

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

Report on test of Massey-Ferguson 590 Tractor



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

Test No. R79/2/7020/O.E.C.D.

Date December 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: 60 hours

Tractor

Make: Massey-Ferguson
Model: M.F. 590
Type: Four wheel, rear wheel driven, unit
construction
Serial No.: G256206

Engine

Make: Perkins
Model: A4 248
Type: 4-stroke, direct injection diesel
Serial No.: 248 UA 745 984L
Cylinders: 4 cylinders, vertical, in-line, 101 mm
(4.0 in) dia bore x 127 (5.0 in) stroke,
capacity 4070 cm³ (248 in³), compression
ratio 16:1 (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 on pressure side of feed
pump; fuel tank capacity 98.0 l (21.6 U.K.
gal); C.A.V. distributor type DPA 3241
F 570 injection pump, Serial No. R13088RT,
manufacturer's production setting
14.9 - 15.7 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 6600 injector nozzles, injection
pressure 18.75 MPa (185 atm), pump delivery
starts 24° before T.D.C.

Governor:	C.A.V. mechanical, incorporated in fuel injection pump, governed range of engine speed 1000 to 2420 rev/min, rated engine speed 2200 rev/min
Air cleaner:	Lautrette, 3-stage paper element filter, 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 8.0 l o (14.0 pt), recommended oil S.A.E. 20W/30, viscosity 54 cSt at 50 °C (122 °F), oil and filter change period 250 hours
Cooling system:	Water cooled, pressurised at 69 kPa (10 lb/in ²) thermosyphon assisted by centrifugal pump, 394 mm (15.5 in) dia 6-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 manifold flame-type cold starting aid
Exhaust:	Silencer vertical above bonnet on right-hand side
<u>Electrical system</u>	
Voltage:	12, negative earth
Generator:	Lucas alternator type 23 A.C.R.
Battery:	Fulman, lead-acid, 120 Ah at 20-hour rating
<u>Transmission</u>	
Clutch:	Auburn Laycock, single plate, dry, pedal operated, 305 mm (12.0 in) dia
Gearbox:	Own make, 12 forward and 4 reverse speeds, comprising hydraulically operated Multi-power two range constant mesh input gears, 3 forward and 1 reverse sliding gear gearbox with manually operated high-low range epicyclic gear at output end
Rear axle and final drive:	Own make, crown wheel and pinion and differential, epicyclic reduction gear final drives; pedal-operated differential lock
Oil capacities:	Transmission 32.0 l (56.3 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), oil change period 500 hours, filter change period 250 hours.

Gear	Number of engine revolutions for one revolution of driving wheel	Nominal travelling speed for 2200 rev/min rated engine speed,* km/h (mile/h)	
Forward			
Low 1 LM	324.92	1.84	(1.14)
1 HM	251.39	2.38	(1.48)
2 LM	216.62	2.76	(1.72)
2 HM	167.59	3.56	(2.21)
3 LM	118.15	5.05	(3.14)
3 HM	91.41	6.53	(4.06)
High 1 LM	79.43	7.52	(4.67)
1 HM	61.45	9.72	(6.04)
2 LM	52.95	11.28	(7.01)
2 HM	40.97	14.58	(9.06)
3 LM	28.88	20.68	(12.85)
3 HM	22.35	26.72	(16.61)
Reverse			
Low LM	216.62	2.76	(1.72)
HM	167.59	3.56	(2.21)
High LM	52.95	11.28	(7.01)
HM	40.97	14.58	(9.06)

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

LM = Low multi-power

HM = High multi-power

Power take-off

At rear of tractor in vertical centre plane, height above ground 583 mm (23.0 in), distance behind rear axle 296 mm (11.6 in), 34.9 mm (1 $\frac{3}{8}$ in) dia, optional 6 or 21 spline stub shafts, to I.S.O. standard, when stub shaft is fitted in position the correct speed ratio is selected, engaged by hand-lever operating hydraulic clutch, independent of main clutch;

6-spline shaft: proportional engine speed giving 627 rev/min at 2200 rev/min rated engine speed, 540 rev/min (standard p.t.o. speed) at 1895 rev/min engine speed,

Power take-off continued ...

21-spline shaft: proportional engine speed giving 1158 rev/min at 2200 rev/min rated engine speed, 1000 rev/min (standard p.t.o. speed) at 1900 rev/min engine speed, direction of rotation clockwise viewed facing driving end

Power lift

Own make, live, hydraulic, 4 cylinder piston pump with suction side control, driven from forward end of p.t.o. shaft, oil supplied from transmission 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, vertical height to centre of clevis 347 mm (13.7 in) and 498 mm (19.6 in) changed by inverting drawbar, distance behind rear axle centre 537 mm (21.1 in) and 651 mm (25.6 in), distance behind p.t.o. 241 mm (9.5 in) and 355 mm (14.0 in), lateral adjustment 222 mm (8.7 in) and 393 mm (15.5 in), pivot position 130 mm (5.1 in) forward of rear wheel centre, drawbar pin hole 26 mm (1.0 in) dia

Steering

Danfoss hydrostatic, incorporating manual control for emergency, oil supplied from engine driven Plessey gear pump with integral reservoir

Brakes

Girling, 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, Goodyear Super Rib 7.50-18 cross-ply tyres, 8-ply rating, maximum permissible mass on each tyre 945 kg (2083 lb) at 370 kPa (54 lb/in²), track width 1345 mm (53.0 in) by 102 mm (4.0 in) steps to 1753 mm (69.0 in), changed by extending axle

Driving wheels:

Two at rear, power adjusted variable track type, 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/in²), track width 1523 mm (60.0 in) by 102 mm (4.0 in) steps to 1931 mm (76.0 in), changed by power shifting wheels, with wheels reversed, track width 1879 mm (74.0 in) by 102 mm (4.0 in) steps to 2389 mm (94 in)

Wheelbase: 2290 mm (90.2 in)

Seat Bostrom X, upholstered pan, torsion bar suspension with hydraulic damping, adjustable for driver's weight; range of adjustment 187 mm (7.4 in) forwards and backwards

Safety cab (CS 1010B) Massey-Ferguson, welded pressed plate and sheet steel, anti-vibration mounts, door and mounting step on left-hand side, heating, ventilating and demisting systems in roof

Lighting

Unrestricted beam angle of headlight in plan view 132°

	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)
Head lights	953 (37.5)	127 (5.0) dia	835 (32.9)
Side lights	1593 (62.7)	102 (4.0) x 38 (1.5)	423 (16.7)
Rear lights	1604 (63.1)	83 (3.3) x 38 (1.5)	429 (16.9)
Reflectors	1411 (55.6)	51 (2.0) dia	295 (11.6)

Number of grease points

Whole tractor: 9

CONDITIONS DURING TEST

Masses

Tractor (without driver but with tanks full)

	Front, kg (lb)	Rear, kg (lb)	Total, kg (lb)
Without ballast	1089 (2401)	2195 (4839)	3284 (7240)
With ballast	1662 (3664)	4157 (9164)	5819 (12828)

Ballast

	Number of weights	Total mass, kg (lb)	Water, kg (lb)
Front wheels	Nil	Nil	Nil
Rear wheels	28	1326 (2923)	763 (1682)
Additional	10	446 (983)	Front frame and weights

Track setting during tests

Front - 1345 mm (53.0 in)

Rear - 1523 mm (60.0 in)

Overall dimensions

	Length, m (in)	Width, m (in)	Height, m (in) To top of exhaust	To top of cab
With ballast	4.28 (168.5)	3.37 (132.7)	2.55 (100.4)	2.54 (100.0)
Without ballast	3.82 (150.4)	2.00 (78.7)	2.55 (100.4)	2.54 (100.0)

Minimum ground clearance 377 mm (14.8 in) to underside of drawbar frame

FUEL AND LUBRICANTS USED IN TESTS

Fuel:	Laboratory tests:	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
	Track tests:	Diesel oil to Class A2 British Standard 2869:1970, specific gravity 0.849 at 15 °C (59 °F), viscosity 2.90 cSt at 50 °C (122 °F), Cetane No. 55.0
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)

COMPULSORY TESTS

1. MAIN POWER TAKE-OFF PERFORMANCE

Date and location of tests: 10th May 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						
53.6 (71.9)	2270	1195	17.61 (3.87)	14.74 (32.50)	0.275 (0.452)	3.04 (18.5)
The speed recommended by the manufacturer for drawbar work						
52.6 (70.5)	2200	1158	16.97 (3.73)	14.20 (31.31)	0.270 (0.444)	3.10 (18.9)
Part loads, the governor hand lever set for maximum engine speed						
(1) 85% of the torque obtained at maximum power						
46.3 (62.1)	2310	1216	15.65 (3.44)	13.10 (28.88)	0.283 (0.465)	2.96 (18.0)
(2) Unloaded						
0	2404	1265	5.57 (1.23)	4.66 (10.27)	-	-
(3) 50% of the load defined in (1)						
23.7 (31.8)	2365	1245	10.19 (2.24)	8.53 (18.81)	0.360 (0.592)	2.33 (14.2)
(4) Maximum power						
53.6 (71.9)	2270	1195	17.61 (3.87)	14.74 (32.50)	0.275 (0.452)	3.04 (18.5)
(5) 25% of the load defined in (1)						
12.0 (16.1)	2384	1255	8.53 (1.88)	7.14 (15.74)	0.595 (0.978)	1.41 (8.6)
(6) 75% of the load defined in (1)						
35.2 (47.2)	2341	1232	12.87 (2.83)	10.77 (23.74)	0.306 (0.503)	2.74 (16.6)

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)
Part loads, the governor hand lever in the position corresponding to the standard p.t.o. speed at full load (1000 rev/min)						
(1) 85% of the torque obtained at maximum power						
42.4 (56.9)	1935	1018	12.96 (2.85)	10.85 (23.92)	0.256 (0.421)	3.27 (19.9)
(2) Unloaded						
0	2062	1085	4.01 (0.88)	3.36 (7.41)	-	-
(3) 50% of the load defined in (1)						
21.9 (29.4)	2000	1053	8.14 (1.79)	6.81 (15.01)	0.311 (0.511)	2.69 (16.4)
(4) Maximum power						
49.0 (65.7)	1900	1000	15.28 (3.36)	12.79 (28.20)	0.261 (0.429)	3.21 (19.6)
(5) 25% of the load defined in (1)						
11.2 (15.0)	2035	1071	6.13 (1.35)	5.13 (11.31)	0.458 (0.753)	1.83 (11.2)
(6) 75% of the load defined in (1)						
32.5 (43.6)	1975	1039	10.60 (2.33)	8.87 (19.55)	0.273 (0.449)	3.07 (18.7)

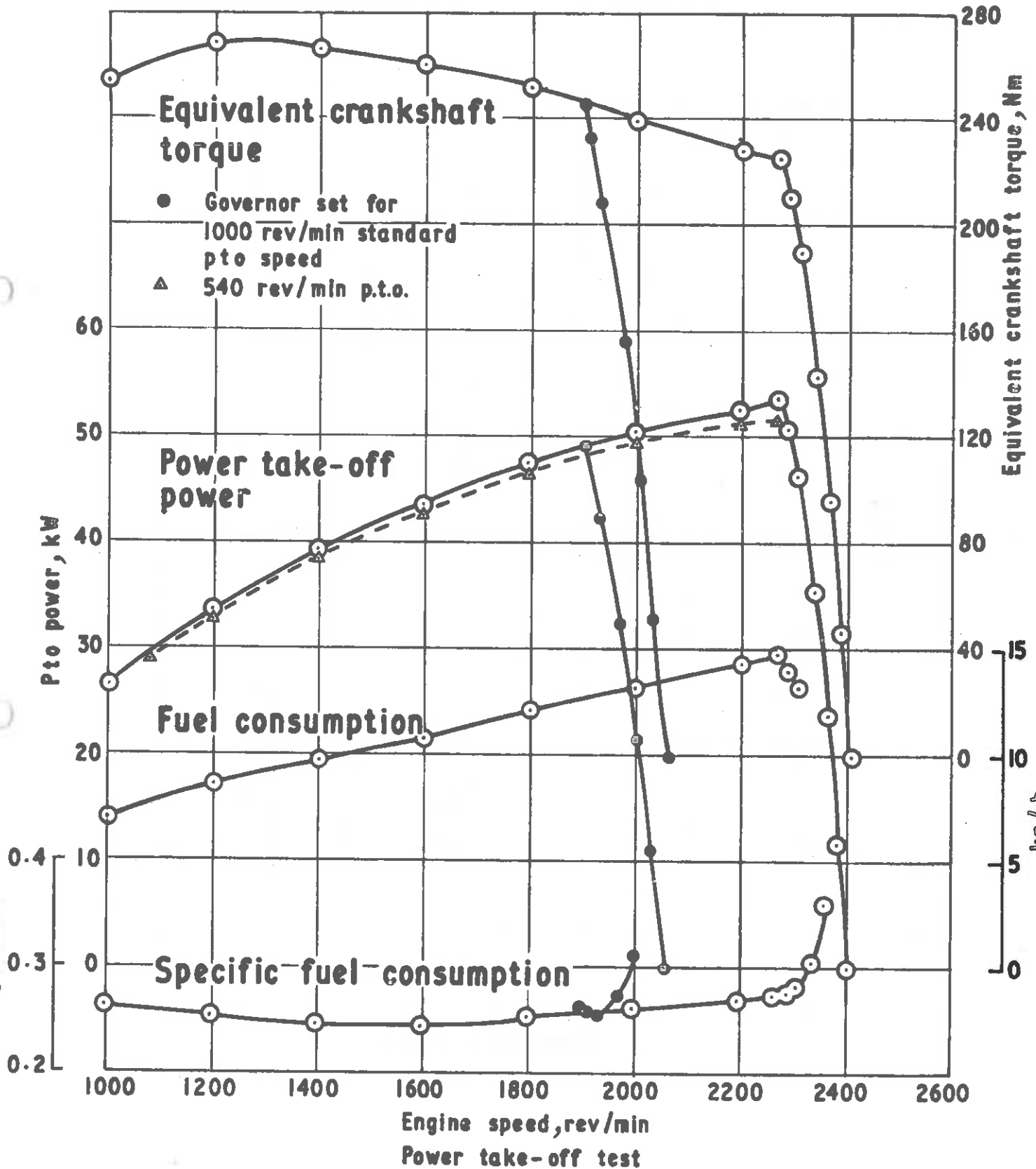
Standard specific fuel consumption, kg/kWh (lb/hph)

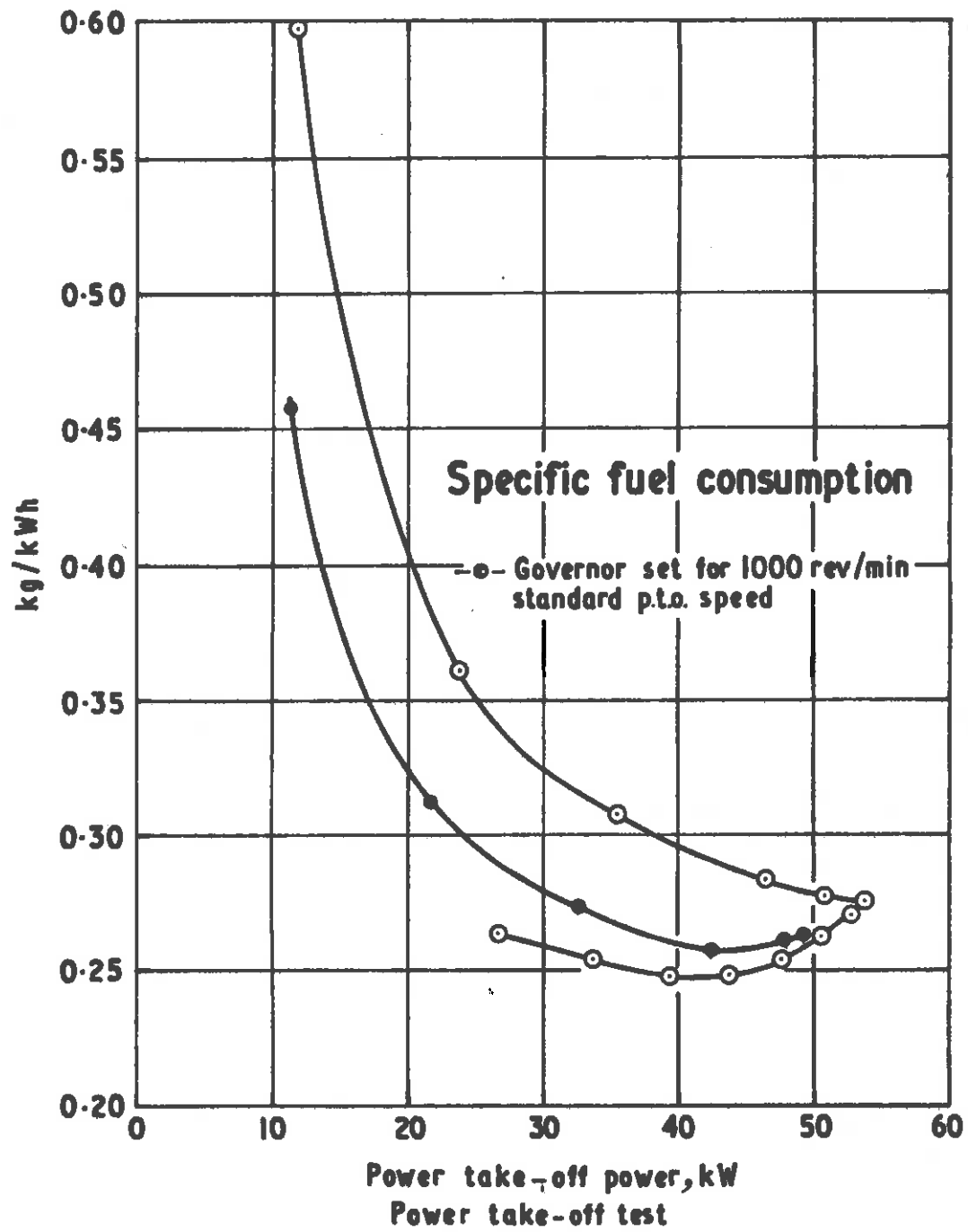
(a) 0.283 (0.465) (b) 0.360 (0.592) (c) 0.256 (0.421) (d) 0.311 (0.511)

No load, maximum engine speed	2404 rev/min
Equivalent crankshaft torque at maximum power	225.3 Nm (166.2 lb ft)
Maximum equivalent crankshaft torque	269.4 Nm (198.7 lb ft) at 1300 rev/min engine speed
Mean atmospheric conditions	temperature 18 °C (64 °F)
	pressure 1027 m bar (30.33 in Hg)
	relative humidity 56%
Maximum temperature	coolant 92 °C (198 °F)
	engine oil 123 °C (253 °F)
	fuel 33 °C (91 °F)
	air intake 26 °C (79 °F)

The following results were obtained with the 540 rev/min p.t.o.

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						
51.8 (69.5)	2270	647	17.57 (3.86)	14.71 (32.43)	0.284 (0.467)	2.95 (18.0)
Standard p.t.o. speed (540 rev/min)						
48.1 (64.5)	1895	540	15.11 (3.32)	12.65 (27.89)	0.263 (0.432)	3.18 (19.4)
The speed recommended by the manufacturer for drawbar work						
51.4 (68.9)	2200	627	17.19 (3.78)	14.39 (31.72)	0.280 (0.460)	2.99 (18.2)





2 DRAWBAR PERFORMANCE Date of tests: 9th - 25th August 1976 Type of track: Concrete Height of drawbar above ground: 410 mm (16.1 in)

Gear	Power, kW (hp)	Drawbar pull, kN (lb)	Speed, km/h (mile/h)	Engine speed, rev/min	Wheel-slip, %	Specific fuel consumption,		Temperature, °C (°F)			Atmospheric conditions		
						kg/kWh (lb/hph)	kWh/l (hph/UKgal)	Coolant	Fuel	Engine oil	Temperature, °C (°F)	Relative humidity, %	Pressure, millibar (in Hg)
(i) MAXIMUM POWER (ballasted)													
L1 IM	20.1* (27.0)	43.0 (9670)	1.68 (1.04)	2356	15.0	0.414 (0.681)	2.05 (12.4)	86 (187)	23 (73)	106 (223)	17 (63)	79	1012 (29.88)
L1 HM	26.1* (35.0)	43.0 (9670)	2.19 (1.36)	2340	15.0	0.368 (0.605)	2.31 (14.1)	85 (185)	23 (73)	111 (232)	16 (61)	78	1012 (29.88)
L2 IM	29.2* (39.2)	43.0 (9670)	2.44 (1.52)	2329	15.0	0.354 (0.582)	2.40 (14.6)	86 (187)	24 (75)	111 (232)	17 (63)	79	1012 (29.88)
L2 HM	37.4* (50.2)	43.0 (9670)	3.13 (1.94)	2306	15.0	0.328 (0.540)	2.59 (15.8)	87 (189)	26 (79)	110 (230)	17 (63)	79	1019 (30.09)
L3 IM	44.3 (59.4)	35.0 (7870)	4.56 (2.83)	2267	11.3	0.310 (0.510)	2.74 (16.7)	87 (189)	28 (82)	119 (246)	17 (63)	79	1019 (30.09)
L3 HM	45.5 (61.0)	26.8 (6020)	6.11 (3.80)	2270	8.3	0.308 (0.506)	2.76 (16.8)	88 (190)	31 (88)	114 (237)	18 (64)	84	1019 (30.09)
H1 IM	46.6 (62.5)	23.0 (5170)	7.29 (4.53)	2270	6.8	0.294 (0.483)	2.89 (17.6)	89 (192)	28 (82)	119 (246)	20 (68)	67	1022 (30.18)
H1 HM	45.5 (61.0)	17.0 (3820)	9.64 (5.99)	2270	4.9	0.302 (0.496)	2.81 (17.1)	88 (190)	32 (90)	104 (219)	24 (75)	54	1022 (30.18)
H2 IM	45.8 (61.4)	15.0 (3370)	10.99 (6.83)	2270	4.3	0.299 (0.492)	2.84 (17.3)	87 (189)	35 (95)	117 (243)	21 (70)	59	1022 (30.18)
(ii) FIVE HOUR TEST AT 75% OF FULL AT MAXIMUM POWER													
L3 HM	35.7 (47.9)	20.1 (4520)	6.39 (3.97)	2308	6.0	0.319 (0.524)	2.66 (16.6)	88 (190)	31 (88)	119 (246)	21 (70)	68	1001 (29.56)
(iii) FIVE HOUR TEST AT FULL CORRESPONDING TO 15% WHEELSLIP IN TEST (i)													
L2 HM	-	43.0 (9670)	3.25 (2.02)	2304	-	-	-	87 (189)	32 (90)	120 (248)	18 (64)	74	1009 (29.80)

Gear	Power, kW (hp)	Drawbar pull, kN (lb)	Speed, km/h (mile/h)	Engine speed, rev/min	Wheel-slip, %	Specific fuel consumption,		Temperature, °C (°F)			Atmospheric conditions			
						kg/kWh (lb/hph)	kWh/l (hph/UKgal)	Coolant	Fuel	Engine oil	Temperature, °C (°F)	Relative humidity, %	Pressure, millibar (in Hg)	
(iv) MAXIMUM POWER (unballasted)														
L2 HM	24.8* (33.3)	27.7 (6230)	3.22 (2.00)	2338	15.0	-	-	86 (187)	30 (86)	109 (228)	22 (72)	61	1025 (30.27)	
L3 LM	34.8* (46.7)	27.7 (6230)	4.52 (2.81)	2320	15.0	-	-	86 (187)	29 (84)	106 (223)	23 (73)	61	1025 (30.27)	
L3 HM	44.4 (59.5)	27.0 (6070)	5.92 (3.68)	2270	13.5	-	-	88 (190)	26 (79)	110 (230)	19 (66)	85	1025 (30.27)	
H1 LM	45.5 (61.0)	22.6 (5080)	7.25 (4.51)	2270	9.1	-	-	87 (189)	24 (75)	94 (201)	19 (66)	85	1025 (30.27)	
H1 HM	46.2 (62.0)	17.5 (3930)	9.50 (5.90)	2250	6.7	-	-	88 (190)	28 (82)	108 (226)	19 (66)	85	1025 (30.27)	
H2 LM	47.9 (64.2)	15.6 (3510)	11.05 (6.87)	2270	5.9	-	-	87 (189)	20 (68)	87 (189)	19 (66)	85	1025 (30.27)	

Total oil consumption during ten hours duration of tests (ii) and (iii) 50.1 g/h (0.110 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 - 1345 mm (53.0 in)
rear - 1523 mm (60.0 in)

	With brakes		Without brakes	
	Right hand	Left hand	Right hand	Left hand
Radius of turning space, $\frac{m}{(in)}$	3.81 (150)	3.75 (148)	4.24 (167)	4.10 (161)
Radius of turning circle, $\frac{m}{(in)}$	3.71 (146)	3.65 (144)	4.14 (163)	4.00 (157)

4. LOCATION OF CENTRE OF GRAVITY

Height above ground, mm (in)	922 (36.3)
Distance forward from the vertical plane containing the axis of the rear wheels, mm (in)	752 (29.6)
Distance from the median plane of the tractor, mm (in)	0

5. BRAKING

Date of tests:

18th - 22nd August 1978

Type of track:

Concrete

Type of decelerometer:

Moto Meter, recording type

Mass of ballasted tractor:

5819 kg (12828 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)	4.1 (13.5)	4.1 (13.5)
Stopping distance, m (ft)	6.9 (22.6)	6.8 (22.3)
Force on brake pedal, N (lb)	350 (79)	500 (112)
Force exerted on the brake pedal to achieve a deceleration of $2.5 m/s^2$ (8.2 ft/s ²), N (lb)	200 (45)	332 (75)

Brake fade characteristics (hot tests)

Maximum deceleration hot/cold, %	100	104
Stopping distance cold/hot, %	103	106
Force on pedal cold/hot, %	100	100

Parking brake

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

Pull on handbrake: 267 N (60 lb)

6. MEASUREMENT OF AMBIENT NOISE EMITTED BY THE TRACTOR

Date of tests: 4th September 1978
 Type of sound level meter: Bruel and Kjaer 2209
 Type of track: Concrete
 Results of tests
 Gear: H3 HM
 Travelling speed before acceleration: 21.1 km/h (13.1 mile/h)
 Sound level: 88 dBA

7. NOISE MEASUREMENT AT THE DRIVER'S EAR LEVEL

Date of tests: 4th September 1978
 Type of sound level meter: Bruel and Kjaer 2209
 Type of track: Concrete

Gear	Travelling speed, km/h (mile/h)	dBA
H1LM	7.8 (4.8)	85

8. POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date of tests: 11th - 22nd September 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): 21.4 - 22.4 MPa (3100 - 3250 lb/in²)

Pump characteristics

i) Opening pressure of relief valve: 18.7 MPa (2710 lb/in²)

Sustained pressure of the open relief valve: 22.0 MPa (3190 lb/in²)

ii) Pump delivery rate at minimum pressure and rated engine speed: 26.3 l/min (5.8 gal/min)

iii) Pump delivery rate at maximum hydraulic power: 27.5 l/min (6.0 gal/min)

Delivery pressure: 18.7 MPa (2710 lb/in)

Power: 8.6 kW (11.5 hp)

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

	Maximum mechanical advantage	Minimum mechanical advantage
Projected length in side view		
Lower links	952	952
Lift arms	(37.5)	(37.5)
Lift rods	225	225
Top link	(8.9)	(8.9)
	678	678
	(26.7)	(26.7)
	735	713
	(28.9)	(28.1)
* Distance of lift rod connection point from pivot point of lower link		
	427	427
	(16.8)	(16.8)
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
Top link pivot point	186 (7.3) behind,	205 (8.1) above
Lift arm pivot point	196 (7.7) forward,	233 (9.2) above
* Maximum and minimum height of lower link hitch points	160 (6.3) above,	470 (18.5) below
Height of lower link hitch points when locked in transport position	Any height within lift range	Any height within lift range

* The lower links have two holes for connection of the lift rods, one above the other but both the same distance from the pivot point

Power lift performance

Lifting height in relation to a horizontal line through the lower link pivoting point	mm (in)	-260 (10.2)	-240 (9.4)	-200 (7.9)	-160 (6.3)	-80 (3.1)	0	+80 (3.1)	+160 (6.3)	+240 (9.4)	+320 (12.6)	+360 (14.2)	+400 (15.7)	+420 (16.5)	+600 (23.6)
At the hitch points Lifting force with the pressure at maximum hydraulic power (18.7 MPa (2710 lb/in ²)), calculated from measurements made at maximum pressure (22.0 MPa (3190 lb/in ²)), kN (lb)	max. mech. advantage		* 19.7 (4430)	20.3 (4560)	20.8 (4680)	21.6 (4860)	21.7 (4880)	21.8 (4900)	21.8 (4900)	21.8 (4900)	21.9 (4920)	22.1 (4970)			
	min. mech. advantage				* 19.4 (4360)	20.7 (4650)	21.4 (4810)	21.8 (4900)	22.0 (4950)	22.1 (4970)	22.2 (4990)	22.3 (5010)	22.5 (5060)	22.6 (5080)	
On the frame	max. mech. advantage	20.5 (4610)	20.6 (4630)	20.7 (4650)	20.7 (4650)	20.4 (4590)	19.9 (4470)	19.4 (4360)	18.8 (4230)	18.2 (4090)	17.5 (3930)	17.2 (3870)	17.0* (3820)		
	min. mech. advantage			17.2 (3870)	17.5 (3930)	17.7 (3980)	17.6 (3960)	17.3 (3890)	16.9 (3800)	16.5 (3710)	15.9 (3570)	15.6 (3510)	15.4 (3460)	15.2 (3420)	14.2* (3190)

* 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

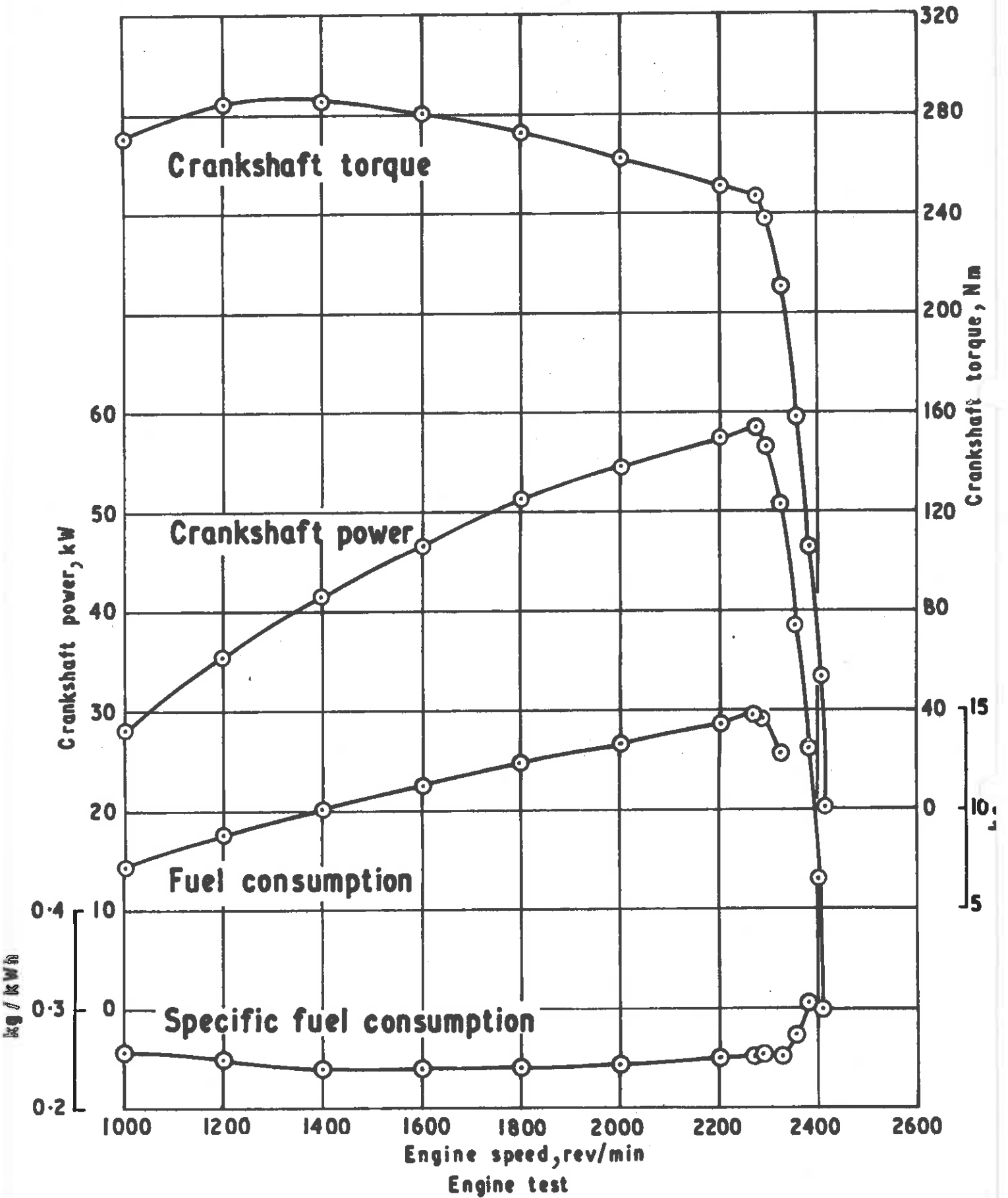
9. PERFORMANCE AT ENGINE CRANKSHAFT

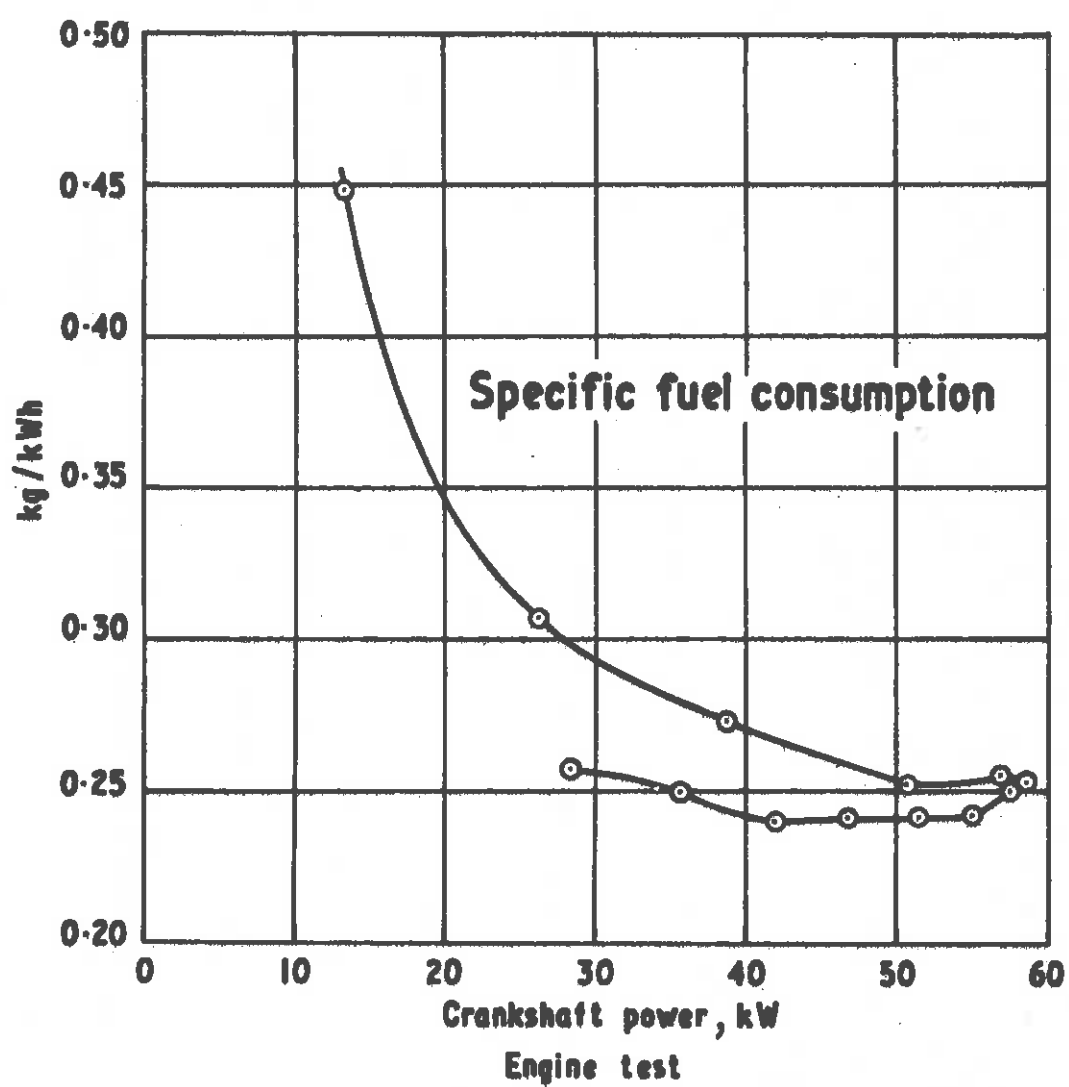
Date and location of tests: 4th May 1978, N.I.A.E., Silsoe, Bedford, U.K.

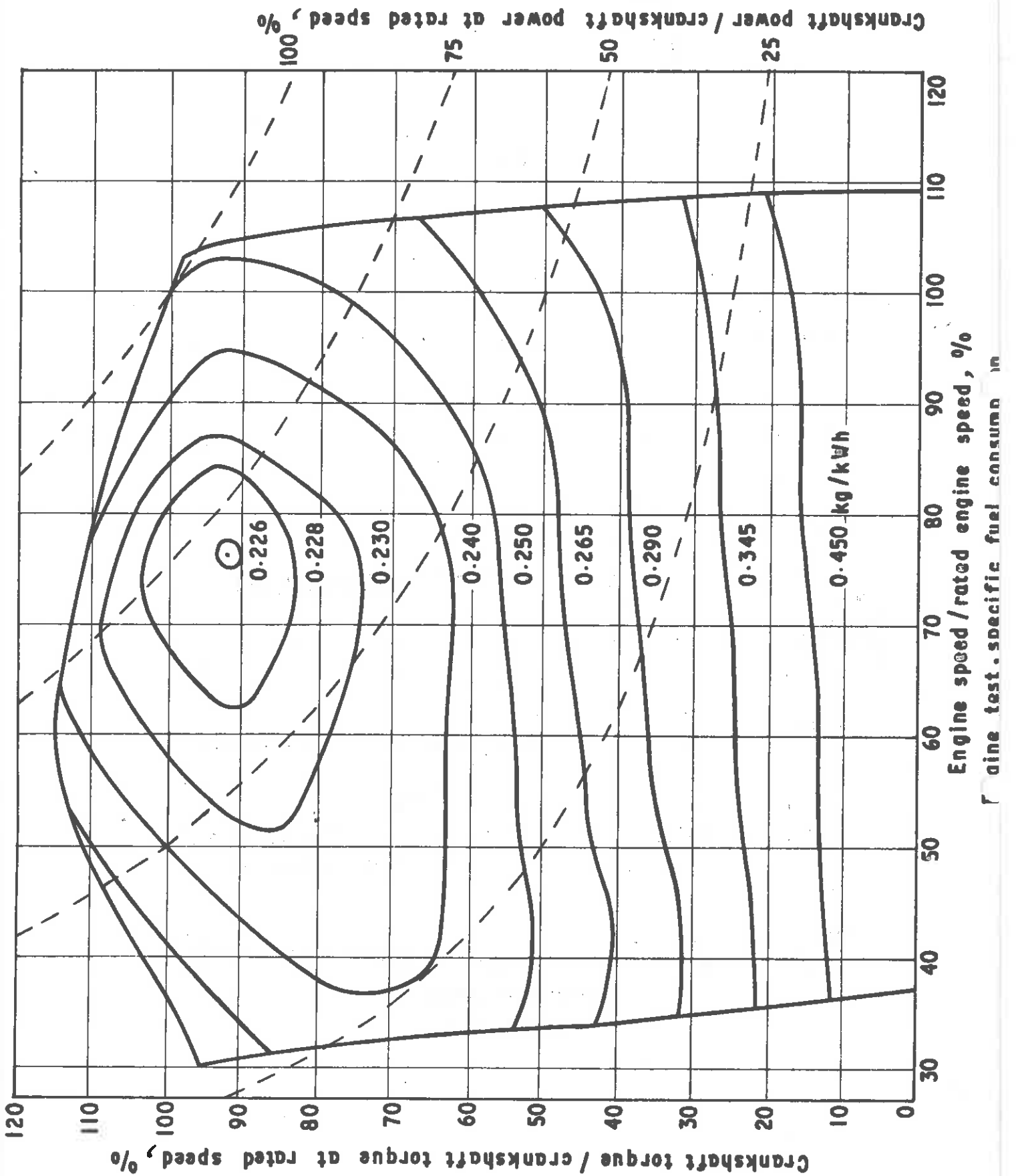
Type of dynamometer: Water brake, Heenan and Froude

Power, kW (hp)	Speed, rev/min	Fuel consumption,			
		l/h (UKgal/h)	kg/h (lb/h)	kg/kWh (lb/hph)	kWh/l (hph/UKgal)
Maximum power - 2 hour test					
58.5 (78.4)	2270	17.68 (3.89)	14.80 (32.63)	0.253 (0.416)	3.31 (20.2)
The speed recommended by the manufacturer for drawbar work					
57.5 (77.1)	2200	17.18 (3.78)	14.38 (31.70)	0.250 (0.411)	3.35 (20.4)
Part loads					
(1) 85% of the torque obtained at maximum power					
50.9 (68.3)	2323	15.33 (3.37)	12.83 (28.28)	0.252 (0.414)	3.32 (20.2)
(2) Unloaded					
0	2404	5.57 (1.23)	4.66 (10.27)	-	-
(3) 50% of the load defined in (1)					
26.1 (35.0)	2380	9.57 (2.11)	8.01 (17.66)	0.307 (0.505)	2.73 (16.6)
(4) Maximum power					
58.5 (78.4)	2270	17.68 (3.89)	14.80 (32.63)	0.253 (0.416)	3.31 (20.2)
(5) 25% of the load defined in (1)					
13.2 (17.7)	2402	7.08 (1.56)	5.93 (13.07)	0.449 (0.738)	1.86 (11.3)
(6) 75% of the load defined in (1)					
38.7 (51.9)	2355	12.66 (2.78)	10.60 (23.37)	0.274 (0.450)	3.06 (18.7)

No load, maximum engine speed	2404 rev/min
Crankshaft torque at maximum power	246.1 Nm (181.5 lb ft)
Maximum crankshaft torque	285.5 Nm (210.6 lb ft) at 1300 rev/min engine speed
Mean atmospheric conditions	temperature 20 °C (68 °F)
	pressure 1010 m bar (29.83 in Hg)
	relative humidity 62 %
Maximum temperature	coolant 93 °C (199 °F)
	engine oil 127 °C (261 °F)
	fuel 31 °C (88 °F)
	air intake 24 °C (75 °F)







REPAIRS AND ADJUSTMENTS DURING TESTS: None

REMARKS: None

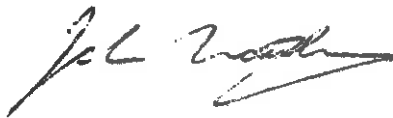
Test carried out by: N.R. Baker, P.C. Seward

Officer in charge: D.W. Smith

Signed:



Head of Tractor Department



for the Director

Date:

8/1/79



