Report 612/O.E.C.D.
November 1969

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

FORD MODEL 4000 TRACTOR

Manufactured by: Ford Motor Co. Ltd,
Basildon, Essex



Test No.: R.69/5516/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: 23rd December 1969 *Serial No.:* 295

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:	Ford Motor Co.Ltd, Basildon, Essex
Selected and submitted for test by:	The manufacturer with the agreement of the testing station
Place of running-in:	Basildon
Duration of running-in:	150 hours

Tractor

Make:	Ford Motor Co.Ltd,
Model:	4000
Type:	Four wheel, rear wheel driven
Serial No.:	B 866874

Engine

Make:	Ford Motor Co.Ltd	Model:	4000
Type:	4-stroke, direct injection diesel	Serial No.:	D 096179

Cylinders:	3 cylinders, vertical, in-line, 4·4 in (111·8 mm) bore x 4·4 in (111·8 mm) stroke, capacity 200·7 in^3 (3·289 l), compression ratio 16·5:1 (nominal), monobloc construction, overhead valves
Fuel system:	Gravity feed fuel system, C.A.V. paper element filter with sediment bowl and water trap between tank and injection pump; C.A.V. type DPA 3233290 fuel injection pump, Serial No. 11792 TZ, manufacturer's production setting 14·1 - 14·9 cm^3 for 200 injections at 900 rev/min pump speed (test bench figures); C.A.V. type BDLL - 140S - 6422 injector nozzles, injector setting 185-190 atm (191-196 kg/cm^2); capacity of fuel tank 13·3 UKgal (60·5 l)
Governor:	C.A.V. mechanical, incorporated in fuel injection pump, governed range of engine speed 600 to 2475 rev/min, rated engine speed 2200 rev/min
Air cleaner:	Burgess oil bath under hood forward of radiator with centrifugal pre-cleaner above hood, oil capacity 2 pt (1·14 l)

Lubricating system: Forced feed from eccentric rotor type pump with metal strainer in sump; Ford full flow replaceable element filter, total oil capacity 13·4 pt (7·6 l), recommended oil change period 300 h (150 h if Supplement I oils are used)

Cooling system: Water cooled, pressurized at 7 lb/in² (0·49 kg/cm²), impeller assisted with 16 in (406 mm) dia, belt driven 4-blade fan, thermostat for temperature control, cooling water capacity 2·9 UKgal (13·2 l)

Starting system: Electrical, 12V Lucas type M45G solenoid engaged starter motor, operable only when high-low range gear selector lever is in neutral

Electrical system

Voltage: 12, negative earth
Generator: Lucas type C40T
Battery: FoMoCo type C5NN 0655-6, lead acid, capacity 128 Ah

Transmission

Clutch: Borg and Beck 11 in (279 mm) dia, single plate dry clutch, pedal operated

Gearbox: Own make, constant mesh type, 8 forward and 2 reverse speeds

Rear axle and final drives: Own make, crown wheel and pinion and differential with epicyclic gear final drives, pedal operated differential lock

Oil capacities: Gearbox 22 pt (12·5 l) SAE 80 EP oil, final drive 54 pt (30·7 l) oil to Ford specification ESEN-M2C86A. Recommended oil change period 1200 h

Gear	Number of engine revolutions for 1 revolution of driving wheel	*Nominal travelling speed for 2200 rev/min rated speed of engine, mile/h	(km/h)
Forward			
1	228·2	1·58	(2·54)
2	182·8	1·97	(3·17)
3	104·1	3·46	(5·57)
4	76·5	4·71	(7·58)
5	63·9	5·63	(9·06)
6	51·2	7·03	(11·31)
7	29·1	12·37	(19·90)
8	21·4	16·82	(27·06)
Reverse			
Low	158·8	2·27	(3·65)
High	44·4	8·11	(13·05)

*Calculated with tyre rolling radius of 27½ in (699 mm)

Power take-off	At rear of tractor, independent of main clutch, $1\frac{3}{8}$ in (34·9 mm) dia, 6-spline, hydraulically engaged, height above ground $23\frac{1}{2}$ in (597 mm), proportional engine speed giving 656 rev/min at 2200 rev/min rated engine speed, 540 rev/min standard p.t.o. speed at 1811 rev/min engine speed, direction of rotation clockwise viewed from driving end
Belt pulley	Available but not fitted for test
Power lift	Own make, hydraulic, gear pump driven from power take-off shaft, independent of main and p.t.o. clutches, supplies oil from transmission housing to ram cylinder and external tapping; Category 2 implement linkage, draught or position control with auxiliary service control and flow control device, vertical lift movement above ground $9\frac{5}{8}$ in (244 mm) to $35\frac{1}{4}$ in (895 mm)
Drawbar	Swinging drawbar: radius of swing $25\frac{1}{2}$ in (648 mm) and 30 in (762 mm), lateral adjustment $14\frac{3}{4}$ in (375 mm) and $18\frac{3}{8}$ in (467 mm), vertical heights to centre of clevis, four positions from $12\frac{3}{4}$ in (324 mm) to $22\frac{1}{4}$ in (565 mm) changed by inverting drawbar and clevis, drawbar hole to take 1 in (25 mm) dia pin, distance behind rear axle $25\frac{1}{2}$ in (648 mm) and 30 in (762 mm), position relative to p.t.o. $9\frac{1}{2}$ in (241 mm) and 14 in (356 mm) to rear. Pivot position on centre line of rear axle
Hitch	None fitted
Steering	Burman recirculating ball type with single drag link
Brakes	Oil immersed disc type, mounted on differential half shafts, pedal operated independently or together, handbrake operating on both brakes for parking

Wheels

Steering wheels:	Two at front, Goodyear Super Rib 7·50 - 16 tyres, 6-ply rating, maximum permissible weight on each tyre 1560 lb (708 kg) at 36 lb/in² (2·5 kg/cm²), track width 53½ in (1359 mm) by 4 in (102 mm) steps to 81½ in (2070 mm) changed by extending front axle
Driving wheels:	Two at rear, Goodyear Traction Sure Grip 13·6/12 - 36 tyres, 6-ply rating, maximum permissible weight on each tyre 3365 lb (1526 kg) at 20 lb/in² (1·4 kg/cm²), track width 56 in (1422 mm) by 4 in (102 mm) steps to 80 in (2032 mm) changed by reversing wheels and offset lug type rims
Wheelbase:	7 ft 1 in (2159 mm)

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

Weight without ballast	Front:	1667 lb	(756 kg)
	Rear:	2890 lb	(1311 kg)
	Total:	4557 lb	(2067 kg)
Ballast	Front:	Weights - nil	
		Liquid - total 43 lb (20 kg)	
	Rear:	Weights - 6 per wheel, total 1267 lb (575 kg)	
		Liquid - 1141 lb (518 kg)	
	Additional:	1 front frame weight - 79 lb (36 kg)	
Weight with full ballast	Front:	1800 lb	(816 kg)
	Rear:	5287 lb	(2398 kg)
	Total:	7087 lb	(3214 kg)

Seat

Bostrom, upholstered combined cushion and back rest, parallelogram linkage with steel torsion bar suspension adjustable for driver's weight, range of adjustment 2 in (51 mm) fore and aft

Number of grease points

Whole tractor: 10

Overall dimensions

Overall length:	11 ft $2\frac{3}{4}$ in (3·4 m) with lift arms in raised position
Overall width:	$69\frac{5}{8}$ in (1768 mm) at 56 in (1422 mm) track, no ballast weights; 87 in (2210 mm) at 56 in (1422 mm) track with 6 weights per wheel
Overall height:	$64\frac{5}{8}$ in (1641 mm) to top of steering wheel 91 in (2311 mm) to top of exhaust pipe
Minimum ground clearance:	$15\frac{1}{4}$ in (387 mm) to underside of drawbar frame

Lighting

	Height above ground of centre, in	(cm)	Size, in	(cm)	Distance from outside edge of tractor at 56 in (1422 mm) wheel track, to centre, in	(cm)
Headlights	36	(91·4)	4 dia	(10·2)	$29\frac{3}{4}$	(75·6)
Side lights	58	(147·3)	2 dia	(5·1)	$10\frac{1}{4}$	(26·0)
Rear lights	$57\frac{5}{8}$	(146·4)	4 x 2	(10·2) x (5·1)	$11\frac{5}{8}$	(29·5)
Reflectors	$55\frac{1}{2}$	(141·0)	4 x 2	(10·2) x (5·1)	$11\frac{5}{8}$	(29·5)

Unrestricted beam angle of headlight in plan view 40°

FUELS AND LUBRICANTS USED IN TESTS

Laboratory and track tests

Fuel:	Diesel oil, specific gravity 0·8295 at 60°F (15·6°C), Cetane No. 53, to Class A, B.S.2869:1957
Engine oil:	Series III, SAE 20W
Gearbox oil:	SAE 80 EP
Final drive oil:	Ford Specification ESEN-M2C86A

COMPULSORY TESTS

1. MAIN POWER TAKE-OFF PERFORMANCE

Date and location of tests: 12th August 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					
53·1 (53·8)	2270	677	2·88 (13·09)	0·450 (201)	18·4 (4·11)
Standard p.t.o. speed (540 rev/min)					
46·0 (46·6)	1811	540	2·33 (10·59)	0·420 (188)	19·8 (4·42)
Standard belt speed of 3100 ft/min (945 m/min)					
		Not applicable			
Speed recommended by the manufacturer for drawbar work					
52·0 (52·7)	2200	656	2·76 (12·55)	0·441 (197)	18·8 (4·19)
Fuel consumption at part loads					
46·1 (46·7)	2320	692	2·54 (11·55)	0·456 (204)	18·2 (4·06)
0	2461	734	0·90 (4·09)	-	-
23·7 (24·0)	2384	711	1·55 (7·05)	0·543 (243)	15·3 (3·41)
53·1 (53·8)	2270	677	2·88 (13·09)	0·450 (201)	18·4 (4·11)
12·0 (12·2)	2414	720	1·19 (5·41)	0·823 (368)	10·1 (2·25)
35·1 (35·6)	2354	702	2·08 (9·46)	0·493 (221)	16·8 (3·75)

No load, maximum engine speed: 2461 rev/min

Equivalent crankshaft torque at maximum power: 122·8 lb ft (17·0 kg m)

Maximum equivalent crankshaft torque: 142·2 lb ft (19·7 kg m) at 1300 rev/min engine speed

Mean atmospheric conditions: temperature 70°F (21°C)
pressure 29·62 in Hg (752 mm Hg)
relative humidity 86%

Maximum temperature: coolant 195°F (91°C)
engine oil 230°F (110°C)
fuel 84°F (29°C)

2. DRAWBAR PERFORMANCE

Date of tests: 19th September - 15th October 1969 Type of track: Concrete Height of drawbar above ground: 16 in (406 mm)

Gear	Horse-power (metric hp)	Drawbar pull, lb (kg)	Speed, mile/h (km/h)	Engine speed, rev/min	Wheel-slip, %	Specific fuel consumption, lb/drawbar hp h (g/metric drawbar hp h)	Specific fuel consumption, drawbar hp h/UKgal (metric drawbar hp h/l)	Temperature, °F (°C) Coolant	Fuel	Engine oil	Atmospheric conditions Temperature, °F (°C)	Relative humidity, %	Pressure, in Hg (mm Hg)
(i) Maximum power (ballasted)													
1	*26·2 (26·6)	7000 (3175)	1·40 (2·25)	2321	15·0	0·649 (290)	12·8 (2·86)	173 (78)	64 (18)	184 (84)	58 (14)	66	30·10 (765)
2	*32·6 (33·1)	7000 (3175)	1·75 (2·82)	2282	15·0	0·618 (276)	13·4 (2·99)	174 (79)	62 (17)	187 (86)	58 (14)	66	30·10 (765)
3	44·4 (45·0)	5150 (2336)	3·23 (5·20)	2263	8·8	0·565 (253)	14·7 (3·28)	177 (81)	73 (23)	180 (82)	60 (16)	68	30·02 (763)
4	46·2 (46·8)	3850 (1746)	4·50 (7·24)	2250	5·8	0·550 (246)	15·1 (3·37)	174 (79)	81 (27)	184 (84)	64 (18)	70	30·00 (762)
5	47·8 (48·5)	3300 (1497)	5·43 (8·74)	2255	4·8	0·524 (234)	15·8 (3·52)	170 (77)	69 (21)	195 (91)	55 (13)	65	30·00 (762)
6	46·8 (47·5)	2550 (1157)	6·88 (11·07)	2230	3·5	0·521 (233)	15·9 (3·55)	177 (81)	77 (25)	199 (93)	67 (19)	65	30·00 (762)
(ii) Five hour test at 75% of pull at maximum power													
4	35·9 (36·4)	2890 (1311)	4·66 (7·50)	2295	4·0	0·570 (255)	14·5 (3·23)	182 (83)	98 (37)	219 (104)	71 (22)	72	30·15 (766)
(iii) +Five hour test at pull corresponding to 15% wheelslip in test (i)													
2	-	7000 (3175)	1·82 (2·93)	-	-	-	-	177 (81)	79 (26)	218 (103)	65 (18)	85	30·13 (765)
(iv) Maximum power (unballasted)													
2	*23·3 (23·6)	4850 (2200)	1·80 (2·90)	2336	15·0	-	-	175 (79)	-	207 (97)	59 (15)	89	30·03 (763)
3	*39·6 (40·2)	4850 (2200)	3·06 (4·92)	2255	15·0	-	-	179 (82)	-	203 (95)	59 (15)	89	30·03 (763)
4	45·6 (46·2)	3850 (1746)	4·44 (7·14)	2261	10·0	-	-	184 (84)	-	218 (103)	67 (19)	85	29·97 (761)
5	47·4 (48·1)	3300 (1497)	5·39 (8·67)	2225	7·9	-	-	178 (81)	-	200 (93)	59 (15)	89	30·03 (763)
6	47·5 (48·2)	2600 (1179)	6·85 (11·0)	2226	5·7	-	-	176 (80)	-	190 (88)	55 (13)	94	30·00 (762)

Total oil consumption during ten hours duration of tests (ii) and (iii) 0·063 lb/h (28·4 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 - 53½ in (1359 mm)
rear - 56 in (1422 mm)

	With brakes		Without brakes	
	Right hand	Left hand	Right hand	Left hand
Radius of turning space	11 ft 2 in (3·40 m)	11 ft 5 in (3·48 m)	12 ft 5 in (3·78 m)	12 ft 8 in (3·86 m)
Radius of turning circle	10 ft 9½ in (3·29 m)	11 ft 0½ in (3·37 m)	12 ft 0½ in (3·67 m)	12 ft 3½ in (3·75 m)

5. LOCATION OF CENTRE OF GRAVITY

Height above ground	29·9 in (759 mm)
Distance forward from the vertical plane containing the axis of the rear wheels	30·3 in (770 mm)
Distance from the median plane of the tractor	0

6. BRAKING

Date of tests: 13th and 16th October 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/s² (m/s²)	15·0	(4·6)	16·9	(5·2)
Stopping distance, ft (m)	22·6	(6·9)	19·1	(5·8)
Force on brake pedal, lb (kg)	80	(36)	110	(50)

Brake fade characteristics (hot tests)

Maximum deceleration hot/maximum deceleration cold x 100:	100%
Stopping distance cold/stopping distance hot x 100:	100%
Force on pedal cold/force on pedal hot x 100:	100%
Efficiency of handbrake:	Satisfactory, hot and cold
Pull on handbrake:	98 lb (44 kg)

7. MEASUREMENT OF AMBIENT NOISE EMITTED BY THE TRACTOR

Date of tests:	10th October 1969	
Type of sound level meter:	Brüel and Kjaer Type 2203	
Type of track:	Concrete	
Results of tests:	gear	8th
	travelling speed before acceleration	13·6 mile/h (21·9 km/h)
	sound level	88 dBA

8. NOISE MEASUREMENTS AT THE DRIVER'S EAR LEVEL

Date of tests:	10th October 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
4th	4·61 (7·42)	125

9. POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date and location of tests: 4th November 1969, N.I.A.E., Silsoe, Bedford, U.K.

Hydraulic fluid

Make and type:	Ford Specification ESEN-M2C86A
Viscosity:	10·5 - 10·6 cS at 210°F (99°C)
Viscosity index:	95

	Vertical movement, in (mm)	Maximum force exerted through full range, lb (kg)	Pressure, lb/in² (kg/cm²)	Linkage load at which unballasted front end of tractor lifts off the ground, lb (kg)
At lower hitch points (height above ground in down position $9\frac{5}{8}$ in (244 mm))	$25\frac{5}{8}$ (651)	3435 (1558)	2600 (183)	- -
On the frame 24 in (610 mm) to rear of lower hitch points	$32\frac{1}{2}$ (826)	2780 (1261)	2600 (183)	2300 (1043)

Type of linkage lock for transport: Hydraulic

Opening pressure of the cylinder over pressure relief valve (manufacturer's figures): 2750-2850 lb/in² (193-200 kg/cm²)

Pump characteristics

i) opening pressure of relief valve: 2320 lb/in² (163 kg/cm²)

sustained pressure of the open relief valve: 2520 lb/in² (177 kg/cm²)

Pump delivery at external tapping

ii) at minimum pressure (rated engine speed): 4·6 gal/min (20·9 l/min)

iii) at maximum hydraulic power: 4·7 gal/min (21·4 l/min)

delivery pressure: 2320 lb/in² (163 kg/cm²)

power: 7·66 hp (7·77 metric hp)

15. REPAIRS AND ADJUSTMENTS DURING TESTS

During preliminary tests of the hydraulic system, the flow control valve override linkage was adjusted in order to obtain maximum flow

REMARKS

None

Officer in charge: D.W. SMITH

Head of Tractor and Ergonomics Department: J.MATTHEWS

Date: 20th November 1969

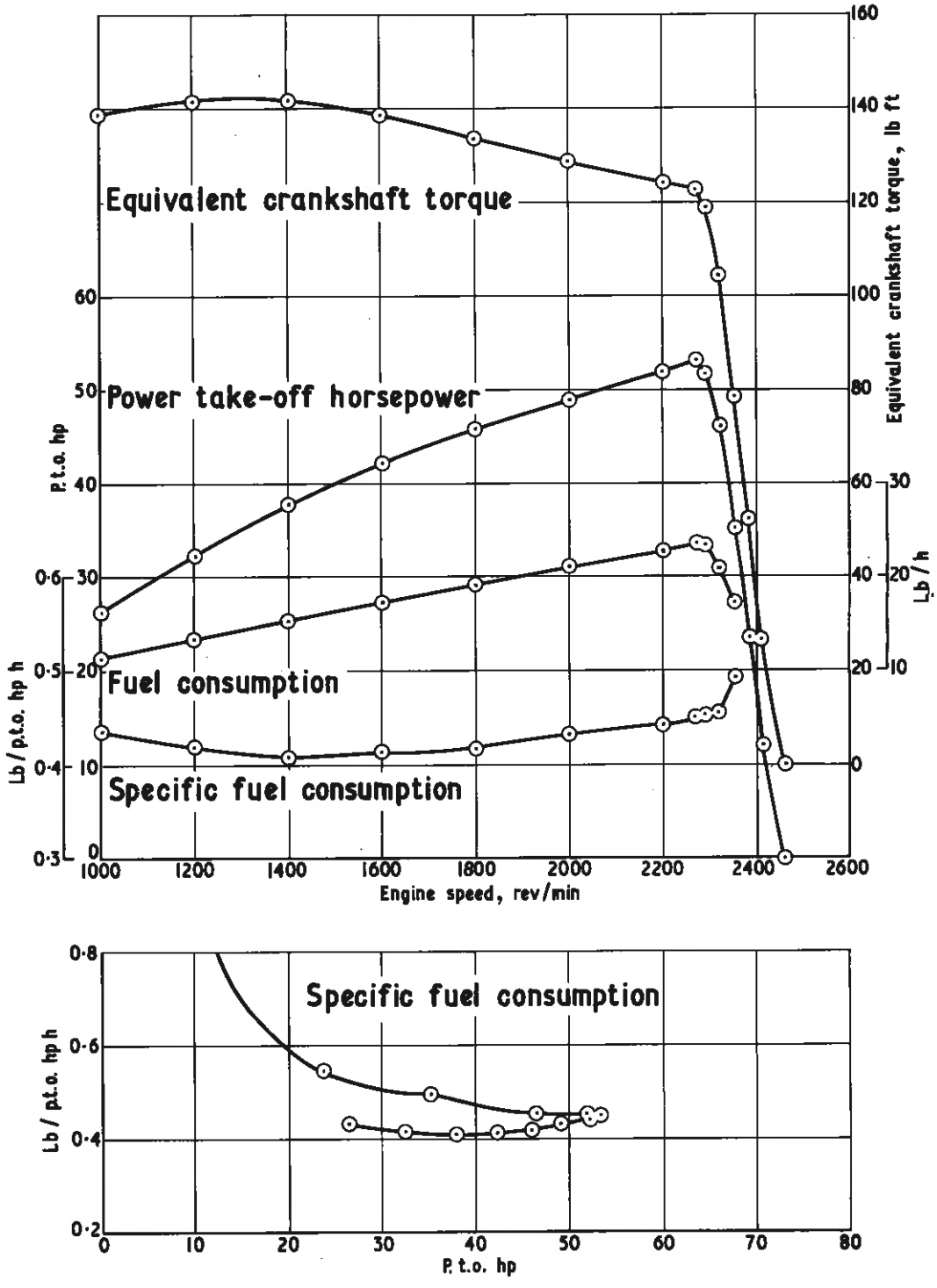


Fig. 1. Power take-off test

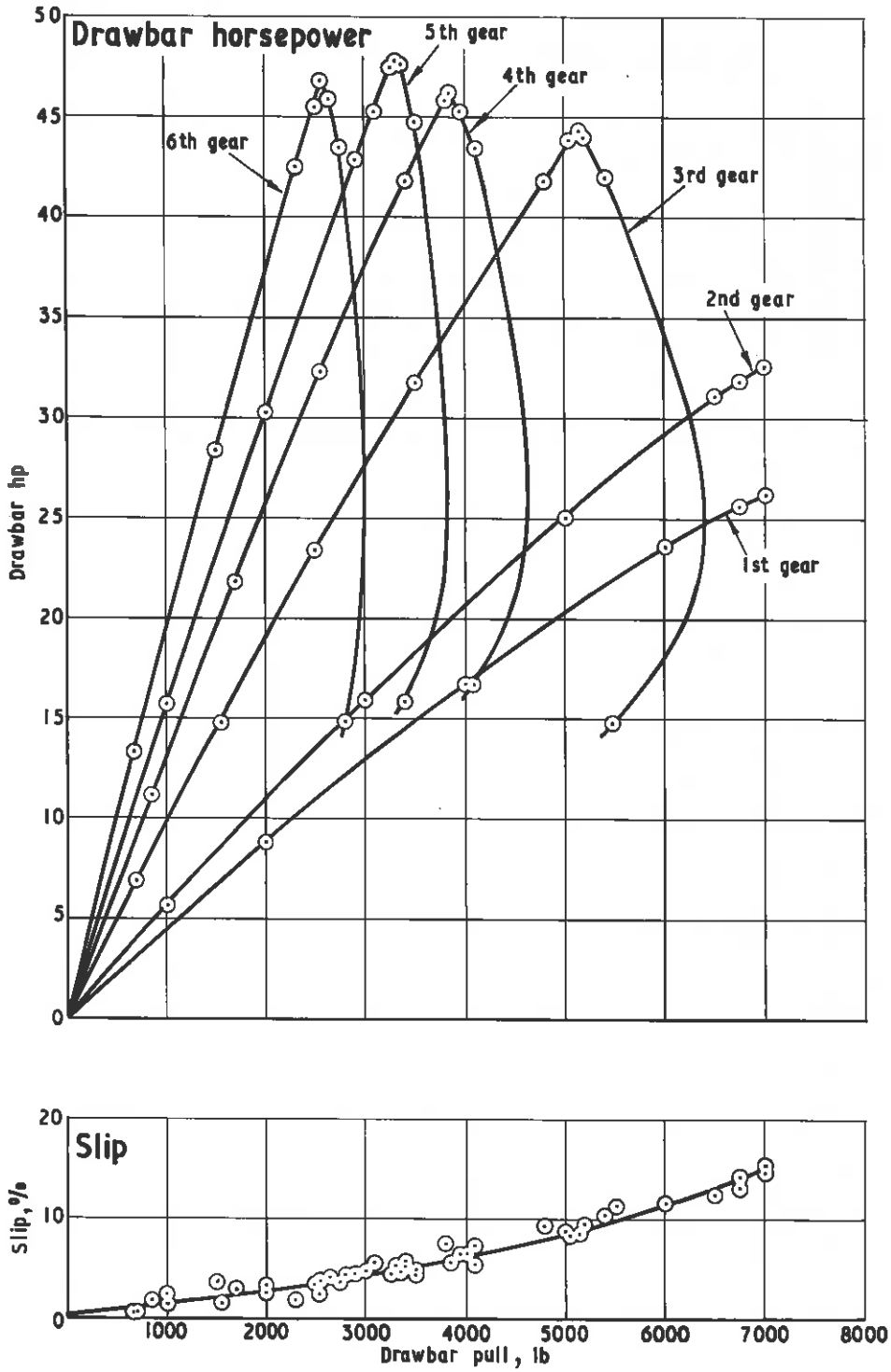


Fig.2. Drawbar test on concrete, with ballast

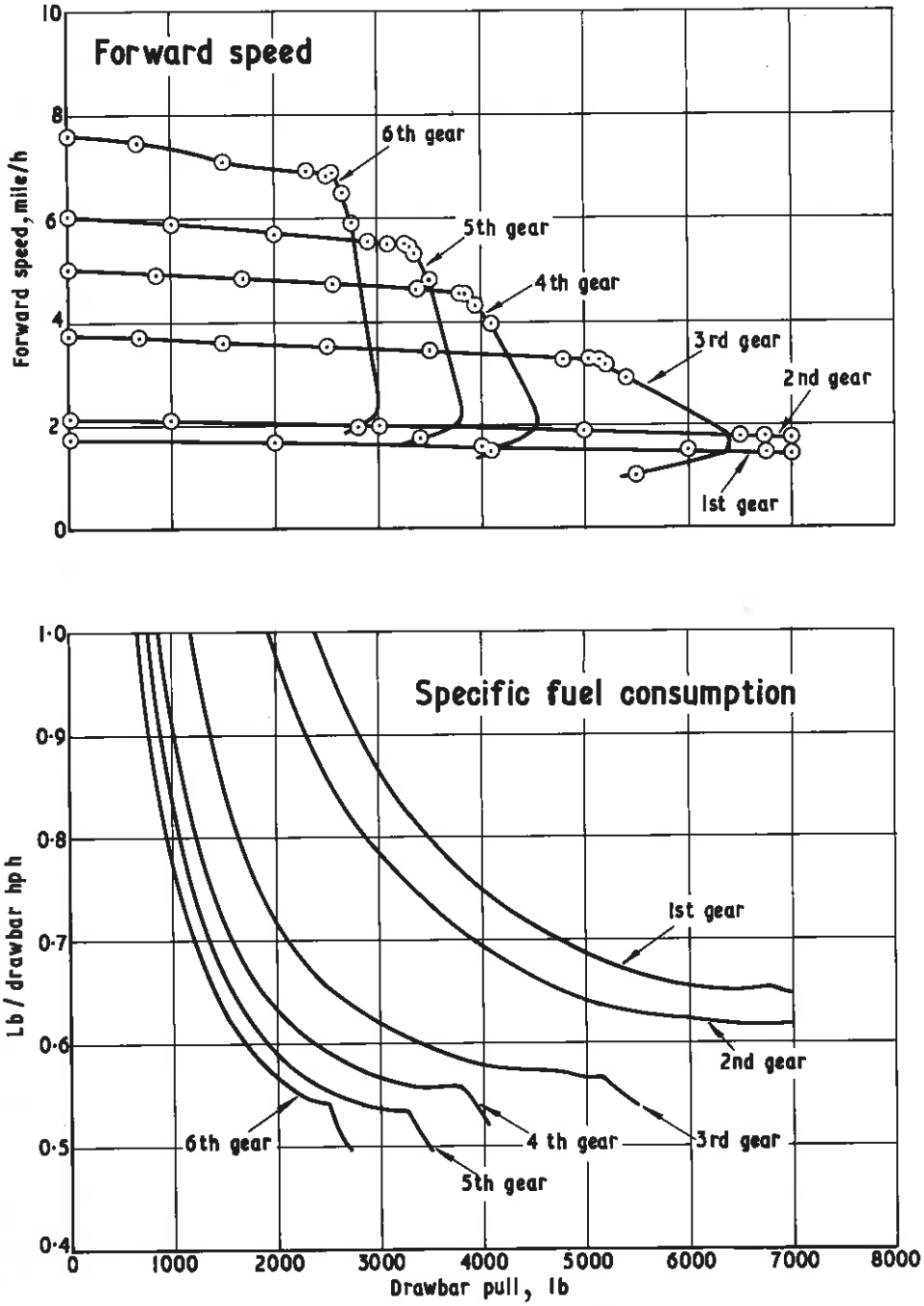


Fig. 3. Drawbar test on concrete, with ballast

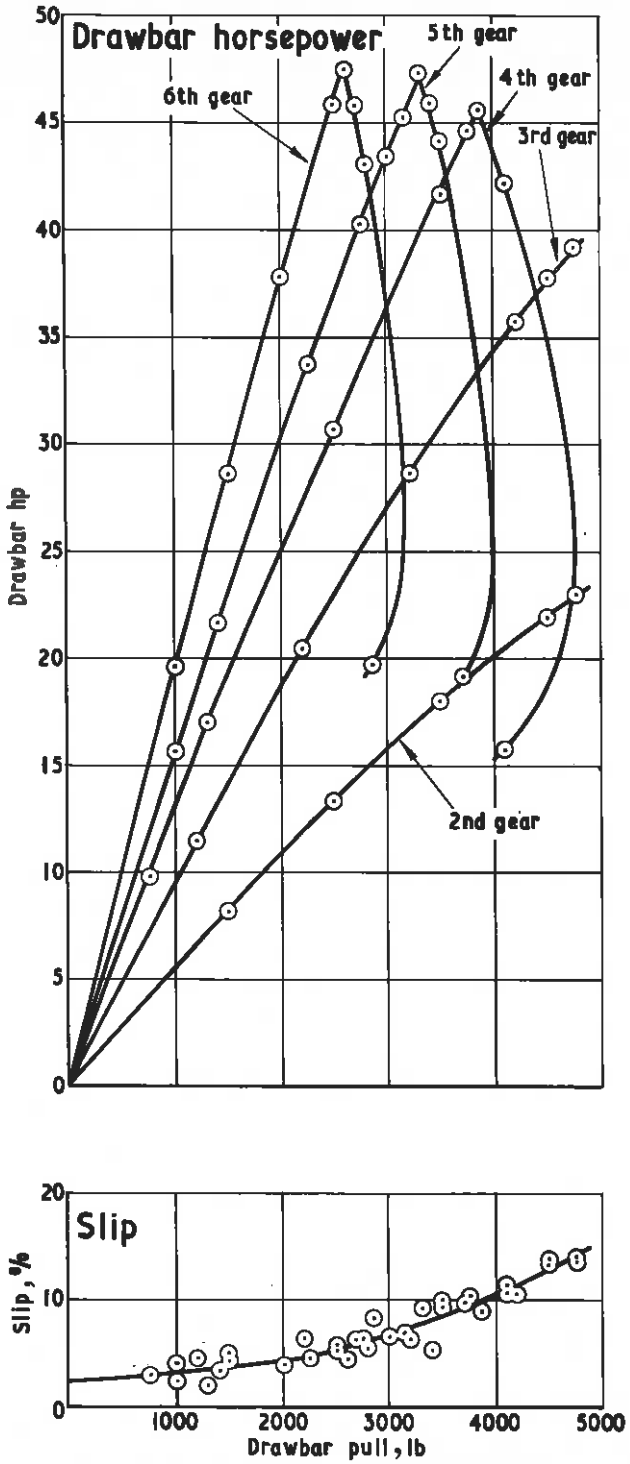


Fig. 4. Drawbar test on concrete, without ballast

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