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

B.M.C. NUFFIELD MODEL 4/65 TRACTOR

Manufactured by: B.M.C. Scotland,
Truck and Tractor Division,
Bathgate,
West Lothian,
Scotland.



Test No.: R.68/5503/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: 9th July 1968 *Serial No.:* 238

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

SPECIFICATION OF TRACTOR

Manufacturer:	**B.M.C. Scotland, Truck and Tractor Division, Bathgate, West Lothian, Scotland**
Selected and submitted for test by:	**The manufacturer**
Place of running-in:	**B.M.C. (Scotland) Limited**
Duration of running-in:	**50 hours**

Tractor

Make:	**B.M.C. Nuffield**
Model:	**4/65**
Serial No:	**65H/3390/100728**

Engine

Make:	**B.M.C.**	**Model:**	**38TD**
Type:	**Direct injection diesel**	**Serial No:**	**6201**

Cylinders

4 cylinders, vertical, in-line, 3·937 in (100 mm) bore x 4·724 in (120 mm) stroke, capacity 230 in^3 (3·77 l), compression ratio 16·5:1, overhead valves, replaceable wet cylinder liners.

Fuel system

A.C. type U fuel feed pump, gauze filter in tank, Simms dual paper element filters incorporating sediment bowls on delivery side of feed pump, fuel tank capacity 15½ UKgal (70·5 l), Simms type P 4801/2 injection pump, Serial No. BM 86094, manufacturer's maximum production setting for injection pump 18·75 pt/h (10·65 l/h) at 1500 rev/min engine speed on full load, Simms type NL 341 injector nozzles, injection pressure 175 atm (183 kg/cm^2)

Governor

Simms mechanical, incorporated in fuel injection pump; governed range of engine speed 600-2385 rev/min, rated engine speed 2200 rev/min

Air cleaner

Cooper's paper element type with centrifugal pre-cleaner above hood

Lubrication system

Forced feed from eccentric rotor type pump with metal strainer in sump, AP replaceable paper element full flow filter, oil capacity 16 pt (9·1 l), recommended oil change period 200 hours.

Cooling system

Water cooled, impeller assisted with 16 in (406 mm) dia 2-blade belt driven fan, cooling water capacity 3 UKgal (13·6 l), thermostat for temperature control, no loss system, fitted with expansion tank, pressurized at 10 lb/in^2 (0·70 kg/cm^2)

Starting system

Electrical, 12V Lucas type M 50G, solenoid engaged starter motor, operable only with gear selector lever in neutral position
Excess fuel device on fuel injection pump for cold starting

Electrical system

Voltage:	12
Generator:	Lucas type C 40T
Battery:	Lucas type THV 17A, capacity 120 Ah

Transmission

Clutch	Borg and Beck dual dry clutch, two 11 in (279 mm) dia plates, one pedal operated for gearbox drive and one hand-lever operated for p.t.o. drive
Gearbox	Own make, sliding gear, 10 forward speeds and 2 reverse
Rear axle and final drives	Own make, crown wheel and bevel pinion with spur gear final drives. Pedal operated mechanical differential lock
Oil capacity	Gearbox and rear axle 96 pt (54·6 l)

Gear	Number of engine revolutions for 1 revolution of driving wheel	Nominal travelling speed for rated speed of engine, mile/h	(km/h)
Forward			
1	225·3	1·61	(2·59)
2	177·7	2·04	(3·28)
3	142·5	2·54	(4·09)
4	112·4	3·23	(5·20)
5	89·19	4·06	(6·53)
6	70·33	5·15	(8·29)
7	49·49	7·33	(11·79)
8	39·03	9·29	(14·95)
9	23·34	15·53	(24·99)
10	18·41	19·69	(31·68)
Reverse			
1	76·96	4·71	(7·58)
2	60·67	5·98	(9·62)

Power take-off

At rear of tractor, $1\frac{3}{8}$ in (34·9 mm) dia, 6-spline, height above ground 32 in (813 mm); proportional engine speed giving 655 rev/min at 2200 rev/min rated engine speed
Engine speed 1813 rev/min at standard p.t.o. speed 540 rev/min
Direction of rotation clockwise viewed from driving end

Belt pulley

Attachable to rear of tractor in two alternative positions, main p.t.o. driven, 9 in (229 mm) dia x $6\frac{1}{2}$ in (165 mm) face width, 3011 ft/min (918 m/min) and 1278 rev/min at rated engine speed 2200 rev/min
Engine speed 2265 rev/min at standard linear speed 3100 ft/min (945 m/min)
Direction of rotation optional, depending on position of unit

Power lift

Own make, hydraulic, gear pump driven independently from the main clutch, operated either together with or independently of the power take-off by selector lever, supplies oil from transmission to a ram cylinder and external tappings. Category 1 and 2 implement linkage with depth control from draught response

Drawbar

Swinging drawbar as tested, vertical heights above ground to centre of clevis, maximum $21\frac{3}{4}$ in (552 mm), minimum 13 in (330 mm), changed by inverting drawbar; distance from rear axle $35\frac{5}{8}$ in (905 mm), position relative to p.t.o. 14 in (356 mm) to rear, lateral adjustment 24 in (610 mm), pivot position relative to rear wheel centre $8\frac{3}{8}$ in (213 mm) to rear

Hitch

Not fitted

Steering

Cam Gears worm and peg type with single drag link

Brakes

Girling multi-disc brakes mounted on final drive pinion shafts, operated independently or together by pedals, lever operating both pedals for parking

Wheels

Steering wheels

Two at front, Dunlop Tractor TF9 7·50-16 tyres, 6 ply rating; maximum permissible weight on each tyre 1560 lb (708 kg) at 36 lb/in^2 (2·5 kg/cm^2), track widths 52 in (1321 mm) by 2 in (51 mm) steps to 68 in (1727 mm) changed by extending front axle.

Driving wheels

Two at rear, Dunlop Fieldmaster RT40 15·30 tyres, 8 ply rating; maximum permissible weight on each tyre 5320 lb (2413 kg) at 20 lb/in^2 (1·4 kg/cm^2); track widths 60 in (1524 mm) and 70 in (1778 mm) changed by reversing wheels

Wheelbase 80 in (2032 mm)

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

Weight without ballast

Front:	2022 lb (917 kg)		
Rear:	3636 lb (1649 kg)	Total:	5658 lb (2566 kg)

Ballast

Front:	weights	- 2 per wheel, total 372 lb (169 kg)
	water	- nil
Rear:	weights	- 13 per wheel, total 2639 lb (1197 kg)
	water	- 1941 lb (880 kg)

Additional: 8 front frame weights, total 547 lb (248 kg)

Weight with full ballast

Front:	3068 lb (1392 kg)		
Rear:	8089 lb (3669 kg)	Total:	11 157 lb (5061 kg)

Seat

Bostrom, seat with matching back rest, parallelogram linkage, torsion bar suspension adjustable for driver's weight, hydraulic damping, range of adjustment 3 in (76 mm) fore and aft

Number of grease points

Whole tractor: 12

Overall dimensions

Overall length:	10 ft 8 in (3·25 m) without ballast weights 11 ft 8 in (3·56 m) with front ballast weights
Overall width:	81½ in (2070 mm) at 62 in (1575 mm) track, no ballast weights 109½ in (2781 mm) at 62 in (1575 mm) track, to outside of wheelweights, 13 per wheel
Overall height:	66½ in (1689 mm) to top of steering wheel 90½ in (2299 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)	Size, in	(cm)	Distance from outside edge of tractor (at 62 in (1575 mm) wheel track), to centre, in	(cm)
Headlights	41¾	(106·0)	4	(10·2) dia	31½	(80·0)
Side lights	60	(152·4)	4½ x 2	(11·4 x 5·1)	12	(30·5)
Rear lights	60	(152·4)	4½ x 2	(11·4 x 5·1)	12	(30·5)
Reflectors	54¾	(139·1)	2¾ x 1¼	(7·0 x 3·2)	12	(30·5)
Unrestricted beam angle of headlight in plan view 60°						

FUELS AND LUBRICANTS USED IN TESTS

Laboratory and track tests

Fuel:	Diesel oil, density 0·845 at 60°F (15·6°C), Cetane No. 53, to Class A, B.S.2869:1957
Engine oil:	S.A.E. 20
Gearbox oil:	S.A.E. 20W/30
Transmission oil:	S.A.E. 20W/30

COMPULSORY TESTS

1. MAIN POWER TAKE-OFF PERFORMANCE

Date and location of tests: 29th September, 1967; 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					
58·5 (59·3)	2242	668	3·32 (15·09)	0·480 (215)	17·6 (3·93)
Standard p.t.o. speed (540 rev/min)					
53·9 (54·7)	1813	540	2·85 (12·96)	0·447 (200)	18·9 (4·22)
Standard belt speed of 3100 ft/min (945 m/min)					
56·3 (57·1)	2265	675	3·22 (14·64)	0·483 (216)	17·5 (3·90)
The speed recommended by the manufacturer for drawbar work					
58·1 (58·9)	2200	655	3·28 (14·91)	0·476 (213)	17·7 (3·95)
Fuel consumption at part loads					
50·5 (51·2)	2277	678	2·87 (13·05)	0·481 (215)	17·6 (3·93)
0	2363	704	1·08 (4·91)	-	-
25·6 (26·0)	2313	689	1·86 (8·46)	0·614 (275)	13·8 (3·08)
58·5 (59·3)	2242	668	3·32 (15·09)	0·480 (215)	17·6 (3·93)
13·0 (13·2)	2340	697	1·47 (6·68)	0·958 (429)	8·8 (1·96)
38·0 (38·5)	2286	681	2·34 (10·64)	0·520 (233)	16·3 (3·61)

No load, maximum engine speed: 2363 rev/min

Equivalent crankshaft torque at maximum power: 136·9 lb ft (18·9 kg m)

Maximum equivalent crankshaft torque: 166·7 lb ft (23·1 kg m) at 1350 rev/min engine speed

Mean atmospheric conditions:

temperature	68°F (20°C)
pressure	29·91 in Hg (760 mm Hg)
relative humidity	69%

Maximum temperature:

coolant	189°F (87°C)
engine oil	248°F (120°C)
fuel	90°F (32°C)

2. DRAWBAR PERFORMANCE

Date of tests: October 1967 - January 1968 Type of track: Tarmacadam Height of drawbar above ground: 18 in (457 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)													
1L	+39·0 (39·6)	10 100 (4581)	1·45 (2·33)	2295	15·0	0·611 (273)	13·8 (3·08)	185 (85)	71 (22)	203 (95)	56 (13)	60	29·57 (751)
1H	48·3 (49·0)	9750 (4423)	1·86 (2·99)	2275	13·6	0·593 (265)	14·2 (3·17)	195 (91)	65 (18)	190 (88)	56 (13)	65	29·57 (751)
2L	51·1 (51·8)	8250 (3742)	2·32 (3·74)	2270	10·0	0·559 (250)	15·1 (3·37)	190 (88)	73 (23)	205 (96)	58 (14)	77	29·49 (749)
2H	52·4 (53·1)	6450 (2926)	3·05 (4·90)	2200	7·3	0·544 (243)	15·5 (3·46)	190 (88)	71 (22)	200 (93)	59 (15)	78	29·49 (749)
3L	53·1 (53·8)	5100 (2313)	3·91 (6·28)	2184	5·4	0·535 (239)	15·8 (3·52)	186 (86)	68 (2)	200 (93)	57 (14)	82	29·49 (749)
3H	53·0 (53·7)	3900 (1769)	5·10 (8·20)	2221	4·0	0·542 (242)	15·6 (3·48)	186 (86)	70 (21)	202 (94)	56 (13)	76	29·49 (749)
4L	52·6 (53·3)	2700 (1225)	7·31 (11·76)	2233	2·6	0·545 (244)	15·5 (3·46)	185 (85)	67 (19)	195 (91)	55 (13)	76	29·49 (749)
4H	51·8 (52·5)	2050 (930)	9·47 (15·25)	2230	1·9	0·558 (250)	15·1 (3·37)	185 (85)	69 (21)	202 (94)	54 (12)	64	29·74 (755)
(ii) Five hour test at 75% of pull at maximum power													
3L	42·4 (43·0)	3825 (1735)	4·16 (6·69)	2293	4·0	0·575 (257)	14·7 (3·28)	183 (84)	62 (17)	225 (107)	47 (8)	86	29·92 (760)
(iii) *Five hour test at pull corresponding to 15% wheelslip in test (i)													
1L	-	10 100 (4581)	1·49 (2·40)	-	-	-	-	186 (86)	- -	229 (109)	52 (11)	69	29·69 (754)
(iv) Maximum power (unballasted)													
2H	+39·4 (40·0)	4925 (2234)	3·00 (4·83)	2296	15·0	-	-	171 (77)	-	192 (89)	37 (3)	91	30·15 (766)
3L	+49·3 (50·0)	4925 (2234)	3·75 (6·03)	2261	15·0	-	-	176 (80)	-	201 (94)	37 (3)	91	30·15 (766)
3H	53·9 (54·7)	4100 (1860)	4·93 (7·93)	2205	9·1	-	-	180 (82)	-	207 (97)	37 (3)	91	30·15 (766)
4L	54·0 (54·8)	2900 (1315)	6·98 (11·23)	2131	5·8	-	-	179 (82)	-	199 (93)	39 (4)	83	30·15 (766)
4H	53·5 (54·2)	2200 (998)	9·12 (14·67)	2195	4·1	-	-	154 (68)	-	175 (79)	39 (4)	83	30·15 (766)

Total oil consumption during ten hours duration of tests (ii) and (iii): Negligible

+ 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 - 52 in (1321 mm)
rear - 62 in (1575 mm)

	With brakes		Without brakes	
	Right hand	Left hand	Right hand	Left hand
Radius of turning space	11 ft 3 in (3·43 m)	11 ft 1 in (3·38 m)	12 ft 6 in (3·81 m)	12 ft 4 in (3·76 m)
Radius of turning circle	10 ft 11 in (3·33 m)	10 ft 9 in (3·28 m)	12 ft 2 in (3·71 m)	12 ft 0 in (3·66 m)

5. LOCATION OF CENTRE OF GRAVITY

Height above ground	35·1 in (892 mm)
Distance forward from the vertical plane containing the axis of the rear wheels	27·8 in (706 mm)
Distance from the median plane of the tractor	0

6. BRAKING

Date of tests: 13th November 1967 and 24th January 1968

Type of track: Tarmacadam

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)	13·7	(4·2)	14·5	(4·4)
Stopping distance, ft (m)	22·3	(6·8)	21·5	(6·6)
Force on brake pedal, lb (kg)	80	(36)	180	(82)

Brake fade characteristics (hot tests)

Maximum deceleration hot/maximum deceleration cold x 100: 108%

Stopping distance cold/stopping distance hot x 100: 100%

Force on pedal cold/force on pedal hot x 100: 100%

Efficiency of hand brake: Satisfactory

Pull on handbrake: 56 lb (25 kg)

7. MEASUREMENT OF AMBIENT NOISE EMITTED BY THE TRACTOR

Date of tests:	10th November 1967	
Type of sound level meter:	Brüel and Kjoer Type 2203	
Type of track:	Tarmacadam	
Results of tests:	gear	10th
	stabilised travelling speed	15·80 mile/h (25·4 km/h)
	sound level	92·5 dBA

8. NOISE MEASUREMENTS AT THE DRIVER'S EAR LEVEL

Date of tests:	10th November 1967
Type of sound level meter and octave filter:	Brüel and Kjoer Type 2203 with octave filter set type 1612
Type of track:	Tarmacadam
Type of frequency analyser:	Brüel and Kjoer Type 2107

Results of Tests

Gear	Travelling speed, mile/h (km/h)	Loudness, sones
5th	4·12 (6·63)	180

9. POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date and location of tests: 28th November 1967; N.I.A.E., Silsoe, Bedford, U.K.

Hydraulic fluid:

make and type: Shell tractor oil Universal
viscosity: SAE 20W/30
viscosity index: 105

	Vertical movement, in	(mm)	Maximum force exerted through full range, lb	(kg)	Pressure, lb/in² (kg/cm²)
Linkage giving maximum mechanical advantage					
At lower hitch points (height above ground in down position					
7 in (178 mm))	23	(584)	4480	(2032)	2500 (176)
On the frame	22	(559)	3300	(1497)	2500 (176)
Linkage giving minimum mechanical advantage					
At lower hitch points (height above ground in down position					
20½ in (521 mm))	21¼	(540)	4480	(2032)	2500 (176)
On the frame	28	(711)	2700	(1225)	2500 (176)

Type of linkage lock for transport	Mechanical
Opening pressure of the cylinder over pressure relief valve	Not applicable, mechanical lock
Pump characteristics	
i) Opening pressure of the relief valve	1800 lb/in² (127 kg/cm²)
Sustained pressure by open relief valve	2500 lb/in² (176 kg/cm²)
Pump delivery rate at external tapping:	
ii) at minimum pressure (rated engine speed)	6·56 gal/min (29·8 l/min)
iii) at maximum hydraulic power	6·61 gal/min (30·0 l/min)
delivery pressure	1850 lb/in² (130 kg/cm²)
power	8·56 hp (8·68 metric hp)

OPTIONAL TESTS

11. PERFORMANCE AT THE BELT PULLEY

Date and location of tests: 6th October 1967; N.I.A.E., Silsoe, Bedford, U.K.

Type of dynamometer: Electrical swinging frame

Horsepower (Metric hp)	Speeds, rev/min		Fuel consumption,		
	Engine	Belt pulley	UKgal/h (l/h)	lb/hp h (g/metric hp h)	hp h/UKgal (metric hp h/l)
Maximum power - 2 hour test					
56·4 (57·2)	2238	1300	3·32 (15·09)	0·498 (223)	17·0 (3·79)
Standard belt speed of 3100 ft/min (945 m/min)					
56·0 (56·8)	2265	1316	3·31 (15·05)	0·500 (224)	16·9 (3·77)
The speed recommended by the manufacturer for drawbar work					
56·2 (57·0)	2200	1278	3·30 (15·00)	0·496 (222)	17·0 (3·79)
Fuel consumption at part loads					
49·2 (49·9)	2297	1334	2·90 (13·18)	0·499 (223)	16·9 (3·77)
0	2365	1374	1·09 (4·96)	-	-
24·9 (25·2)	2324	1350	1·90 (8·64)	0·645 (289)	13·1 (2·92)
56·4 (57·2)	2238	1300	3·32 (15·09)	0·498 (223)	17·0 (3·79)
12·6 (12·8)	2350	1365	1·53 (6·96)	1·027 (459)	8·2 (1·83)
37·2 (37·7)	2314	1344	2·38 (10·82)	0·540 (242)	15·7 (3·50)

No load, maximum engine speed: 2365 rev/min

Equivalent crankshaft torque at maximum power: 132·3 lb ft (18·3 kg m)

Maximum equivalent crankshaft torque: 159·4 lb ft (22·0 kg m) at 1380 rev/min engine speed

Mean atmospheric conditions:	temperature	69°F	(21°C)
	pressure	29·67 in Hg	(754 mm Hg)
	relative humidity	59%	
Maximum temperature:	coolant	196°F	(91°C)
	engine oil	240°F	(116°C)
	fuel	91°F	(33°C)

15. Repairs and adjustments during tests: None

Remarks: There was noticeable vibration at higher engine speeds, especially in the fully ballasted condition. The manufacturer states that action has already been taken to reduce vibration.

Officer in charge: D.W. Smith

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

Date: 16th May 1968

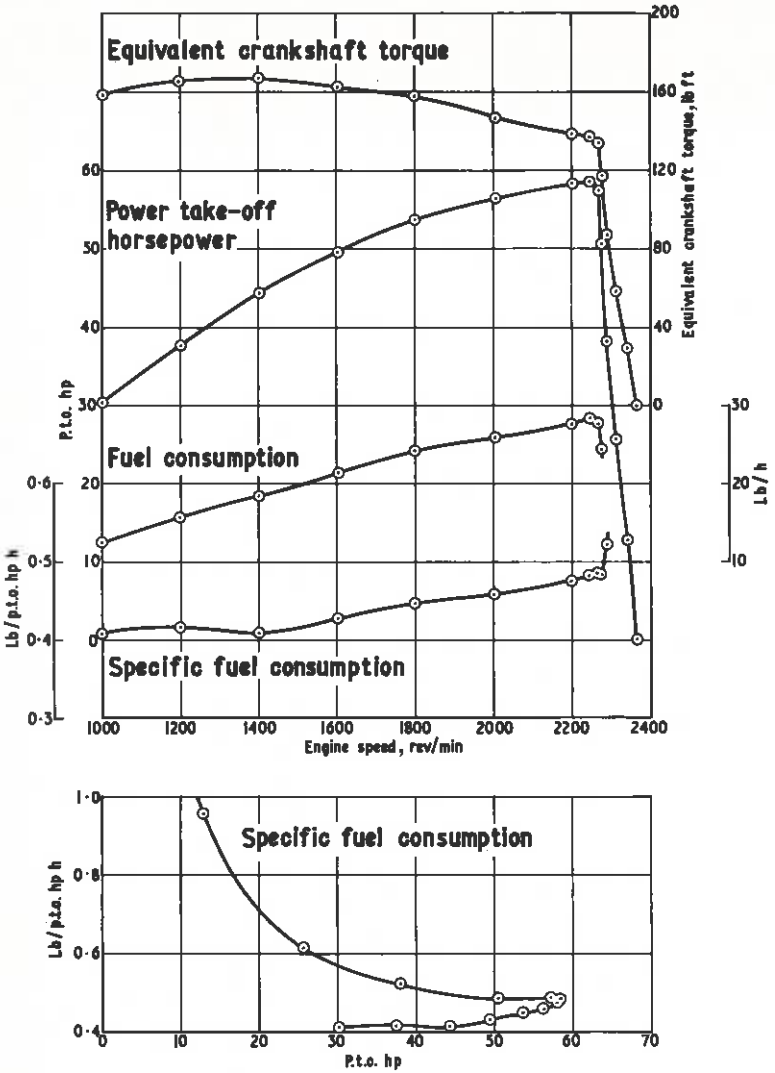


Fig.1. Power take-off test

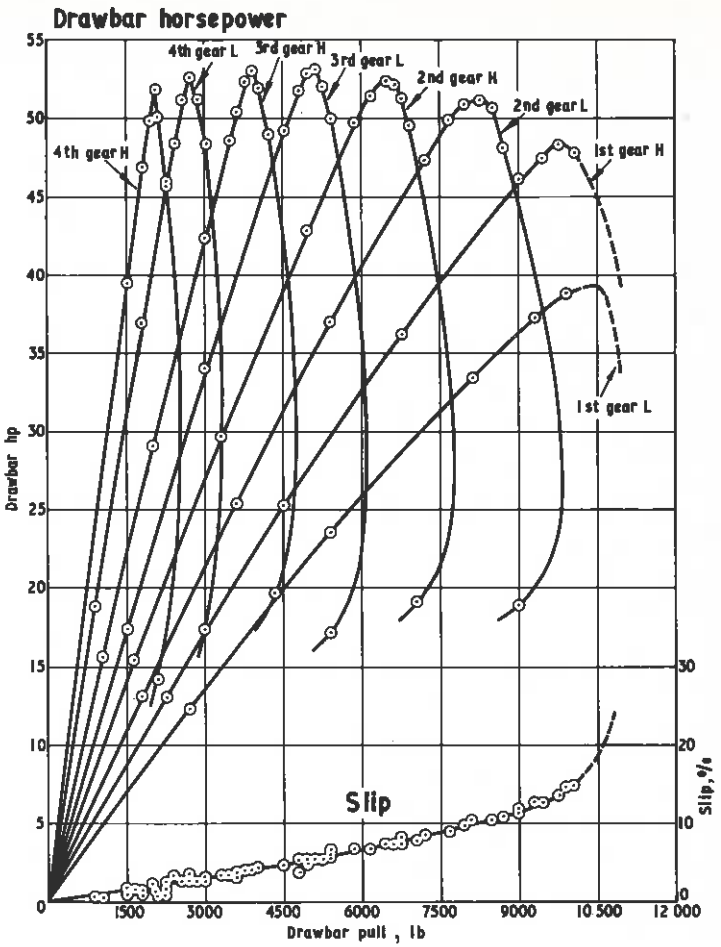


Fig.2. Drawbar test on tarmacadam, with ballast

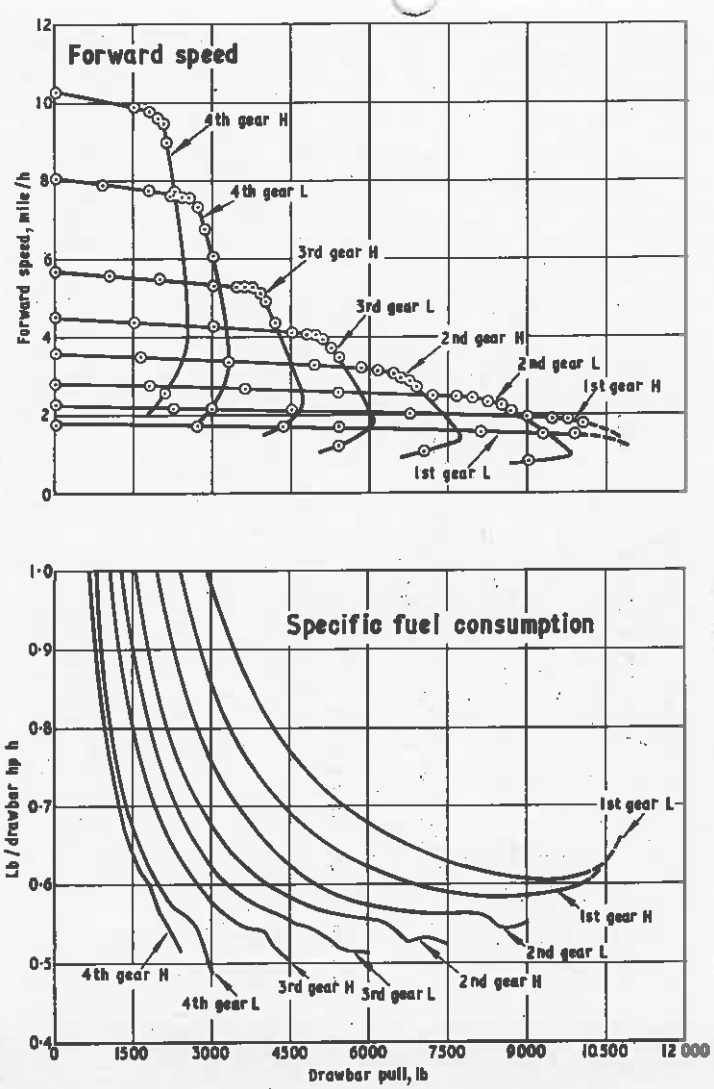


Fig.3. Drawbar test on tarmacadam, with ballast

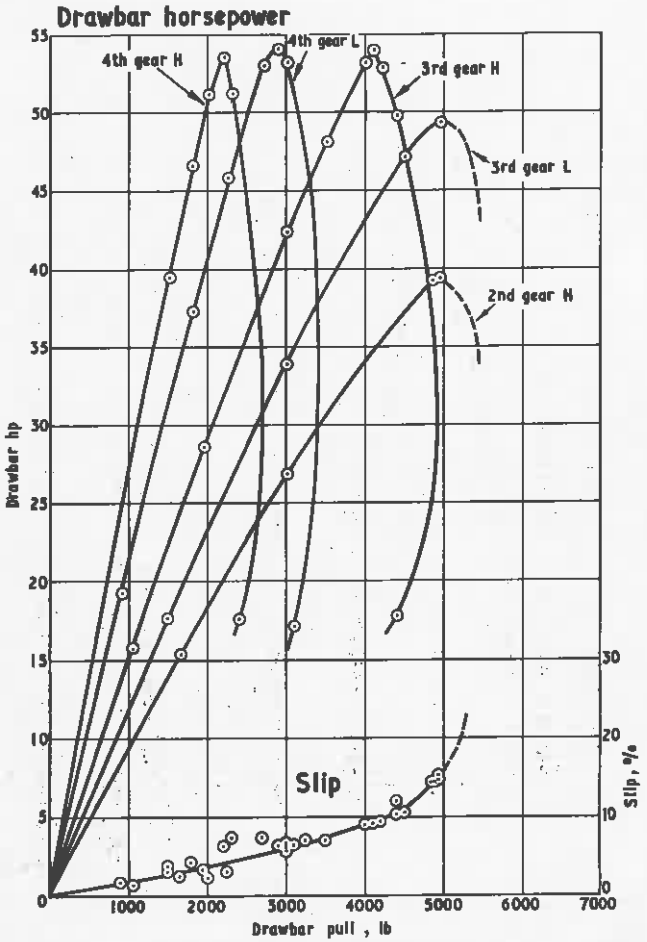


Fig.4. Drawbar test on tarmacadam, without ballast

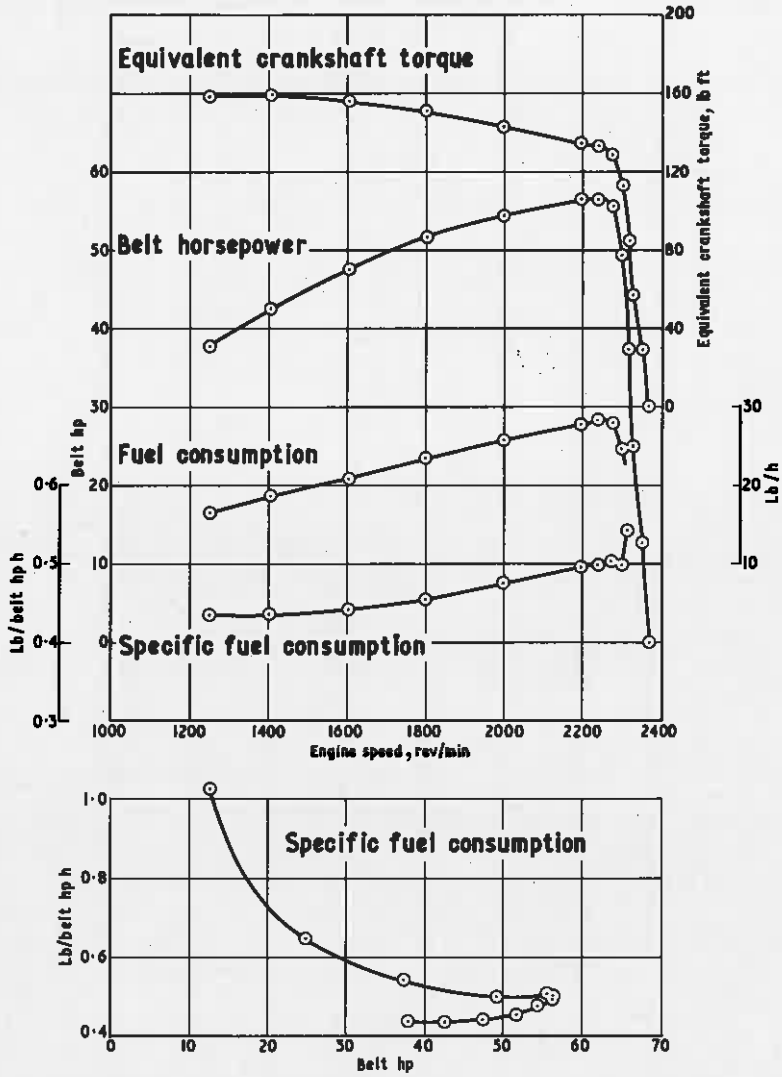


Fig. 5. Belt test

R 68/5903/OECD WK TD 3064

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Henry Burt & Son Ltd, College Street, Kempston, Bedford