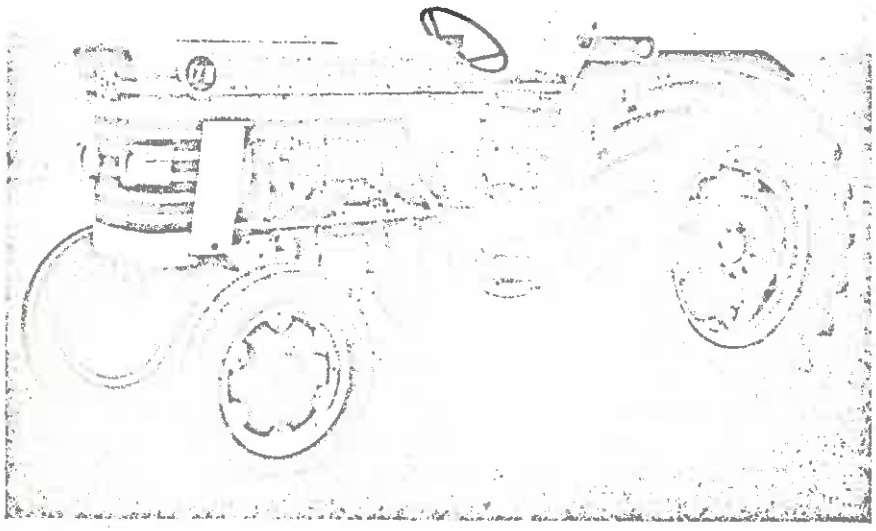
No. 591 O.E.C.D.

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

MASSEY-FERGUSON MODEL 178 TRACTOR

Manufactured by: Massey-Ferguson Manufacturing Ltd,
Banner Lane, Coventry



Test No.: R.68/5506/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: 15th October 1968 *Serial No.:* 247

NATIONAL INSTITUTE OF AGRICULTURAL ENGINEERING
WREST PARK SILSOE BEDFORD

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SPECIFICATION OF TRACTOR

Manufacturer:	Massey-Ferguson Manufacturing Ltd, Banner Lane, Coventry
Submitted for test by:	The manufacturer
Selected by:	The manufacturer with the agreement of the testing station
Place of running-in:	Coventry and district
Duration of running-in:	100 hours

Tractor

Make:	Massey-Ferguson Manufacturing Ltd, Banner Lane, Coventry
Model:	MF 178 with Perkins A4.248 diesel engine and fitted with multi-power transmission
Type:	Four wheel, rear wheel driven, unit construction
Serial No.:	FGH 723038

Engine

Make:	F. Perkins Ltd, Peterborough	Model: A4.248
Type:	4-stroke, direct injection diesel	Serial No.: 248 UA 253
Cylinders:	4 cylinders, vertical, in-line 3·975 in (101·0 mm) bore × 5·0 in (127·0 mm) stroke, capacity 248·2 in³ (4·067 l), compression ratio 16:1, overhead in-line valves, replaceable cast-iron dry cylinder liners	
Fuel system:	A.C. model V.P. mechanical type fuel feed pump with hand primer; two pressurized C.A.V. filters in series with water coalescent paper replaceable elements; primary filter with transparent sediment bowl and drain tap, gauze strainers in fuel tank, lift pump and fuel injection pump, capacity of fuel tank 18 UKgal (81·8 l); C.A.V. type DPA 4244100 injection pump, Serial No. 30390 W1; manufacturer's production setting: 26·2 lb/h (11·88 kg/h) to 27·6 lb/h (12·52 kg/h) at 2000 rev/min rated engine speed and 145°F (63°C) pump temperature, using fuel of 0·837 specific gravity at 60°F (15·6°C); C.A.V. type BDLL 150S 6472B injector nozzles, injector setting 175–180 atm (181–186 kg/cm²)	
Governor:	C.A.V. mechanical, incorporated in fuel injection pump, governed range of engine speed 500 to 2200 rev/min, rated engine speed 2000 rev/min	
Air cleaner:	A.C. oil bath under hood forward of radiator (centrifugal pre-cleaner available, not fitted), oil capacity 1½ pt (0·85 l)	
Lubrication system:	Forced feed from eccentric rotor type pump with metal strainer in sump; A.C. full flow replaceable element filter, total oil capacity 14·0 pt (8·0 l), recommended oil change period 300 h	
Cooling system:	Water cooled, pressurized at 10 lb/in² (0·7 kg/cm²), impeller assisted with 16¼ in (413 mm) dia, belt driven 4 blade fan, 180°F (82°C) thermostat for temperature control, cooling water capacity 3 UKgal (13·6 l)	
Starting system:	Electrical, 12 V Lucas type M 45 G solenoid engaged starter motor, operable only when high-low range gear selector lever is in neutral, C.A.V. Mark IIIC inlet manifold flame type cold starting aid	

Electrical system

Voltage:	12, negative earth
Generator:	Lucas C 40 A
Battery:	Lucas type BTHV 17A, lead acid, capacity 125 Ah at 10 hour rating

Transmission

Clutch: Auburn Laycock dual dry clutch, two plates, 9 in (229 mm) dia for p.t.o. shaft drive, and 11 in (279 mm) dia for gearbox drive, pedal operated

Gearbox: Own make, 12 forward and 4 reverse speeds, multi-power unit comprising constant mesh input gear with hydraulically operated finger tip controlled 30% overdrive engagable on the move and under load, sliding gear 3 forward and 1 reverse speed gearbox and dual range epicyclic reduction gear at output end; transmission oil for overdrive operation by live p.t.o. driven gear pump

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

Oil capacities: Transmission 46 pt (26·1 l), final drives 2 pt (1·1 l) each
Recommended oil change period 600 h

Gear	*Number of engine revolutions for one revolution of driving wheel*	*Nominal travelling speed for 2000 rev/min rated speed of engine, mile/h*	*(km/h)*
Forward			
1st low	254·20	1·29	(2·08)
1st high	195·60	1·67	(2·69)
2nd low	169·50	1·93	(3·11)
2nd high	130·40	2·51	(4·04)
3rd low	92·37	3·54	(5·70)
3rd high	71·05	4·61	(7·42)
4th low	63·56	5·15	(8·29)
4th high	48·89	6·69	(10·76)
5th low	42·37	7·72	(12·42)
5th high	32·59	10·04	(16·15)
6th low	23·09	14·17	(22·80)
6th high	17·76	18·42	(29·64)
Reverse			
1st low	186·40	1·76	(2·83)
1st high	143·40	2·28	(3·67)
2nd low	46·61	7·02	(11·30)
2nd high	35·85	9·13	(14·69)

Power take-off

Main: Manually engaged, proportional engine speed or proportional ground speed, 6 spline, $1\frac{3}{8}$ in (34·9 mm) dia, at rear of tractor in vertical centre plane, height above ground $23\frac{1}{2}$ in (597 mm), proportional engine speed: 641 rev/min at 2000 rev/min rated engine speed, 540 rev/min (standard p.t.o. speed) at 1684 rev/min engine speed, independent of main clutch, direction of rotation clockwise viewed from tractor rear; proportional ground speed: 1 revolution of p.t.o. for approximately 19 in (483 mm) of travel, direction of rotation clockwise viewed from tractor rear in forward gear

Belt pulley

Attachable to rear of tractor in two alternative horizontal positions, main p.t.o. driven, manually engaged, $10\frac{1}{4}$ in (260 mm) dia × $6\frac{1}{2}$ in (165 mm) face width, 1191 rev/min giving 3197 ft/min (974 m/min) linear speed at 2000 rev/min rated engine speed; 1155 rev/min giving 3100 ft/min (945 m/min) linear speed at 1940 rev/min engine speed; direction of rotation related to position of unit; clockwise with pulley on right side and anti-clockwise with pulley on left side, viewed from tractor right side

Power lift

Own make, live hydraulic, 4 cylinder piston type pump with Ferguson suction side control, oil from transmission supplied to single-acting ram cylinder and 4 external tappings

Controls: Two-way draught control with top link sensing, controls for position and selective response on drop; external oil supply operated by tractor hydraulic controls or external spool valves; pressure control for selective weight transfer from semi-mounted implements by direct action from lower links (or through the pressure control coupler when fitted, in the case of towed implements and trailers) and control of pressure for external supply; Category 2 three point linkage with adjustable lift rods, vertical lift movement above ground: $9\frac{3}{8}$ in (238 mm) to $39\frac{3}{8}$ in (1000 mm) or 20 in (508 mm) to 42 in (1067 mm) depending on lift rod position

Auxiliary hydraulics: Available (not fitted for power tests), own make, live hydraulics for external hydraulic equipment controlled by external spool valves, comprising two p.t.o. driven gear type pumps in tandem, oil cooler in front of tractor radiator, combining valve between gear pumps and tractor main power lift pump; the smaller pump supplies transmission oil to the cooler and multi-power transmission and the larger pump supplies transmission oil separately or combined with power lift pump for external use

Drawbar

Linkage drawbar: Drawbar fixed on lower links with central hole and 4 holes $2\frac{1}{8}$ in (54 mm) apart either side of centre line, vertical adjustment from $9\frac{3}{4}$ in (248 mm) to $21\frac{3}{4}$ in (552 mm) changed by adjustable stay links, drawbar holes to take $\frac{3}{4}$ in (19 mm) dia pin, distance from rear axle $36\frac{5}{8}$ in (930 mm) as tested

Swinging drawbar: Radius of swing $24\frac{7}{8}$ in (632 mm) and $29\frac{1}{2}$ in (749 mm), lateral adjustment $17\frac{3}{4}$ in (451 mm) and $21\frac{1}{4}$ in (540 mm), vertical heights to centre of clevis, 6 positions from $15\frac{1}{4}$ in (387 mm) to $16\frac{1}{2}$ in (419 mm), drawbar hole to take 1 in (25 mm) dia pin, distance behind rear axle $17\frac{3}{8}$ in (441 mm), $19\frac{7}{8}$ in (505 mm) and $24\frac{1}{8}$ in (622 mm), position relative to p.t.o. $7\frac{1}{8}$ in (181 mm), $9\frac{5}{8}$ in (244 mm) and $14\frac{1}{4}$ in (362 mm) to rear

Hitch

Rear: Automatic hitch (optional, not fitted), hook type, height above ground $17\frac{7}{8}$ in (454 mm), distance from rear axle $7\frac{7}{8}$ in (200 mm) to rear

Front: Towing hitch, combined with front weight carrier, height above ground to centre of clevis $28\frac{1}{4}$ in (718 mm)

Steering Worm and peg type with single drag link, power assisted

Brakes Girling double disc dry type on rear axle high speed shafts; independent or combined pedal operated, hand lever with ratchet operating both brakes for parking

Wheels

Steering wheels: Two at front, with cast-iron centres, Goodyear Super Rib 6·00–19 tyres, 6 ply rating, maximum permissible weight on each tyre 1500 lb (680 kg) at 48 lb/in² (3·4 kg/cm²), track width 52 in (1321 mm) by 4 in (102 mm) steps to 68 in (1727 mm) changed by extending front axle

Driving wheels: Two at rear, power adjusted variable track type, cast-iron centres, Goodyear Traction Sure Grip 15–30 tyres, 6 ply rating on W13 rims, maximum permissible weight on each tyre 4650 lb (2109 kg) at 16 lb/in² (1·1 kg/cm²), track width 56 in (1422 mm) to 88 in (2235 mm) changed by power shifting and interchanging wheels

Wheelbase: 7 ft 0 in (2134 mm)

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

Weight without ballast

Front:	2270 lb (1030 kg)
Rear:	3664 lb (1662 kg)
Total:	5934 lb (2692 kg)

Ballast

Front:	Nil
Rear:	Weights—18 per wheel, total 3839 lb (1741 kg) Liquid—1812 lb (822 kg)
Additional:	9 front frame weights and frame, total 595 lb (270 kg)

Weight with full ballast

Front:	3002 lb (1362 kg)
Rear:	9178 lb (4163 kg)
Total:	12 180 lb (5525 kg)

Seat

Make: Kneedler type made by Sankey of Wellington, upholstered cushion and back rest, parallelogram linkage with spring and hydraulic damper adjustable for driver's weight; range of adjustment 2½ in (64 mm) fore and aft in median plane of tractor

Number of grease points

Whole tractor: 15

Overall dimensions

Overall length:	Without front weights 11 ft 6 in (3·51 m) With front weight 12 ft 4½ in (3·77 m)
Overall width:	Without ballast weights 6 ft 6½ in (1·99 m) at 60 in (1524 mm) track With ballast weights 11 ft 9½ in (3·59 m) at 60 in (1524 mm) track
Overall height:	To top of steering wheel 67⅜ in (1·7 m) To top of exhaust pipe 85⅝ in (2·17 m)
Minimum ground clearance:	To underside of gearbox casing 19 in (483 mm) To underside of swinging drawbar 12¼ in (311 mm)

Lighting

	Height above ground of centre, in	(cm)	*Size,* in	(cm)	*Distance from outside edge of tractor at 60 in (1524 mm) wheel track, to centre,* in	(cm)
Headlights	42¼	(107)	4	(10·2) dia	32½	(82·6)
Side lights	60½	(154)	2	(5·1) dia	9¼	(23·5)
Rear lights	58½	(149)	4½ 2	(11·4) × (5·1)	11½	(29·2)
Reflectors	55¾	(142)	2¾ 1½	(7·0) × (3·8)	11½	(29·2)

Unrestricted beam angle of headlight in plan view 100°

FUELS AND LUBRICANTS USED IN 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:	Shell Multi-Purpose 20W/30
Transmission oil:	Shell Multi-Purpose 20W/30
Final drives:	Shell Spirax 90 EP

COMPULSORY TESTS

1. Main power take-off performance

Date and location of tests: 9th February 1968; 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					
73·7 (74·7)	2067	663	3·46 (15·73)	0·397 (178)	21·3 (4·75)
Standard p.t.o. speed (540 rev/min)					
64·8 (65·7)	1684	540	2·90 (13·18)	0·378 (169)	22·3 (4·98)
Standard belt speed of 3100 ft/min (945 m/min)					
70·9 (71·9)	1940	622	3·27 (14·87)	0·390 (174)	21·7 (4·84)
*Speed recommended by the manufacturer for drawbar work					
72·3 (73·3)	2000	641	3·36 (15·27)	0·393 (176)	21·5 (4·80)
Fuel consumption at part loads					
63·9 (64·8)	2110	677	3·04 (13·82)	0·402 (180)	21·0 (4·69)
0	2198	705	0·91 (4·14)	—	—
32·3 (32·8)	2133	684	1·85 (8·41)	0·485 (217)	17·4 (3·88)
73·7 (74·7)	2067	663	3·46 (15·73)	0·397 (178)	21·3 (4·75)
16·4 (16·6)	2159	692	1·38 (6·27)	0·710 (318)	11·9 (2·65)
48·4 (49·1)	2131	683	2·43 (11·05)	0·424 (190)	20·0 (4·46)

* The manufacturer made no specific recommendation for speed for drawbar work and the results given are at the rated engine speed

No load, maximum engine speed: 2198 rev/min
Equivalent crankshaft torque at maximum power: 187·3 lb ft (25·9 kg m)
Maximum equivalent crankshaft torque: 212·8 lb ft (29·4 kg m) at 1290 rev/min engine speed

Mean atmospheric conditions:	temperature	64°F	(18°C)
	pressure	29·63 in Hg	(753 mm Hg)
	relative humidity		38%
Maximum temperature:	coolant	189°F	(87°C)
	engine oil	232°F	(111°C)
	fuel	70°F	(21°C)

2. Drawbar performance

Date of tests: April–May 1968
Type of track: Tarmacadam
Height of drawbar above ground: 18½ in
See table on page 9

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)	drawbar hp h UKgal (metric drawbar hp h ?)	Temperature, F (C), Coolant	Fuel	Engine oil	Atmospheric conditions, Temperature, F (C)	Relative humidity, %	Pressure, inHg (mmHg)
(i) Maximum power (ballasted)													
1L	†29·7 (30·1)	9400 (4264)	1·18 (1·90)	2139	15·0	0·610 (273)	13·9 (3·10)	176 (80)	71 22	196 (91)	55 (13)	59	29·70 (754)
1H	†38·4 (38·9)	9400 (4264)	1·53 (2·46)	2117	15·0	0·552 (247)	15·3 (3·41)	178 (81)	72 22	200 (93)	59 (15)	57	29·70 (754)
2L	†44·4 (45·0)	9400 (4264)	1·77 (2·85)	2108	15·0	0·520 (233)	16·3 (3·64)	178 (81)	71 22	199 (93)	57 (14)	61	29·70 (754)
2H	56·4 (57·2)	9300 (4218)	2·27 (3·65)	2092	14·7	0·523 (234)	16·2 (3·61)	179 (82)	76 24	201 (94)	56 (13)	65	29·70 (754)
3L	62·0 (62·9)	6750 (3062)	3·44 (5·53)	2071	8·8	0·476 (213)	17·7 (3·95)	180 (82)	83 28	195 (91)	60 (16)	58	29·44 (748)
3H	62·1 (63·0)	5025 (2291)	4·63 (7·45)	2091	6·1	0·473 (212)	17·9 (3·99)	184 (84)	73 23	195 (91)	55 (13)	65	29·44 (748)
4L	64·2 (65·1)	4600 (2087)	5·23 (8·42)	2099	5·6	0·461 (206)	18·3 (4·08)	179 (82)	63 17	191 (88)	54 (12)	64	29·44 (748)
4H	62·6 (63·5)	4325 (1542)	6·85 (11·02)	2070	4·0	0·472 (211)	17·9 (3·99)	177 (81)	65 18	186 (86)	57 (14)	55	29·44 (748)
5L	64·2 (65·1)	3000 (1361)	8·03 (12·92)	2078	3·3	0·457 (204)	18·5 (4·13)	177 (81)	68 20	179 (82)	55 (13)	65	29·26 (743)
(ii) Five-hour test at 75% of pull at maximum power													
4L	49·5 (50·2)	3450 (1565)	5·38 (8·66)	2135	4·0	0·480 (215)	17·6 (3·93)	177 (81)	79 26	215 (102)	54 (12)	64	29·45 (748)
(iii) *Five-hour test at pull corresponding to 15% wheelslip in Test (i)													
2L	—	9400 (4264)	1·83 (2·94)	—	—	—	—	179 (82)	79 26	217 (103)	62 (17)	41	29·45 (748)
(iv) Maximum power (unballasted)													
3L	47·8 (48·5)	5500 (2495)	3·26 (5·25)	2094	14·3	—	—	180 (82)	—	200 (93)	55 (13)	70	29·68 (754)
3H	59·4 (60·3)	5100 (2313)	4·37 (7·03)	2090	10·8	—	—	179 (82)	—	206 (97)	55 (13)	76	29·68 (754)
4L	62·2 (63·0)	4600 (2087)	5·07 (8·15)	2107	8·6	—	—	180 (82)	—	202 (94)	51 (11)	81	29·68 (754)
4H	61·8 (62·7)	3400 (1542)	6·82 (10·97)	2100	5·1	—	—	180 (82)	—	202 (94)	52 (11)	75	29·68 (754)
5L	64·8 (65·7)	3050 (1383)	7·96 (12·81)	2101	4·6	—	—	180 (82)	—	200 (93)	52 (11)	75	29·60 (752)

Total oil consumption during ten hours duration of tests (ii) and (iii) 0·025 lb/h (11·3 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—52 in (1321 mm)

Rear—60 in (1524 mm)

	With brakes		*Without brakes*	
	Right-hand	*Left-hand*	*Right-hand*	*Left-hand*
Radius of turning space	11 ft 8½ in (3·57 m)	11 ft 11½ in (3·64 m)	12 ft 9½ in (3·90 m)	13 ft 2½ in (4·03 m)
Radius of turning circle	11 ft 4 in (3·45 m)	11 ft 7 in (3·53 m)	12 ft 5 in (3·78 m)	12 ft 10 in (3·91 m)

5. Location of centre of gravity

Height above ground	30·4 in (772 mm)
Distance forward from the vertical plane containing the axis of the rear wheels	31·7 in (805 mm)
Distance from the median plane of the tractor	0

6. Braking

Date of tests: 7th and 10th May 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)	13·5	(4·1)	12·9	(3·9)
Stopping distance, ft (m)	19·0	(5·8)	17·0	(5·2)
Force on brake pedal, lb (kg)	120	(54)	160	(73)

Brake fade characteristics (hot tests)

Maximum deceleration hot/maximum deceleration cold × 100: 102%

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

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

Efficiency of handbrake: Satisfactory

Pull on handbrake: 75 lb (34 kg)

7. Measurement of ambient noise emitted by the tractor

Date of tests:	7th May 1968	
Type of sound level meter:	Brüel and Kjoer Type 2203	
Type of track:	Tarmacadam	
Results of tests:	gear	3rd high
	travelling speed before acceleration:	15·1 mile/h (24·3 km/h)
	sound level	87 dBA

8. Noise measurements at the driver's ear level

Date of tests:	7th May 1968
Type of sound level meter and octave filter:	Brüel and Kjoer Type 2203 with octave filter set Type 1612
Type of track:	Tarmacadam

Results of Tests

Gear	*Travelling speed, mile/h*	*(km/h)*	*Loudness, sones*
3H	4·76	(7·66)	140

9. Power lift and hydraulic pump performance

Date and location of tests:	7th and 8th March 1968, N.I.A.E., Silsoe, Bedford, U.K.
Hydraulic fluid	
Make and type:	Shell Tractor Oil Universal
Viscosity:	20W/30
Viscosity index:	105

	Vertical movement,		*Maximum force exerted through full range,*		*Pressure,*		*Linkage load at which unballasted front end of tractor lifts off the ground,*	
	in	*(mm)*	*lb*	*(kg)*	*lb/in²*	*(kg/cm²)*	*lb*	*(kg)*
Linkage giving maximum mechanical advantage								
At lower hitch points (height above ground in down position 20 in (508 mm))	22	(559)	6000	(2723)	3100	(218)	—	—
On the frame 24 in (610 mm) to rear of lower hitch points	24	(610)	3850	(1746)	3100	(218)	3800	(1724)
Linkage giving minimum mechanical advantage								
At lower hitch points (height above ground in down position 9⅜ in (238 mm))	29½	(749)	3650	(1656)	3100	(218)	—	—
On the frame 24 in (610 mm) to rear of lower hitch points	34	(864)	3400	(1542)	3100	(218)	—	—

Type of linkage lock for transport:	Hydraulic
Opening pressure of the cylinder over pressure relief valve (manufacturer's figures):	Not applicable

Pump characteristics

(i) opening pressure of relief valve:	2950 lb/in² (207 kg/cm²)
sustained pressure of the open relief valve:	3100 lb/in² (218 kg/cm²)
Pump delivery rate at external tapping	
(ii) at minimum pressure (rated engine speed):	3·10 gal/min (14·1 l/min)
(iii) at maximum hydraulic power:	2·97 gal/min (13·5 l/min)
delivery pressure:	2950 lb/in² (207 kg/cm²)
power:	6·14 hp (6·23 metric hp)

When an auxiliary hydraulic pump and relief valve was fitted the following results were obtained from the combined pumps:

Pump characteristics

(i) opening pressure of relief valve:	1800 lb/in² (127 kg/cm²)
sustained pressure of the open relief valve:	2225 lb/in² (156 kg/cm²)
Pump delivery rate at external tapping	
(ii) at minimum pressure (rated engine speed):	10·28 gal/min (46·7 l/min)
(iii) at maximum hydraulic power:	9·55 gal/min (43·4 l/min)
delivery pressure:	2000 lb/in² (141 kg/cm²)
power:	13·38 hp (13·57 metric hp)

OPTIONAL TESTS

10. Performance at the engine crankshaft

Date and location of tests: 6th February 1968: 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/UK gal (metric hp h/l)*
Maximum power—2 hour test				
75·8 (76·9)	2070	3·46 (15·73)	0·386 (173)	21·9 (4·89)
Standard p.t.o. speed (540 rev/min)				
66·0 (66·9)	1684	2·91 (13·23)	0·373 (167)	22·7 (5·06)
Standard belt speed of 3100 ft/min (945 m/min)				
73·0 (74·0)	1940	3·28 (14·91)	0·379 (170)	22·3 (4·98)
*Speed recommended by the manufacturer for drawbar work				
74·5 (75·5)	2000	3·36 (15·27)	0·381 (170)	22·2 (4·95)
Fuel consumption at part loads				
66·0 (66·9)	2120	3·00 (13·64)	0·385 (172)	22·0 (4·91)
0·2 (0·2)	2195	0·83 (3·77)	—	—
33·4 (33·9)	2145	1·84 (8·32)	0·464 (208)	18·2 (4·06)
75·8 (76·9)	2070	3·46 (15·73)	0·386 (173)	21·9 (4·89)
16·9 (17·1)	2168	1·29 (5·86)	0·648 (290)	13·1 (2·92)
50·0 (50·7)	2140	2·43 (11·05)	0·411 (184)	20·6 (4·60)

* The manufacturer made no specific recommendation for speed for drawbar work and the results given are at the rated engine speed

No load, maximum engine speed: 2195 rev/min

Crankshaft torque at maximum power: 192·3 lb ft (26·6 kg m)

Maximum crankshaft torque: 211·8 lb ft (29·3 kg m) at 1360 rev/min engine speed

Mean atmospheric conditions:

temperature	64°F	(18°C)
pressure	29·04 in Hg	(738 mm Hg)
relative humidity		43%

Maximum temperature:

coolant	201°F	(94°C)
engine oil	238°F	(114°C)
fuel	80°F	(27°C)

Optimum fuel consumption recorded: 0·349 lb/hp h (156 g/metric hp h) at 38·1 hp (38·6 metric hp) and 1220 rev/min engine speed

11. Performance at the belt pulley shaft

Date and location of tests: 16th February 1968; 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	*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					
72·5 (73·5)	2069	1232	3·43 (15·59)	0·400 (179)	21·1 (4·71)
Standard belt speed of 3100 ft/min (945 m/min)					
69·9 (70·9)	1940	1155	3·23 (14·68)	0·391 (175)	21·6 (4·82)
*Speed recommended by the manufacturer for drawbar work					
71·2 (72·2)	2000	1191	3·36 (15·27)	0·398 (178)	21·2 (4·73)
Fuel consumption at part loads					
63·2 (64·1)	2124	1265	3·02 (13·73)	0·403 (180)	20·9 (4·66)
0	2191	1305	0·90 (4·09)	—	—
32·1 (32·5)	2157	1285	1·90 (8·64)	0·501 (224)	16·9 (3·77)
72·5 (73·5)	2069	1232	3·43 (15·59)	0·400 (179)	21·1 (4·71)
16·1 (16·3)	2166	1290	1·40 (6·36)	0·733 (328)	11·5 (2·57)
48·0 (48·7)	2149	1280	2·44 (11·09)	0·429 (192)	19·7 (4·40)

* The manufacturer made no specific recommendation for speed for drawbar work and the results given are at the rated engine speed

No load, maximum engine speed: 2191 rev/min

Equivalent crankshaft torque at maximum power: 184·1 lb ft (25·5 kg m)

Maximum equivalent crankshaft torque: 206·4 lb ft (28·5 kg m) at 1320 rev/min engine speed

Mean atmospheric conditions:	temperature	62°F	(17°C)
	pressure	29·94 in Hg	(760 mm Hg)
	relative humidity		36%
Maximum temperature:	coolant	190°F	(88°C)
	engine oil	237°F	(114°C)
	fuel	71°F	(22°C)

15. Repairs and adjustments during tests: None

Remarks: None

Officer in charge: D. W. SMITH

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

Date: 28th June 1968

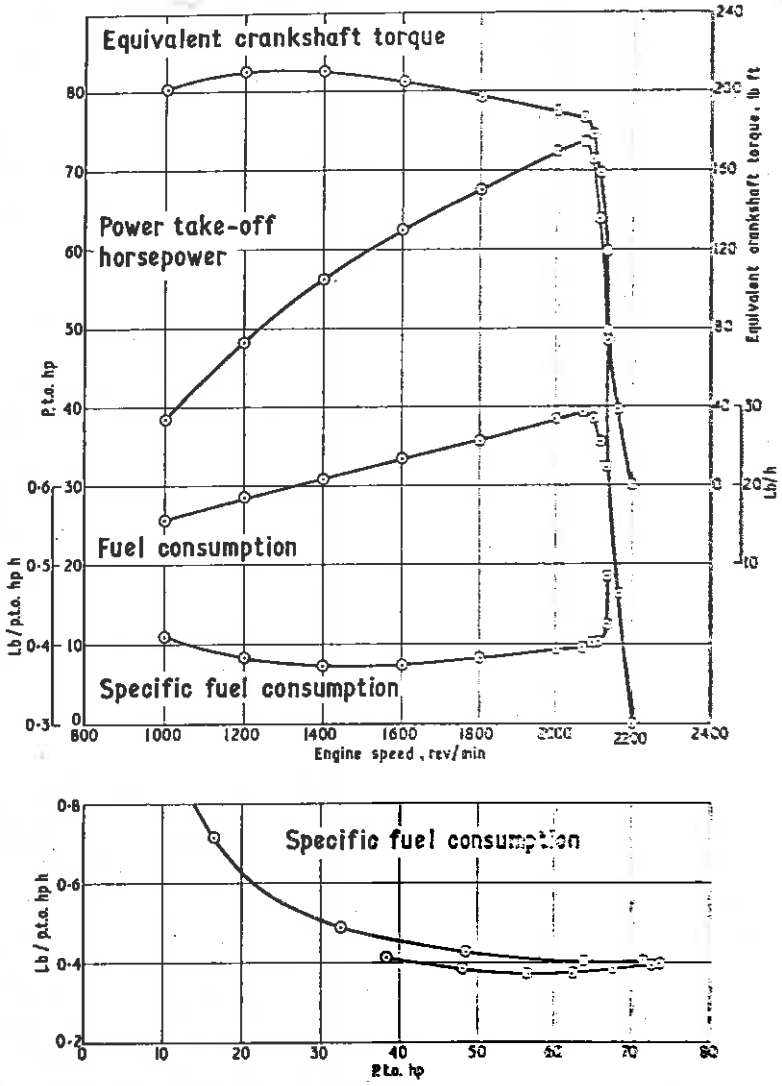


FIG. 1. Power take-off test

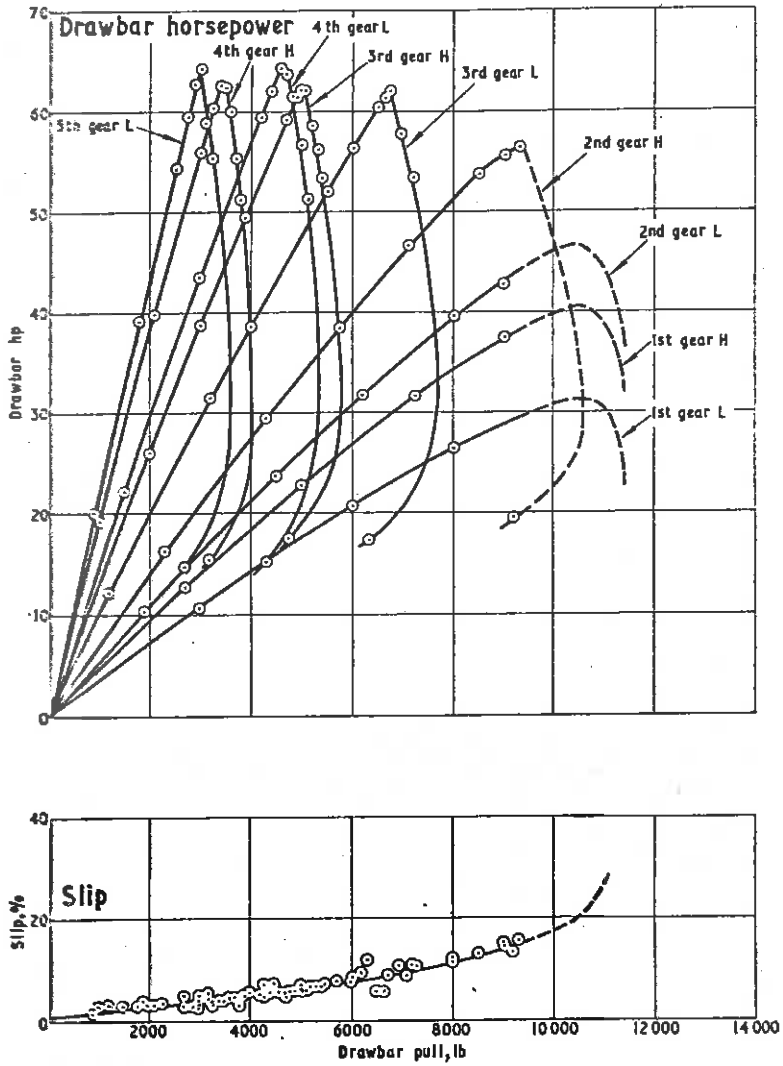


FIG. 2. Drawbar test on tarmacadam, with ballast

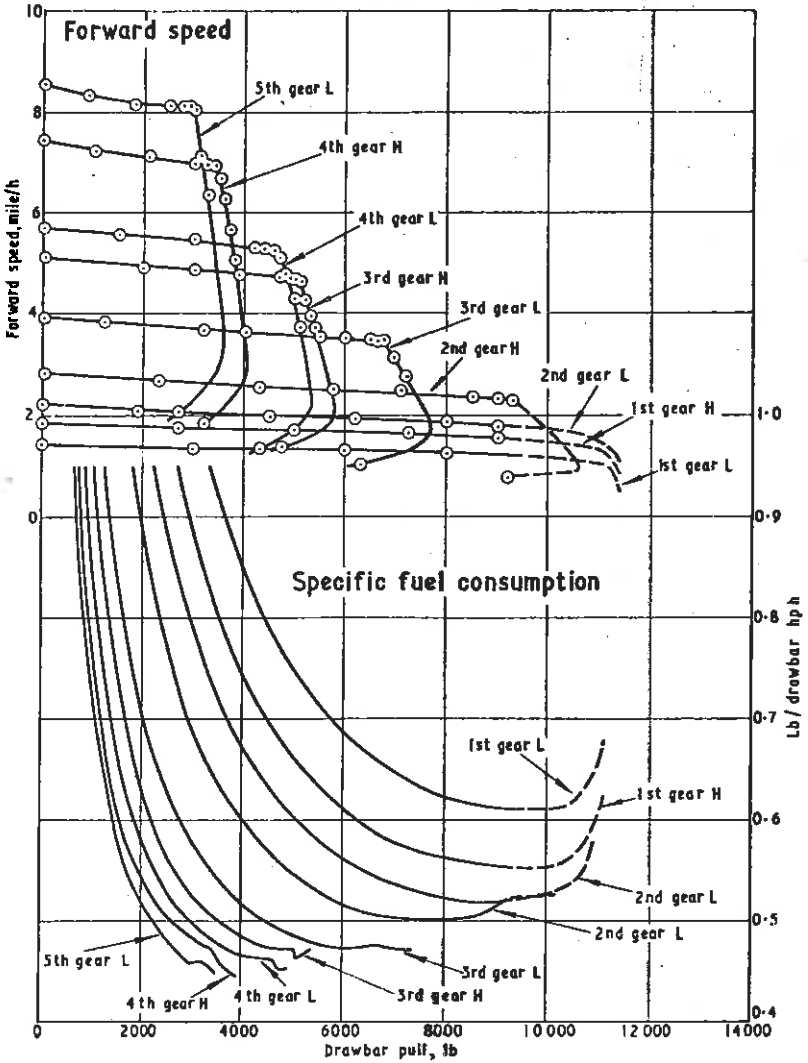


FIG. 3. Drawbar test on tarmacadam, with ballast

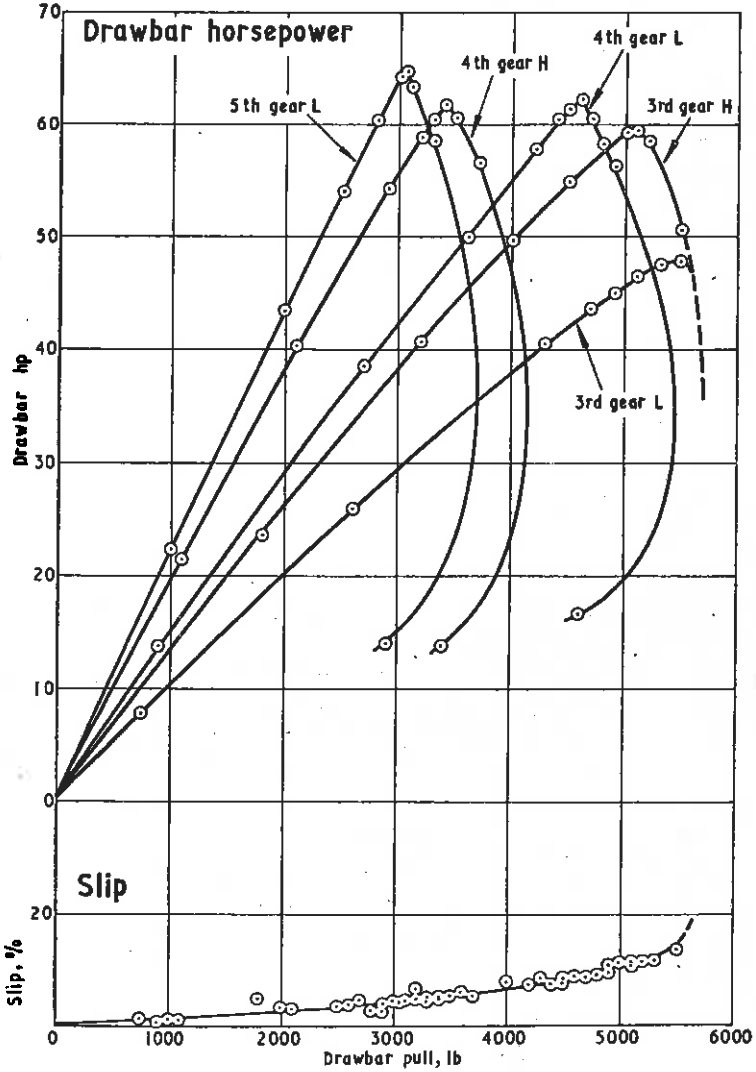


FIG. 4. Drawbar test on tarmacadam, without ballast

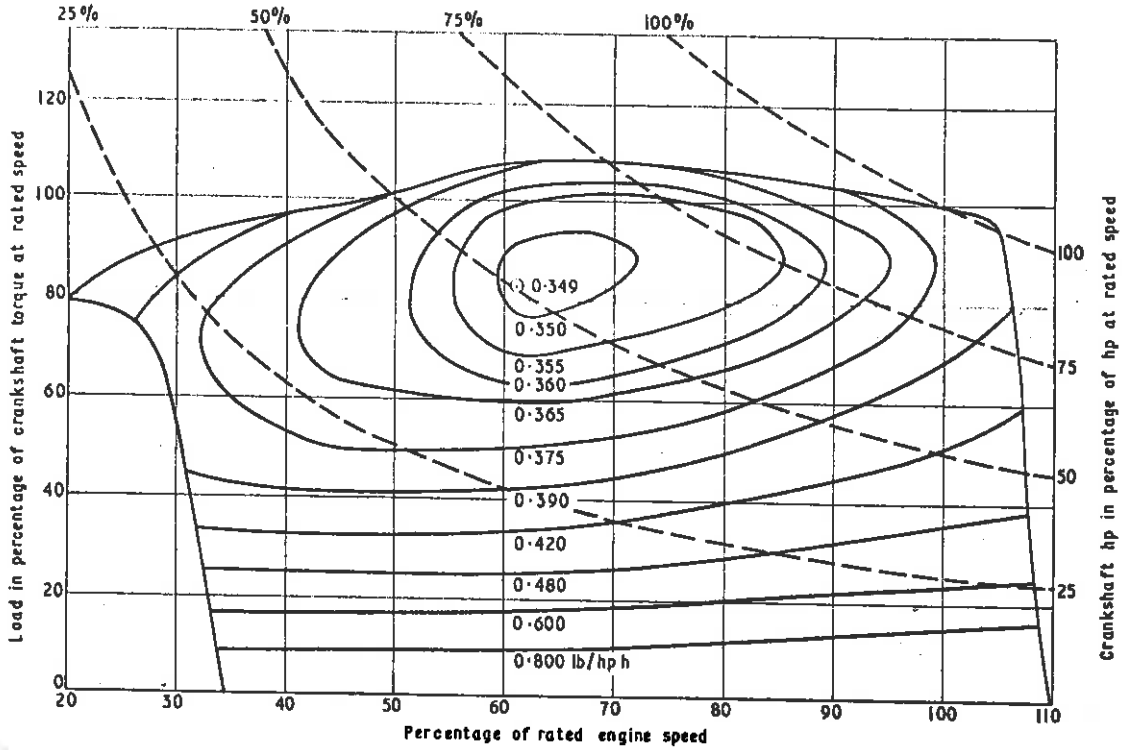
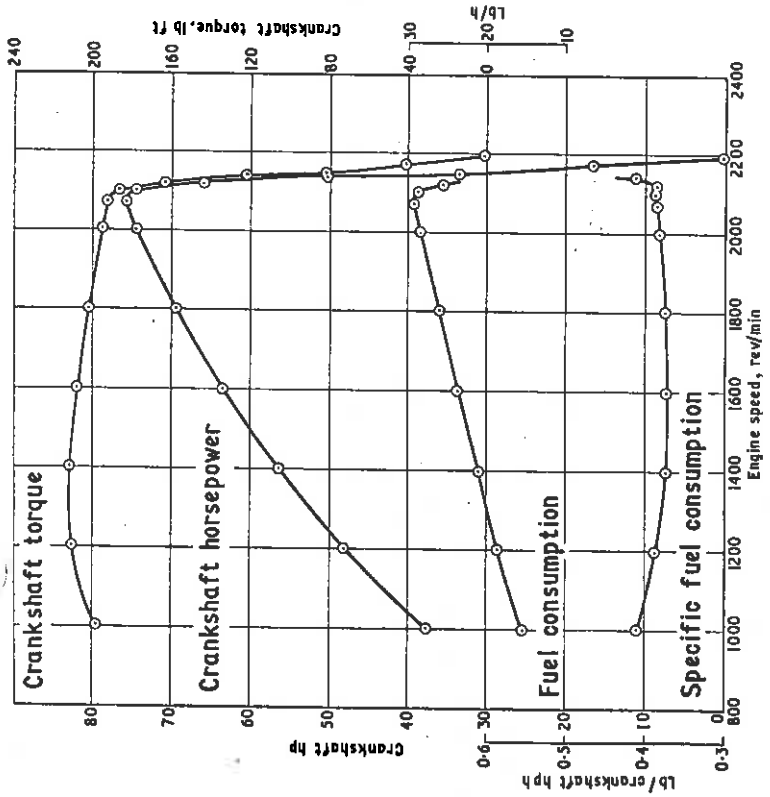


FIG. 6. Engine test



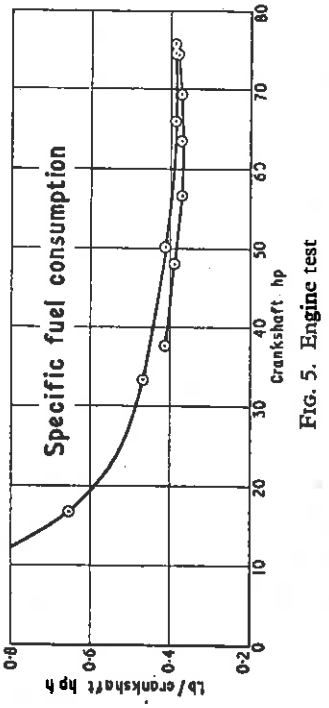


FIG. 5. Engine test

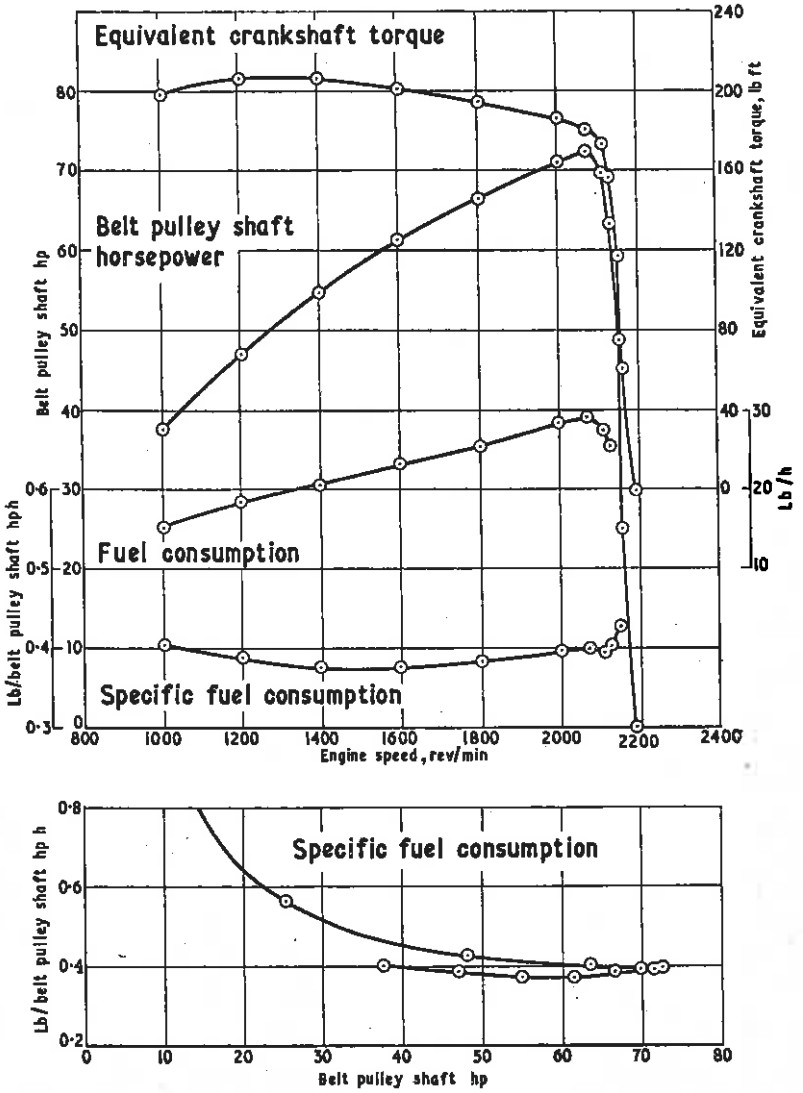


FIG. 7. Belt pulley shaft test