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

FORD 4100 TRACTOR



Test No.: R76/7929/O.E.C.D.

Manufacturer: Ford Motor Company Limited,
Basildon,
Essex.

NATIONAL INSTITUTE OF AGRICULTURAL ENGINEERING

Wrest Park . Silsoe . Bedford MK45 4HS

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SPECIFICATION OF TRACTOR

Manufacturer:	Ford Motor Company Limited, Basildon, Essex
Submitted for test by:	The manufacturer
Selected for test by:	The manufacturer with the agreement of the testing station
Place of running-in:	Basildon
Duration of running-in:	140 hours

Tractor

Make:	Ford
Model:	4100
Type:	Four wheel, rear wheel driven, unit construction
Serial No.:	B273758

Engine

Make:	Ford
Model:	4100
Type:	4-stroke, direct injection diesel
Serial No.:	KO44818
Cylinders:	3 cylinders, vertical, in-line, 106·7 mm (4·2 in) dia bore × 111·8 mm (4·4 in) stroke, capacity 2997 cm^3 (183 in^3), compression ratio 16·3 : 1 (nominal), monobloc construction, overhead valves
Fuel system:	Gravity feed; C.A.V. twin paper element fuel filters with sediment bowl and water trap; fuel tank capacity 49·1 l (10·8 U.K. gal); C.A.V. type 3233 F640 distributor injection pump, serial No. R30246NT, manufacturer's production setting for injection pump: 11·72–12·45 cm^3 for 200 injections at 900 rev/min pump speed (test bench figures); C.A.V. BDLL 150S 6665 injector nozzles, injection pressure 19·4–20·0 MPa (191–197 atm), injectors open 16° before T.D.C.
Governor:	C.A.V., mechanical, incorporated in fuel injection pump, governed range of engine speed 600–2475 rev/min, rated engine speed 2200 rev/min
Air cleaner:	Burgess, oil bath, oil capacity 1·42 l (2·5 pt), situated forward of radiator, centrifugal pre-cleaner above bonnet
Lubrication system:	Force feed from eccentric rotor pump with metal strainer in sump; full flow replaceable element filter; total oil capacity 6.65 l (11·7 pt), recommended oil Series 3 quality, viscosity 65 cSt at 50 °C (122 °F), change period 300 hours
Cooling system:	Water cooled, pressurised at 50 kPa (7 lb/in^2), impeller-assisted with 406 mm (16·0 in) dia belt driven 4-blade fan, thermostat for temperature control, cooling water capacity 10·4 l (18·3 pt)
Starting system:	Electrical, 12V Lucas M50 G solenoid-engaged starter motor, operable only when high–low gear selector lever is in neutral position

Electrical system

Voltage:	12, negative earth
Generator:	Lucas alternator, type 15 ACR
Battery:	Ford type C5NN 10655-G lead acid, 120–128 Ah at 20-hour rating

Transmission

Clutch: Borg and Beck single plate dry clutch, pedal-operated, 279 mm (11·0 in) dia

Gearbox: Ford, constant mesh, 8 forward and 2 reverse speeds, comprising 4 forward and 1 reverse speed gearbox with high–low range selector

Rear axle and final drive: Ford, crown wheel and pinion with differential and epicyclic reduction gear final drives; pedal-operated differential lock

Oil capacity: Gearbox 12·96 l (22·8 pt), final drive 45·8 l (80·6 pt), recommended oil Mild E.P. S.A.E. 80, viscosity 54 cSt at 50 °C (122 °F), change period 1200 hours

Gear	*Number of engine revolutions for one revolution of driving wheel*	*Nominal travelling speed for 2200 rev/min rated speed of engine*, km/h*	*(mile/h)*
Forward			
Low 1	228·11	2.47	(1.53)
2	182·77	3·08	(1·91)
3	104·14	5·40	(3·36)
4	76·51	7·35	(4·57)
High 1	63·85	8·81	(5·47)
2	51·16	10·99	(6·83)
3	29·15	19·29	(11·99)
4	21·41	26·26	(16·32)
Reverse			
1	158·69	3·54	(2·20)
2	44·41	12·66	(7·87)

*Calculated with tyre rolling radius of 678 mm (26·7 in)

Power take-off At rear of tractor in vertical centre plane, 6 spline, 34·9 mm (1⅜ in) dia, to I.S.O. standard, manually engaged by hand lever, hydraulic clutch, independent of main clutch, height above ground 581 mm (22·9 in), proportional engine speed giving 660 rev/min at 2200 rev/min rated engine speed, 540 rev/min (standard p.t.o. speed) at 1800 rev/min engine speed, direction of rotation clockwise viewed facing driving end

Power lift Ford, hydraulic, gear pump driven from power take-off shaft, independent of main and p.t.o. clutches, oil supplied from rear axle housing to ram cylinder and external tapping; Category 1 and 2 implement linkage with interchangeable ball ends, top link sensing, draught or position control with auxiliary service control and flow control device

Drawbar Swinging drawbar, vertical height to centre of clevis 548 mm (21·6 in), 452 mm (17·8 in), 411 mm (16·2 in) and 313 mm (12·3 in), changed by inverting drawbar and clevis, distance from rear axle centre 645 mm (25·4 in) and 759 mm (29·9 in) to rear, position relative to p.t.o. 248 mm (9·8 in) and 362 mm (14·3 in) to rear, lateral adjustment 381 mm (15·0 in) and 451 mm (17·8 in), pivot position in line with rear wheel centre, drawbar pin hole 27 mm (1·1 in) dia

Steering Cam Gears, recirculating ball type with double drop arms and drag links

Brakes Oil-immersed multi-plate disc brakes mounted on planetary shafts, independent or combined pedal-operated, hand lever with ratchet operating both brakes for parking

Wheels

Steering wheels: Two at front, Firestone Ribbed Tractor 7·50–16 cross-ply tyres, 6-ply rating, maximum permissible mass on each tyre 744 kg (1640 lb) at 220 kPa (32 lb/in²), track width 1358 mm (53·5 in) by 102 mm (4·0 in) steps to 2072 mm (81·6 in), changed by extending axle and reversing wheels

Driving wheels: Two at rear, Goodyear Traction Sure Grip 12·4/11–36 cross-ply tyres, 6-ply rating, maximum permissible mass on each tyre 1347 kg (2970 lb) at 145 kPa (21 lb/in²), track width 1422 mm (56·0 in) by 102 mm (4·0 in) steps to 2034 mm (80·1 in), changed by reversing wheels and offset lug rims

Wheelbase: 1969 mm (77·5 in)

Lighting

Unrestricted beam angle of headlight in plan view 130°

	Height above ground of centre, *mm*	(*in*)	*Size,* *mm*	(*in*)	*Distance from outside edge of tractor at 1422 mm (56·0 in) wheel track, to centre,* *mm*	(*in*)
Headlights	1149	(45·2)	127 (5·0) dia		494	(19·4)
Side lights	1514	(59·6)	70 (2·8) × 70 (2·8)		197	(7·8)
Rear lights	1511	(59·5)	70 (2·8) × 70 (2·8)		156	(6·1)
Reflectors	1511	(59·5)	70 (2·8) × 57 (2·2)		235	(9·3)

Number of grease points

Whole tractor: 10

CONDITIONS DURING TEST

Masses

Tractor (without driver but with tanks full)

	Front, *kg*	(*lb*)	*Rear,* *kg*	(*lb*)	*Total,* *kg*	(*lb*)
Without ballast	761	(1678)	1292	(2848)	2053	(4526)
With ballast	761	(1678)	2363	(5210)	3124	(6887)

Ballast

	Number of weights	*Total mass,* *kg*	(*lb*)	*Water* *kg*	(*lb*)
Front wheels	Nil	Nil		Nil	
Rear wheels	14	672	(1482)	399	(880)
Additional	Nil	Nil		Nil	

Track setting during tests

Front: 1358 mm (53·5 in)

Rear: 1422 mm (56·0 in)

Overall dimensions

	Length	*Width*	*Height*
With ballast	3·429 m (135·0 in)	2·388 m (94·0 in)	2·280 m (89·8 in)
Without ballast	3·429 m (135·0 in)	1·740 m (68·5 in)	2·283 m (89·9 in)

Overall height measured to top of exhaust pipe

Seat Sifra, upholstered pan, torsion coupling suspension with rubber plug damping, adjustable for driver's weight, range of adjustment 38 mm (1·50 in) forwards and backwards

FUEL AND LUBRICANTS USED IN TESTS

Fuel: Diesel oil to class A2 British Standard 2869: 1970, specific gravity 0·843 at 15·6°C (60°F), viscosity 2·36 cSt at 50°C (122°F), cetane No. 54

Engine oil: Ford, ESEN/M2C 88/A

Transmission oil: Ford, ESEN/M2C 85/A for gearbox and 86/A for rear axle

COMPULSORY TESTS

1. Main power take-off performance

Date and location of tests: 10th August 1976, N.I.A.E., Silsoe Bedford, U.K.

Type of dynamometer: Water brake, Heenan and Froude

Power,	*Speed, rev/min*		*Fuel consumption,*			
kW (hp)	*Engine*	*P.t.o.*	*l/h (UKgal/h)*	*kg/h (lb/h)*	*g/kWh (lb/hp h)*	*kWh/l (hp h/UK gal)*
Maximum power—2 hour test						
34·5 (46·3	2360	708	12·03 (2·65)	10·12 (22·31)	293 (0·482)	2·87 (17·5)
Standard p.t.o. speed (540 rev/min)						
30·5 (40·9)	1800	540	9·53 (2·10)	8·02 (17·68)	263 (0·432)	3·20 (19·5)
The speed recommended by the manufacturer for drawbar work						
33·5 (44·9)	2200	660	11·20 (2·46)	9·42 (20·77)	281 (0·462)	2·99 (18·2)
Part loads						
(1) 85% of the torque obtained at maximum power						
29·6 (39·7)	2383	715	10·88 (2·39)	9·15 (20·17)	309 (0·508)	2·72 (16·6)
(2) Unloaded						
0	2467	740	4·12 (0·91)	3·47 (7·65)	—	—
(3) 50% of the load defined in (1)						
15·2 (20·4)	2437	731	7·28 (1·60)	6·12 (13·49)	403 (0·663)	2·09 (12·7)
(4) Maximum power						
34·5 (46·3)	2360	708	12·03 (2·65)	10·12 (22·31)	293 (0·482)	2·87 (17·5)
(5) 25% of the load defined in (1)						
7·6 (10·2)	2455	737	5·63 (1·24)	4·75 (10·47)	625 (1·027)	1·35 (8·2)
(6) 75% of the load defined in (1)						
22·5 (30·2)	2413	724	8·96 (1·97)	7·54 (16·62)	335 (0·551)	2·51 (15·3)

No load, maximum engine speed: 2467 rev/min

Equivalent crankshaft torque at maximum power: 139·6 Nm (103·0 lb ft)

Maximum equivalent crankshaft torque: 172·5 Nm (127·2 lb ft) at 1300 rev/min engine speed

Mean atmospheric conditions:
- temperature: 23°C (73°F)
- pressure: 1022 m bar (30·18 in Hg)
- relative humidity: 54%

Maximum temperature:
- coolant: 93°C (199°F)
- engine oil: 110°C (230°F)
- fuel: 39°C (102°F)
- air intake: 28°C (82°F)

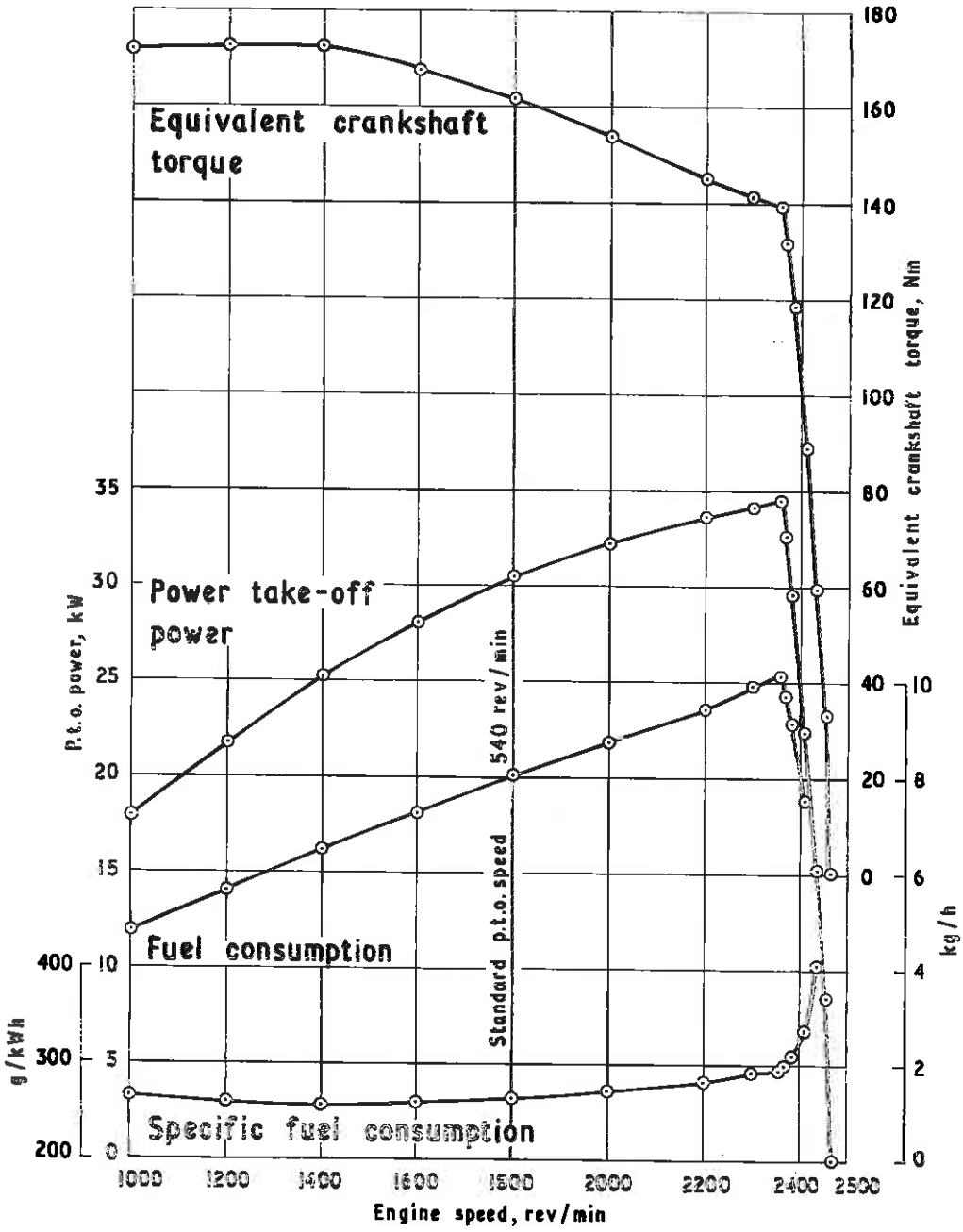


Fig 1. Power take-off test

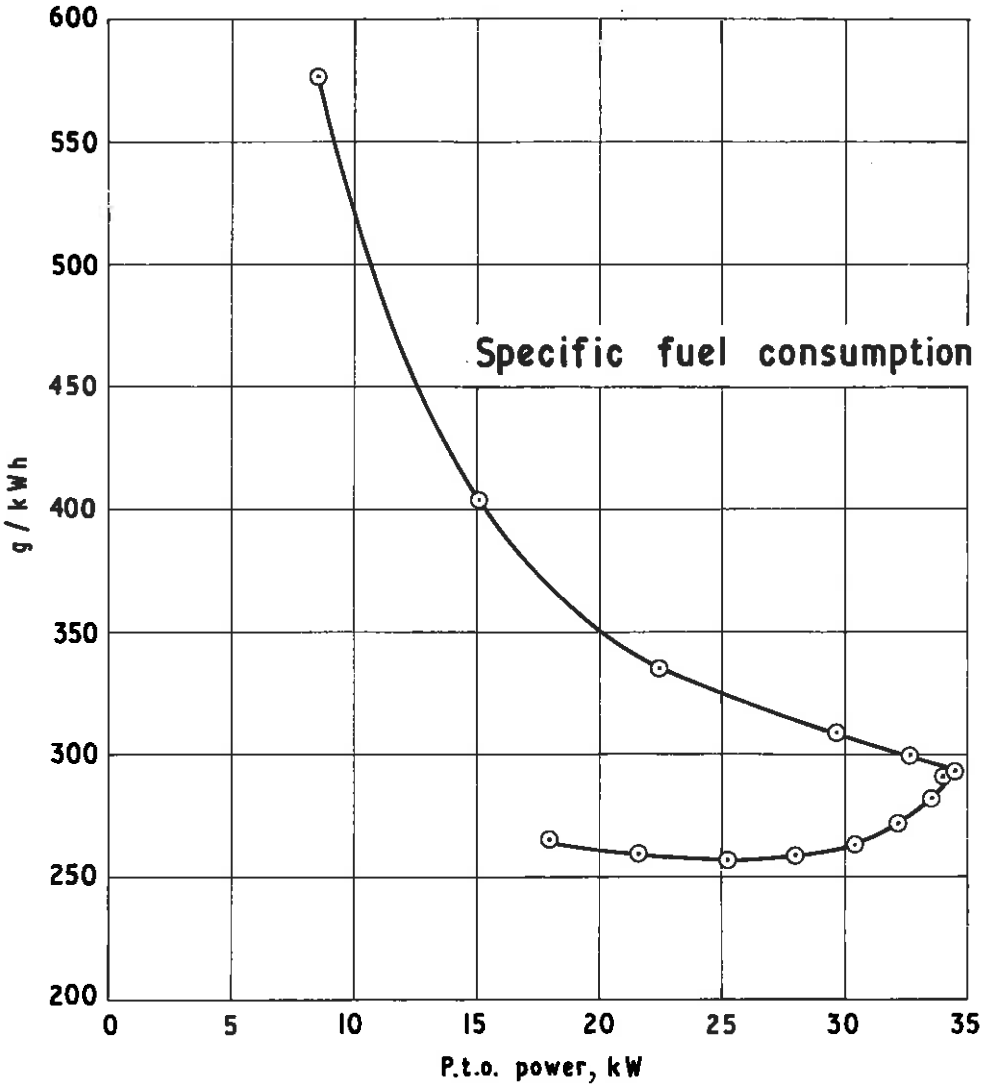


Fig. 2. Power take-off test

2. Drawbar performance

Date of tests: 18th August–8th September 1976 Type of track: Concrete Height of drawbar above ground: 445 mm (17·5 in)

Gear	Power, kW (hp)	Drawbar pull, kN (lb)	Speed, km/h (mile/h)	Engine speed, rev/min	Wheel-slip, %	Specific fuel consumption, g/kWh (lb/hp h)	kWh/l (hp h/UKgal)	Temperature, °C (°F) Coolant	Fuel	Engine Oil	Atmospheric conditions Temperature, °C (°F)	Relative humidity, %	Pressure, mbar (in Hg)
(i) Maximum power (ballasted)													
L1	15·7* (21.1)	24·5 (5510)	2·31 (1·44)	2428	15·0	448 (0·737)	1·88 (11·5)	77 (171)	29 (84)	99 (210)	17 (63)	84	1023 (30·21)
L2	19·6* (26·3)	24·5 (5510)	2·88 (1·79)	2410	15·0	399 (0·656)	2·11 (12·9)	78 (172)	30 (86)	102 (216)	16 (61)	89	1023 (30·21)
L3	28·8 (38·6)	20·2 (4540)	5·14 (3·19)	2368	11·5	345 (0·567)	2·44 (14·9)	81 (178)	32 (90)	103 (217)	17 (63)	84	1023 (30·21)
L4	30·3 (40·6)	15·0 (3370)	7·27 (4·52)	2360	7·8	331 (0·544)	2·54 (15·5)	81 (178)	34 (93)	99 (210)	19 (66)	80	1023 (30·21)
H1	30·8 (41·3)	12·5 (2810)	8·86 (5·51)	2360	6·4	322 (0·529)	2·61 (15·9)	79 (174)	35 (95)	93 (199)	19 (66)	80	1023 (30·21)
H2	30·0 (40·2)	9·7 (2180)	11·12 (6·91)	2360	5·4	316 (0·519)	2·67 (16·3)	82 (180)	35 (95)	104 (219)	21 (70)	64	1023 (30·21)
(ii) Five hour test at 75% of pull at maximum power													
L4	23·4 (31·4)	11·3 (2540)	7·47 (4·64)	2393	6·7	382 (0·628)	2·20 (13·41)	81 (178)	40 (104)	107 (225)	22 (72)	65	1023 (30·21)
(iii) Five hour test at pull corresponding to 15% wheelslip in test (i)†													
L2	—	24·5 (5510)	2·82 (1·75)	—	—	—	—	81 (178)	46 (115)	106 (223)	24 (75)	48	1026 (30·30)
(iv) Maximum power (unballasted)													
L2	14·6* (19·6)	18·4 (4140)	2·86 (1·78)	2438	15·0	—	—	79 (174)	36 (97)	104 (219)	20 (68)	62	1014 (29·94)
L3	25·6* (34·3)	18·4 (4140)	5·00 (3·11)	2384	15·0	—	—	79 (174)	32 (90)	93 (199)	20 (68)	62	1014 (29·94)
L4	29·6 (39·7)	14·8) (3330	7·19 (4·47)	2345	9·4	—	—	80 (176)	33 (91)	98 (208)	20 (68)	62	1014 (29·94)
H1	30·5 (40·9)	12·7 (2860)	8·64 (5·37)	2340	7·5	—	—	81 (178)	30 (86)	101 (214)	20 (68)	62	1014 (29·94)
H2	30·2 (40·5)	10·0 (2250)	10·86 (6·75)	2326	6·1	—	—	81 (178)	27 (81)	98 (208)	19 (66)	66	1014 (29·94)

Total oil consumption during ten hours duration of tests (ii) and (iii) 18·4 g/h (0·041 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—1358 mm (53·5 in)
rear—1422 mm (56·9 in)

	With brakes		*Without brakes*	
	Right-hand	*Left-hand*	*Right-hand*	*Left-hand*
Radius of turning space	2·93 m (115 in)	3·04 m (120 in)	3·23 m (127 in)	3·33 m (131 in)
Radius of turning circle	2·82 m (111 in)	2·93 m (115 in)	3·12 m (123 in)	3·22 m (127 in)

4. Location of centre of gravity

Height above ground	711 m (28·0 in)
Distance forward from the vertical plane containing the axis of the rear wheels	714 m (28·1 in)
Distance from the median plane of the tractor	0

5. Braking

Date of tests: 1st and 2nd September 1976

Type of track: Concrete

Type of decelerometer: Moto Meter, recording type

Mass of ballasted tractor: 3124 kg (6887 lb)

Cold brakes

	Tractor without ballast		*Tractor ballasted*	
Travelling speed of the tractor, km/h (mile/h)	25·0	(15·5)	25·0	(15·5)
Maximum deceleration, m/s² (ft/s²)	4·9	(16·0)	5·2	(17·1)
Stopping distance, m (ft)	6·4	(21)	6·1	(20)
Force on brake pedal, N (lb)	400	(90)	520	(120)
Force exerted on the brake pedal to achieve a deceleration of 2·5 m/s² (8·2 ft/s²), N (lb)	40	(9)	220	(50)

Brake fade characteristics (hot tests, ballasted tractor)

Maximum deceleration hot/maximum decleration cold × 100: 103%

Stopping distance cold/stopping distance hot × 100: 103%

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

Efficacy of handbrake: Satisfactory facing up and down slope

Pull on handbrake: 310 N (70 lb)

6. Measurement of ambient noise emitted by the tractor

Date of tests:	7th September 1976
Type of sound level meter:	Bruel and Kjaer 2204
Type of track:	Concrete
Results of tests:	
Gear:	H4
Travelling speed before acceleration:	21·4 km/h (13·3 mile/h)
Sound level:	87 dBA

7. Noise measurement at the driver's ear level

Date of tests:	7th September 1976
Type of sound level meter:	Bruel and Kjaer 2204
Type of track:	Concrete

Gear	*Travelling speed, km/h (mile/h)*	*dBA*
L4	7·3 (4·5)	96

8. Power lift and hydraulic pump performance

Date of tests:	13th and 14th September 1976
Hydraulic fluid	
Make and type:	Ford S.A.E. 80 Mild E.P.
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):	19·65–20·34 MPa (2850–2950 lb/in²)
Pump characteristics	
(i) Opening pressure of relief valve:	15·9 MPa (2310 lb/in²)
Sustained pressure of the open relief valve:	17·9 MPa (2600 lb/in²)
(ii) Pump delivery rate at minimum pressure and rated engine speed:	32·7 l/min (7·2 gal/min)
(iii) Pump delivery rate at maximum hydraulic power:	32·3 l/min (7·1 gal/min)
Delivery pressure:	15·2 MPa (2200 lb/in²)
Power:	8·2 kW (11·0 hp)

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

Projected length in side view		
lower links	864	(34·0)
lift arms	254	(10·0)
lift rods	757	(29·8)
top link	678	(26·7)
Distance of lift rod connection point from pivot point of lower link	480	(18·9)
The following dimensions are given relative to the rear wheel centre line, situated 678 mm (26·7 in) above the ground level		
lower link pivot point	68 (2·7) behind,	203 (8·0) below
top link pivot point	262 (10·3) behind,	153 (6·0) above
lift arm pivot point	203 (8·0) forward,	257 (10·1) above
maximum and minimum height of lower link hitch points	216 (8·5) above,	419 (16·5) below
height of lower link hitch points when locked in transport position	Any height within lift range	

Power lift performance

Lifting heights in relation to a horizontal line through the lower link pivoting point	*mm* (*in*)	−254 (−10)	−224 (−9)	−203 (−8)	−152 (−6)	−76 (−3)	0	+76 (+3)	+152 (+6)	+229 (+9)	+305 (+12)	+381 (+15)	+406 (+16)	+457 (+18)	+508 (+20)
Lifting force with the pressure at maximum hydraulic horse-power (15·2 MPa (2200 lb/in²)) calculated from measurements made at maximum pressure (17·9 MPa (2600 lb/in²), kN (lb)	At the hitch points			12·7* (2860)	13·5 (3030)	14·7 (3300)	15·6 (3510)	16·5 (3710)	17·2 (3870)	17·5 (3930)	18·1 (4070)	18·5 (4160)	18·9 (4250)		
	At the frame	11·9* (2680)	12·3 (2770)		12·9 (2900)	13·4 (3010)	13·5 (3030)	13·7 (3080)	13·6 (3060)	13·2 (2970)	13·1 (2940)	12·9 (2900)		12·7 (2860)	12·1 (2720)

*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

Repairs and adjustments during tests	None
Remarks	None

Officer in charge: D. W. Smith

Head of Tractor and Cultivation Division: J. Matthews

Date: 28th September 1976

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