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No. 507/O.E.C.D.

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

FORD MAJOR DIESEL TRACTOR MODEL 4000

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



Date of Tests: January–March 1966
Test No.: R.66033/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

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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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PART I

SPECIFICATION OF TRACTOR

Tractor

Make:	Ford
Model:	Ford Major
Type:	4000
Serial No.:	B 814636 K185

Engine

Make:	Ford Motor Co. Ltd, type 4000, direct injection diesel, Serial No. PD-092641 K275
Cylinders:	3 cylinders, vertical, in-line, 4·4 in (111·8 mm) bore × 4·4 in (111·8 mm) stroke, capacity 200·7 in³ (3·289 l), compression ratio 16·5:1 (nominal). Monobloc construction, overhead valves
Rated speeds:	2200 rev/min, governor setting—no load engine speed 2395–2445 rev/min
Fuel system:	Fuel—Diesel oil C.A.V. type DPA 3232978 injection pump, Serial No. R 25062 UG, C.A.V. type BDLL 150S 6476 injector nozzles. Manufacturer's production setting for injection pump: 13·3–13·5 cm³ for 200 injections at 550 rev/min pump speed (test bench figures). Injection pressure 185–190 atm (191–196 kp/cm²). Gravity feed fuel system with gauze type filter in fuel tank, two C.A.V. paper element parallel flow filters, each with sediment bowl and water trap, between tank and injection pump. 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 600–2445 rev/min
Air cleaner:	Burgess oil-bath under hood forward of radiator, 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 replaceable element filter. SAE 10W Supplement I oil for first 600 h, then SAE 20W Supplement I or Series III when fuel sulphur content is more than 1%; recommended oil change period 300 h; oil capacity 13·4 pt (7·6 l) including filter
Cooling system:	Water cooled, pressurized at 7 lb/in² (0·49 kp/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)

Transmission

Clutch:	Borg and Beck, 11 in (279 mm) dia, single plate dry clutch, foot-pedal operated
Gear-box:	Own make, constant mesh type, 8 forward speeds and 2 reverse
Differential:	Crown wheel and pinion and differential with epicyclic reduction gear final drives, foot-pedal operated differential lock. Transmission oil capacities: gear-box 28·2 pt (16·0 l) SAE 80 EP oil, rear axle 46·4 pt (26·4 l) oil to Ford specification ESEN-M2C86A

Gear	*Number of engine revolutions for one revolution of driving wheel*	*Theoretical 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)

Steering device Recirculating ball type with single drag link

Brakes Hand lever operated transmission brake; independent or combined foot-pedal operated oil immersed disc brakes on differential half shafts

Wheels

Steering wheels: Two at front. Tyres 7·50–16, 6-ply pneumatic. Track 54 in (1372 mm) by 4 in (102 mm) steps to 82 in (2083 mm) changed by extending front axle. Maximum permissible weight on each tyre: 1560 lb (708 kg) at 36 lb/in² (2·5 kp/cm²)

Driving wheels: Two at rear. Tyres 12–36, 6-ply pneumatic. Track 56 in (1422 mm) by 4 in (102 mm) steps to 80 in (2032 mm) changed by reversing wheel centres and offset lug type rims. Maximum permissible weight on each tyre: 3365 lb (1526 kg) at 20 lb/in² (1·4 kp/cm²)

Wheelbase: 7 ft $0\frac{1}{2}$ in (2146 mm)

Belt pulley

Location: Attachable to rear of tractor in two alternative horizontal positions, main p.t.o. driven

Diameter × width: $10\frac{1}{4}$ in (260 mm) × $6\frac{1}{2}$ in (165 mm)

Speeds: 1209 rev/min giving 3245 ft/min (16·48 m/s) linear speed at 2200 rev/min rated engine speed; 1155 rev/min giving 3100 ft (15·75 m/s) linear speed at 2102 rev/min engine speed

Direction of rotation: Optional, depending on position of unit

Power take-off

Main: Hydraulically engaged proportional engine speed, 6 spline, $1\frac{3}{8}$ in (34·9 mm) dia at rear of tractor

Height above ground: $23\frac{1}{2}$ in (597 mm)

Speeds: 656 rev/min at 2200 rev/min rated engine speed
540 rev/min at 1811 rev/min engine speed
Independent of main clutch

Direction of rotation: Clockwise viewed from tractor rear

Power lift

Own make, hydraulic, gear pump driven from power take-off shaft, independent of main and p.t.o. clutches, supplying oil from transmission at nominal pressure of 2500 lb/in² (176 kp/cm²) to ram cylinder and external tapping. Oil flow from external tapping at maximum horsepower delivered by hydraulic system, test figures: 4·38 UKgal/min (19·9 l/min) at 2300 lb/in² (162 kp/cm²) and 2200 rev/min rated engine speed, oil temperature 56 °C

Category 1 and 2 implement linkage, draught or position control with auxiliary service control and flow control device, maximum load liftable at end of lower links, test figures: through complete range—2700 lb (1225 kg); at top of lift range—3600 lb (1633 kg); manufacturer's recommended figure—2000 lb (907 kg) at 24 in (610 mm) to rear of lower link balls. Radius of motion of lower links: 35 in (889 mm)

Drawbar

Swinging drawbar, radius of swing 30 in (762 mm) and 25½ in (648 mm), lateral adjustment 18 in (457 mm) and 11 in (279 mm), vertical heights to centre of clevis 12⅜ in (314 mm), 16¼ in (413 mm), 17¾ in (451 mm) and 21¾ in (552 mm). Distance behind rear axle 30 in (762 mm) and 25½ in (648 mm)

Hitch

None fitted

Electrical equipment

Voltage:	12, negative earth
Generator:	Lucas type C40A
Battery:	Ford type C5NN 10655 C, lead acid, 128 Ah capacity
Starting device:	Ford type C5NF 11001-A solenoid engaged starter motor, operable only when the gear selector is in neutral

Overall dimensions

Overall length:	11 ft 11¼ in (3·64 m) as tested with 5 front weights 11 ft 6½ in (3·52 m) as tested without ballast
Overall width:	8 ft 11¾ in (2·74 m) at 60 in (1524 mm) track to outside of wheel weights, 11 per wheel 6 ft 2¼ in (1·89 m) at 60 in (1524 mm) track, no ballast weights
Overall height:	7 ft 3½ in (2·22 m) to top of exhaust pipe 5 ft 4¾ in (1·64 m) to top of steering wheel
Minimum ground clearance:	15⅜ in (391 mm) to bottom of drawbar frame

Weights

With full fuel tank, oil, cooling water, no driver

	Without additional weight, lb (kg)	*With maximum additional weight, lb (kg)*
On front wheels	1677 (761)	2496 (1132)
On rear wheels	2902 (1316)	6503 (2950)
Total	4579 (2077)	8999 (4082)

Special remarks

None

PART II

LABORATORY TESTS

1. Compulsory tests: Power take-off test
   Date and location of tests: 5th January 1966, N.I.A.E., Silsoe, Bedford, U.K.
   Type of dynamometer: Water brake, Heenan and Froude
   Fuel: Diesel oil, density 0·837 at 60 °F (15·6 °C), Cetane No. 54
   Engine oil: SAE 10W Supplement I
   Transmission oil: Gear-box SAE 80 EP
   Final drive, Ford specification ESEN—M2C86A

Horse-power (Metric hp)	*Speeds, rev/min*		*Equivalent crankshaft torque, lb ft (kp m)*	*Fuel consumption,*			*Temperature, °F (°C)*			*Atmos. conditions*	
	Engine	*P.t.o.*		*UKgal/h (l/h)*	*lb/hp h (g/metric hp h)*	*hp h/ UKgal (metric hp h/l)*	*Coolant*	*Oil*	*Fuel*	*Temp., °F (°C)*	*Press., inHg (mmHg)*
A. Maximum power											
48·6 (49·3)	2327	694	109·7 (15·17)	2·89 (13·14)	0·498 (223)	16·8 (3·75)	177 (81)	201 (94)	80 (27)	62 (17)	30·18 (767)
B. Power at standard p.t.o. speed (540 rev/min)											
43·6 (44·2)	1811	540	126·4 (17·48)	2·22 (10·09)	0·426 (191)	19·7 (4·40)	173 (78)	190 (88)	75 (24)	60 (16)	30·18 (767)
C. Power at maximum torque											
26·8 (27·2)	1000	298	140·9 (19·49)	1·29 (5·86)	0·403 (180)	20·8 (4·64)	185 (85)	179 (82)	80 (27)	61 (16)	30·18 (767)
D. Power at rated speed											
47·6 (48·3)	2200	656	113·6 (15·71)	2·63 (11·96)	0·463 (207)	18·1 (4·04)	176 (80)	200 (93)	79 (26)	62 (17)	30·18 (767)

No load, maximum engine speed: 2448 rev/min

2. Supplementary tests: Engine test (in installed condition)
   Date and location of tests: 18th January 1966, N.I.A.E., Silsoe, Bedford, U.K.
   Type of dynamometer: Water brake, Heenan and Froude
   Fuel: Diesel oil, density 0·837 at 60 °F (15·6 °C), Cetane No. 54
   Engine oil: SAE 10W Supplement I

Horse-power (Metric hp)	*Speed, rev/min*	*Crank-shaft torque, lb ft (kp m)*	*Fuel consumption,*			*Temperature, °F (°C)*			*Atmos. conditions*	
			UKgal/h (l/h)	*lb/hp h (g/metric hp h)*	*hp h/ UKgal (metric hp h/l)*	*Coolant*	*Oil*	*Fuel*	*Temp., °F (°C)*	*Press., inHg (mmHg)*
A. Maximum power										
51·6 (52·3)	2320	116·8 (16·15)	2·84 (12·91)	0·461 (206)	18·1 (4·04)	184 (84)	210 (99)	78 (26)	67 (19)	29·86 (758)
B. Power at standard p.t.o. speed (540 rev/min)										
46·1 (46·7)	1811	133·7 (18·49)	2·25 (10·23)	0·408 (182)	20·5 (4·57)	182 (83)	208 (98)	81 (27)	67 (19)	29·86 (758)
C. Power at maximum torque										
27·1 (27·5)	980	145·2 (20·08)	1·29 (5·86)	0·400 (179)	20·9 (4·66)	182 (83)	183 (84)	89 (32)	58 (14)	29·86 (758)
D. Power at rated speed										
49·7 (50·4)	2200	118·6 (16·40)	2·63 (11·96)	0·443 (198)	18·9 (4·22)	182 (83)	208 (98)	80 (27)	67 (19)	29·86 (758)

No load, maximum engine speed: 2430 rev/min

3. Supplementary tests: Belt test
Date and location of tests: 6th January 1966, N.I.A.E., Silsoe, Bedford, U.K.
Type of dynamometer: Electrical, swinging frame
Fuel: Diesel oil, density 0·837 at 60 °F (15·6 °C), Cetane No. 54
Engine oil: SAE 10W Supplement I
Transmission oil: Gear-box, SAE 80 EP
Final drive, Ford specification ESEN—M2C86A

Horse-power (Metric hp)	*Speeds*		*Equivalent crankshaft torque, lb ft (kp m)*	*Fuel consumption,*			*Temperature, °F (°C)*			*Atmos. conditions*	
	Engine, rev/min	*Belt, ft/min (m/s)*		*UKgal/h (l/h)*	*lb/hp h (g/metric hp h)*	*hp h/ UKgal (metric hp h/l)*	*Coolant*	*Oil*	*Fuel*	*Temp., °F (°C)*	*Press., inHg (mmHg)*
A. Maximum power											
46·8 (47·5)	2321	3423 (17·39)	106·0 (14·66)	2·86 (13·00)	0·512 (229)	16·4 (3·66)	178 (81)	204 (96)	77 (25)	65 (18)	30·23 (768)
B. Power at standard belt speed (3100 ft/min [15·75 m/s])											
45·0 (45·6)	2102	3100 (15·75)	112·4 (15·54)	2·56 (11·64)	0·476 (213)	17·6 (3·93)	178 (81)	201 (94)	81 (27)	62 (17)	30·23 (768)
C. Power at maximum torque											
25·7 (26·1)	980	1446 (7·35)	137·7 (19·04)	1·31 (5·96)	0·426 (191)	19·7 (4·40)	181 (83)	182 (83)	79 (26)	60 (16)	30·23 (768)
D. Power at rated speed											
45·7 (46·3)	2200	3245 (16·48)	109·1 (15·09)	2·67 (12·14)	0·489 (219)	17·1 (3·82)	178 (81)	201 (94)	82 (28)	64 (18)	30·23 (768)
No load, maximum engine speed: 2430 rev/min											

PART III

DRAWBAR TESTS ON ARTIFICIAL TRACK

Date of tests: 23rd February–1st March 1966
Type of track: Tarmacadam
Position of governor control lever: Fully open, giving no load engine speed of 2395–2445 rev/min
Type of tyre: Rear—Goodyear Traction Sure Grip, straight bar open centre, 12–36, 6-ply, pneumatic
Front—Goodyear Super Rib, 7·50–16, 6-ply, pneumatic
Fuel: Diesel oil, density 0·837 at 60 °F (15·6 °C), Cetane No. 54
Engine oil: SAE 10W Supplement I
Transmission oil: Gear-box SAE 80 EP
Final drive, Ford specification ESEN—M2C86A

A. Tests with maximum additional weight

Weight of tractor, without driver:

Weight without ballast: Front—1677 lb (761 kg)
Rear—2902 lb (1316 kg)
Ballast: Front: Weights, 1 per wheel—181 lb (82 kg)
Water—149 lb (68 kg)
Rear: Weights, 11 per wheel—2342 lb (1062 kg)
Calcium chloride solution—1346 lb (611 kg)
Additional: 5 front frame weights—402 lb (182 kg)

Weight with full ballast:	Front—2496 lb (1132 kg)
	Rear—6503 lb (2950 kg)
	Total—8999 lb (4082 kg)
Tyre pressure:	Front—28 lb/in² (1·97 kp/cm²)
	Rear—20 lb/in² (1·41 kp/cm²)
Height of drawbar above ground:	20 in (508 mm)

(1) *Maximum powers and pulls*

Gear	*Maximum powers*						*Air temp., °F (°C)*	*Atmos. press., inHg (mmHg)*	*Maximum pulls*	
	Horse-power (Metric hp)	*Corres-ponding pull, lb (kp)*	*Wheel slip, %*	*Engine speed, rev/min*	*Speed, mile/h (km/h)*	*Engine coolant temp., °F (°C)*			*Pull, lb (kp)*	*Reason for stall*
1	28·8 (29·2)	7850 (3561)	19·0	2338	1·38 (2·22)	191 (88)	51 (11)	29·66 (753)	8500 (3856)	Wheelspin
2	35·8 (36·3)	7825 (3549)	18·7	2330	1·72 (2·77)	195 (91)	51 (11)	30·09 (764)	8500 (3856)	Wheelspin and bouncing
3	42·0 (42·6)	4700 (2132)	7·9	2308	3·35 (5·39)	193 (89)	47 (8)	29·38 (746)	6150 (2790)	Engine stall
4	42·7 (43·3)	3400 (1542)	5·2	2322	4·71 (7·58)	195 (91)	49 (9)	29·38 (746)	4550 (2064)	Engine stall
5	43·1 (43·7)	2850 (1293)	4·2	2310	5·67 (9·12)	191 (88)	49 (9)	29·38 (746)	3750 (1701)	Engine stall
6	42·7 (43·3)	2250 (1021)	3·2	2304	7·12 (11·46)	190 (88)	49 (9)	29·38 (746)	3000 (1361)	Engine stall

(2) *Fuel consumption*

Gear	*Optimum fuel consumption*			*Range of pull, lb (kp) over which specific fuel consumption does not exceed optimum consumption by more than 10%*
	Specific fuel consumption, lb/drawbar hp h (g/metric drawbar hp h)	*Drawbar hp h/UKgal (metric drawbar hp h/l)*	*Corresponding pull, lb (kp)*	
1	0·699 (313)	12·0 (2·68)	6950 (3153)	4690 – 8260 (2127) (3747)
2	0·663 (297)	12·6 (2·81)	5750 (2608)	3600 – 8150 (1633) (3697)
3	0·534 (239)	15·7 (3·50)	5800 (2631)	4720 – 6150 M.S.P. (2141) (2790)
4	0·499 (223)	16·8 (3·75)	4500 (2041)	3660 – 4550 M.S.P. (1660) (2064)
5	0·460 (206)	18·2 (4·06)	3700 (1678)	3340 – 3750 M.S.P. (1515) (1701)
6	0·454 (203)	18·4 (4·11)	2900 (1315)	2570 – 3000 M.S.P. (1166) (1361)

B. **Tests without ballast**

Weight of tractor without driver:

Weight without ballast: Front—1677 lb (761 kg)
Rear—2902 lb (1316 kg)
Total—4579 lb (2077 kg)

Tyre pressure: Front—20 lb/in² (1·41 kp/cm²)
Rear—12 lb/in² (0·84 kp/cm²)

Height of drawbar above ground: 20 in (508 mm)

(1) *Maximum powers and pulls*

Gear	*Maximum powers*						*Air temp., °F (°C)*	*Atmos. press., inHg (mmHg)*	*Maximum pulls*	
	Horse-power (Metric hp)	*Corresponding pull, lb (kp)*	*Wheel slip, %*	*Engine speed, rev/min*	*Speed, mile/h (km/h)*	*Engine coolant temp., °F (°C)*			*Pull, lb (kp)*	*Reason for stall*
2	21·6 (21·9)	4500 (2041)	17·2	2409	1·80 (2·90)	183 (84)	43 (6)	30·09 (764)	4900 (2223)	Wheelspin
3	37·0 (37·5)	4500 (2041)	17·2	2345	3·08 (4·96)	187 (86)	49 (9)	30·09 (764)	4900 (2223)	Wheelspin
4	42·2 (42·8)	3500 (1588)	10·2	2330	4·52 (7·27)	190 (88)	50 (10)	30·09 (764)	4600 (2087)	Engine stall
5	43·3 (43·9)	2950 (1338)	8·1	2324	5·50 (8·85)	192 (89)	51 (11)	30·09 (764)	3850 (1746)	Engine stall
6	43·5 (44·1)	2350 (1066)	6·5	2304	6·94 (11·17)	185 (85)	51 (11)	30·09 (764)	3050 (1383)	Engine stall

PART IV

1. Location of centre of gravity

	Tractor unballasted
Height above ground	32·4 in (823 mm)
Distance forward from the vertical plane containing the axis of the rear wheels	30·1 in (765 mm)
Distance from the median plane parallel to the longitudinal axis of the tractor bisecting the track	0

2. **Turning space and turning radius**

Wheel equipment: As for drawbar test without ballast

Wheel track: Front—54 in (1372 mm)
Rear—60 in (1524 mm)

	With brakes		*Without brakes*	
	Right-hand	*Left-hand*	*Right-hand*	*Left-hand*
Radius of turning space	10 ft 8 in (3·25 m)	10 ft 8 in (3·25 m)	11 ft 10 in (3·61 m)	11 ft 10½ in (3·62 m)
Turning radius	10 ft 4 in (3·15 m)	10 ft 4 in (3·15 m)	11 ft 6 in (3·51 m)	11 ft 6½ in (3·52 m)

PART V

1. **Repairs and adjustments during tests:** None

2. **Remarks:** When running at or near maximum power the exhaust smoke density was rather high

Officer in charge: D. W. SMITH

Head of Tractor and Drier Performance Department: P. H. BAILEY

Date: 7th June 1966

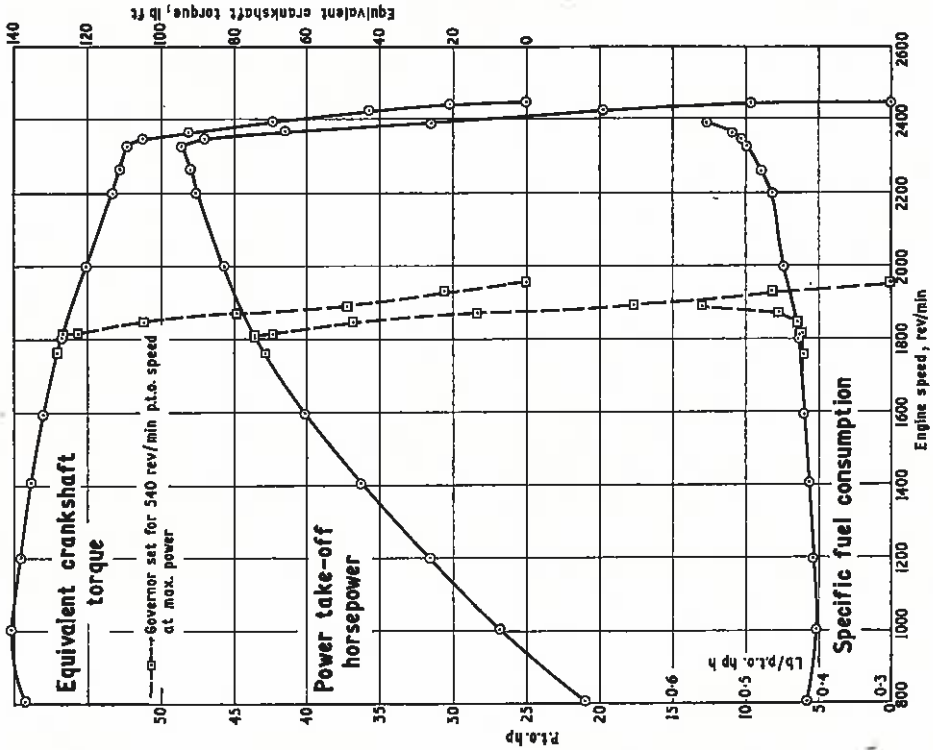


FIG. 1. Power take-off test

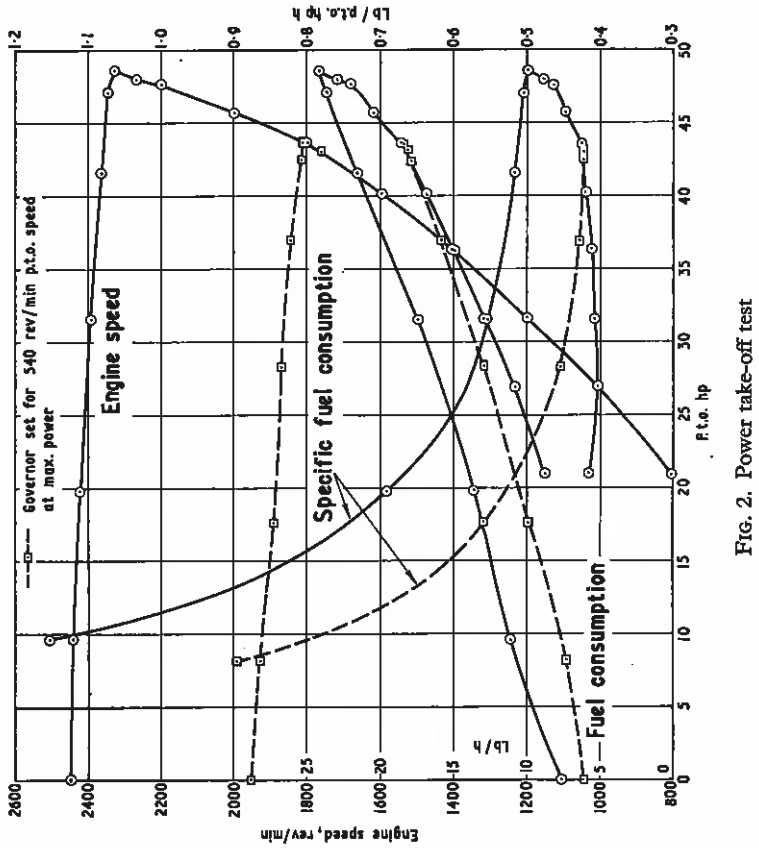


FIG. 2. Power take-off test

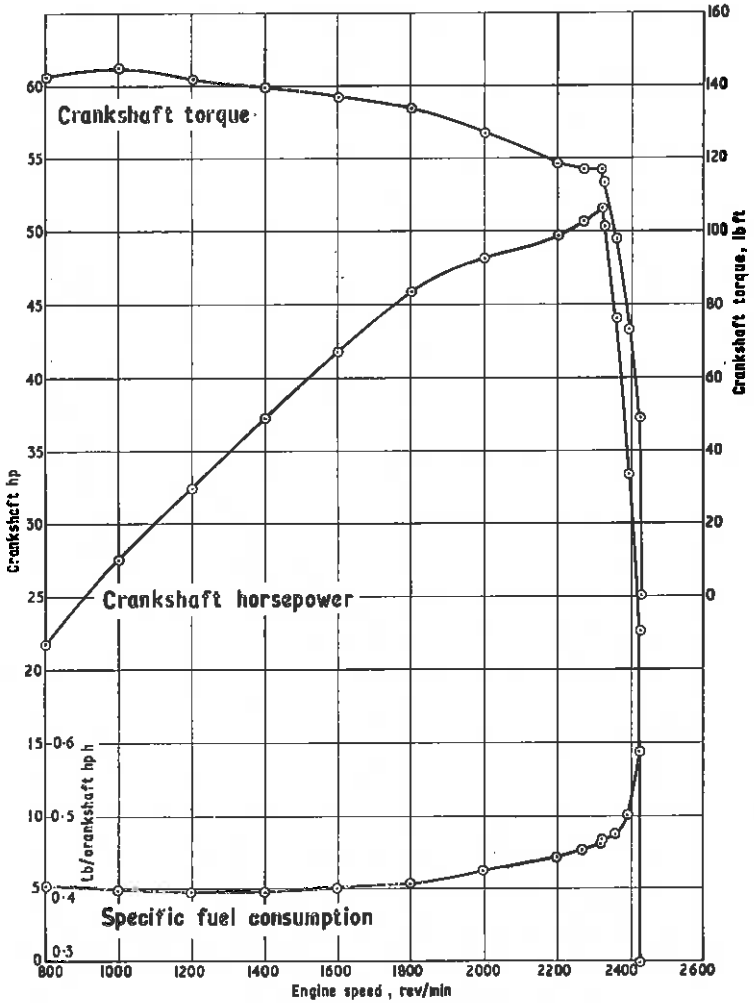


FIG. 3. Engine test

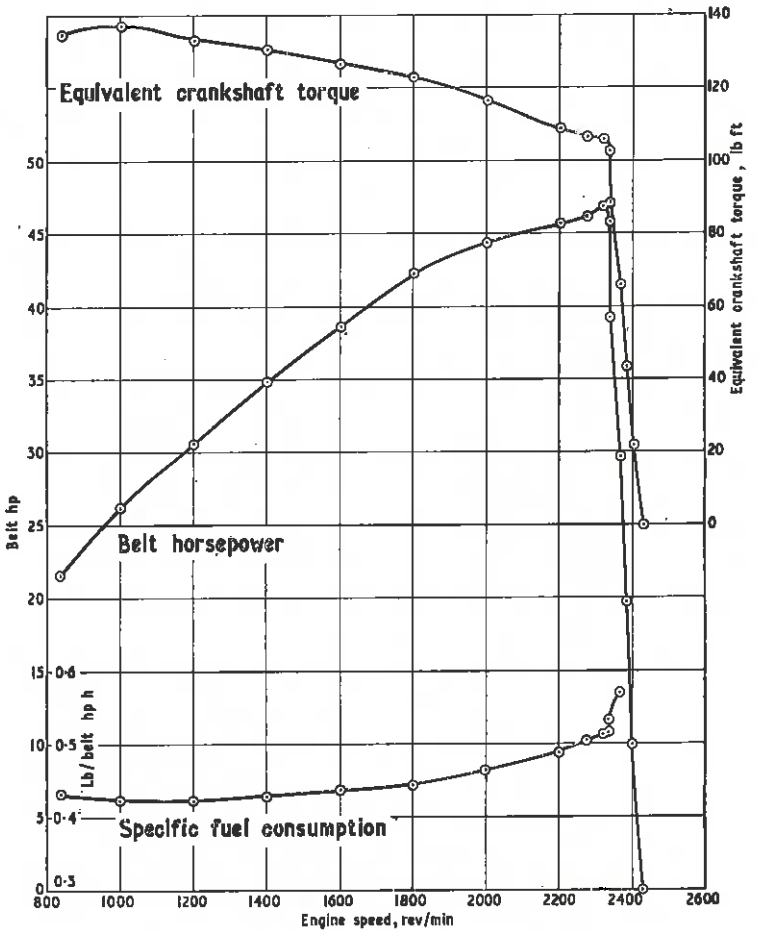


FIG. 4. Belt test

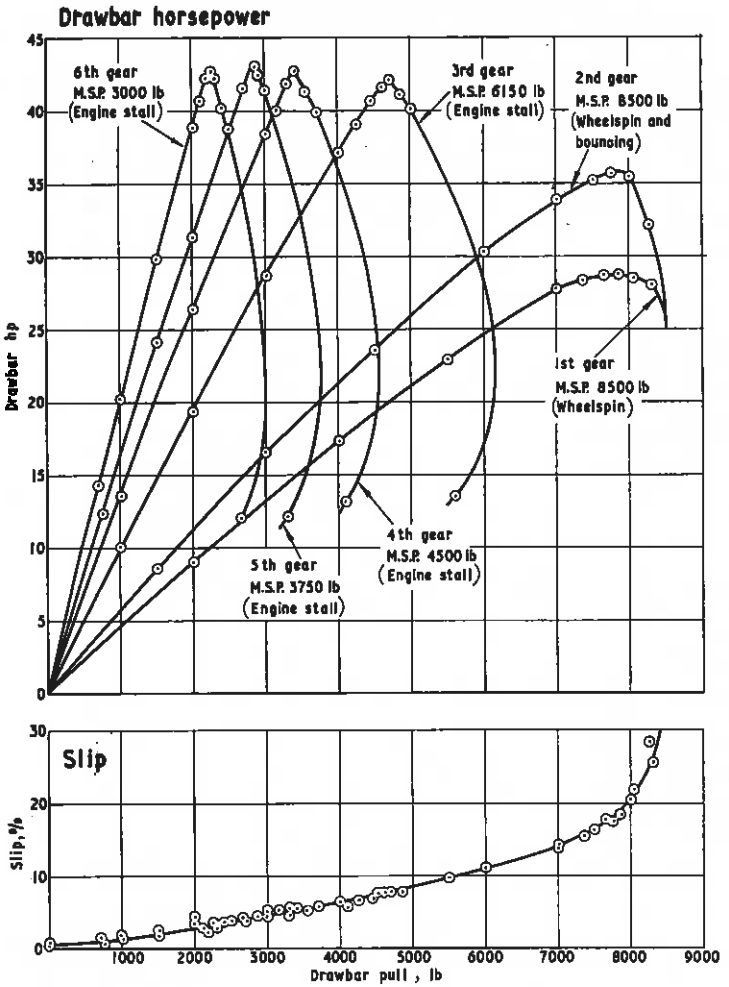


FIG. 5. Drawbar test on tarmacadam, with ballast

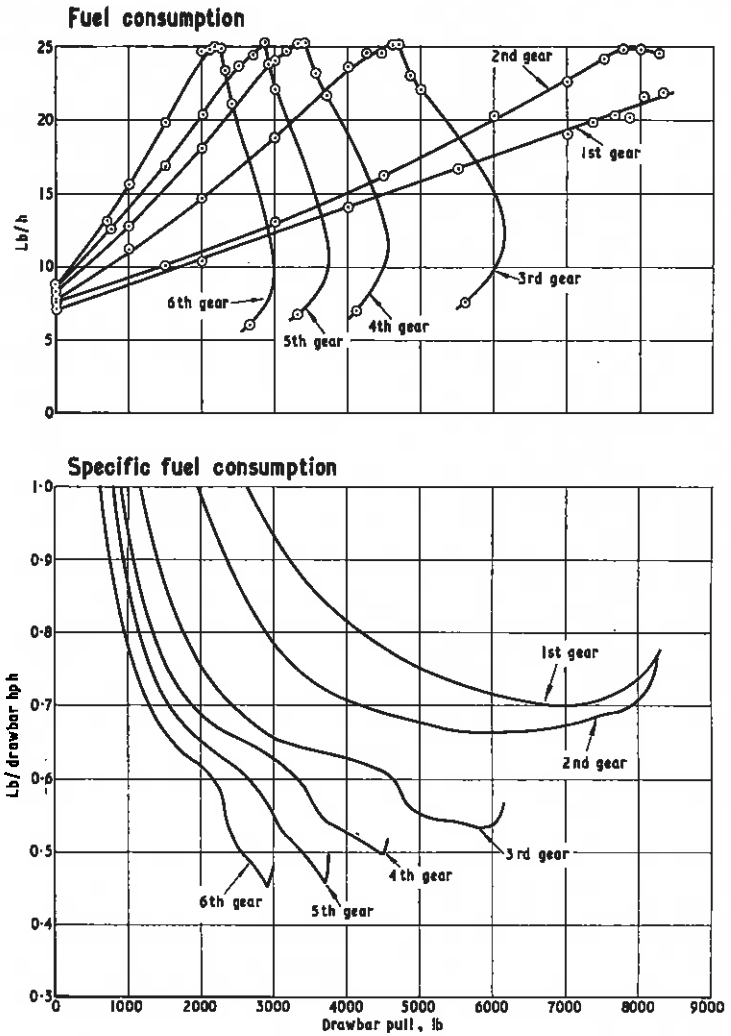


FIG. 6. Drawbar test on tarmacadam, with ballast

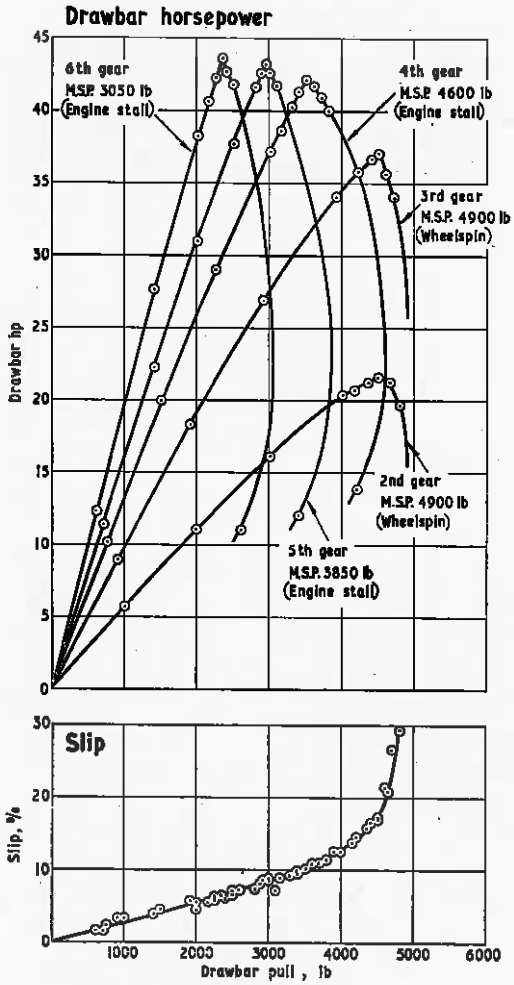


FIG. 7. Drawbar test on tarmacadam, without ballast

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