OECD Approval No. 981

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

Report on test of Zetor 9111 Tractor



Manufactured by Zavody Tazkeho Strojarstva
Narodny Podnik
Box 03657 Martin
Czechoslovakia

Test No. R85/70479/OECD

Report No. 704

Date October 1985

THE BRITISH SOCIETY FOR RESEARCH IN AGRICULTURAL ENGINEERING

National Institute of Agricultural Engineering
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Tractor manufacturer's name and address:	Zavody Tazkeho Strojarstva, Narodny Podnik, Box 03657 Martin, Czechoslovakia.
Submitted for test by:	The manufacturer
Selected for test by:	The manufacturer with the agreement of the testing station
Place of running in:	Z.T.S. Martin, Czechoslovakia
Duration of running in:	206 hours

I. SPECIFICATION OF TRACTOR

TRACTOR

Make:	Z.T.S. N.P. Martin
Trade name:	Zetor
Model:	Z 9111
Type:	2 wheel-drive, unit construction
Serial No:	9111 0001
1st Serial No:	9111 0001

ENGINE

Make:	Z.T.S. N.P. Martin
Model:	Z 8002.11 34
Type:	4 stroke, direct injection diesel, turbocharged
Serial No:	000 013

Cylinders

Number/disposition:	4, vertical in-line
Bore/stroke:	110 mm x 120 mm (4.3 in x 4.7 in)
Capacity:	4562 cm^3 (278 in^3)
Compression ratio:	17:1 nominal
Arrangement of valves:	Overhead
Cylinder liners:	Replaceable, wet

Supercharging

Make:	CZM
Model:	K27.2960 u/6.11
Type:	Exhaust driven
Supercharging pressure:	0.90 MPa (130 lb/in^2)

Fuel System	
Fuel feed system:	Lift pump integral with fuel injection pump
Make, type and model of fuel filter(s):	Autobrzdy, dual, FD 10RP24
Capacity of fuel tank:	125 l (27.5 UK gal)
Make, type and model of injection pump:	Motorpal, in line, PP4 M9 KLE 3135
Serial No:	V6555
Manufacturer's production setting of injection pump:	18.0-18.9 l/h (31.7-33.3 pt/h) at 2200 rev/min engine speed at full load
Injection pump timing:	Delivery starts 22° + 2° before T.D.C.
Make, type and model of injectors:	Motorpal, DOP 150S5351417, 5 hole
Injection pressure:	16.8-17.6 MPa (166-174 atm)
Governor	
Make:	Motorpal
Type:	Mechanical
Model:	RV 3M 300/1100
Governed range of engine speed:	600-2450 rev/min
Rated engine speed:	2200 rev/min
Air cleaner	
Pre-cleaner	
Make:	Sandrik
Type:	Stack cap with centrifugal dust trap
Model:	PC 500
Location:	Above bonnet on centre line
Main	
Make:	Sandrik
Type:	Oil bath
Model:	9450.11
Oil capacity:	2.1 l (3.7 UK pt)
Location:	Under bonnet forward of radiator
Maintenance indicator	None
Lubrication system	
Type of feed pump:	Gear
Total oil capacity including filter(s):	10.0 l (17.6 UK pt)
Oil change period:	200 hours
Type of filter(s):	Centrifugal, replaceable element
Number:	1
Filter(s) change period:	200 hours
Recommended oil:	See "Fuels and lubricants used in tests"

Cooling system	
Type of coolant:	Water and anti-freeze 1:1
Specification of pump	
Type:	Centrifugal, belt driven
Description of fan:	Belt driven
Number of fan blades:	4
Fan diameter:	460 mm (18.1 in)
Coolant capacity:	23.0 l (40.5 UK pt)
Type of temperature control:	Thermostat
Superpressure system:	0.41 bar (5.9 lb/in^2)
Starting system	
Safety device:	Gear selector lever to be in neutral position
Make:	Pal-Magneton
Type:	Electrical, solenoid engaged
Model and starter motor power rating:	12V, 2.9 kW (3.9 hp)
Cold starting aid:	None
Electrical system	
Voltage:	12
Generator:	Alternator
Make:	Pal-Magneton
Model:	443 113 516 184
Type:	14v, 55A
Power:	55 A at 9000 rev/min
Batteries	2, Prazska, Accumulators
Rating:	2 x 100 Ah at 20-hour rating
Exhaust system	
Make:	Z.T.S.
Type:	Oval, baffle
Location:	Left-hand side of engine, vertical
Height of outlet above ground:	2.60 m (102 in)

TRANSMISSION

Clutch	For transmission only
Make:	Z.T.S.
Type:	Dry
Number of plates:	1
Diameter of plate:	350 mm (13.8 in)
Method of operation:	Mechanically by pedal
Gear box	
Make:	Povazske Strojarne
Type:	Mechanical
Arrangement:	4 forward x 2 ranges x torque multiplyer
	4 reverse x torque multiplyer
Number of speeds:	16 forward and 8 reverse
Available options:	1 creep gear, less torque multiplyer
Rear axle and final drives	
Make:	ZPC Ursus
Type:	Crown wheel and pinion, bevel gear and differential, planetary reduction gear final drives
Differential lock	
Type:	Mechanical
Method of engagement:	Manual by pedal
Method of disengagement:	Self disengaging
Front axle	
Make:	ZPC Ursus
Transmission oils	
Capacity	
Gear box and transmission housing:	53.5 l (94.2 UK pt) including oil for hydraulics
Change period:	1200 hours
Filter change period:	600 hours
Final drive(s):	2 x 4.0 l (14.1 UK pt)
Change period:	1200 hours
Recommended oil:	See "Fuels and lubricants used in test"

Gear	Group No.	Number of engine revolutions for one revolution of the driving wheels	Nominal travelling speed at rated engine speed: 2200 rev/min, km/h	(mile/h)
Forward				
1	LM	244.71	2.69	(1.67)
1	L	182.91	3.60	(2.24)
2	LM	155.26	4.25	(2.64)
2	L	116.06	5.68	(3.53)
3	LM	97.71	6.75	(4.19)
1	HM	83.88	7.86	(4.88)
3	L	73.04	9.03	(5.61)
4	LM	68.64	9.61	(5.97)
1	H	62.70	10.52	(6.54)
2	HM	53.22	12.39	(7.70)
4	L	51.31	12.85	(7.98)
2	H	39.78	16.58	(10.30)
3	HM	33.49	19.69	(12.23)
3	H	25.04	26.33	(16.36)
4	HM	23.53	28.02	(17.41)
4	H	17.59	37.48	(23.29)
Reverse				
1	M	178.95	3.68	(2.29)
1		133.76	4.93	(3.06)
2	M	113.54	5.81	(3.61)
2		84.87	7.77	(4.83)
3	M	71.46	9.23	(5.74)
3		53.42	12.34	(7.67)
4	M	50.19	13.14	(8.16)
4		37.52	17.57	(10.92)

M = Torque multiplier engaged L = Low range H = High range
Rear tyre size: 16.9-38
Tyre loaded radius: 795 mm (31.3 in)

POWER TAKE-OFF

Main power take-off

Type: Hydraulically operated, independent of main clutch
Method of engagement: By hand lever
Number of shafts: 1
Method of changing power take-off speeds: Manually, by exchanging shafts

Power take-off proportional to engine speed

(i) 540 rev/min

Location:	At rear of tractor
Diameter of power take-off shaft:	34.9 mm (1.375 in)
Number of splines:	6 to ISO standard
Height above ground:	655 mm (25.8 in)
Tyre sizes, Front, Rear	7.5-20, 16.9-38
Distance from the median plane of the tractor:	Central
Distance behind rear axle:	510 mm (20.1 in)
Pto speed at rated engine speed:	628 rev/min
Engine speed at standard power take-off speed:	1890 rev/min
Engine to pto ratio:	3.50:1
Power restriction:	45.0 kW (60.3 hp)
Direction of rotation (viewed facing driving end):	Clockwise

(ii) 1000 rev/min

Location:	At rear of tractor
Diameter of power take-off shaft:	34.9 mm (1.375 in)
Number of splines:	21 to ISO standard
Height above ground:	655 mm (25.8 in)
Tyre sizes, Front, Rear	7.5-20, 16.9-38
Distance from the median plane of the tractor:	Central
Distance behind rear axle:	510 mm (20.1 in)
Pto speed at rated engine speed:	1146 rev/min
Engine speed at standard power take-off speed:	1920 rev/min
Engine to pto ratio:	1.92:1
Direction of rotation (viewed facing driving end):	Clockwise

Power take-off proportional to ground speed

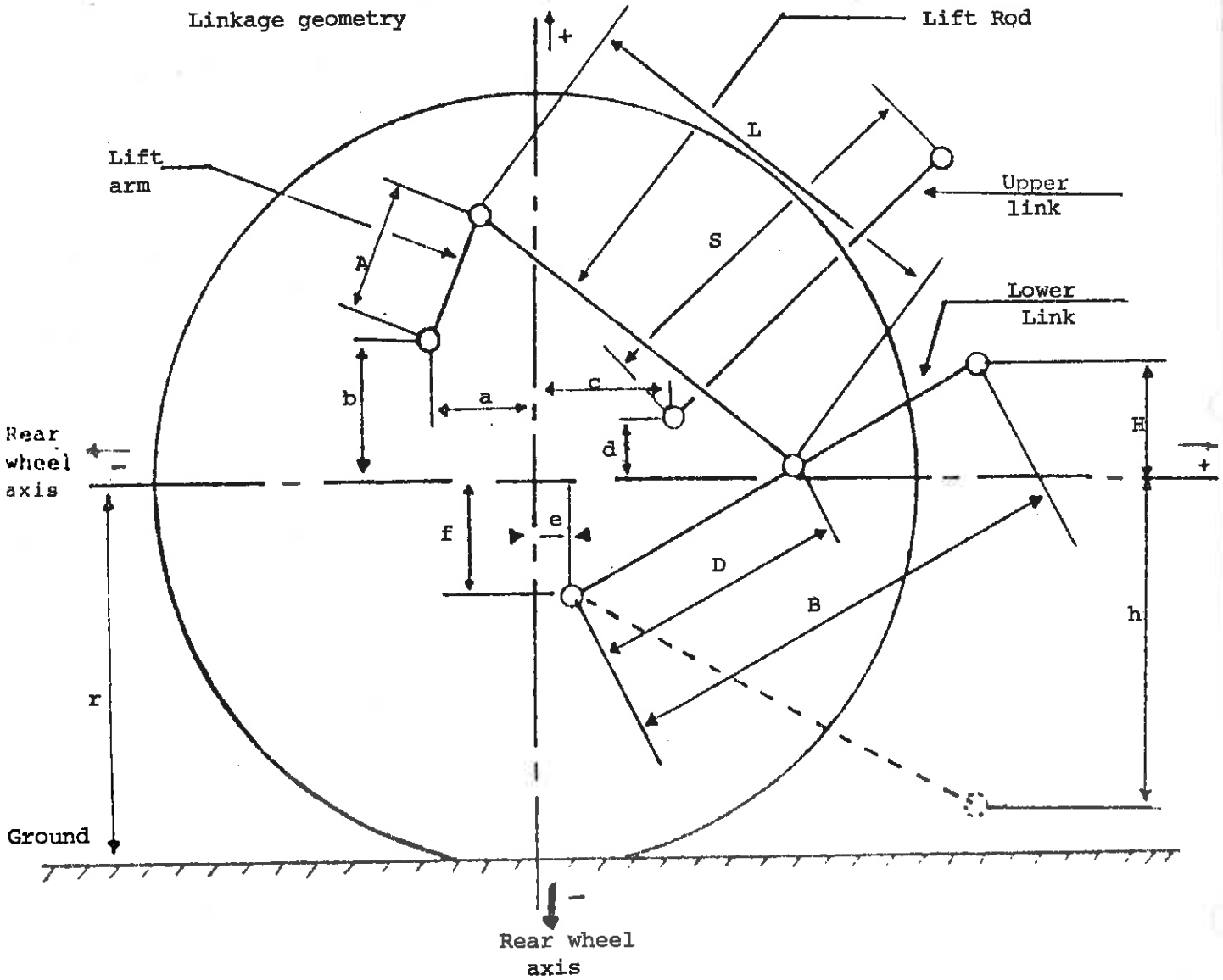
Speed of shaft:	1000 rev/min
Size of tyre:	16.9-38
Travelling distance for one revolution of power take-off shaft:	182 mm (7.2 in)
Number of pto shaft revolutions for one revolution rear wheels:	27.4
Direction of rotation with forward gear engaged:	Clockwise

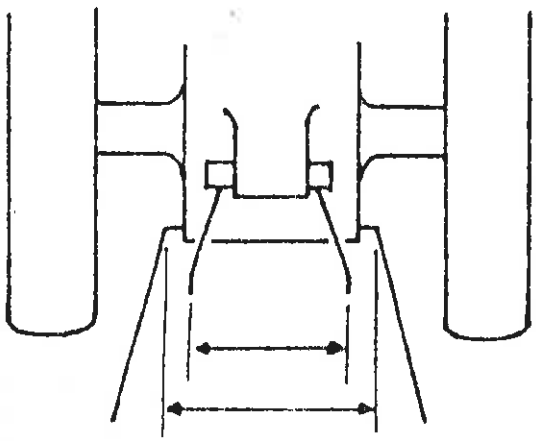
POWER LIFT

Make:	PZL Hydral Wroclaw
Type:	88 400 000
Type and number of cylinders:	One internal single acting, one external single acting
Type of linkage lock for transport:	Hydraulic
Relief valve pressure setting:	18.0 - 20.5 MPa (2610-2970 lb/in^2)
Opening pressure of cylinder safety valve:	19.0 - 22.0 MPa (2760-3190 lb/in^2)
Lift pump type:	Gear, PZ 2-18KS
Transmission between pump and engine:	Gear driven
Make and number of filters:	ZPC, 2
Time between oil changes:	1200 hours
Time between filter changes:	600 hours
Oil capacity:	53.5 l (94.2 UK pt)
Site of oil reservoir	Main transmission housing
Type and number of tapping points:	6, quick release at rear of tractor
Maximum volume of oil available to external cylinders:	15.0 l (26.4 UK pt)
Recommended oil:	See "Fuels and lubricants used in test"

THREE-POINT LINKAGE

Category:	2 to ISO standard
Controls	Draught or position control, lower link sensing, adjustable speed on drop.


Linkage geometry
+
Lift Rod
L
Lift
arm
Upper
link
S
A
Lower
Link
b
a
c
d
H
Rear
wheel
axis
f
e
D
B
h
r
Ground
Rear wheel
axis



Linkage dimensions for the lifting test

Rear tyres: (size 16.9-30) loaded radius:		(r)	795 mm (31.3 in)
+Front tyres:(size 7.5-20) loaded radius:		(r')	410 mm (14.9 in)
Length of lift arms:		(A)	330 mm (13.0 in)
Length of lower links:		(B)	915 mm (36.0 in)
Distance of lift arm pivot point from rear wheel centre line	horizontally:	(a)	170 mm (6.7 in)
	vertically:	(b)	286 mm (11.3 in)
Horizontal distance between the two lower link points:		(u)	525 mm (20.7 in)
Horizontal distance between the two lift arm end points:		(v)	555 mm (21.8 in)
Length of upper link:		(S)	662 mm (26.1 in)
Distance of upper link pivot point from rear wheel centre line	horizontally:	(c)	385 mm (15.2 in)
	vertically:	(d)	210 mm (8.3 in)
Distance of lower link pivot point from rear wheel centre	horizontally:	(e)	130 mm (5.1 in)
	vertically:	(f)	255 mm (10.0 in)
Distance of lower link pivot points to lift rod pivot points on lower links:		(D)	439 mm (17.3 in)
Length of lift rods:		(L)	585 mm (23.0 in)
Height of lower hitch points relative to the rear wheel centre line, situated 795 mm above the ground level			
- in low position:		(h)	630 mm (24.8 in)
- in high position:		(H)	138 mm (5.4 in)
Height of lower hitch points when locked in transport position:			Any height within lift range

+Steering tyres at 150 kPA, no tyre radius index available.

FIXED DRAWBAR

Height above ground, maximum:	418 mm (16.5 in)
minimum:	364 mm (14.3 in)
Type of adjustment:	Inverting drawbar
Tyre sizes, Front, Rear	7.5-20, 16.9-38
Distance of hitch point from rear axle centre:	905 mm and 855 mm (35.6 and 33.7 in) to rear
Distance of hitch point from power take-off shaft ends:	
vertically:	322 and 240 mm (12.7 and 9.4 in)
horizontally:	400 and 350 mm (15.7 and 13.8 in) to rear
Lateral adjustment:	None
Distance of pivot point from rear axles horizontally:	330 mm (13.0 in) to rear
Diameter drawbar pin hole:	32 mm (1.3 in)

LINKAGE DRAWBAR

Height above ground, maximum:	1060 mm (41.6 in)
minimum:	120 mm (4.7 in)
Tyre sizes, Front, Rear	7.5-20, 16.9-38
Horizontal distance to power take-off shaft end:	535 mm (21.1 in), to rear
Number of holes:	7
Distance between holes:	82 mm (3.2 in)
Hole diameter:	32 mm (1.3 in)
Thickness and width of drawbar:	70 mm x 85 mm (2.8 in x 3.3 in) overall with 32 mm (1.3 in) full width lateral slot

TRAILER HITCH

Height above ground, maximum:	845 mm (33.3 in)
minimum:	695 mm (27.4 in)
Tyre sizes, Front, Rear	7.5-20, 16.9-38
Distance of hitch point from rear axle centre:	860 mm (33.9 in) to rear
Distance of hitch point from power take-off shaft end:	
vertically above maximum:	180 mm (7.1 in)
minimum:	30 mm (1.2 in)
horizontally:	355 mm (14.0 in) to rear
Maximum vertical permissible load:	22.0 kN (4950 lb)
Diameter of pin hole	32 mm (1.3 in)

FRONT TOWING HITCH

Vertical height at centre of clevis:	805 mm (31.7 in)
Tyre sizes, Front, Rear	7.5-20, 16.9-38
Width of clevis:	70 mm (2.8 in)
Diameter of pin hole:	32 mm (1.3 in)

STEERING

Method of operation:	Mechanical linkage power assisted with single, double acting ram and transmission mounted gear pump
Make:	Pilmet
Model:	89276
Type:	Power assisted
Working pressure:	8.6 MPa (1250 lb/in^2)
Oil capacity:	8.0 l (14.1 UK pt)
Oil change period:	1200 hours
Make and model of filter	ZSM Sedzyozow. Poland, PP-8,4
Filter(s) change period:	1200 hours
Recommended oil:	See "Fuels and lubricants used in test"

BRAKES

Service brake

Make:	Zetor
Model:	89 227 000
Type:	Dry disc, multiplate, 2 per side
Method of operation:	Hydraulic by pedals coupled or independent

Parking brake

Type:	Mechanical
Method of operation:	Hand lever with ratchet operating mechanical linkage on service brakes

Trailer brakes — Air brake operated by tractor pedals

STEERING WHEELS

Number:	2
Location:	At front of tractor
Tyres:	Barum
Size:	7.5-20
Ply rating:	6
Type of casing:	Cross ply
Maximum permissible load on each tyre:	850 kg (1874 lb)
Corresponding inflation pressure:	250 kPa (36 lb/in^2)
Track widths:	1400-1850 mm (55-73 in) by 150 mm (5.9 in) steps
Method of adjustment:	By changing wheel discs to either side of wheel centre and extending axle

DRIVING WHEELS

Number:	2
Location:	At rear of tractor
Rear tyres:	Barum
Size:	16.9-38
Ply rating:	8
Type of casing:	Cross ply
Maximum permissible load on each tyre:	2520 kg (5556 lb)
Corresponding inflation pressure:	170 kPa (25 lb/in^2)
Track widths:	1500-1875 mm (59-74 in) by 75 mm (3.0 in) steps
Method of adjustment:	Reversing wheels and off-set lug rims

WHEELBASE 2390 mm (94.1 in)

PROTECTIVE STRUCTURE SPECIFICATIONS

OECD approval number:	None
Trade name:	Zetor BK 12111
Manufacturer's name and address:	Vlad, Presov

Description

The safety cab has an integral six-post protective structure attached to the tractor through four anti-vibration mounts, the unit does not tilt. Mounting steps and a door are fitted at each side. The structure has a steel roof, safety glass windows and noise reduction cladding.

DRIVER'S SEAT

Make:	Mars
Type of suspension:	Parallelogram linkage
Type of damping:	Hydraulic
Range of adjustment, longitudinal:	150 mm (5.9 in)
vertical:	90 mm (3.5 in)

MISCELLANEOUS

Passenger's seat:	Mars
Location:	Behind driver
Number of places:	One

LIGHTING

Tyre size:

Front:	7.5-20
Rear:	16.9-38

Unrestricted beam angle of head light in plan view 22°

	Height above ground of centre, mm (in)	Size mm in)	Distance from outside edge of tractor to centre, at 1500 mm 59.1 in) track width mm (in)
Headlights,	1095 (43.1)	124 (4.9) dia	785 (30.9)
Sidelights,	1770 (69.7)	55 x 50 (2.2 x 2.0)	65 (2.6)
Rear lights,	1612 (63.5)	105 x 75 (4.1 x 3.0)	260 (10.2)
Reflectors,	1085 (42.7)	80 (3.1) dia	55 (2.2)

CONDITIONS DURING TEST

Overall dimensions

(front: 7.5-20, rear: 16.9-38 tyres fitted)

	Length, m (in)	Width, min. m (in)	Width, max. m (in)	Height at top of, exhaust silencer, m (in)	Height at top of, protective structure, m (in)
With ballast	4.140 (163)	1.940 (76)	2.280 (90)	2.575 (102)	2.655 (105)
Without ballast	4.140 (163)	1.954 (77)	2.280 (90)	2.600 (102)	2.680 (106)

Ground clearance

Clearance: 300mm (11.8 in) limited by drawbar bracket

Track setting

Front: 1550 mm (61.0 in)

Rear: 1500 mm (59.1 in)

Tractor mass and ballasting

Tractor mass

(without driver but with tanks full - with cab)

		Front	Rear	Total
Without ballast	kg (lb)	1455 (3208)	2773 (6113)	4228 (9321)
With ballast	kg (lb)	1455 (3208)	3794 (8364)	5249 (11572)

Ballast

	Weights		Water, kg (lb)
	Number	Total mass, kg (lb)	
Front	Nil	Nil	Nil
Rear	8	337 (743)	684 (1508)
Additional	Nil	Nil	Nil

Fuel and lubricants used in tests

Fuel

Type:	Diesel oil to Class D British Standard 2869: 1970
	Specific gravity at 15°C: 0.848

Oils	Recommended	Used during test
Engine oil		
Type:	S.A.E. 10w/30	As recommended
Viscosity:	71.5 cSt at 50°C (122°F)	
Classification:	MIL-45199B or L-2104C	
Transmission oils		
Type:	SAE 80	PP 80
Viscosity:	44.2 cSt at 50°C (122°F)	44.2 cSt at 50°C (122°F)
Classification:	API GL-4	API GL-4
Final drives		
Type:	S.A.E. 90	As recommended
Viscosity	125 cSt at 50°C (122°F)	
Classification:	API GL-3	
Hydraulic fluid:		
Type:	S.A.E. 80	PP80
Viscosity:	44.2 cSt at 50°C (122°F)	44.2 cSt at 50° (122°F)
Classification:	API GL-4	API GL-4
Steering oil		
Type:	OL-N2	As recommended
Viscosity:	15.2 cSt at 50°C (122°F)	
Classification:	ISO WG-22	
Recommended grease:	Mobilgrease MP	As recommended
Number of lubrication points:	14	

II TEST RESULTS

A, COMPULSORY TESTS

1. MAIN POWER TAKE-OFF PERFORMANCE

Date and location of tests: 18th July 1985, NIAE, Silsoe, Bedford, UK.

Type of dynamometer: Heenan & Froude, Water brake

Power, kW (hp)	Speed, rev/min		Fuel consumption, Hourly, l/h (UKgal/h)	Hourly, kg/h (lb/h)	Specific, kg/kWh (lb/hph)	Specific energy, kWh/l (hph/UKgal)
	Engine	P.t.o.				
MAXIMUM POWER - 2 HOUR TEST						
58.5 (78.4)	2198	1144	16.48 (3.62)	13.98 (30.82)	0.239 (0.393)	3.54 (21.6)
POWER AT RATED ENGINE SPEED						
58.5 (78.4)	2198	1144	16.48 (3.62)	13.98 (30.82)	0.239 (0.393)	3.54 (21.6)
POWER AT STANDARD POWER TAKE-OFF SPEED						
58.4 (78.3)	1920	1000	15.77 (3.46)	13.37 (29.47)	0.228 (0.375)	3.70 (22.6)
PART LOADS						
(i) The torque corresponding to maximum power at rated engine speed						
58.5 (78.4)	2198	1144	16.48 (3.62)	13.98 (30 82)	0.239 (0.393)	3.54 (21.6)
(ii) 85% of the torque obtained in (i)						
50.8 (68.1)	2242	1167	14.97 (3.25)	12.54 (27.65)	0.247 (0.406)	3.43 (20.3)
(iii) 75% of the torque defined in (ii)						
38.4 (51.5)	2280	1187	12.23 (2.69)	10.37 (22.88)	0.270 (0.444)	3.13 (18.6)
(iv) 50% of the torque defined in (ii)						
26.6 (35.6)	2327	1212	9.94 (2.18)	8.43 (18.58)	0.317 (0.521)	2.67 (15.8)
(v) 25% of the torque defined in (ii)						
12.9 (17.3)	2361	1229	7.28 (1.60)	6.17 (13.61)	0.479 (0.787)	1.77 (10.5)
(vi) Unloaded						
0	2419	1259	5.11 (1.12)	4.33 (9.55)	-	-

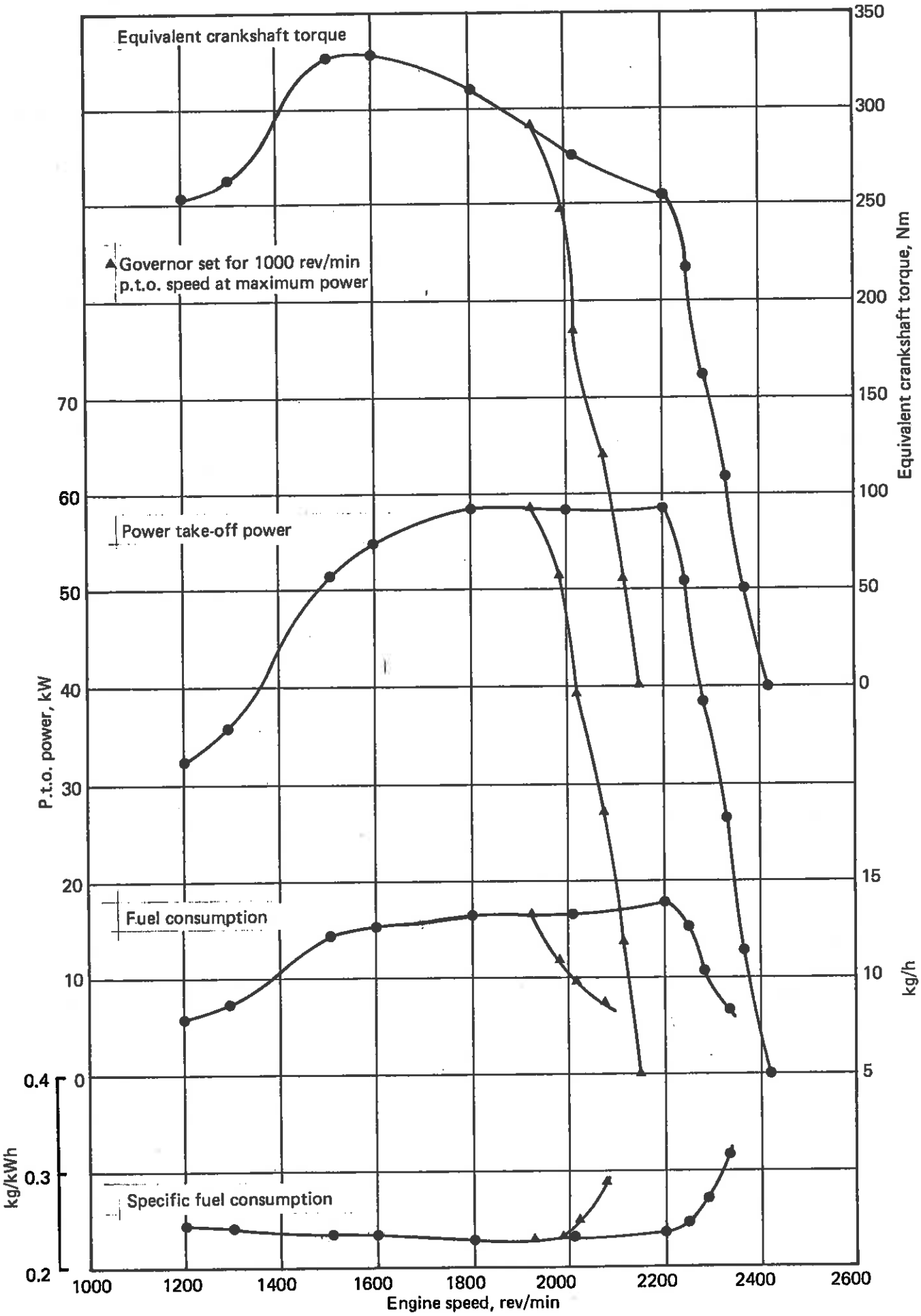
Part loads, the governor hand lever in the position corresponding to the standard p.t.o. speed at full load (1000 rev/min).

Power, kW (hp)	Speed, rev/min		Fuel consumption, Hourly,		Specific,	Specific energy,
	Engine	P.t.o.	l/h (UKgal/h)	kg/h (lb/h)	kg/kWh (lb/hph)	kWh/l (hph/UKgal)
(i) The torque corresponding to maximum power at standard p.t.o. speed						
58.4 (78.3)	1920	1000	15.77 (3.46)	13.37 (29.47)	0.228 (0.375)	3.70 (22.5)
(ii) 85% of the torque obtained in (i)						
51.3 (68.8))	1980	1031	14.04 (3.08)	11.90 (26.24)	0.232 (0.381)	3.65 (21.6)
(iii) 75% of the torque defined in (ii)						
39.1 (52.5)	2019	1051	11.5 (2.53)	9.76 (21.51)	0.249 (0.409)	3.40 (20.2)
(iv) 50% of the torque defined in (ii)						
27.0 (36.1)	2072	1079	9.10 (2.00)	7.72 (17.02)	0.286 (0.471)	2.95 (17.5)
(v) 25% of the torque defined in (ii)						
13.4 (18.0)	2113	1100	6.42 (1.41)	5.45 (12.01)	0.406 (0.668)	2.08 (12.4)
(vi) Unloaded						
0	2149	1119	4.19 (0.92)	3.56 (7.85)	-	-

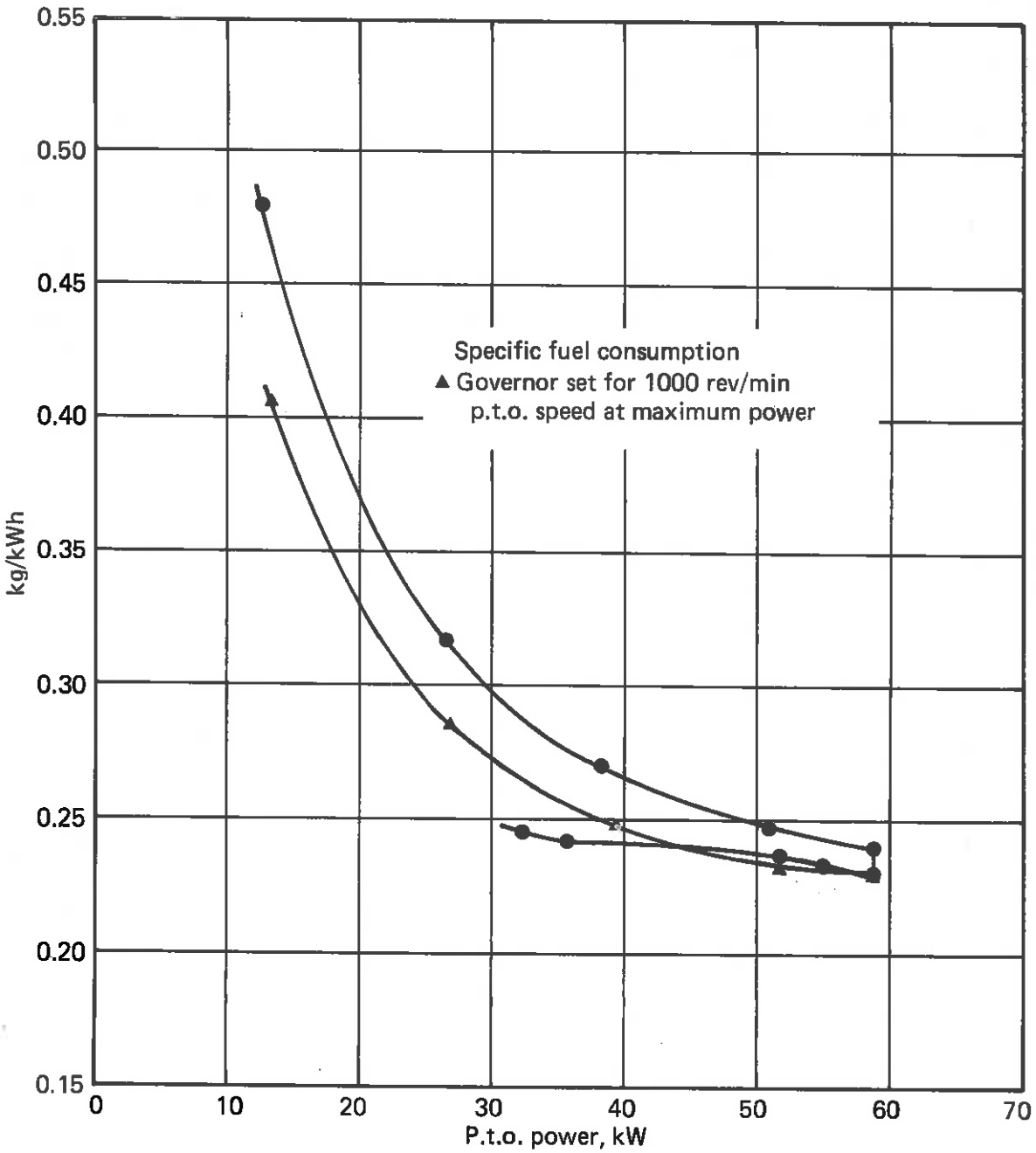
Standard specific fuel consumption, kg/kWh (lb/hph)

a) 0.247 (0.406)
b) 0.317 (0.521)
c) 0.232 (0.381)
d) 0.286 (0.471)

No load, maximum engine speed		2419 rev/min
Equivalent crankshaft torque at maximum power		254.1 Nm (197.4 lb ft)
Maximum equivalent crankshaft torque		328.0 Nm (241.9lb ft) at 1550 rev/min engine speed
Mean atmospheric conditions	temperature	23°C (73.4°F)
	pressure	1006 m bar (29.7 in Hg)
	relative humidity	44%
Maximum temperature	coolant	80°C (176°F)
	engine oil	102°C (216°F)
	fuel	52°C (126°F)
	air intake	44°C (111°F)



Power take-off test



Power take-off test

2. LIFTING FORCE AND HYDRAULIC POWER

Date of tests: 29th July 1985

Hydraulic fluid

Make and type:)
Viscosity:) See "Fuels and lubricants used in tests"

Type of hydraulic system: Closed centre

Hydraulic fluid temperature at beginning of test: 55°C (131°F)

Power lift test (with single assist ram)

	Height of lower hitch point above ground in down position, mm (in)	Vertical movement, mm (in)	Maximum force exerted through full range, kN (lb)	Corresponding pressure of hydraulic fluid, MPa (lb/in^2)	Moment about rear axle, kNm (lbft)	Maximum tilt angle of mast over range of lift, degrees
At the hitch point	165 (6.5)	768 (30.2)	30.8 (6920)	16.0 (2320)	32.2 (23750)	-
On the frame	165 (6.5)	918 (36.1)	22.8 (5130)	16.0 (2320)	37.7 (27810)	14

Main linkage dimensions - see drawings and table on pages 8 and 9

Lifting heights relative to the horizontal plane including the lower link pivot points

mm	-375	-360	-300	-240	-160	0	+160	+360	+445
in	14.76	14.17	11.81	9.45	6.30	0	6.30	14.17	17.52

Lifting forces at hitch points
(corresponding pressure 16.0 MPa 2320 lb/in^2)

kN	-	30.8	30.8	31.3	31.8	32.6	33.1	34.0	-
lb	-	6920	6920	7040	7150	7330	7440	7640	-

Lifting forces at test frame
(corresponding pressure 16.0 MPa 2320 lb/in^2)

kN	29.7	29.6	29.2	29.0	28.7	27.6	26.1	23.9	22.8
lb	6680	6660	6560	6520	6450	6200	5870	5370	5130

Hydraulic power test

Sustained pressure with relief valve open	18.8 MPa	(2730 lb/in^2)
Pump delivery rate at minimum pressure	47.6 l/min	(10.5 UK gal/min)

Flow rate corresponding to a hydraulic pressure equivalent to 90 per cent of the actual relief valve pressure setting and corresponding hydraulic power

Flow rate	31.5 l/min	(6.9 UK gal/min)
Pressure	16.9 MPa	(2450 lb/in^2)
Power	8.9 kW	(11.9 hp)

Flow rate and hydraulic pressure corresponding to maximum hydraulic power

Flow rate	45.8 l/min	(10.1 UK gal/min)
Pressure	16.0 MPa	(2320 lb/in^2)
Power	12.2 kW	(16.4 hp)

Tapping point used for test: Auxiliary service connection

Temperature of hydraulic fluid, if different from $65^{\circ} \pm 5^{\circ}C$ Not applicable

Opening pressure of the unloading valve Not applicable

Closing pressure of the unloading valve Not applicable

3 DRAWBAR PERFORMANCE

Date of tests: 19th and 21st August 1985
Type of track: Concrete

Height of drawbar above ground: Unballasted: 370 mm (14.6 in)
Ballasted: 340 mm (13.4 in)

Gear	Speed, km/h (mile/h)	Power, kW (hp)	Drawbar pull, kN (lb)	Engine speed, rev/min	Wheel-slip, %	Specific fuel consumption, kg/kWh (lb/hph)	kWh/l (hph/UKgal)	Temperature, °C (°F) Fuel	Coolant	Engine oil	Atmospheric conditions Temperature, °C (°F)	Relative humidity %	Pressure, m bar (in Hg)
(i) MAXIMUM POWER (unballasted) Tyre inflation pressure: front 150 kPa (22 lb/in²), rear 80 kPa (12 lb/in²)													
L2	4.89 (3.05)	*40.2 (53.9)	29.6 (6650)	2299	15.0	-	-	45 (113)	85 (185)	96 (205)	13 (56)	69	1011 (29.88)
L3M	5.67 (3.53)	*46.7 (62.6)	29.6 (6650)	2215	15.0	-	-	44 (112)	85 (185)	94 (202)	13 (56)	67	1011 (29.88)
H1M	6.78 (4.23)	48.2 (64.6)	25.6 (5760)	2200	11.2	-	-	46 (115)	85 (185)	95 (203)	13 (56)	66	1011 (29.88)
L3	7.97 (4.97)	48.3 (64.8)	21.8 (4900)	2200	8.9	-	-	47 (117)	85 (185)	97 (207)	14 (57)	66	1011 (29.88)
L4M	8.49 (5.30)	47.4 (63.6)	20.1 (4520)	2200	8.5	-	-	46 (116)	85 (185)	96 (205)	14 (57)	67	1011 (29.88)
H1	9.55 (5.95)	49.1 (65.8)	18.5 (4160)	2200	7.0	-	-	47 (117)	85 (185)	98 (208)	14 (57)	68	1011 (29.88)
H2M	11.35 (7.08)	49.5 (66.4)	15.7 (3530)	2200	5.5	-	-	48 (119)	85 (185)	98 (208)	14 (57)	69	1010 (29.85)
L4	11.78 (7.35)	47.3 (63.4)	14.4 (3240)	2200	4.9	-	-	48 (119)	85 (185)	98 (208)	14 (57)	68	1010 (29.85)
(ii) MAXIMUM POWER (ballasted) Tyre inflation pressure: front 150 kPa (22 lb/in²), rear 110 kPa (16.6 lb/in²)													
L1M	2.39 (1.49)	*26.4 (35.4)	39.8 (8940)	2350	15.0	0.391 (0.643)	2.16 (13.2)	48 (118)	85 (185)	99 (210)	17 (62)	44	1016 (30.03)
L1	3.14 (1.95)	*34.7 (46.5)	39.8 (8940)	2314	15.0	0.355 (0.584)	2.38 (14.5)	47 (117)	85 (185)	98 (209)	17 (62)	48	1016 (30.03)
L2M	3.68 (2.28)	*40.7 (54.6)	39.8 (8940)	2296	15.0	0.335 (0.551)	2.52 (15.4)	46 (114)	85 (185)	99 (210)	12 (54)	51	1016 (30.03)
L2	4.95 (3.07)	46.4 (62.2)	33.8 (7580)	2208	10.5	0.322 (0.530)	2.62 (16.0)	50 (122)	85 (185)	100 (212)	16 (60)	51	1017 (30.03)
L3M	6.00 (3.73)	48.2 (64.6)	28.9 (6490)	2209	9.0	0.301 (0.495)	2.81 (17.1)	50 (112)	85 (185)	100 (212)	17 (62)	47	1016 (30.03)
H1M	7.06 (4.39)	48.6 (65.1)	24.8 (5560)	2201	7.7	0.299 (0.492)	2.83 (17.2)	51 (125)	85 (185)	99 (211)	16 (62)	51	1016 (30.03)
L3	8.21 (5.10)	47.9 (64.2)	21.0 (4710)	2204	6.4	0.312 (0.513)	2.71 (16.5)	51 (125)	85 (185)	100 (212)	16 (62)	52	1016 (30.03)
(iii) FIVE HOUR TEST AT 75% OF PULL AT MAXIMUM POWER													
H1M	7.55 (4.69)	39.1 (52.4)	18.6 (4170)	2308	5.8	0.325 (0.535)	2.60 (15.9)	46 (115)	85 (185)	98 (209)	13 (57)	58	1014 (29.95)
(iv)+ FIVE HOUR TEST AT PULL CORRESPONDING TO 15% WHEELSLIP IN TEST (ii).													
L2M	3.79 (2.35)	-	39.8 (8940)	2291	-	-	-	49 (121)	85 (185)	100 (212)	14 (58)	51	998 (29.05)

Total oil consumption during ten hours duration of tests (iii) and (iv) 88.7 g/h (0.196 lb/h)

*Maximum power available at 15% wheelslip

+ Test (iv) was carried out with additional ballast and the results for power, slip and fuel consumption have no practical significance.

4. TURNING SPACE AND TURNING CIRCLE

Details of wheel equipment: As in specification, without ballast

Track of wheels: front - 1550 mm (61.0 in)

rear - 1500 mm (59.0 in)

	With brakes		Without brakes	
	Left-hand	Right-hand	Left-hand	Right-hand
Radius of turning space, m (in)	4.31 (170)	4.16 (164)	3.70 (146)	3.57 (141)
Radius of turning circle, m (in)	4.21 (166)	4.06 (160)	3.60 (142)	3.47 (137)

5. LOCATION OF CENTRE OF GRAVITY

Height above ground, mm (in)	971 (38.2)
Distance forward from the vertical plane containing the axis of the rear wheels, mm (in)	819 (32.2)
Distance from the median plane of the tractor, mm (in)	0

6. BRAKING

Date of tests: 13th August 1985

Type of track: Concrete

Masses during brake test

	Front, kg	(lb)	Rear, kg	(lb)	Total, kg	(lb)
Ballasted	1700	(3748)	5040	(11111)	6740	(14859)
Unballasted	1445	(3208)	2773	(6113)	4228	(9321)

Tyres: As in specification

Type 0 Service brakes (cold)

Travelling speed before application of brakes, 29.6 km/h (18.5 mile/h)

Ballasted	Force on brake pedal	N (lb)	350 (79)	400 (90)	450 (101)	500 (112)	550 (124)	600 (135)	650 (146)
	Mean deceleration	m/s^2 (ft/s^2)	2.2 (7.2)	2.6 (8.5)	3.0 (9.8)	3.3 (10.8)	3.4 (11.1)	3.4 (11.1)	3.4 (11.1)
Unballasted	Force on brake pedal	N (lb)	350 (79)	400 (90)	450 (101)	500 (112)	550 (124)	600 (135)	650 (146)
	Mean deceleration	m/s^2 (ft/s^2)	2.7 (8.9)	3.1 (10.1)	3.5 (11.5)	3.7 (12.1)	3.7 (12.1)	3.7 (12.1)	3.7 (12.1)

Type 1 Service brakes (fade)

Ballasted	Force on brake pedal	N (lb)	350 (79)	400 (90)	450 (101)	500 (112)	550 (124)	600 (135)	650 (146)
	Mean deceleration	m/s^2 (ft/s^2)	1.5 (4.9)	1.8 (5.9)	2.0 (6.6)	2.3 (7.5)	2.5 (8.2)	2.7 (8.9)	2.7 (8.9)

Brakes were heated by: Driving

Comments on deviation and vibration: None

Parking brake:

	Force applied on slope of 18%		Force applied on slope of 12% with trailer of 3 tonnes (6614 lb)	
	Up	Down	Up	Down
Pull on handbrake N (lb)	178 (40)	178 (40)	89 (20)	89 (20)

7. MEASUREMENT OF EXTERNAL NOISE LEVEL

Date of tests:	8th August 1985
Type of sound level meter:	Bruel and Kjaer 2209
Type of track:	Concrete
Results of test	
Gear:	H4
Travelling speed before acceleration:	29.6 km/h (18.5 mile/h)
Sound level:	85 dBA

8. NOISE MEASUREMENT AT THE DRIVER'S EAR

Date of tests:	1st August 1985
Type of sound level meter:	Bruel and Kjaer 2209
Type of track:	Concrete
Cab fitted:	Yes

Results of tests:

Gear	Drawbar pull at which the tractor develops maximum sound level, kN (lb)	Measured travelling speed, km/h (mile/h)	Sound level, dBA
All openings closed with cab fitted			
*H1M	10 (2250)	8.1 (5.1)	85
*H1M	Light load	8.4 (5.3)	82
H4	Light load	39.5 (24.7)	84

* The H1M gear corresponds to the nominal travelling speed nearest to 7.5 km/h (4.7 mile/h)

B. SUPPLEMENTARY TESTS

Lifting force

Linkage set to manufacturer's specification for normal use

Date of tests: 30th July 1985, NIAE

Hydraulic fluid

Make and type:) See "Fuels and lubricants used in test"
Viscosity:)

Type of hydraulic system: Closed centre

Hydraulic fluid temperature at beginning of test: 50°C

Power lift test

	Height of lower hitch point above ground in down position, mm (in)	Vertical movement, mm (in)	Maximum force exerted through full range, kN (lb)	Corresponding pressure of hydraulic fluid, MPa (lb/in^2)	Moment about rear axle, kNm (lbft)	Maximum tilt angle of mast over range of lift, degrees
At the hitch point	307 (12.1)	665 (26.2)	35.9 (8070)	16.0 (2320)	37.5 (27656)	-
On the frame	307 (12.1)	775 (30.5)	27.3 (6130)	16.0 (2320)	45.2 (33324)	10

Main linkage dimensions - see drawings and table on pages 8 and 27

Lifting heights relative to the horizontal plane including the lower link pivot points

mm	205	193	100	0	100	250	+300	+433	+495
in	8.1	7.6	3.9	0	3.9	9.8	11.8	17.0	19.5

Lifting forces at hitch points
(corresponding pressure 16.9 MPa 2450 lb/in^2)

kN	-	35.9	37.8	39.1	39.5	40.8	40.2	40.1	-
lb	-	8070	8500	8790	8880	9170	9050	9020	-

Lifting forces at test frame
(corresponding pressure 16.9 MPa 2450 lb/in^2)

kN	36.2	36.3	36.3	35.6	33.8	32.0	30.7	28.6	27.3
lb	8140	8160	8160	8010	7590	7190	6910	6430	6130

Linkage dimensions for the supplementary lifting test

Rear tyres (size 16.9-38) radius index:		(r)	795 mm	(31.3 in)
+Front tyres (size 7.5-20) radius index:		(r')	410 mm	(14.9 in)
Length of lift arms:		(A)	330 mm	(13.0 in)
Length of lower links:		(B)	915 mm	(36.0 in)
Distance of lift arm pivot point from rear wheel centre line	horizontally:	(a)	170 mm	(6.7 in)
	vertically:	(b)	286 mm	(11.3 in)
Horizontal distance between the 2 lower link points:		(u)	525 mm	(20.7 in)
Horizontal distance between the 2 lift arm end points:		(v)	555 mm	(21.8 in)
Length of top link:		(S)	662 mm	(26.1 in)
Distance of top link pivot point from rear wheel centre line	horizontally:	(c)	385 mm	(15.2 in)
	vertically:	(d)	210 mm	(8.3 in)
Distance of lower link pivot point from rear wheel centre	horizontally:	(e)	130 mm	(5.1 in)
	vertically:	(f)	255mm	(10.0 in)
Distance of lower link pivot points to lift rod pivot points on lower links:		(D)	498 mm	(19.6 in)
Length of lift rods:		(L)	559 mm	(22.0 in)
Height of lower hitch points relative to the rear wheel centre line, situated 795 mm above the ground level				
- in low position:		(h)	488 mm	(19.2 in)
- in high position:		(H)	177 mm	(7.0 in)
Height of lower hitch points when locked in transport position:			Any height within lift range	

+Steering tyres at 150 kPA. No tyre radius index available.

REPAIRS AND ADJUSTMENTS DURING TESTS: None

REMARKS: None

Test carried out by: J.P. Evans; P.A. Pope

Officer in charge: P.C Seward

Signed: D. W. Smith Head of Tractor Test Section

R. M. Stagner for the Director

Date: 1st October 1985.