No. 485/O.E.C.D.

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

NORTHROP MODEL 5004 DIESEL TRACTOR

Manufactured by: British Northrop Ltd,
Blackburn, Lancs.



Date of Tests: September-October 1965
Test no.: R.65075/O.E.C.D.

This report has been approved by the O.E.C.D. Co-ordinating 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
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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:	Northrop
Model:	5004
Type:	Four-wheel drive
Serial No.:	10012

Engine

Make:	Ford Motor Co. Ltd, Type 5000 direct injection diesel engine, fitted with CAV turbocharger, Serial No. RD040701 E27S
Cylinders:	4 cylinders, vertical, in-line, 4.2 in (106.7 mm) bore x 4.2 in (106.7 mm) stroke, capacity 232.8 in^3 (3.81 l), compression ratio 17:1, no cylinder liners, overhead valves
Rated speeds:	2300 rev/min, governor setting - no-load engine speed 2515 rev/min
Fuel system:	Fuel - Diesel oil Simms type P4666x injection pump, Serial No. YM24775; Simms type NL 341 injector nozzles. Manufacturer's production setting for injection pump: 14.6-14.8 cm^3 per element for 200 injections at 600 rev/min pump speed. Injection pressure 185 atm (191 kp/cm^2), AC diaphragm type fuel feed pump, two CAV paper cartridge fuel filters in series on pressure side of lift pump, each with transparent sediment bowl and water trap. Capacity of fuel tank 16.6 UK gal (75.5 l)
Governor:	Simms mechanical governor incorporated in injection pump. Governed range of engine speed 600-2515 rev/min
Air cleaner:	Coopers Mechanical Joints Ltd, 8 in (203.2 mm) Cyclopac dry air cleaner with air inlet outside hood
Lubricating system:	Forced feed from eccentric rotor type pump with metal strainer in sump. Ford Rotunda replaceable cartridge type oil filter, SAE 10W Supplement I oil for first 600 h, then SAE 20W Supplement I; recommended oil change period 300 h; oil capacity (engine sump) 13.4 pt (7.6 l)
Cooling system:	Water cooled, pressurized 13 lb/in^2 (0.91 kp/cm^2) impeller assisted with 16 in (406 mm) dia, belt driven, 4-blade fan, thermostat for temperature control, cooling water capacity 3.2 UKgal (14.5 l)

Transmission

Clutch:	Borg and Beck, 13 in (330 mm) dia, single plate dry clutch, foot-pedal operated

Gearbox: Ford Motor Co. 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. Own make, optional engagement front axle with differential lock, driven by propellor shaft from transfer box on centre line of tractor, epicyclic reduction gears in front hubs. Transmission oil capacities, gearbox 31.4 pt (17.8 l) SAE 80 EP oil, rear axle and transfer gearbox 72 pt (40.9 l) oil to Ford specification ESN M_2C53A, also 16 pt (9.1 l) front axle differential casing. Front axle hubs 5 pt (2.8 l) SAE 80 EP oil each

Gear	Number of engine revolutions for one revolution of driving wheel	Theoretical travelling speed for 2300 rev/min rated speed of engine, mile/h (km/h)	
Forward			
1	221.41	1.66	(2.67)
2	141.39	2.59	(4.17)
3	84.47	4.34	(6.98)
4	61.99	5.92	(9.53)
5	61.99	5.92	(9.53)
6	39.70	9.24	(14.87)
7	23.70	15.48	(24.91)
8	17.42	21.06	(33.89)
Reverse			
Low	135.92	2.70	(4.34)
High	38.08	9.63	(15.49)

Steering device: Recirculating ball type with single drag link, power assisted

Brakes: Hand-lever operated transmission brake; independent or combined foot-pedal operated oil immersed disc brakes on differential half shafts front and rear; hydraulically operated front, and mechanical linkage to rear

Wheels: Two at front, two at rear, all tyres 14-30, 6-ply pneumatic, steering by front wheels, optional front wheel drive, track $63\frac{1}{2}$ in (1613 mm) and $77\frac{1}{2}$ in (1969 mm) front, 64 in (1626 mm) and 78 in (1981 mm) rear. Maximum permissible weight on each tyre 3920 lb (1778 kg) at 16 lb/in^2 (1.12 kp/cm^2), 3320 lb (1506 kg) at 12 lb/in^2 (0.84 kp/cm^2). Overload allowance of up to 35 per cent on tractor rear tyres when fitted to front axle
Wheel base: 6 ft 3 in (1904 mm)

Belt pulley: None fitted for test

Power take-off

Main: Hydraulically engaged proportional engine speed, 6 spline, $1\frac{3}{8}$ in (34.9 mm) dia at rear of tractor (not designed to transmit the full power of the engine)

Height above ground: 25 in (635 mm)

Speeds: 557 rev/min at 2300 rev/min rated engine speed
540 rev/min at 2230 rev/min engine speed
Independent of main clutch

Direction of rotation: Clockwise viewed from tractor rear

Power lift: Ford Motor Co., 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/in^2 (176 kp/cm^2) to ram cylinder and external tapping. Mean oil delivery at maximum horsepower delivered by hydraulic system, test figures 4.2 gal/min (19.09 l/min) at 2500 lb/in^2 (176 kp/cm^2) and 2300 rev/min rated engine speed, oil temperature 53°C
Category II 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 - 3000 lb (1361 kg); at top of lift range - 4150 lb (1882 kg). Manufacturer's recommended figure - 2600 lb (1180 kg) at 24 in (609 mm) to rear of lower link balls. Radius of motion of end of lower links 34 in (864 mm)

Drawbar: Swinging drawbar, radius of swing 24$\frac{7}{8}$ in (632 mm) and 30$\frac{7}{8}$ in (784 mm), position of pivot centre relative to rear wheel centre 1/16 in (1.6 mm) to rear, lateral adjustment 13 in (330 mm) and 18$\frac{1}{2}$ in (470 mm), vertical heights to centre of clevis 11$\frac{3}{4}$ in (298 mm), 12$\frac{3}{8}$ in (314 mm), 15$\frac{3}{4}$ in (400 mm) and 16$\frac{3}{8}$ in (416 mm)

Hitch: None fitted

Electrical equipment

Voltage: 12, negative earth

Generator: Lucas type C40A

Battery: Ford type C5NN 10657E, lead acid, capacity 128 Ah

Starting device: Autolite type CCNF 11001A solenoid engaged starter motor

Overall dimensions

Overall length: 12 ft 9$\frac{1}{2}$ in (3.9 m) as tested with 6 front weights
11 ft 10 in (3.6 m) as tested without ballast

Overall width: 6 ft 11 in (2.11 m) at 64 in (1626 mm) track to outside of wheel weights, 4 per wheel
6 ft 8 in (2.03 m) at 64 in (1626 mm) track, no ballast weights

Overall height: 8 ft 8 in (2.64 m) to top of cab
8 ft 6$\frac{1}{2}$ in (2.60 m) to top of exhaust pipe
6 ft 8 in (2.03 m) to top of steering wheel

Minimum ground clearance: 13$\frac{3}{8}$ in (340 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	5103 (2315)	8641 (3919)
On rear wheels	3621 (1642)	4973 (2256)
Total	8724 (3957)	13 614 (6175)

Special remarks Manually operated excess fuel device fitted for cold starting

PART II

LABORATORY TESTS

NOTE: The power take-off test was not carried out because the power take-off was not designed to transmit the full power of the engine.

Supplementary tests : Engine test (in installed condition)
Date and location of tests : 24th September 1965, 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	Crankshaft torque, lb ft (kp m)	Fuel consumption, UKgal/h (l/h)	lb/hp h (g/metric hp h)	hp h/ UKgal (metric hp h/l)	Temperature, °F (°C) Coolant	Oil	Fuel	Atmos. conditions Temp., °F (°C)	Press., inHg (mmHg)
A. Maximum power										
79.0 (80.1)	2300	180.4 (24.95)	4.31 (19.59)	0.456 (204)	18.3 (4.08)	212 (100)	260 (127)	95 (35)	66 (19)	29.450 (748)
B. Power at standard p.t.o. speed (540 rev/min)										
			Not applicable							
C. Power at maximum torque										
60.6 (61.4)	1530	208.0 (28.77)	2.83 (12.87)	0.390 (174)	21.4 (4.77)	206 (97)	240 (116)	99 (37)	67 (19)	29.450 (748)
D. Power at rated speed										
79.0 (80.1)	2300	180.4 (24.95)	4.31 (19.59)	0.456 (204)	18.3 (4.08)	212 (100)	260 (127)	95 (35)	66 (19)	29.450 (748)
No load, maximum engine speed: 2515 rev/min										

PART III

DRAWBAR TESTS ON ARTIFICIAL TRACK

(Drive to front axle engaged)

Date of tests:	13-19th October 1965
Type of track:	Tarmacadam
Position of governor control lever:	Fully open, giving no-load engine speed of 2515 rev/min
Type of tyre:	Front and rear, Goodyear Traction Sure Grip, straight bar, open centre, 14-30, 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:	Gearbox SAE 80 EP; final drive, Ford specification ESN M_2C53A

A. TESTS WITH MAXIMUM ADDITIONAL WEIGHT

Weight of tractor, without driver:

Weight without ballast:	Front - 5103 lb (2315 kg) Rear - 3621 lb (1642 kg)
Ballast:	Front: Weights - 4 per wheel, 515 lb (234 kg) Water - 1389 lb (630 kg) Rear: Weights - 4 per wheel, 504 lb (229 kg) Water - 1420 lb (644 kg) Additional: 6 front frame weights, 1062 lb (482 kg)
Weight with full ballast:	Front - 8641 lb (3919 kg) Rear - 4973 lb (2256 kg) Total - 13 614 lb (6175 kg)
Tyre pressure:	Front - 16 lb/in^2 (1.1 kp/cm^2) Rear - 12 lb/in^2 (0.8 kp/cm^2)
Height of drawbar above ground:	16 in (406 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	50.7 (51.4)	12 500 (5670)	15.5	2468	1.52 (2.45)	182 (83)	56 (13)	30.28 (769)	13 000 (5897)	Wheelspin and bouncing
2	63.0 (63.9)	9750 (4423)	8.4	2324	2.42 (3.89)	185 (85)	56 (13)	30.28 (769)	11 700 (5307)	Engine stall
3	63.9 (64.8)	5750 (2608)	4.1	2290	4.17 (6.71)	177 (81)	61 (16)	29.86 (758)	6700 (3039)	Engine stall
4	63.2 (64.1)	4200 (1905)	2.9	2241	5.64 (9.07)	180 (82)	55 (13)	29.97 (761)	5000 (2268)	Engine stall
5	64.7 (65.6)	4300 (1950)	2.9	2240	5.64 (9.07)	182 (83)	54 (12)	29.97 (761)	5150 (2336)	Engine stall
6	59.5 (60.3)	2600 (1179)	1.8	2152	8.58 (13.81)	178 (81)	56 (13)	29.97 (761)	3050 (1383)	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	0.690 (309)	12.1 (2.70)	11 600 (5262)	8300 (3765) - >12 800 (5806)
2	0.547 (245)	15.3 (3.41)	11 300 (5126)	10 000 (4536) - 11 700 (5307) M.S.P.
3	0.540 (242)	15.5 (3.46)	6400 (2903)	5700 (2586) - 6700 (3039) M.S.P.
4	0.533 (238)	15.7 (3.50)	4700 (2132)	4100 (1860) - 5000 (2268) M.S.P.
5	0.521 (233)	16.1 (3.59)	4800 (2177)	4200 (1905) - 5150 (2336) M.S.P.
6	0.524 (234)	16.0 (3.57)	2950 (1338)	2680 (1216) - 3050 (1383) M.S.P.

B. TESTS WITHOUT BALLAST

Weight of tractor without driver:

Front - 5103 lb (2315 kg)
Rear - 3621 lb (1642 kg)
Total - 8724 lb (3957 kg)

Tyre pressure: Front - 12 lb/in^2 (0.8 kp/cm^2)
Rear - 12 lb/in^2 (0.8 kp/cm^2)

Height of drawbar above ground: 14 in (356 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
2	54.2 (55.0)	8400 (3810)	14.4	2470	2.42 (3.89)	180 (82)	58 (14)	30.22 (768)	9300 (4218)	Wheelspin
3	63.8 (64.7)	5750 (2608)	5.9	2320	4.16 (6.69)	185 (85)	57 (14)	30.22 (768)	6800 (3084)	Engine stall
4	63.9 (64.8)	4350 (1973)	3.4	2190	5.51 (8.87)	185 (85)	57 (14)	30.22 (768)	5150 (2336)	Engine stall
5	65.2 (66.1)	4450 (2019)	3.5	2185	5.49 (8.83)	186 (86)	57 (14)	30.22 (768)	5250 (2381)	Engine stall
6	63.8 (64.6)	2650 (1202)	1.5	2250	9.03 (14.53)	183 (84)	57 (14)	30.22 (768)	3250 (1474)	Engine stall

PART IV

1. Location of centre of gravity

	Tractor unballasted
Height above ground	38.5 in (978 mm)
Distance forward from the vertical plane containing the axis of the rear wheels	43.0 in (1092 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: 64 in (1626 mm)

	With brakes		Without brakes	
	Right hand	Left hand	Right hand	Left hand
Radius of turning space	10 ft 4 in (3.15 m)	10 ft 5 in (3.18 m)	16 ft 1 in (4.88 m)	17 ft 8 in (5.38 m)
Turning radius	9 ft 8 in (2.95 m)	9 ft 9 in (2.97 m)	15 ft 5 in (4.70 m)	17 ft 0 in (5.18 m)

PART V

1. Repairs and adjustments during tests: None

2. Remarks: None

Test Engineer: D. W. Smith

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

Date: 18th January 1966

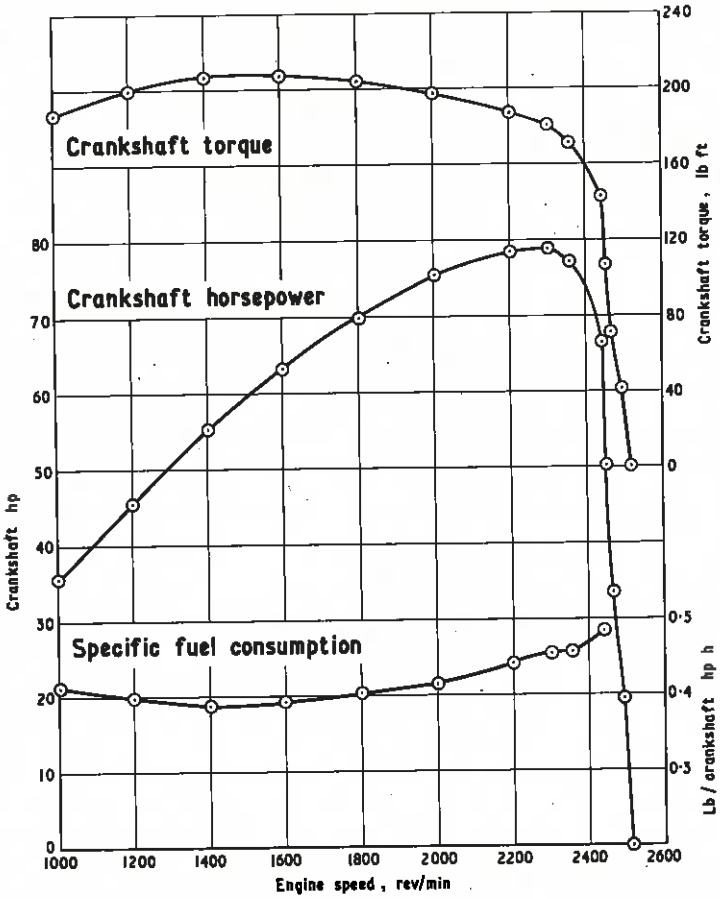


Fig.1. Engine test

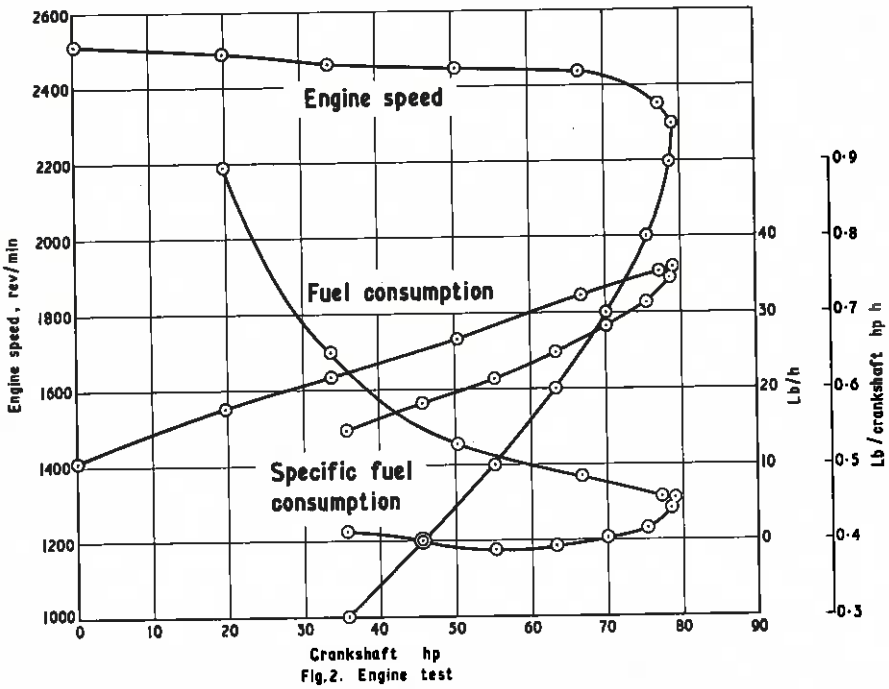
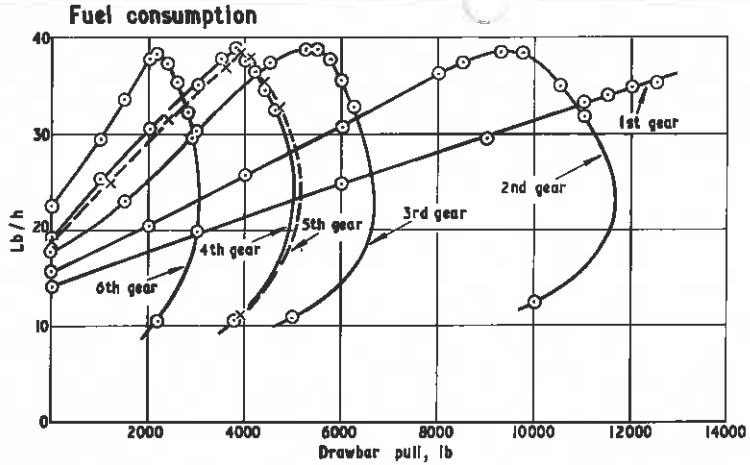


Fig.2. Engine test



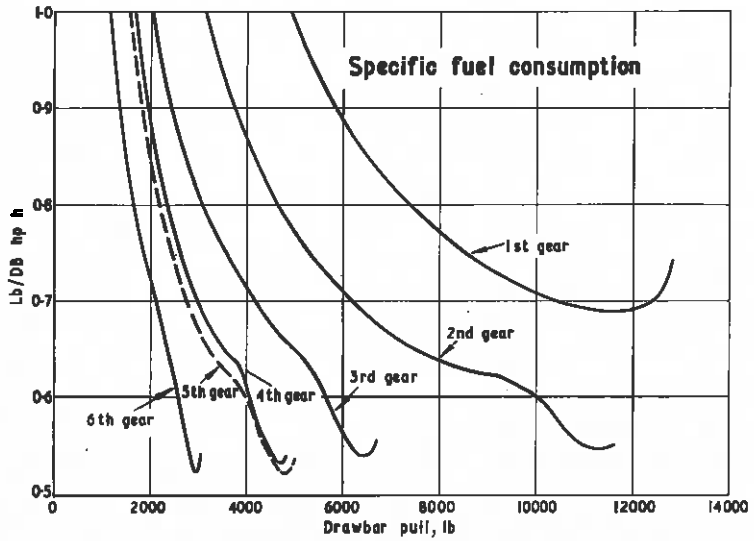
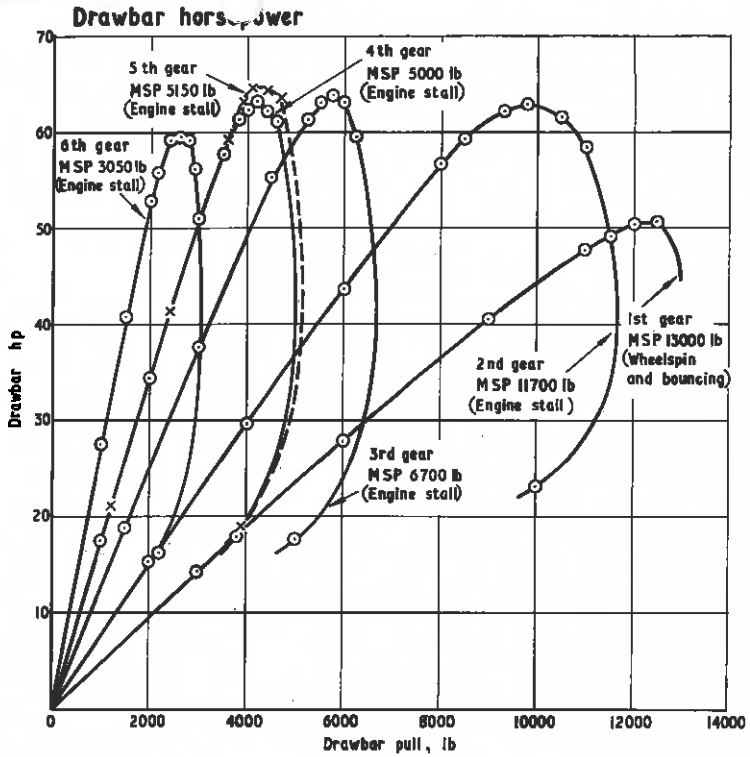


Fig. 4. Drawbar test on tarmacadam, with ballast



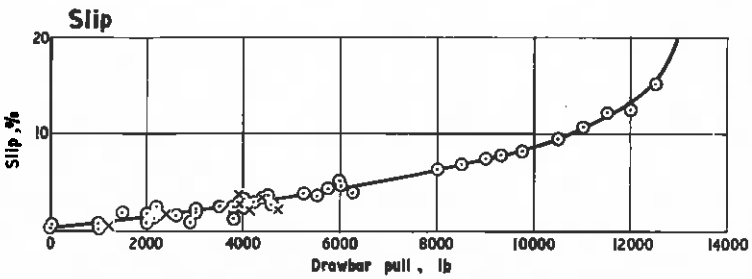


Fig. 3. Drawbar test on tarmacadam, with ballast

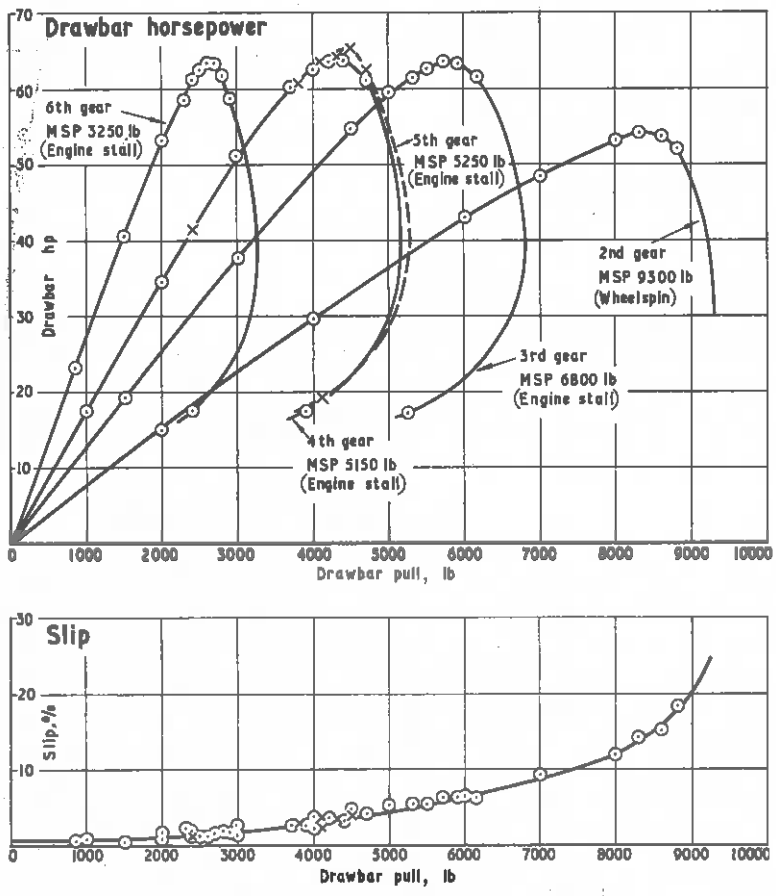


Fig. 5. Drawbar test on tarmacadam, without ballast

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