OECD Approval No. 609

Report No. 656

Test in accordance with the OECD standard code for the official testing of agricultural tractors

Report on test of Massey-Ferguson 285 Tractor.



Manufactured by Massey-Ferguson Manufacturing Co.,
Banner Lane,
Coventry, Warwickshire.

Test No. R78/2/7025/O.E.C.D.

Date August, 1978.

THE BRITISH SOCIETY FOR RESEARCH IN AGRICULTURAL ENGINEERING

National Institute of Agricultural Engineering
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SPECIFICATION OF TRACTOR

Manufacturer:	Massey-Ferguson Manufacturing Company, Banner Lane, Coventry, Warwickshire.
Submitted for test by:	The manufacturer
Selected for test by:	The manufacturer with the agreement of the testing station
Place of running-in:	Coventry
Duration of running-in:	50 hours

Tractor

Make:	Massey-Ferguson
Model:	MF 285
Type:	Four wheel, rear wheel driven, unit construction
Serial No.:	V329061

Engine

Make:	Perkins
Model:	A4-248
Type:	4-stroke, direct injection diesel
Serial No.:	15366L 2480A
Cylinders:	4 cylinders, vertical, in-line, 101.0 mm (4.0 in) dia bore x 127 mm (5.0 in) stroke, capacity 4070 cm^3 (248 in^3), compression ratio 16.0:1 (nominal), replaceable dry cylinder liners, overhead valves
Fuel system:	A.C. Delco mechanical fuel feed pump with hand-primer, C.A.V. paper element filter with sediment bowl between feed and injection pumps; fuel tank capacity 90 l (19.8 UK gal); C.A.V. distributor type DPA 3241 F 102 injection pump, Serial No. R515877T, manufacturer's production setting 14.94 - 15.74 l/h (26.3 - 27.7 pt/h) at 2000 rev/min engine speed and 63 °C (145 °F) cambox temperature: C.A.V. type BDLL 150S 6556 injector nozzles, injection pressure 17.73 MPa (175 atm), pump delivery starts 24° before T.D.C.

Governor:	C.A.V. mechanical, incorporated in fuel injection pump, governed range of engine speed 700 to 2200 rev/min, rated engine speed 2000 rev/min
Air cleaner:	Lautrette, oil bath, oil capacity 1.0 l (1.8 pt) situated forward of radiator, centrifugal pre-cleaner above bonnet
Lubrication system:	Forced feed from gear pump with metal strainer in sump: full flow replaceable element filter; total oil capacity 8.2 l (14.5 pt), recommended oil SAE 20W/30, viscosity 54 cSt at 50 °C (122 °F), oil and filter change period 250 hours.
Cooling system:	Water cooled, pressurised at 50 kPa (7 lb/in^2), thermosyphon assisted by centrifugal pump, 394 mm (15.5 in) dia 4-blade belt-driven fan, thermostat for temperature control, cooling water capacity 14.2 l (25.0 pt)
Starting system:	Electrical, Lucas M50G solenoid engaged starter motor, operable only when high-low gear selector lever is in neutral position, C.A.V. Thermostart MK IIIC manifold flame-type cold starting aid
Exhaust system:	Silencer vertical above bonnet on right-hand side.

Electrical system

Voltage:	12, negative earth
Generator:	Lucas type 16 ACR alternator
Battery:	Lucas 385A lead-acid, 90 Ah at 20-hour rating

Transmission

Clutch:	Laycock, dual, dry, pedal operated, 254 mm (10.0 in) dia plate for p.t.o. drive, 305 mm (12.0 in) dia plate for gearbox drive
Gearbox:	Own make, sliding gear, 8 forward and 2 reverse speeds, comprising 4 forward and 1 reverse speed gearbox with high-low range epicyclic gear
Rear axle and final drives:	Own make, crown wheel and pinion with differential and epicyclic reduction gear final drives; pedal operated differential lock
Oil capacities:	Gearbox and rear axle housing 40 l (70.0 pt), recommended oil S.A.E. 20W/30, viscosity 54 cSt at 50 °C (122 °F); final drives 1.7 l (3.0 pt) each, recommended oil S.A.E. 90, viscosity 115 cSt at 50 °C (122 °F), change period 500 hours, transmission filter change period 250 hours.

Gear	Number of engine revolutions for one revolution of driving wheel	Nominal travelling speed for 2000 rev/min rated engine speed,* km/h	(mile/h)
Forward			
L1	244.29	2.22	(1.38)
L2	166.56	3.26	(2.03)
L3	121.94	4.45	(2.77)
L4	90.85	5.98	(3.72)
H1	59.71	9.09	(5.65)
H2	40.71	13.33	(8.28)
H3	29.81	18.21	(11.32)
H4	22.21	24.44	(15.19)
Reverse			
L	179.37	3.03	(1.89)
H	43.85	12.38	(7.69)

*Calculated with a tyre rolling radius of 720 mm (28.3 in)

Power take-off

At rear of tractor in vertical centre plane, height above ground 580 mm (22.8 in), 6-spline, 34.9 mm (1 $\frac{3}{8}$ in) dia, to ISO standard, selected by handlever and engaged by second plate of main clutch, proportional engine speed giving 641 rev/min at 2000 rev/min rated engine speed, 540 rev/min (standard p.t.o. speed) at 1684 rev/min engine speed, direction of rotation clockwise viewed facing driving end

Belt pulley

Attachable to rear of tractor in two alternative horizontal positions, p.t.o. driven, 260 mm (10.25 in) dia x 165 mm (6.5 in) face width, 1191 rev/min giving 973 m/min (3192 ft/min) at 2000 rev/min rated engine speed, 1157 rev/min giving 945 m/min (3100 ft/min) standard belt speed at 1942 rev/min engine speed, direction of rotation related to position of unit

Power lift

Own make, hydraulic, 4-cylinder piston pump driven from the forward end of the pto shaft through second plate of the clutch, oil supplied from rear axle housing to ram cylinder and external tapping; Category 2 implement linkage; top link sensing, draught, position and pressure control, selective response on drop

Drawbar	Swinging drawbar, verical height to centre of clevis 348 mm (13.7 in) to 503 mm (19.8 in) changed by inverting drawbar and clevis, distance behind rear axle centre 547 mm (21.5 in) and 661 mm (26.0 in), distance behind p.t.o. 241 mm (9.5 in) and 356 mm (14.0 in), lateral adjustment 213 mm (8.4 in) and 392 mm (15.4 in), pivot position 130 mm (5.1 in) forward of rear wheel centre, drawbar pin hole 26 mm (1.0 in) dia
Steering	Power assisted, worm and peg with single drop arm and drag link, oil supplied by Plessey gear driven pump
Brakes	Oil immersed multi-disc on inner high speed axle shafts, independent or combined, pedal-operated, hand-lever with ratchet operating both brakes for parking
Wheels	
Steering wheels:	Two at front, Dunlop Tracteur 7.50-16, cross-ply tyres, 8-ply rating, maximum permissible mass on each tyre 870 kg (1918 lb) at 370 kPa (54 lb/in^2), track width 1371 mm (54.0 in) by 102 mm (4.0 in) steps to 1779 mm (70.0 in), changed by extending axle
Driving wheels:	Two at rear, power adjusted variable track, cast iron centres, Goodyear Traction Sure Grip 18.4/15-30, cross-ply tyres, 6-ply rating, maximum permissible mass on each tyre 2120 kg (4674 lb) at 110 kPa (16 lb/in^2), track width 1523 mm (60.0 in) by 102 mm (4.0 in) steps to 2237 mm (88.0 in) changed by power shifting and inter-changing wheels
Wheelbase:	2286 mm (90 in)
Seat	Fritzmeier, upholstered pan, suspension spring with ride height adjustment; range of adjustment 216 mm (8.5 in) forwards and backwards

Lighting

Unrestricted beam angle of headlight in plan view 131°

	Height above ground of centre, mm (in)	Size, mm (in)	Distance from outside edge of tractor at 1523 mm (60.0 in) wheel track, to centre, mm (in)
Headlights	873 (34.4)	124 (4.9) dia	833 (32.8)
Side lights	1502 (59.1)	100 (3.9) x 32 (1.3)	248 (9.8)
Rear lights	1464 (57.6)	76 (3.0) x 38 (1.5)	337 (13.3)
Reflectors	1375 (54.1)	70 (2.8) x 30 (1.2)	292 (11.5)

Number of grease points

Whole tractor: 11

CONDITIONS DURING TEST

Masses

Tractor (without driver but with tanks full)

	Front, kg (lb)	Rear, kg (lb)	Total, kg (lb)
Without ballast	984 (2170)	1751 (3861)	2735 (6031)
With ballast	1354 (2985)	3678 (8109)	5032 (11094)

Ballast

	Number of weights	Total mass, kg (lb)	Water, kg (lb)
Front wheels	Nil	Nil	Nil
Rear wheels	26	1226 (2703)	773 (1704)
Additional	8	298 (656)	Front frame and weights

Track setting during tests

Front - 1371 mm (54.0 in)
Rear - 1523 mm (60.0 in)

Overall dimensions

	Length, m (in)	Width, m (in)	Height, m (in)
With ballast	4.26 (167.7)	3.10 (122.0)	2.49 (98.0)
Without ballast	3.80 (149.6)	1.98 (78.0)	2.50 (98.4)

Overall height measured to top of exhaust pipe
Minimum ground clearance 290mm (11.4in) to underside of drawbar frame

FUEL AND LUBRICANTS USED IN TESTS

Fuel:	Diesel oil to Class A2 British Standard 2869:1970, specific gravity 0.837 at 15 °C (59 °F), viscosity 2.34 cSt at 50 °C (122 °F), Cetane No. 52.7
Engine oil:	Agricastrol M.P. S.A.E. 20W/30, viscosity 54 cSt at 50 °C (122 °F)
Transmission oil:	Agricastrol M.P. S.A.E. 20W/30, viscosity 54 cSt at 50 °C (122 °F)
Final drives:	Mobilube GX S.A.E. 90, viscosity 115 cSt at 50 °C (122 °F)

COMPULSORY TESTS

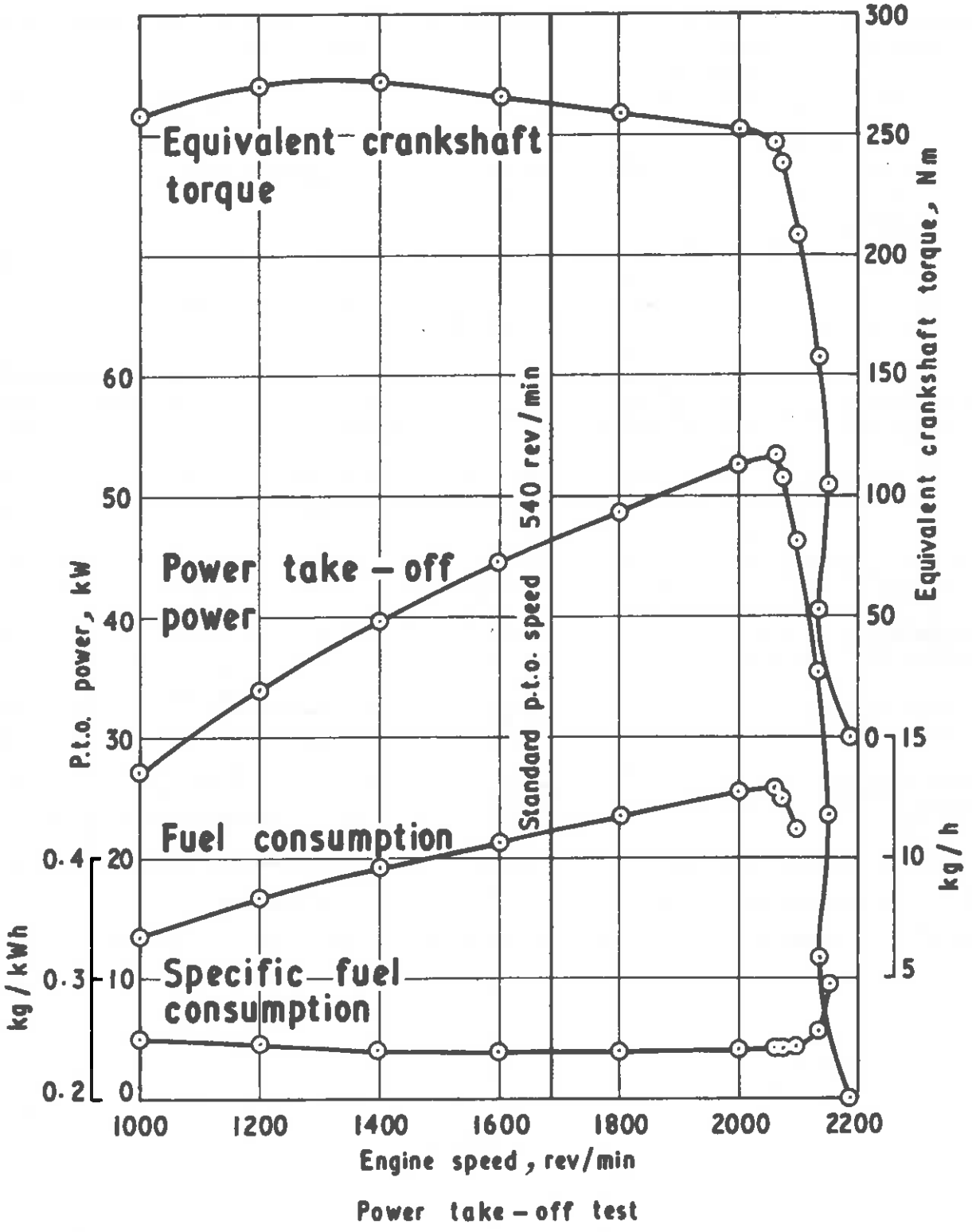
1. MAIN POWER TAKE-OFF PERFORMANCE

Date and location of tests: 6th January, 1978, N.I.A.E., Silsoe, Bedford, U.K.

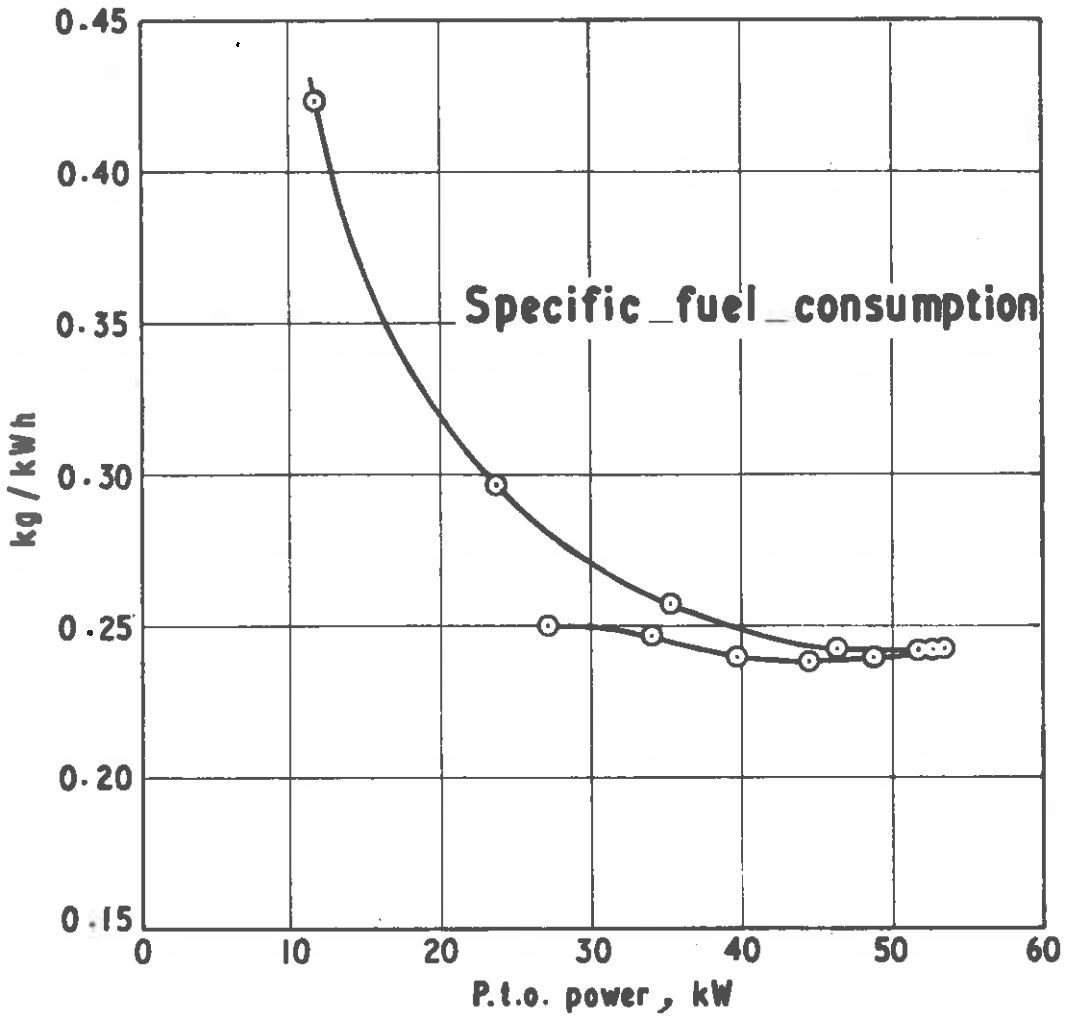
Type of dynamometer: Water brake, Heenan and Froude

Power, kW (hp)	Speed, rev/min		Fuel consumption,			
	Engine	P.t.o.	l/h (UKgal/h)	kg/h (lb/h)	kg/kWh (lb/hph)	kWh/l (hph/UKgal)
Maximum power - 2 hour test						
53.2 (71.3)	2060	661	15.45 (3.40)	12.93 (28.51)	0.243 (0.400)	3.44 (21.0)
Standard p.t.o. speed (540 rev/min)						
46.3 (62.1)	1684	540	13.28 (2.92)	11.11 (24.49)	0.240 (0.395)	3.49 (21.3)
The speed recommended by the manufacturer for drawbar work						
52.8 (70.8)	2000	641	15.27 (3.36)	12.78 (28.17)	0.242 (0.398)	3.46 (21.1)
Part loads						
(1) 85% of the torque obtained at maximum power						
46.0 (61.7)	2098	673	13.36 (2.94)	11.18 (24.65)	0.243 (0.400)	3.44 (21.0)
(2) Unloaded						
0	2183	700	3.79 (0.83)	3.17 (6.99)	-	-
(3) 50% of the torque defined in (1)						
23.6 (31.6)	2150	690	8.35 (1.84)	6.99 (15.41)	0.296 (0.487)	2.83 (17.3)
(4) Maximum power						
53.2 (71.3)	2060	661	15.45 (3.40)	12.93 (28.51)	0.243 (0.400)	3.44 (21.0)
(5) 25% of the torque defined in (1)						
11.7 (15.7)	2137	685	5.93 (1.30)	4.96 (10.93)	0.424 (0.697)	1.97 (12.0)
(6) 75% of the torque defined in (1)						
35.1 (47.1)	2132	684	10.78 (2.37)	9.02 (19.89)	0.257 (0.423)	3.26 (19.9)

No load, maximum engine speed		2183 rev/min	
Equivalent crankshaft torque at maximum power		246.5 Nm	(181.8 lb ft)
Maximum equivalent crankshaft torque		272.0 Nm at 1320 rev/min engine speed	(200.6 lb ft)
Mean atmospheric conditions	temperature	16 °C	(61 °F)
	pressure	1028 m bar	(30.36 in Hg)
	relative humidity	54%	
Maximum temperature	coolant	85 °C	(185 °F)
	engine oil	114 °C	(237 °F)
	fuel	37 °C	(99 °F)
	air intake	24 °C	(75 °F)



Power take - off test



Power take — off test

2. DRAWBAR PERFORMANCE Date of Tests: 21st March-24th April 1978 Type of track: Concrete Height of drawbar above ground: 415 mm (16.3 in)

Gear	Power, kW (hp)	Drawbar pull, kN (lb)	Speed, km/h (mile/h)	Engine speed, rev/min	Wheel-slip, %	Specific fuel consumption, kg/kWh (lb/hph)	Specific fuel consumption, kWh/l (hph/UKgal)	Temperature, °C(°F) Coolant	Fuel	Engine oil	Atmospheric conditions Temperature, °C (°F)	Relative humidity, %	Pressure, mbar (in Hg)
(i)	MAXIMUM POWER (ballasted)												
L1	22.9* (30.7)	41.5 (9330)	1.99 (1.24)	2170	15.0	0.346 (0.569)	2.42 (14.8)	83 (181)	20 (68)	100 (212)	9 (48)	66	1011 (29.85)
L2	33.1* (44.4)	41.5 (9330)	2.87 (1.78)	2139	15.0	0.310 (0.510)	2.70 (16.5)	85 (185)	22 (72)	101 (214)	9 (48)	66	1011 (29.85)
L3	43.1 (57.8)	40.4 (9080)	3.84 (2.39)	2060	14.1	0.305 (0.501)	2.74 (16.7)	88 (190)	23 (73)	90 (194)	10 (50)	67	1021 (30.15)
L4	45.3 (60.7)	30.0 (6740)	5.44 (3.38)	2060	9.6	0.288 (0.473)	2.91 (17.7)	88 (190)	22 (72)	99 (210)	9 (48)	79	1021 (30.15)
H1	45.8 (61.4)	19.2 (4320)	8.59 (5.34)	2060	5.3	0.284 (0.467)	2.95 (18.0)	88 (190)	29 (84)	106 (223)	10 (50)	67	1021 (30.15)
H2	44.2 (59.3)	12.3 (2770)	12.94 (8.04)	2070	3.3	0.295 (0.485)	2.84 (17.3)	87 (189)	25 (77)	98 (208)	9 (48)	66	994 (29.35)
(ii)	FIVE HOUR TEST AT 75% OF PULL AT MAXIMUM POWER												
H1	36.1 (48.4)	14.4 (3240)	9.03 (5.61)	2109	4.0	0.269 (0.442)	3.11 (19.0)	85 (185)	27 (81)	105 (221)	13 (55)	43	1025 (30.27)
(iii)	+FIVE HOUR TEST AT PULL CORRESPONDING TO 15% WHEELSLIP IN TEST (i)												
L2	-	41.5 (9330)	2.97 (1.85)	-	-	-	-	84 (183)	31 (88)	106 (223)	13 (55)	50	1019 (30.09)
(iv)	MAXIMUM POWER (unballasted)												
L2	*21.0 (28.2)	25.5 (5730)	2.96 (1.84)	2144	15.0	-	-	83 (181)	34 (93)	102 (215)	17 (63)	60	1009 (29.80)
L3	*28.2 (37.8)	25.5 (5730)	3.98 (2.47)	2122	15.0	-	-	84 (183)	33 (91)	105 (221)	17 (63)	60	1009 (29.80)
L4	36.8 (49.3)	25.0 (5620)	5.30 (3.29)	2085	13.8	-	-	87 (189)	32 (90)	100 (212)	17 (63)	60	1009 (29.80)
H1	45.1 (60.5)	19.5 (4380)	8.33 (5.18)	2040	8.5	-	-	88 (190)	32 (90)	106 (223)	14 (57)	82	1009 (29.80)
H2	45.8 (61.4)	12.8 (2880)	12.88 (8.00)	2045	4.8	-	-	86 (187)	24 (75)	100 (212)	14 (57)	82	1009 (29.80)

Total oil consumption during ten hours duration of tests (ii) and (iii) 107.7 g/h (0.237 lb/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. TURNING SPACE AND TURNING CIRCLE

Details of wheel equipment: As in specification, without ballast

Track of wheels: front - 1371 mm (54.0 in)
rear - 1523 mm (60.0 in)

	With brakes		Without brakes	
	Right-hand	Left-hand	Right-hand	Left-hand
Radius of turning space, m (in)	3.71 (146)	3.68 (145)	4.10 (161)	4.09 (161)
Radius of turning circle, m (in)	3.60 (142)	3.57 (141)	3.99 (157)	3.98 (157)

4. LOCATION OF CENTRE OF GRAVITY

Height above ground, mm (in)	810 (31.9)
Distance forward from the vertical plane containing the axis of the rear wheels, mm (in)	812 (32.0)
Distance from the median plane of the tractor, mm (in)	0

5. BRAKING

Date of tests: 19th and 20th April 1978
Type of track: Concrete
Type of decelerometer: Moto Meter, recording type
Mass of ballasted tractor: 5032 kg (11094 lb)

Cold brakes

	Tractor without ballast	Tractor ballasted
Travelling speed of tractor, km/h (mile/h)	25.0 (15.5)	25.0 (15.5)
Maximum deceleration, m/s^2 (ft/s^2)	4.4 (14.4)	4.6 (15.1)
Stopping distance, m (ft)	5.8 (19.0)	5.3 (17.4)
Force on brake pedal, N (lb)	311 (70)	534 (120)
Force exerted on the brake pedal to achieve a deceleration of 2.5 m/s^2 (8.2 ft/s^2), N (lb)	98 (22)	231 (52)

Brake fade charateristics (hot tests)

Maximum deceleration hot/cold,	%	100	103
Stopping distance cold/hot,	%	100	100
Force on pedal cold/hot,	%	100	100

Parking brake

Efficacy of handbrake: Satisfactory facing up and down slope of 16%

Pull on handbrake: 302 N (68 lb)

6. MEASUREMENT OF AMBIENT NOISE EMITTED BY THE TRACTOR

Date of tests:	24th April 1978
Type of sound level meter:	Bruel and Kjaer 2209
Type of track:	Concrete
Results of tests:	
Gear:	H4
Travelling speed before acceleration:	19.1 km/h (11.9 mile/h)
Sound level:	88 dBA

7. NOISE MEASUREMENT AT THE DRIVER'S EAR LEVEL

Date of tests:	24th April 1978
Type of sound level meter:	Bruel and Kjaer 2209
Type of track:	Concrete

Gear	Travelling speed,* km/h (mile/h)		dBA
L4	5.6	(3.5)	98
H1	8.7	(5.4)	99

*The first gear tested corresponds to the travelling speed nearest to 7.5 km/h (4.7 mile/h)

8. POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date of tests:	28th April, 2nd and 3rd May 1978
Hydraulic fluid	
Make and type:	Agricastrol **M.P. S.A.E.** 20W/30
Viscosity:	54 cSt at 50 °C (122 °F)
Type of linkage lock for transport:	Hydraulic
Opening pressure of the cylinder over pressure relief valve (manufacturer's figures):	22.4 MPa (3250 lb/in^2)
Pump characteristics	
i) Opening pressure of relief valve:	18.6 MPa (2700 lb/in^2)
Sustained pressure of the open relief valve:	22.2 MPa (3220 lb/in^2)
ii) Pump delivery rate at minimum pressure and rated engine speed:	17.6 l/min (3.9 gal/min)
iii) Pump delivery rate at maximum hydraulic power:	17.4 l/min (3.8 gal/min)
Delivery pressure:	18.6 MPa (2700 lb/in^2)
Power:	5.4 kW (7.2 hp)

Linkage geometry when connected to the standard frame, mm (in)

	Maximum mechanical advantage	Minimum mechanical advantage
Projected length in side view		
Lower links	1016 (40.0)	1016 (40.0)
Lift arms	267 (10.5)	267 (10.5)
Lift rods	678 (26.7)	678 (26.7)
Top link	799 (31.5)	777 (30.6)
Distance of lift rod connection point from pivot point of lower link*	578 (22.8)	578 (22.8)
The following dimensions are given relative to the rear wheel centre line, situated 720 mm (28.3 in) above the ground level		
Lower link pivot point	32 (1.3) forward, 212 (8.3) below	32 (1.3) forward, 212 (8.3) below
Top link pivot point	186 (7.3) behind, 205 (8.1) above	216 (8.5) behind, 132 (5.2) above
Lift arm pivot point	196 (7.7) forward, 233 (9.2) above	196 (7.7) forward, 233 (9.2) above
Maximum and minimum height of lower link hitch points	178 (7.0) above, 440 (17.3) below	262 (10.3) above, 348 (13.7) below
Height of lower link hitch points when locked in transport position	Any height within lift range	Any height within lift range

*For maximum mechanical advantage the lift rod connection point on the lower link is 51 mm (2.0 in) above the point for minimum mechanical advantage

Power lift performance

Lifting height in relation to a horizontal line through the lower link pivoting point		mm (in)	-220 (8.7)	-200 (7.9)	-140 (5.5)	-120 (4.7)	-80 (3.1)	0	+80 (3.1)	+160 (6.3)	+240 (9.4)	+320 (12.6)	+360 (14.2)	+420 (16.5)	+460 (18.1)	+600 (23.6)
Lifting force with the pressure at maximum hydraulic power (18.6 MPa (2700 lb/in^2)) calculated from measurements made at maximum pressure (22.2 MPa (3220 lb/in^2)), kN (lb)	At the hitch points	max. mech. advantage	*19.2 (4320)	19.5 (4380)	20.1 (4520)	20.4 (4590)	20.7 (4650)	21.0 (4720)	21.1 (4740)	21.2 (4770)	21.1 (4740)	21.0 (4720)	20.9 (4700)			
		min. mech. advantage				*19.4 (4360)	19.9 (4470)	20.6 (4630)	21.1 (4740)	21.3 (4790)	21.5 (4830)	21.5 (4830)	21.5 (4830)	21.4 (4810)	21.3 (4790)	
	On the frame	max. mech. advantage		19.7 (4430)	19.7 (4430)	19.6 (4410)	19.5 (4380)	19.3 (4340)	18.8 (4230)	18.3 (4110)	17.6 (3960)	17.0 (3820)	16.6 (3730)	*16.1 (3620)		
		min. mech. advantage			16.6 (3730)	16.7 (3750)	16.8 (3780)	16.9 (3800)	16.8 (3780)	16.5 (3710)	16.1 (3620)	15.7 (3530)	15.4 (3460)	15.0 (3370)	14.8 (3330)	*13.6 (3060)

*Maximum force exerted throughout whole range

Force at which front of tractor is calculated to lift with maximum allowable front ballast is in excess of measured values.

OPTIONAL TESTS

9. PERFORMANCE AT THE ENGINE CRANKSHAFT

Date and location of tests: 10th January 1978, N.I.A.E., Silsoe, Bedford, U.K.

Type of dynamometer: Water brake, Heenan and Froude

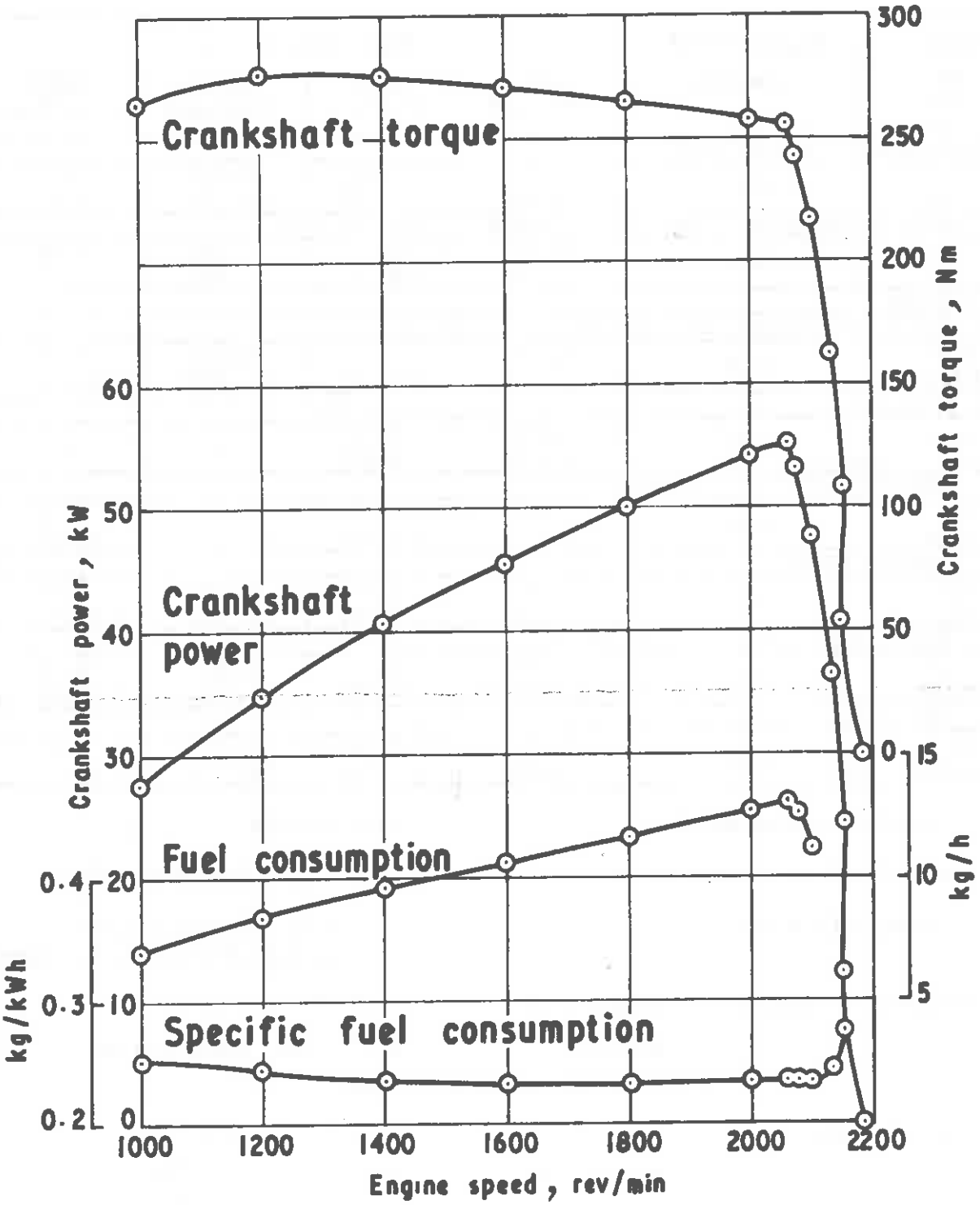
Power kW (hp)	Engine speed, rev/min	Fuel consumption, l/h (UKgal/h)	kg/h (lb/h)	kg/kWh (lb/hph)	kWh/l (hph/UKgal)
Maximum power - 2 hour test					
55.1 (73.9)	2060	15.61 (3.43)	13.06 (28.79)	0.237 (0.390)	3.53 (21.5)
The speed recommended by the manufacturer for drawbar work					
54.2 (72.7)	2000	15.29 (3.36)	12.79 (28.20)	0.236 (0.388)	3.54 (21.6)
Part loads					
(1) 85% of the torque obtained at maximum power					
47.8 (64.1)	2100	13.43 (2.95)	11.23 (24.76)	0.235 (0.386)	3.56 (21.7)
(2) Unloaded					
0	2183	3.79 (0.83)	3.17 (6.99)	-	-
(3) 50% of the torque defined in (1)					
24.5 (32.9)	2154	8.11 (1.78)	6.79 (14.97)	0.277 (0.455)	3.02 (18.4)
(4) Maximum power					
55.1 (73.9)	2060	15.61 (3.43)	13.06 (28.79)	0.237 (0.390)	3.53 (21.5)
(5) 25% of the torque defined in (1)					
12.2 (16.4)	2150	5.59 (1.23)	4.67 (10.30)	0.383 (0.630)	2.18 (13.3)
(6) 75% of the torque defined in (1)					
36.4 (48.8)	2136	10.75 (2.36)	8.99 (19.82)	0.247 (0.406)	3.39 (20.7)

No load, maximum engine speed — 2183 rev/min

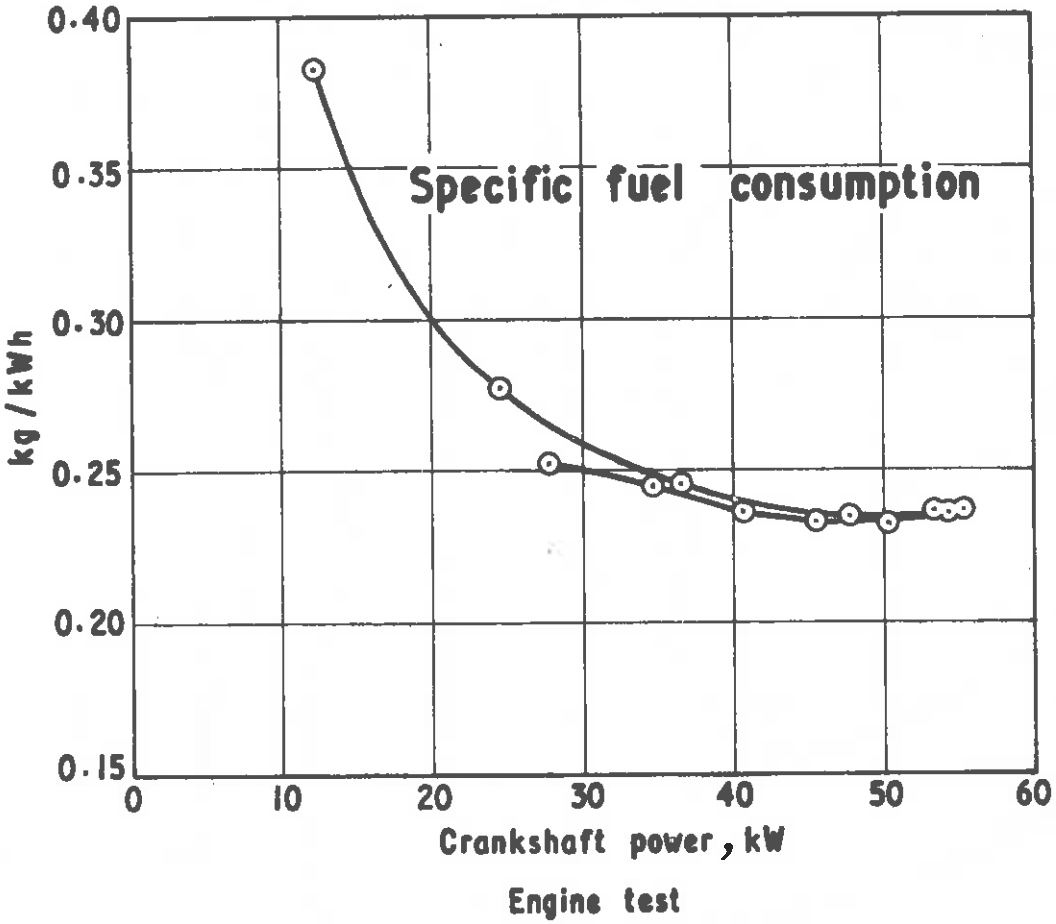
Crankshaft torque at maximum power — 255.5 Nm (188.4 lb ft)

Maximum crankshaft torque — 278.0 Nm (205.0 lb ft) at 1320 rev/min engine speed

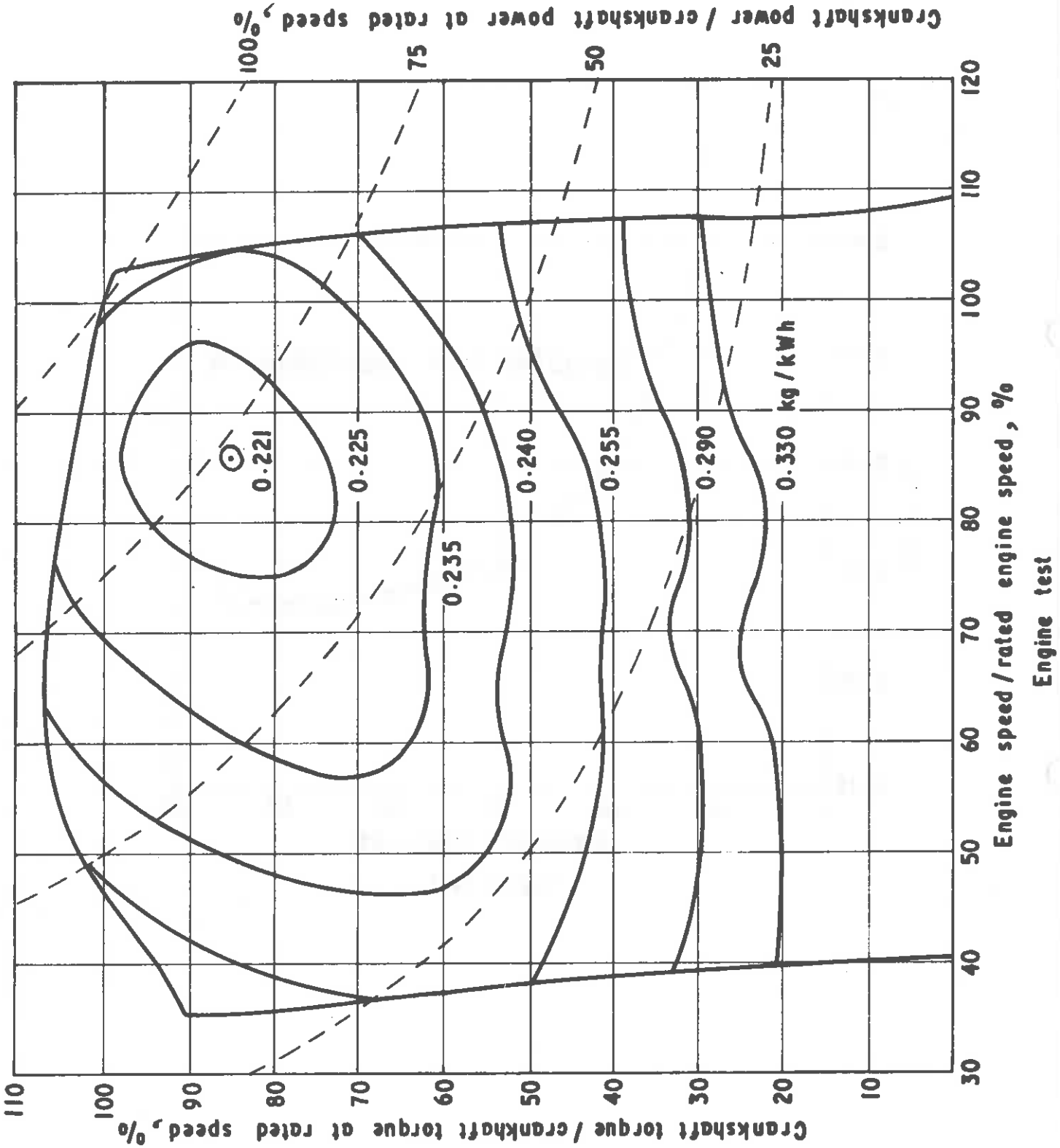
Mean atmospheric conditions	temperature	16 °C	(61 °F)
	pressure	1010 m bar	(29.83 in Hg)
	relative humidity	44%	
Maximum temperature	coolant	87 °C	(189 °F)
	engine oil	115 °C	(239 °F)
	fuel	34 °C	(93 °F)
	air intake	23 °C	(73 °F)


Crankshaft torque
Crankshaft power
Fuel consumption
Specific fuel consumption
Crankshaft power , kW
Crankshaft torque , Nm
kg/h
kg/kWh
Engine speed , rev/min
1000
1200
1400
1600
1800
2000
2200
0
10
20
30
40
50
60
100
150
200
250
300
5
15
0.2
0.3
0.4

Engine test


Specific fuel consumption
0.40
0.35
0.30
0.25
0.20
0.15
kg / kWh
0
10
20
30
40
50
60
Crankshaft power, kW

Engine test


Crankshaft power / crankshaft power at rated speed , %
100
75
50
25
0.221
0.225
0.235
0.240
0.255
0.290
0.330 kg/kWh
Crankshaft torque / crankshaft torque at rated speed , %
110
100
90
80
70
60
50
40
30
20
10
Engine speed / rated engine speed , %
30
40
50
60
70
80
90
100
110
120
Engine test

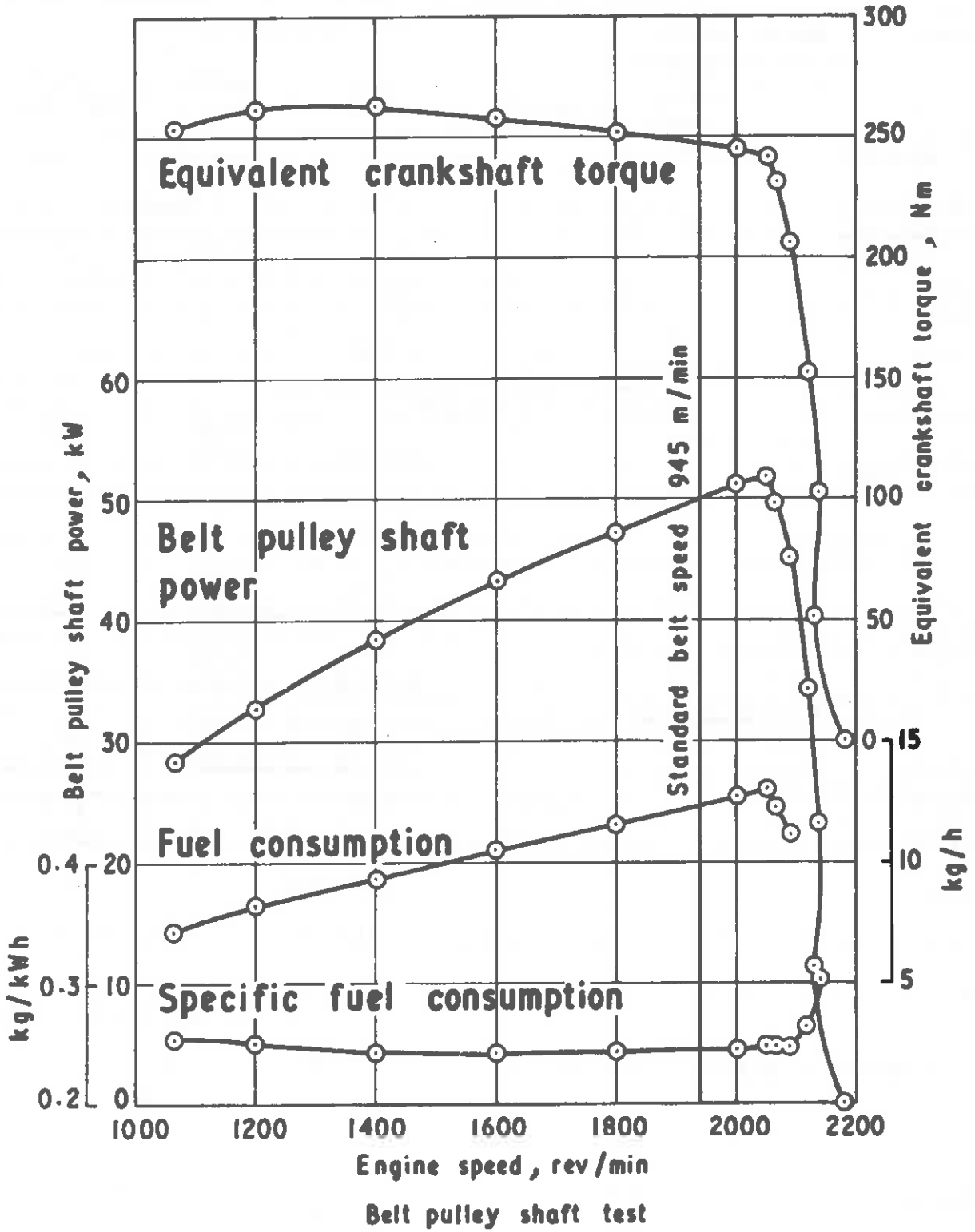
10. PERFORMANCE AT THE BELT PULLEY SHAFT

Date and location of tests: 13th January 1978, N.I.A.E., Silsoe, Bedford, U.K.

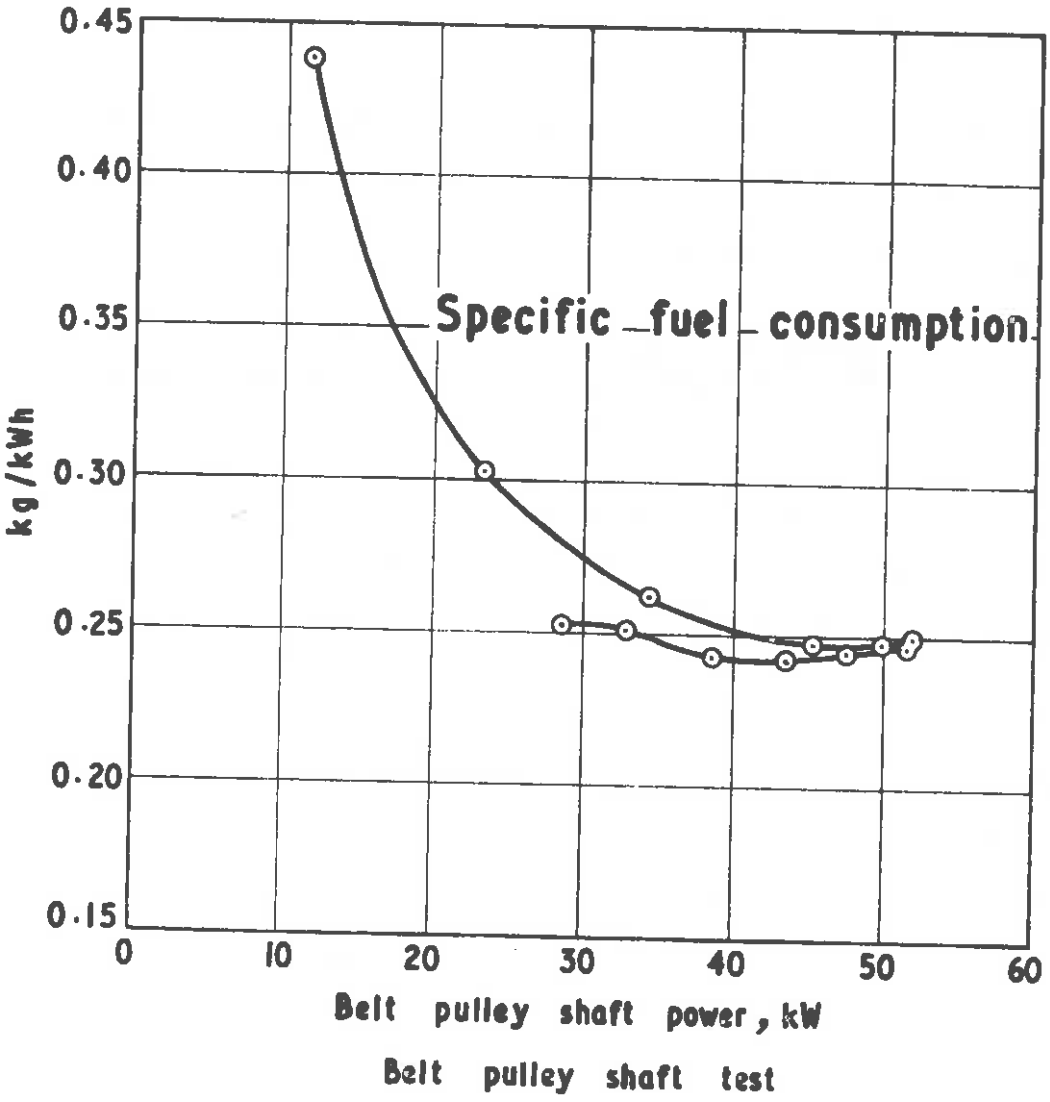
Type of dynamometer: Water brake, Heenan and Froude

Power, kW (hp)	Speed, rev/min		Fuel consumption,			
	Engine	Belt pulley shaft	l/h (UKgal/h)	kg/h (lb/h)	kg/kWh (lb/hph)	kWh/l (hph/UKgal)
Maximum power - 2 hour test						
51.9 (69.6)	2050	1221	15.51 (3.41)	12.98 (28.62)	0.250 (0.411)	3.35 (20.4)
Standard belt speed of 945 m/min (3100 ft/min)						
50.0 (67.1)	1942	1157	14.70 (3.23)	12.30 (27.12)	0.246 (0.404)	3.40 (20.7)
The speed recommended by the manufacturer for drawbar work						
51.4 (68.9)	2000	1191	15.18 (3.34)	12.70 (28.00)	0.247 (0.406)	3.39 (20.7)
Part loads						
(1) 85% of the torque obtained at maximum power						
45.0 (60.3)	2090	1245	13.34 (2.93)	11.16 (24.60)	0.248 (0.408)	3.37 (20.5)
(2) Unloaded						
0	2179	1298	3.80 (0.84)	3.18 (7.01)	-	-
(3) 50% of the torque defined in (1)						
23.0 (30.8)	2140	1275	8.36 (1.84)	6.99 (15.41)	0.304 (0.500)	2.75 (16.8)
(4) Maximum power						
51.9 (69.6)	2050	1221	15.51 (3.41)	12.98 (28.62)	0.250 (0.411)	3.35 (20.4)
(5) 25% of the torque defined in (1)						
11.5 (15.4)	2130	1269	6.02 (1.32)	5.04 (11.11)	0.438 (0.720)	1.91 (11.6)
(6) 75% of the torque defined in (1)						
34.2 (45.9)	2120	1263	10.75 (2.36)	8.99 (19.82)	0.263 (0.432)	3.18 (19.4)

No load, maximum engine speed		2179 rev/min	
Equivalent crankshaft torque at maximum power		241.8 Nm	(178.3 lb ft)
Maximum equivalent crankshaft torque		264.0 Nm at 1320 rev/min	(194.7 lb ft) engine speed
Mean atmospheric conditions	temperature	16 °C	(61 °F)
	pressure	1029 m bar	(30.39 in Hg)
	relative humidity	35%	
Maximum temperature	coolant	87 °C	(189 °F)
	engine oil	117 °C	(243 °F)
	fuel	38 °C	(100 °F)
	air intake	22 °C	(72 °F)



Belt pulley shaft test


0·45
0·40
0·35
0·30
0·25
0·20
0·15
kg/kWh
Specific fuel consumption
0
10
20
30
40
50
60
Belt pulley shaft power, kW
Belt pulley shaft test

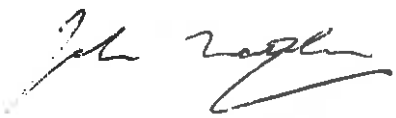
REPAIRS AND ADJUSTMENTS DURING TESTS — None

REMARKS — None

Test carried out by: F. Thistlethwaite, N.R. Baker, P.C. Seward

Officer in charge: D.W. Smith

Signed:  Head of Tractor Department

 for the Director

Date: 31/8/78