (4.46)
Standard belt speed of 3100 ft/min (945 m/min)					
		Not applicable			
The speed recommended by the manufacturer for drawbar work					
64.1 (65.0)	2500	651	3.41 (15.50)	0.447 (200)	18.8 (4.19)
Fuel consumption at part loads					
56.0 (56.8)	2612	680	2.95 (13.41)	0.443 (198)	19.0 (4.24)
0	2709	705	0.97 (4.41)	-	-
28.6 (29.0)	2665	694	1.86 (8.46)	0.548 (245)	15.4 (3.44)
64.9 (65.8)	2570	669	3.48 (15.82)	0.451 (202)	18.6 (4.15)
14.4 (14.6)	2692	701	1.40 (6.36)	0.818 (366)	10.3 (2.30)
42.5 (43.1)	2643	688	2.41 (10.96)	0.476 (213)	17.6 (3.93)

No load, maximum engine speed: 2709 rev/min

Equivalent crankshaft torque at maximum power: 132.6 lb ft (18.3 kg m)

Maximum equivalent crankshaft torque: 155.8 lb ft (21.5 kg m)
at 1320 rev/min engine speed

Mean atmospheric conditions: temperature 65°F (18°C)
pressure 29.77 in Hg (756 mm Hg)
relative humidity 44%

Maximum temperature: coolant 199°F (93°C)
engine oil 253°F (123°C)
fuel 66°F (19°C)

The following results were obtained with the high ratio p.t.o.

Horsepower (Metric hp)	Speeds, rev/min		Fuel consumption,		
	Engine	P.t.o.	UKgal/h (l/h)	lb/hp h (g/metric hp h)	hp h/UKgal (metric hp h/l)
Maximum power - 2 hour test					
65.4 (66.3)	2570	1243	3.48 (15.82)	0.448 (200)	18.8 (4.19)
Standard p.t.o. speed (1000 rev/min)					
57.3 (58.1)	2067	1000	2.86 (13.00)	0.419 (187)	20.0 (4.46)
The speed recommended by the manufacturer for drawbar work					
64.4 (65.3)	2500	1209	3.39 (15.41)	0.443 (198)	19.0 (4.24)

2. DRAWBAR PERFORMANCE

Date of tests: 9th to 17th June 1969 Type of track: Concrete Height of drawbar above ground: 18½ in (464 mm)

Gear	Horse- power (metric hp)	Drawbar pull, lb (kg)	Speed, mile/h (km/h)	Engine speed, rev/min	Wheel- slip, %	Specific fuel consumption,		Temperature, °F(°C)		Atmospheric conditions			
						lb/drawbar hp h (g/metric drawbar hp h)	UKgal (metric drawbar hp h/l)	Coolant	Fuel	Engine oil	Temperature, °F (°C)	Relative humidity, %	Pressure, in Hg (mm Hg)
(i) Maximum power (ballasted)													
1	*31.0 (31.4)	9200 (4173)	1.26 (2.03)	2637	15.0	0.654 (293)	12.7 (2.83)	203 (95)	90 (32)	203 (95)	65 (18)	75	29.99 (762)
2	*44.0 (44.6)	9200 (4173)	1.79 (2.88)	2600	15.0	0.592 (265)	14.0 (3.12)	197 (92)	86 (30)	216 (102)	72 (22)	65	29.99 (762)
3	51.7 (52.4)	6750 (3062)	2.87 (4.62)	2573	8.7	0.563 (252)	14.7 (3.28)	194 (90)	78 (26)	199 (93)	72 (22)	65	30.01 (762)
4	50.6 (51.3)	4550 (2054)	4.17 (6.71)	2595	5.1	0.565 (253)	14.7 (3.28)	190 (88)	96 (36)	202 (94)	70 (21)	64	30.01 (762)
5	52.6 (53.3)	3500 (1588)	5.64 (9.07)	2605	3.9	0.554 (248)	15.0 (3.35)	193 (89)	83 (28)	203 (95)	66 (19)	75	30.00 (762)
6	50.3 (51.0)	2450 (1111)	7.70 (12.39)	2469	2.5	0.561 (251)	14.8 (3.30)	191 (88)	83 (28)	194 (90)	67 (19)	71	30.01 (762)
(ii) Five hour test at 75% of pull at maximum power													
5	40.7 (40.9)	2625 (1191)	5.81 (9.27)	2605	2.9	0.585 (262)	14.8 (3.30)	201 (94)	100 (38)	246 (119)	78 (26)	53	29.90 (759)
(iii) + Five hour test at pull corresponding to 15% wheelslip in test (i)													
2	-	9200 (4173)	1.89 (3.04)	-	-	-	-	200 (93)	100 (38)	252 (122)	75 (24)	51	29.74 (755)
(iv) Maximum power (unballasted)													
2	34.0 (34.5)	7000 (3175)	1.82 (2.93)	2642	15.0	-	-	198 (92)	-	207 (97)	66 (19)	71	29.58 (751)
3	48.8 (49.5)	6750 (3062)	2.71 (4.36)	2596	10.9	-	-	193 (89)	-	202 (94)	66 (19)	71	29.58 (751)
4	51.0 (51.7)	4800 (2177)	3.98 (6.40)	2573	8.3	-	-	193 (89)	-	203 (95)	67 (19)	75	29.62 (752)
5	51.7 (52.4)	3600 (1633)	5.39 (8.67)	2505	5.4	-	-	181 (83)	-	207 (97)	66 (19)	71	29.62 (752)
6	52.5 (53.2)	2600 (1179)	7.57 (12.18)	2432	3.1	-	-	195 (91)	-	208 (98)	66 (19)	71	29.62 (752)

Total oil consumption during ten hours duration of tests (ii) and (iii) 0.10 lb/h (45.4 g/h)

* Maximum power available at 15% wheelslip

+ Test (iii) was carried out with additional ballast and the results for power, slip and fuel consumption have no practical significance

3 and 4. TURNING SPACE AND TURNING CIRCLE

Details of wheel equipment: As in specification, without ballast

Track of wheels: Front - $57\frac{5}{8}$ in (1464 mm)
Rear - 62 in (1575 mm)

	With brakes		Without brakes	
	Right hand	Left hand	Right hand	Left hand
Radius of turning space	10 ft 6 in (3.20 m)	10 ft 11 in (3.33 m)	11 ft 8 in (3.56 m)	12 ft $5\frac{1}{2}$ in (3.80 m)
Radius of turning circle	10 ft 2 in (3.10 m)	10 ft 7 in (3.23 m)	11 ft 4 in (3.45 m)	12 ft $1\frac{1}{2}$ in (3.70 m)

5. LOCATION OF CENTRE OF GRAVITY

Height above ground	31.9 in (810 mm)
Distance forward from the vertical plane containing the axis of the rear wheels	25.1 in (638 mm)
Distance from the median plane of the tractor	0

6. BRAKING

Date of tests: 11th and 18th June 1969

Type of track: Concrete

Cold brakes

	Tractor without ballast		Tractor ballasted	
Travelling speed of tractor, mile/h (km/h)	15.5	(25.0)	15.5	(25.0)
Maximum deceleration, ft/s ² (m/s ²)	18.0	(5.5)	27.0	(8.2)
Stopping distance, ft (m)	18.8	(5.7)	15.3	(4.7)
Force on brake pedal, lb (kg)	100	(45.4)	200	(90.7)

Brake fade characteristics (hot tests)

Maximum deceleration hot/maximum deceleration cold x 100: 100%
Stopping distance cold/stopping distance hot x 100: 96%
Force on pedal cold/force on pedal hot x 100: 100%
Efficiency of parking latch: None fitted,
transmission lock
Efficiency of handbrake: None fitted,
transmission lock

7. MEASUREMENT OF AMBIENT NOISE EMITTED BY THE TRACTOR

Date of tests: 13th June 1969
Type of sound level meter: Brüel and Kjaer Type 2203
Type of track: Concrete
Results of tests: gear 8th
travelling speed before
acceleration 13.4 mile/h
(21.6 km/h)
sound level 88 dBA

8. NOISE MEASUREMENTS AT THE DRIVER'S EAR LEVEL

Date of tests: 13th June 1969
Type of sound level meter and octave filter: Brüel and Kjaer Type 2203 with octave
filter set type 1612
Type of track: Concrete

Results of Tests

Gear	Travelling speed, mile/h (km/h)	Loudness, sones
4	4.20 (6.76)	90

9. POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date and location of tests: 20th and 21st March 1969; N.I.A.E.,
Silsoe, Bedford, U.K.

Hydraulic fluid:

make and type: JDM J 14. B John Deere special purpose
viscosity: 8.6 to 9.75 cS at 210°F (100°C)

	Vertical movement, in (mm)	Maximum force exerted through full range, lb (kg)	Pressure, lb/in ² (kg/cm ²)	Linkage load at which unballasted front end of tractor lifts off the ground, lb (kg)	
<u>Linkage giving maximum mechanical advantage</u>					
At lower hitch points (height above ground in down position 18½ in (464 mm))	21½ (546)	3515 (1594)	2200 (155)	-	-
On the frame 24 in (610 mm) to rear of lower hitch points	28½ (718)	3025 (1372)	2200 (155)	2300	(1043)
<u>Linkage giving minimum mechanical advantage</u>					
At lower hitch points (height above ground in down position 8½ in (216 mm))	24 (610)	3300 (1497)	2200 (155)	-	-
On the frame 24 in (610 mm) to rear of lower hitch points	27½ (699)	3200 (1452)	2200 (155)	2300	(1043)

Type of linkage lock for transport

Hydraulic

Opening pressure of the cylinder over-pressure relief valve (manufacturer's figures):

3485 lb/in² (245 kg/cm²) to
4480 lb/in² (315 kg/cm²)

Pump characteristics

(a) With main pump being supplied by charge pump only

- i) opening pressure of relief valve: 1900 lb/in² (134 kg/cm²)
- sustained pressure of relief valve: 2200 lb/in² (155 kg/cm²)

Pump delivery rate at external tapping

- ii) at minimum pressure (rated engine speed): 6.9 gal/min (31.4 l/min)
- iii) at maximum hydraulic power: 7.14 gal/min (32.5 l/min)
- delivery pressure: 1900 lb/in² (134 kg/cm²)
- power: 9.5 hp (9.6 metric hp)

Time to empty main pump reservoir at maximum engine speed and minimum pressure:

4.6 sec

(b) With main pump being supplied by charge pump and oil return

- i) opening pressure of relief valve: 1600 lb/in² (112 kg/cm²)
sustained pressure of relief valve: 2200 lb/in² (155 kg/cm²)

Pump delivery rate at external tapping (permanent flow)

- ii) at minimum pressure (rated engine speed): 10.3 gal/min (46.8 l/min)
iii) at maximum hydraulic power: 10.4 gal/min (47.3 l/min)
delivery pressure: 1700 lb/in² (120 kg/cm²)
power: 12.4 hp (12.6 metric hp)

OPTIONAL TESTS

10. PERFORMANCE AT THE ENGINE CRANKSHAFT

Date and location of tests: 12th March 1969; N.I.A.E., Silsoe, Bedford, U.K.

Type of dynamometer: Water brake, Heenan and Froude

Horsepower (Metric hp)	Engine speed, rev/min	Fuel consumption,		
		UKgal/h (l/h)	lb/hp h (g/metric hp h)	hp h/UKgal (metric hp h/l)
Maximum power - 2 hour test				
70.1 (71.1)	2570	3.48 (15.82)	0.417 (187)	20.2 (4.51)
Rated engine speed				
69.0 (70.0)	2500	3.41 (15.50)	0.415 (186)	20.3 (4.53)
Fuel consumption at part loads				
60.5 (61.3)	2610	2.97 (13.50)	0.413 (185)	20.4 (4.55)
0	2720	0.86 (3.91)	-	-
30.9 (31.3)	2663	1.85 (8.41)	0.503 (225)	16.7 (3.73)
70.1 (71.1)	2570	3.48 (15.82)	0.417 (187)	20.2 (4.51)
15.6 (15.8)	2685	1.35 (6.14)	0.730 (327)	11.5 (2.57)
45.9 (46.5)	2637	2.35 (10.68)	0.431 (193)	19.5 (4.35)

Optimum fuel consumption recorded: 0.376 lb/hp h (168 g/metric hp h) at 30.1 hp (30.5 metric hp) and 1310 rev/min
 No load, maximum engine speed: 2720 rev/min
 Crankshaft torque at maximum power: 143.3 lb ft (19.8 kg m)
 Maximum crankshaft torque: 166.0 lb ft (23.0 kg m) at 1320 rev/min engine speed

Mean atmospheric conditions: temperature 61°F (16°C)
 pressure 29.45 in Hg (748 mm Hg)
 relative humidity 54%

Maximum temperature: coolant 201°F (94°C)
 engine oil 242°F (117°C)
 fuel 69°F (21°C)

15. REPAIRS AND ADJUSTMENTS DURING TESTS:

A small adjustment was made to the governor to obtain repeatability of speed control. A steering housing 'O' ring was replaced during the drawbar tests.

REMARKS: None

Officer in charge: D.W. SMITH

Head of Tractor and
Ergonomics Department: J. MATTHEWS

Date: 16th September 1969

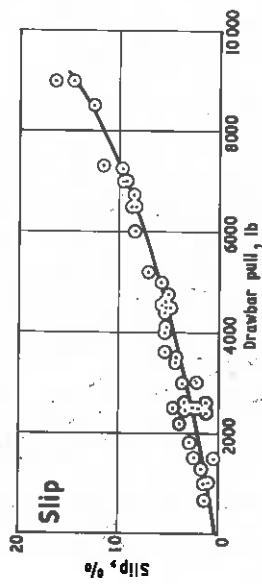
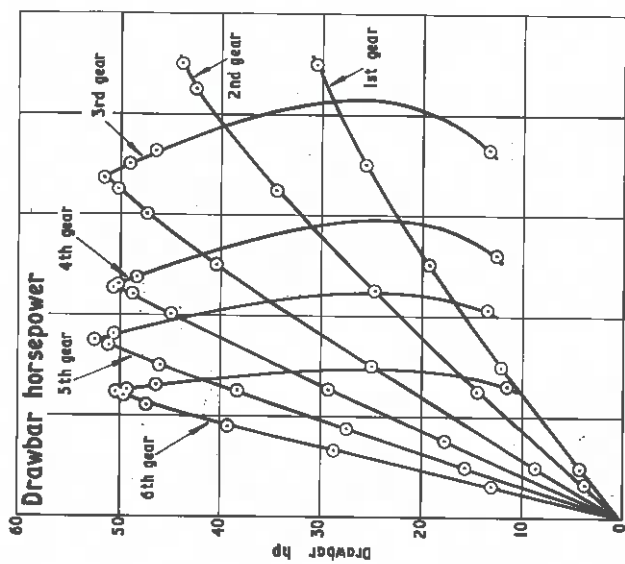


Fig. 2. Drawbar test on concrete, with ballast

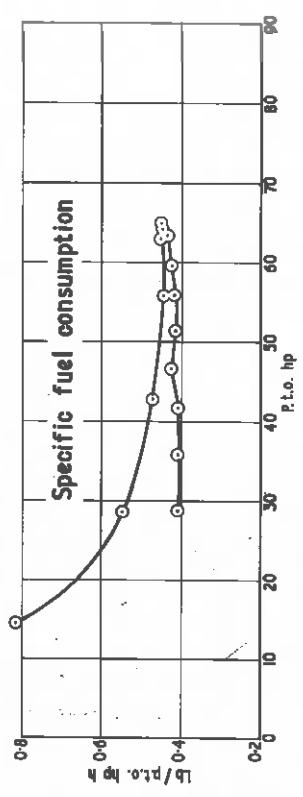
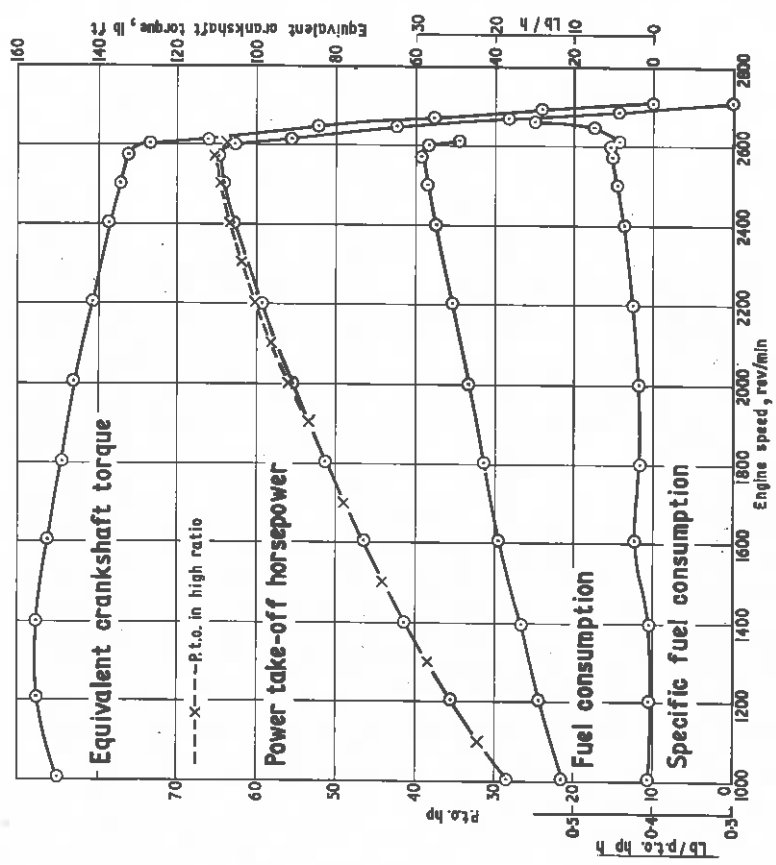


Fig. 1. Power take-off test

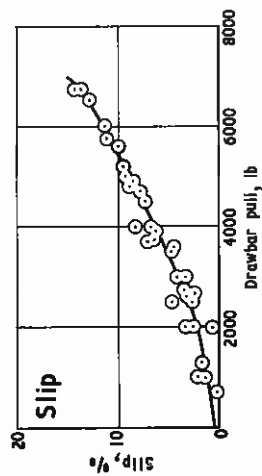
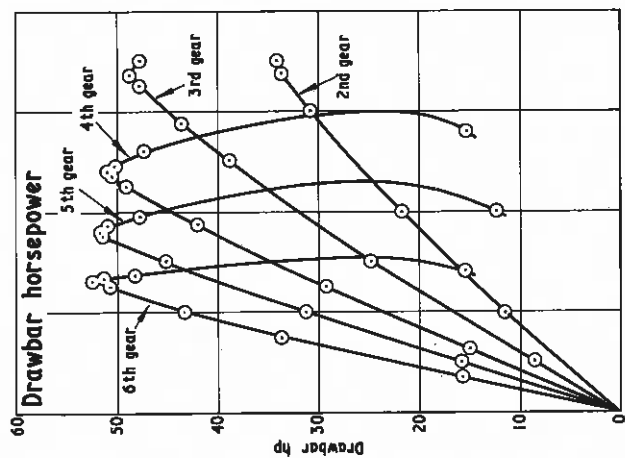


Fig. 4. Drawbar test on concrete, without ballast

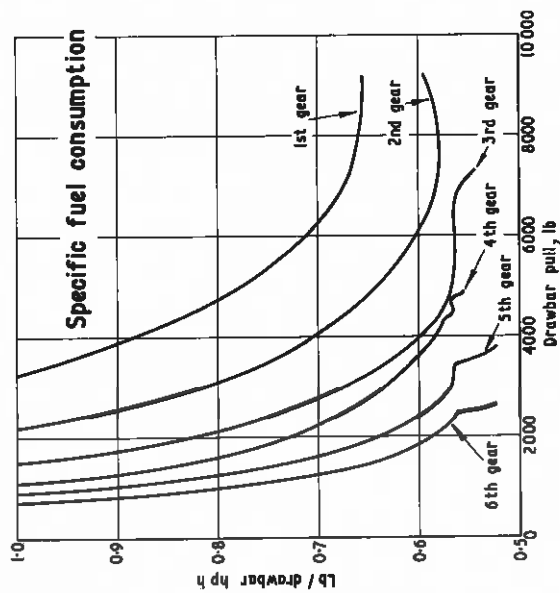
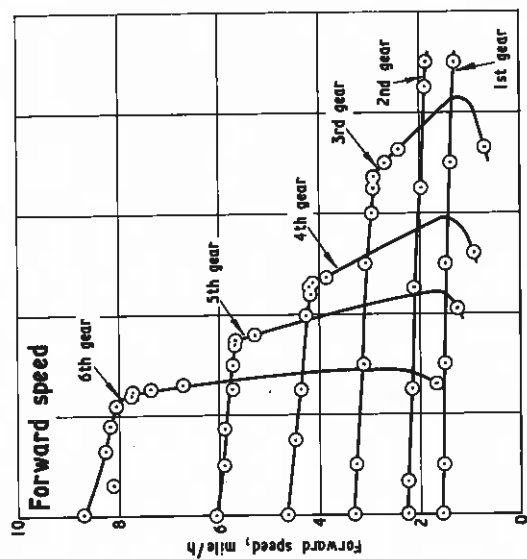


Fig. 3. Drawbar test on concrete with ballast

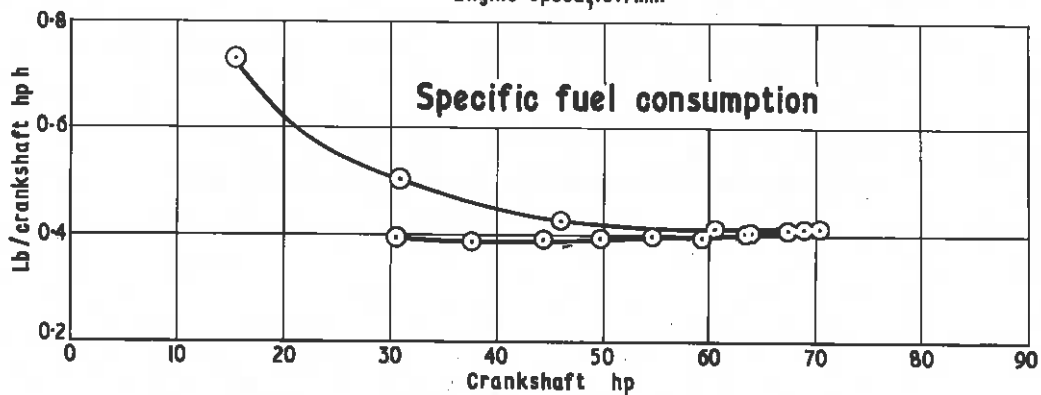
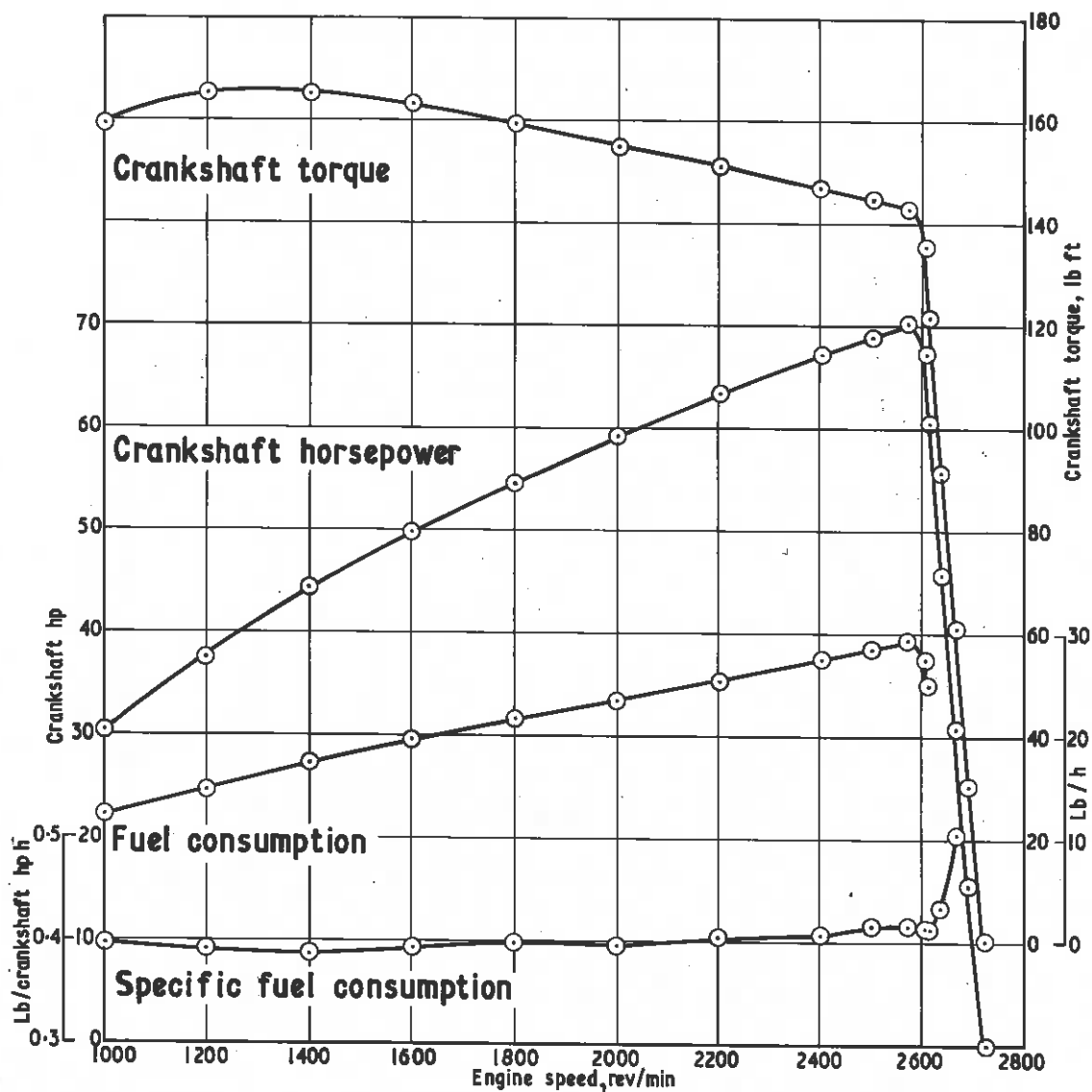


Fig. 5. Engine test

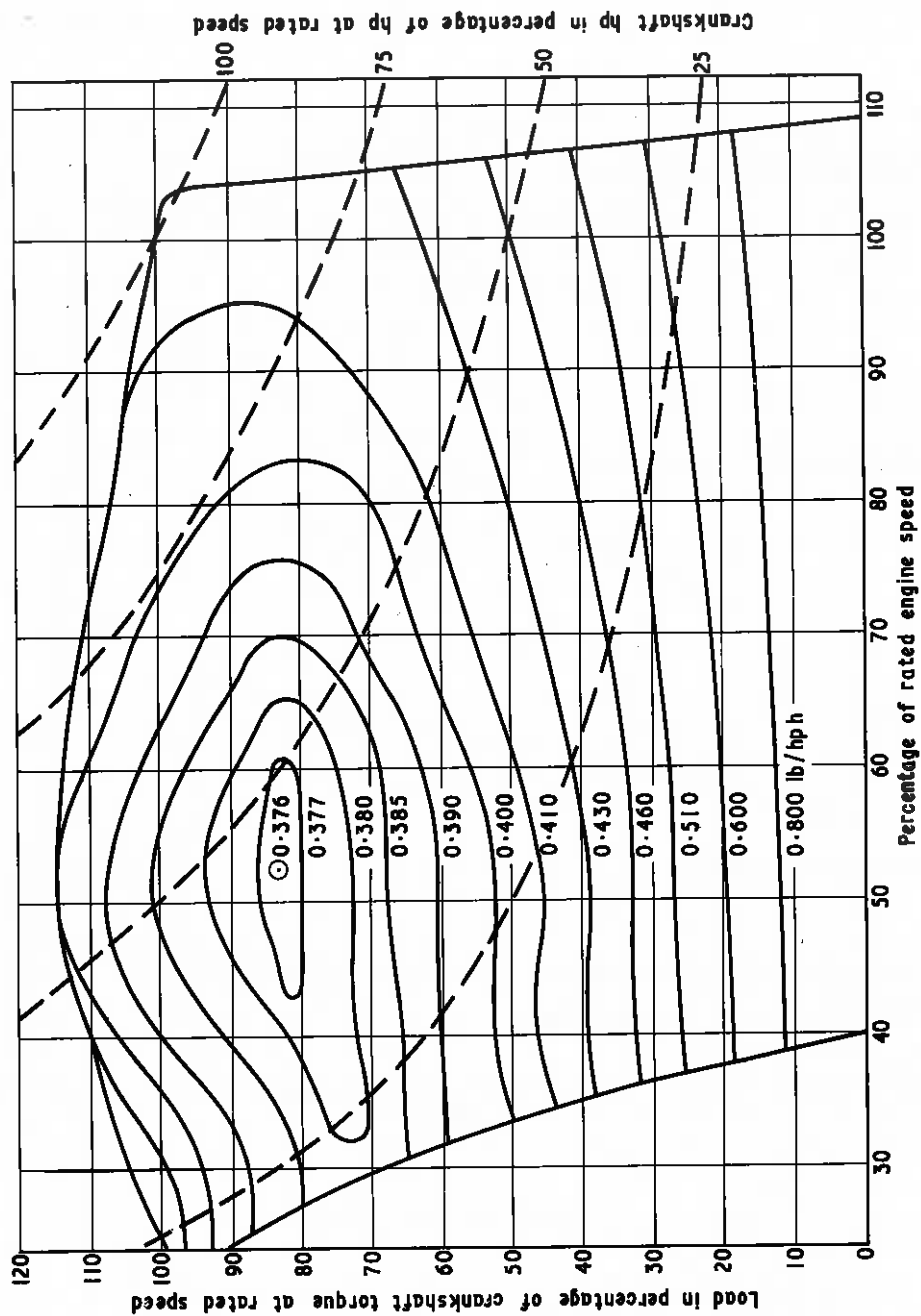


Fig. 6. Engine test