SILSOE RESEARCH INSTITUTE
Wrest Park, Silsoe,
Bedford MK45 4HS

2.

Report No: OECD/7595/0198
OECD Approval No: 2/1817
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Report on test in accordance with the OECD STANDARD CODE II (RESTRICTED CODE) for the Official Testing of Agricultural and Forestry Tractors

New Holland 618335(TS110)Four-Wheel Drive Tractor with 16-speed Power-Shift Transmission (40 km/h)



Manufactured by: New Holland UK Ltd
Basildon
Essex
United Kingdom

Submitted for test by: The manufacturer

Report No: 797

Date: November 1998

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Tractor manufacturer's name and address:	New Holland UK Ltd Basildon, Essex, United Kingdom
Location of tractor assembly:	Basildon, Essex
Submitted for test by:	The manufacturer
Selected for test by:	The manufacturer
Place of running in:	Basildon, Essex
Duration of running in:	45 hours
Location of test:	Silsoe Research Institute Wrest Park, Silsoe, United Kingdom

1. SPECIFICATIONS OF TRACTOR

1. 1 Identification

Make:	New Holland
Model:	618335 (TS 110) with 16 -speed power-shift transmission
Type:	Four wheel drive unit construction
Serial No:	082929B
1st Serial No:	082947B

1.2 Engine

Make:	New Holland
Model:	450T/PD
Type:	4 stroke direct injection turbo charged diesel
Serial No:	PD750646

1.2.1 Cylinders

Number/disposition:	4 vertical in-line
Bore/stroke:	111.8 mm/127.0 mm
Capacity:	4987 cm^3
Compression ratio:	17.5 :1
Arrangement of valves:	Overhead
Cylinder liners:	None, monobloc construction

1.2.2 Supercharging

Make:	Garrett
Model:	T250
Type:	Exhaust driven
Pressure:	95 kPa at 2070 rpm and 100% load

1.2.3 Fuel system

Fuel feed system:	Stanadyne electric
Make, type and model of fuel filter:	Plastic strainer in tank and one disposable canister filter with sediment bowl and water seperator plus secondary disposable canister filter between tank and injection pump
Capacity of fuel tank:	160 litres
Make, type and model of injection pump:	Lucas/CAV Rotary, DP203, DSA 1261
Serial No:	02351 MPG
Manufacturer's production setting of injection pump:	
Flow rate:	89.0+/-2.7 mm^3 per stroke at 2070 rev/min speed and full load
Timing:	Delivery starts 3° before T.D.C (dynamic)
Make, type and model of injectors:	Lucas/CAV, multihole, L067PBA
Injection pressure:	292-300 bar

1.2.4 Governor

Make:	Lucas
Model:	None
Type:	Mechanical incorporated in fuel injection pump
Governed range of engine speed:	700 rev/min to 2245 rev/min
Rated engine speed:	2070 rev/min

1.2.5 Air cleaner

Pre-cleaner	Optional
Main cleaner	
Make:	Locker Air Maze or Donaldson
Type:	3 stage dry paper element with replaceable cartridge
Model:	None
Location:	Under engine bonnet above engine
Location of air intake:	By roof on RH A- pillar of cab
Maintenance indicator:	Warning light on instrument panel

1.2.6 Lubrication system

Type of feed pump:	Forced feed from eccentric rotor pump
Type of filter:	Metal mesh strainer in sump on suction line and full flow disposable canister on pressure line to engine
Number:	1

1.2.7 Cooling system

Type of coolant:	Water or water and antifreeze (50% solution)
Type of pump:	Belt driven centrifugal impeller
Specification of fan:	Thermal controlled with viscous clutch
Number of fan blades:	5
Fan diameter:	480 mm
Coolant capacity:	16.0 litres
Type of temperature control:	Thermostat with full flow bypass
System pressure:	90 kPa

1.2.8 Starting system

Make:	Bosch JF
Model:	JF
Type:	Electrical, positive engagement, solenoid operated
Starter motor power rating:	3.1/3.6 kW
Cold starting aid:	CAV Thermostart - Lucas 357-33 or Iskra 11-720-375
Safety device:	Starting operable when all gear levers are in neutral

1.2.9 Electrical system

Voltage:	12 V
Generator:	Alternator
Make:	Magneti Marrelli
Model:	MME A 127
Type:	Belt driven
Power:	55/100 amps at 6000 rev/min
Batteries:	2 x 800 cca lead acid, mounted on right-hand side under cab (1 x 800 option)
Rating:	107 AH at 20 hours rating

1.2.10 Exhaust system

Make:	Nelson Burgess
Model:	None
Type:	Underhood horizontal silencer with vertical stack pipe
Location:	Left-hand side of engine, under bonnet
Height of outlet above ground:	2895 mm

1.3 Transmission

1.3.1 Main clutch (Travel alone)

Make:	New Holland
Model:	None
Type:	Wet multiplate - located within gearbox, for travel only
Number of plates:	8
Diameter of plates:	159 mm
Method of operation:	Electro-hydraulic, pedal button operation

1.3.2 Gear box

Make:	New Holland (Electroshift™)
Model:	16 x 16 Synchromesh
Operation:	Mechanical/electrical manual synchromesh operation, 4-powershift speeds and 4 ranges selected with two side mounted levers. A third side mounted lever selects forward or reverse for each combination.
Number of gears:	16 forward, 16 reverse (40 km/h)
Available options:	12 x 12 with 24 x 24 Synchroshift™

1.3.3 Rear axle final drives

Make:	New Holland
Model:	None
Type:	Crown wheel and pinion with differential and inboard epicyclic reduction gear final drive
Differential lock:	
Type:	Mechanical
Method of engagement:	Electro-hydraulic actuation in response to signal from switch on right-hand control panel
Method of disengagement:	Via panel switch or in response to electrical signal from brakes on application

1.3.4 Front axle and final drives

Make:	New Holland
Model:	None
Type:	Crown wheel and pinion with differential and outboard epicyclic reduction gear final drives
Drive engagement:	
Type:	Multiplate clutch - located within the gearbox
Method of operation:	Electro-hydraulic actuation in response to signal from switch on the RH control panel
Differential lock:	
Type:	Mechanical
Method of engagement:	Electro-hydraulic actuation in response to signal from switch on right-hand control panel
Method of disengagement:	Via panel switch or in response to electrical signal from brakes on application

1.3.5 Total ratios and travelling speeds

Gear	Group No	Number of engine revolutions for one revolution of the driving wheels	Nominal travelling speed at rated engine speed:* 2070 rev/min km/h
Forward			
1	1L	288.67	2.22
2	2L	235.08	2.72
3	3L	193.16	3.31
4	4L	157.29	4.07
5	5L	122.26	5.23
6	6L	99.56	6.43
7	7L	81.81	7.82
8	1H	70.20	9.12
9	8L	66.62	9.61
10	2H	57.17	11.19
11	3H	46.97	13.62
12	4H	38.25	16.73
13	5H	29.73	21.52
14	6H	24.21	26.43
15	7H	19.89	32.17
16	8H	16.20	39.50
Reverse			
1	1L	291.30	2.20
2	2L	237.22	2.70
3	3L	194.91	3.28
4	4L	158.72	4.03
5	5L	123.37	5.19
6	6L	100.47	6.37
7	7L	82.55	7.75
8	1H	70.84	9.03
9	8L	67.22	9.52
10	2H	57.69	11.09
11	3H	47.40	13.50
12	4H	38.60	16.58
13	5H	30.00	21.33
14	6H	24.43	26.19
15	7H	20.08	31.88
16	8H	16.35	39.14

L = Low range H = High range

(*) Calculated with a tyre dynamic radius index of 820mm (ISO 421/1-1992)

Number of revolutions of front wheels for one revolution of rear wheels: 1.341

1.4 Power take-off

1.4.1 Main power take-off

Type:	Independent
Method of engagement:	Electro - hydraulically operated multi-plate clutch in response to a signal from switch on the right-hand control panel
Number of shafts:	1 interchangeable shaft, 6 or 21 spline to ISO 500/1991
Method of changing power take-off speeds:	Manually by hand lever in cab

Clutch

Make:	New Holland
Model:	None
Type:	Multiplate, wet
Number of plates:	5
Diameter of plates:	148.6 mm

1.4.2 Power take-off proportional to engine speed

Two speed shiftable power take-off

(Fitted for test)	*540 rev/min*	*1000 rev/min*
Location:	Rear of tractor	Rear of tractor
Diameter of power take-off shaft:	34.9 mm	34.9 mm
Number of splines:	6 or 21	6 or 21
Height above ground:	773 mm	773 mm
Distance from the median plane of the tractor:	Central	Central
Distance behind rear wheel axis:	457 mm	457 mm
Pto speed at rated engine speed:	591 rev/min at 2070	985 rev/min at 2070
Engine speed at standard power take-off speed:	1890 rev/min	2103 rev/min
Ratio of rotation speeds:	3.50:1	2.103:1
Power restriction and maximum torque:	None	None
Direction of rotation (viewed from behind tractor):	Clockwise	Clockwise

1.4.2 Optional PTO system available (not fitted for test)

Two speed power take-off selected by exchanging shafts

540 rev/min

Location:	Rear of tractor
Diameter of power take-off shaft:	34.9 mm
Number of splines:	6
Height above ground:	773 mm
Distance from the median plane of the tractor:	Central
Distance behind rear wheel axis:	457 mm
PTO speed at rated engine speed:	591 rev/min at 2070
Engine speed at standard power take-off speed:	1890 rev/min
Ratio of rotation speeds:	3.50:1
Power restriction and maximum torque:	None
Direction of rotation (viewed from behind tractor):	Clockwise

1000 rev/min

Location:	Rear of tractor
Diameter of power take-off shaft:	34.9 mm
Number of splines:	21
Height above ground:	773 mm
Distance from the median place of the tractor:	Central
Distance behind rear wheel axis:	457 mm
PTO speed at rated engine speed:	1010 rev/min at 2070
Engine speed at standard power take-off speed:	2049 rev/min
Ratio of rotation speeds:	2.049:1
Power restriction and maximum torque:	None
Direction of rotation (viewed from behind tractor):	Clockwise

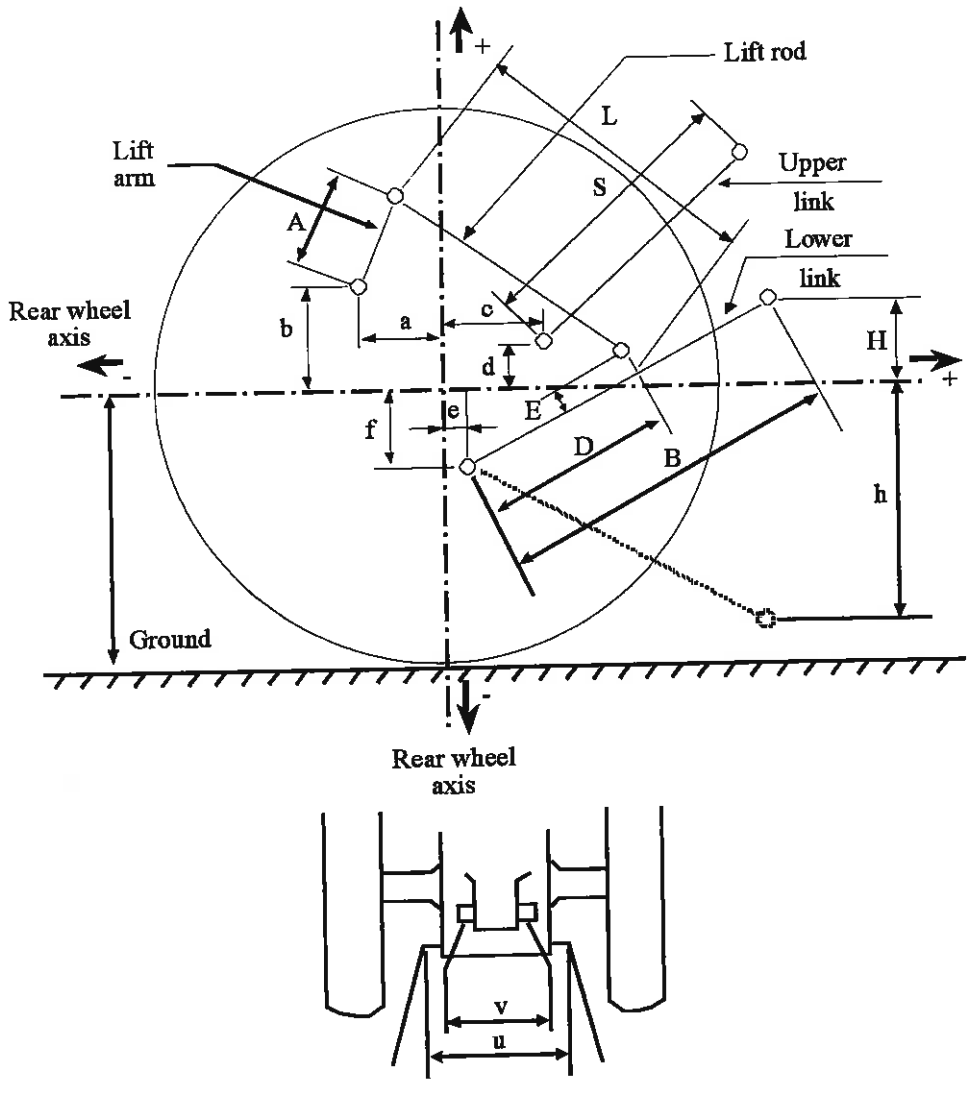
1.5 Hydraulic power lift - standard

Pump - standard

Make:	Sauer Sundstrand
Model:	None
Type:	Piston type, variable displacement closed centre load sensing system
Type and number of cylinders:	1 located inside transmission housing plus the option of 1 or 2 single acting, externally mounted assistor rams (None, 1 or 2 fitted for tests)
Type of linkage lock for transport:	Hydraulic
Relief valve pressure setting:	17.6 - 18.3 MPa
Opening pressure of cylinder safety valve:	19.7 MPa
Lift pump type:	Gear
Transmission between pump and engine:	Gear driven from pto shaft, independent of main and pto clutches
Type and number of filters:	3 replaceable paper element filter canisters
Site of oil reservoir:	Rear axle housing
Type, number and position of tapping points:	1 front face of hydraulic top cover
Maximum volume of oil available to external cylinders:	18.2 litres

1.6 Three point linkage

Category:	2 to ISO standard 730-1:1994
Category adaptor:	None
Controls:	Electronic draught/position control link. (Optional - draught or position control) Lower link sensing



LIFT TEST
Linkage geometry

Fig 2.1

Table 2.1
Dimensions of linkage when attached to the standard frame (ISO 730-1:1994 CAT 2)
(B2.3 ISO mast height from 730/3-1982 CAT 2)
(B2.4 ASAE S349.2 / SAE J283 mast height)

			Dimensions or range	Settings used test		
				Main test	B2.2	B2.3 /2.4
Length of lift arms		(A)	254	254	254	254
Length of lower links		(B)	915	915	915	915
Distance of lift arm pivot point from rear wheel centre line:	horizontally:	(a)	102	102	102	102
	vertically:	(b)	341	341	341	341
Horizontal distance between the two lower link points:		(u)	527	527	527	527
Horizontal distance between the two lift arm end points:		(v)	610	610	610	610
Length of upper link:		(S)	610 - 830	710	698	675 / 675
Distance of upper link pivot point from rear wheel centre line:	horizontally:	(c)	325	325	325	325
	vertically:	(d)	149 - 205	149	149	205
Distance of lower link pivot point from rear wheel centre line:	horizontally:	(e)	102	102	102	102
	vertically:	(f)	229	229	229	229
Distance of lower link points to lift rod pivot points on lower link centre line:	horizontally:	(D)	412 - 520	466	466	520
	vertically:	(E)	on centre line	on centre line	on centre line	on centre line
Length of lift rods:		(L)	743 - 879	820	785	743 / 830,775
ISO mast height			-	610	610	510 / 483
Height of lower hitch points (*) relative to the rear wheel centre line, situated 820 mm above the ground level:						
- in low position		(h)	308 to 794	624	544	300 / 543 , 377
- in high position		(H)	-77 to 224	51	120	240 / 71, 181
Height of lower hitch points when locked in transport position (*)		Any height within lift range (hydraulic transport lock)				

ssuming r = tyre dynamic radius index of820 mm ISO 4251/1-1984
r 740 mm for supplementary test (B2.2)

1.7 Swinging drawbar

(Incorporated in vertical frame)

Type:	Clevis
Height above ground, unballasted maximum:	550 mm
minimum:	437 mm
Type of adjustment:	Inverting drawbar
Distance of hitch point from rear-wheel axis, horizontally:	685 mm 800 mm 850 mm
Distance of hitch point from power take-off shaft end:	
Vertically:	223 mm 336 mm
Horizontally:	228 mm 343 mm 393 mm
Lateral adjustment from the (centre of clevis):	
Right-hand	145 mm 168 mm 180 mm
Left-hand	145 mm 168 mm 180 mm
Distance of pivot point from rear axles horizontally:	13 mm behind rear axle
Width of clevis:	70 mm
Diameter of pin hole:	29/33 mm
Maximum vertical permissible load - Clevis uppermost:	1630 kg 1065 kg 910 kg
Clevis underneath:	1135 kg 1065 kg 910 kg

1.8 Trailer Hitch

Type:	Coupling
Hole diameter:	29/33 mm
Height above ground maximum:	968 mm
minimum:	518 mm
Type of adjustment:	Vertical
Distance of hitch point from rear-wheel axis, horizontally:	610 mm
Distance of hitch point from power take-off shaft end:	
Vertically: (50mm Increments)	-255 mm to +195 mm
Horizontally:	160 mm
Maximum vertical permissible load:	1500 kg

1.9 Linkage Drawbar

Type:	None fitted

Front Towing Hitch

Type	None fitted

1.10 Steering

Make:	New Holland
Model:	None
Type:	Hydrostatic
Method of operation:	
Pump:	Sauer Sundstrand
Motor:	Danfoss OSPC-150-OR/160-OR
Ram:	2 double acting balanced cylinders, one operating on each steering arm
Filter:	Integral with hydraulic power lift system
Working pressure:	170 - 175 bar

1.11 Brakes

1.11.1 Service brake

Make:	New Holland
Model:	None
Type:	Oil-immersed multi plate discs
Method of operation:	Hydraulic, independent on rear wheels. On 40 km/h (4WD) models when the service brakes are actuated the front wheel drive is automatically engaged providing 4-wheel braking
Trailer braking take-off:	Hydraulic connector fitted to ISO 5676-1983

1.11.2 Parking brake

Make:	New Holland
Type:	Mechanical linkage coupled to service brakes via cables
Method of operation:	Hand lever with ratchet

1.12 Wheels

Number:	4
Front:	2 steering and driving
Rear:	2 driving
Wheelbase:	2362 mm

Track settings

	Minimum mm	Maximum mm	Adjustment method
Front	1404	2115	Reversing wheels and offset lug rims
Rear	1528	2028	Reversing wheels and offset lug rims

1.13 Protective structure

Make:	New Holland
Model:	New Holland 582 MK SK 90
Type:	Safety cab
Manufacturer's name and address:	Airflow - Streamlines PLC, Northampton
Protective device:	
Rollguard:	Safety cab
Tiltable/Not tiltable:	Non tiltable

OECD approval

Approval number:	CSD-1329/113-130
Date of approval:	1 September 1997

Nos. of minor modification certificates, if any:
The Certificates for minor modifications established by and under the responsibility of the National Authority of DENMARK

1.14 Seat

1.14.1 Drivers seat

Make/Model/Type:	Grammer MSG 93/20
Seat and steering wheel reversible:	No
Type of suspension:	Low frequency, parallelogram suspension spring
Type of damping:	Double acting, hydraulic
Range of adjustment:	
Longitudinal:	± 75 mm
Vertical:	± 30 mm
Safety belt:	Yes

1.15 Lighting

In accordance with EEC Directive 78/933/EEC

Unrestricted beam angle of headlight in plan view: 140°

	Height above ground to centre mm	Size mm	Distance from outside edge to median plane of tractor mm
Headlight	1372	150 x 90	210
Sidelights	1820	105 x 30	772
Rear lights	1755	60 x 60	840
Axle reflectors	825	125 x 45	585
Cab reflectors	1755	60 x 60	840

2 TEST CONDITIONS

2.1 Overall dimensions

Length mm	Width		Height at top of	
	Minimum mm	Maximum mm	Protective structure mm	Exhaust pipe mm
4110	2180	2495	2763	2895

2.2 Ground clearance (unballasted tractor) 360 mm

Clearance-limiting part: Drawbar clevis in lowest position

2.3 Tractor mass (with safety cab)

	Unballasted		Ballasted	
	Without driver kg	With driver kg	Without driver kg	With driver kg
Front	1745	1751	--	--
Rear	2790	2859	--	--
Total	4535	4610	--	--

2.5 Tyres and track width specification

	Front	Rear
Tyres dimensions ply rating type	 14.9 R 28 128AB Radial	 18.4 R 38 146A8 Radial
Maximum load (tyre manufacturer's), kg 30 km/h (40 km/h)	1925 (1800)	3210 (3000)
Maximum load (tractor manufacturer's), kg	1925 (1800)	3210 (3000)
Inflation pressure (tyre manufacturer's), Bar	1.6	1.6
Dynamic radius index, mm	640	820
Chosen track width (manufacturer's nominal), mm	1706	1625

2.6 Fuel

Type: Diesel oil to Class D, 1.5 to 5.5 cSt
Density at at 15°C: 0.8370 g/cm^3

2.7 Oils and lubrication

2.7.1 Capacity and change interval

	Capacity litre	Oil change hours	Filter change hours
Engine	11.4	300	300
Front axle differential	6.2	1200	None
Final drive (front) - per side	3.0	1200	None
Rear axle Range command + CCLS	60.6	1200	300
Gearbox } Hydraulic system } Final drives (rear) } Steering }	Integral with rear axle		
Brakes	0.5	Top-up	None

2.7.2 Specifications

	NH spec	Recommended	Used during test
Engine oil Type: Viscosity: Classification:	82922933	SAE 10W/30 11.5 cSt at 100°C API CE/SF	As recommended
Transmission oils Type: Viscosity: Classification:	85700812	Not specified 9 cSt at 100°C API GL-4	As recommended
Rear final drives Type: Viscosity: Classification:	85700812	Not specified 9 cSt at 100°C API GL-4	As recommended
Hydraulic fluid Type: Viscosity: Classification:	85700812	Not specified 9 cSt at 100°C API GL-4	As recommended
Steering oil Type: Viscosity: Classification:	85700812	Not specified 9 cSt at 100°C API GL-4	As recommended
Front differential and final drives Type: Viscosity: Classification:	85700812	Not specified 9 cSt at 100°C API GL-4	As recommended
Hydraulic brakes Type: Viscosity: Classification:	82865344	Not specified 6 cSt at 100°C No equivalent	As recommended
2.7.3 Grease points Type: Classification:	82948889	Lithium based NLG1 2	As recommended
Number of lubrication points:	12		

3. COMPULSORY TESTS RESULTS

3.1 Main power take-off (1000)

Date and location of tests: 16 July 1998
Silsoe Research Institute,
Wrest Park, Silsoe, Bedford

Type of dynamometer: Eddy Current, Borghi and Saveri

Power kW	Speed		Fuel consumption			Specific energy kWh/l
	Engine rev/min	P.T.O. rev/min	Hourly kg/h	Hourly l/h	Specific g/kWh	
3.1.1 MAXIMUM POWER - TWO HOUR TEST						
73.7	2000	951	17.94	21.44	243	3.44
3.1.2 POWER AT RATED ENGINE SPEED						
73.3	2070	984	18.30	21.87	250	3.35
3.1.3 STANDARD POWER TAKE-OFF SPEED (1000 ± 25 rev/min)						
–	–	–	--	--	--	--
3.1.4 PART LOADS 3.1.4.1 The torque corresponding to maximum power at rated engine speed						
73.3	2070	984	18.30	21.87	250	3.35
3.1.4.2 85% of the torque defined in 3.1.4.1						
64.4	2143	1019	16.58	19.81	257	3.25
3.1.4.3 75% of the torque defined in 3.1.4.2						
49.3	2183	1038	13.56	16.20	275	3.04
3.1.4.4 50% of the torque defined in 3.1.4.2						
33.2	2204	1048	10.91	13.03	328	2.55
3.1.4.5 25% of the torque defined in 3.1.4.2						
16.6	2210	1051	7.82	9.34	471	1.78
3.1.4.6 Unloaded						
0	2231	1061	4.70	5.61	--	--

No load, maximum engine speed:	2231 rev/min
Torque (equivalent crankshaft) at maximum power:	352.1 Nm
Torque (equivalent crankshaft) at rated speed:	338.0 Nm
Maximum torque (equivalent crankshaft): (engine speed 1409 rev/min)	425.6 Nm
Mean atmospheric conditions:	
• Temperature	23 °C
• Pressure	100.6 kPa
• Relative humidity	46 %
Maximum temperatures:	
• Coolant	87 °C
• Engine oil	112 °C
• Fuel	54 °C
• Engine air intake	28 °C

3.2 Hydraulic power and lifting force

Date of tests: 1 September 1998

3.2.1 Hydraulic power test

Sustained pressure with relief valve open:	18.9 MPa
Pump delivery rate at minimum pressure:	79.0 l/min

	Flow rate l/min	Pressure MPa	Power kW
Flow rate corresponding to a hydraulic pressure equivalent to 90% of the actual relief valve pressure setting and corresponding hydraulic power	51.7	17.0	14.64
Flow rate and hydraulic pressure corresponding to maximum hydraulic power	69.5	15.4	17.84

Tapping point used for test:	Auxiliary service connection
Temperature of hydraulic fluid if different from 65 ± 5°C	– °C
Opening pressure of the unloading valve:	-- MPa
Closing pressure of the unloading valve:	-- MPa

3.2.2 Power lift test - (To ISO 730-1:1994)

	At the hitch point	On the frame
Height of lower hitch points above ground in down position	196 mm	196 mm
Vertical movement	675 mm	904 mm
Maximum corrected force exerted through full range	(1) 20.0 kN (2) 29.0 kN (3) 39.1 kN (4) 46.4 kN	(1) 15.2 kN (2) 21.3 kN (3) 28.5 kN (4) 31.0 kN
Corresponding pressure of hydraulic fluid	17.0 MPa	17.0 MPa
Moment about rear-wheel axis	(1) 20.3 kNm (2) 29.5 kNm (3) 39.8 kNm (4) 47.2 kNm	(1) 24.7 kNm (2) 34.7 kNm (3) 46.4 kNm (4) 50.4 kNm
Maximum tilt angle of mast from vertical	--	13 degrees

Linkage settings for test - see Table 2.1 and Figure 2.1

(1) No Assistor ram fitted

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	-503	-394	-300	-200	-100	0	100	200	250	281	401
Lifting forces (the values measured are corrected to correspond to a hydraulic pressure equivalent to 90% of the actual relief valve pressure delivered by the hydraulic system)											
at the hitch points kN	--	20.0	20.8	22.4	23.2	23.7	23.8	23.9	24.0	24.0	--
Corresponding pressure: 17.0 MPa											
at the frame kN	16.1	16.9	17.5	17.7	17.6	17.6	17.1	16.6	16.2	16.0	15.2
Corresponding pressure: 17.0 MPa											

(2) 1 Assistor ram fitted (45mm)

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	-503	-394	-300	-200	-100	0	100	200	250	281	401
Lifting forces (the values measured are corrected to correspond to a hydraulic pressure equivalent to 90% of the actual relief valve pressure delivered by the hydraulic system)											
at the hitch points kN	--	29.0	30.2	31.5	32.5	33.5	33.7	33.8	33.8	33.8	--
Corresponding pressure: 17.0 MPa											
at the frame kN	24.1	24.8	25.4	25.5	25.3	25.1	24.2	23.6	23.1	22.9	21.3
Corresponding pressure: 17.0 MPa											

(3) 2 Assistor rams fitted (45mm)

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	-503	-394	-300	-200	-100	0	100	200	250	281	401
Lifting forces (the values measured are corrected to correspond to a hydraulic pressure equivalent to 90% of the actual relief valve pressure delivered by the hydraulic system)											
at the hitch points kN	--	39.1	40.6	41.9	42.3	43.9	44.2	44.8	44.4	44.5	--
Corresponding pressure: 17.0 MPa											
at the frame kN	32.9	33.3	33.3	33.4	33.4	32.6	32.0	31.0	30.1	29.8	28.5
Corresponding pressure: 17.0 MPa											

(4) 2 Assistor rams fitted (50mm)

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	-503	-394	-300	-200	-100	0	100	200	250	281	401
Lifting forces (the values measured are corrected to correspond to a hydraulic pressure equivalent to 90% of the actual relief valve pressure delivered by the hydraulic system)											
at the hitch points kN	--	46.4	46.7	47.5	48.8	49.4	49.3	49.1	49.0	49.0	--
Corresponding pressure: 17.0 MPa											
at the frame kN	37.2	37.3	37.5	37.5	36.9	36.4	35.3	34.1	33.4	33.1	31.0
Corresponding pressure: 17.0 MPa											

3.3 Drawbar power test (unballasted tractor), 4 wheel drive

Date and Location of tests: 10 August 1998
Silsoe Research Institute
Wrest Park
Silsoe
Bedford MK45 4HS

Type of track: Concrete

Height of drawbar above ground	Tyre inflation pressure (kPa)	
	Front	Rear
405 mm	90	90

Gear and Range	Power	Drawbar Pull	Speed	Engine Speed	Slip of wheels or track	Spec Fuel cons	Spec energy	Temperature			Atmospheric conditions		
								Fuel	Coolant	Eng oil	Temp	Rel Humidity	Pressure
	kW	kN	km/h	rev/min	%	g/kwh	kWh/l	Deg C	Deg C	Deg C	Deg C	%	kPa
3.3.1 MAXIMUM POWER IN TESTED GEARS													
1L	25.4	45.0	2.03	2187	15.3	423	1.98	57	84	107	22	63	101.0
2L	31.1	43.5	2.57	2176	12.2	398	2.10	58	84	108	22	58	101.0
3L	37.8	43.1	3.16	2155	10.6	361	2.32	58	83	107	23	55	101.0
4L	45.1	41.9	3.88	2139	10.1	342	2.45	59	84	108	24	45	101.0
5L	55.6	41.7	4.80	2072	10.1	317	2.64	59	87	108	23	55	101.0
6L	59.8	36.4	5.91	2004	7.0	296	2.83	59	84	108	24	56	101.0
7L	58.0	28.4	7.36	2007	4.8	305	2.74	57	85	103	25	52	101.0
1H	60.6	25.2	8.67	2000	4.1	294	2.85	54	86	107	20	70	101.0
8L	57.4	22.6	9.14	2006	3.8	306	2.74	60	85	108	25	51	100.9
2H	58.0	19.4	10.76	2002	3.2	302	2.77	59	85	107	25	51	100.9
3H	56.1	15.3	13.18	2003	2.6	311	2.70	59	85	107	26	51	100.9
4H	55.5	12.3	16.25	2002	2.3	314	2.67	62	86	109	26	49	100.9
3.3.FUEL CONSUMPTION 3.3.2.1 In selected gear , at maximum power at rated speed													
1H	57.5	23.1	8.98	2064	3.8	311	2.69	55	86	109	20	69	101.0
3.3.2.1.1 75% of pull at maximum power at rated speed													
1H	45.5	17.3	9.44	2150	2.8	335	2.50	57	84	109	21	66	101.0
3.3.2.1.2 50% of pull at maximum power at rated speed													
1H	30.9	11.5	9.70	2188	1.9	393	2.13	57	84	109	21	63	101.0
3.3.2.1.3 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.1.1													
2H	45.4	17.3	9.46	1754	2.9	301	2.78	61	85	107	26	50	100.9
3.3.2.1.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.1.2													
2H	31.0	11.5	9.73	1787	2.0	340	2.46	59	84	105	26	50	100.9
3.3.2.2 In selected gear nearest to 7.5 km/h, at maximum power at rated speed													
7L	56.7	26.8	7.61	2070	4.6	313	2.68	58	85	105	25	52	101.0
3.3.2.2.1 75% of pull at maximum power at rated speed													
7L	44.6	20.1	7.99	2146	3.5	342	2.45	60	84	106	25	51	100.9
3.3.2.2.2 50% of pull at maximum power at rated speed													
7L	30.4	13.4	8.20	2177	2.3	395	2.12	59	84	107	25	52	100.9
3.3.2.2.3 Next higher gear at reduced engine speed; same pull and travelling speed as in3.3.2.2.1													
1H	44.9	20.1	8.02	1835	3.3	300	2.79	60	85	105	27	50	100.9
3.3.2.2.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.2.2													
1H	30.6	13.4	8.25	1866	2.3	345	2.43	60	83	105	26	49	100.9

SUPPLEMENTARY TESTS

3.1 Main power take-off (540)

Date and location of tests: 16 July 1998
Silsoe Research Institute
Wrest Park, Silsoe, Bedford

Type of dynamometer: Eddy Current, Borghi and Saveri

Power kW	Speed		Fuel consumption			Specific energy kWh/l
	Engine rev/min	P.T.O. rev/min	Hourly kg/h	Hourly l/h	Specific g/kWh	
3.1.1 MAXIMUM POWER						
73.3	2002	572	18.01	21.51	246	3.41
3.1.2 POWER AT RATED ENGINE SPEED						
72.5	2069	591	18.13	21.67	250	3.35
3.1.3 STANDARD POWER TAKE-OFF SPEED (540 ± 10 rev/min)						
72.5	1890	540	17.53	20.94	242	3.46
3.1.4 PART LOADS 3.1.4.1 The torque corresponding to maximum power at rated engine speed						
72.5	2069	591	18.13	21.67	250	3.35
3.1.4.2 85% of the torque defined in 3.1.4.1						
63.4	2132	609	16.52	19.73	261	3.21
3.1.4.3 75% of the torque defined in 3.1.4.2						
48.5	2172	621	13.59	16.24	280	2.99
3.1.4.4 50% of the torque defined in 3.1.4.2						
32.5	2192	626	10.81	12.92	332	2.52
3.1.4.5 25% of the torque defined in 3.1.4.2						
16.4	2209	631	8.09	9.67	493	1.70
3.1.4.6 Unloaded						
0	2230	637	4.91	5.87	--	--

Power kW	Speed		Fuel consumption			Specific energy kWh/l
	Engine rev/min	P.T.O. rev/min	Hourly kg/h	Hourly l/h	Specific g/kWh	
3.1.5 PART LOADS AT STANDARD POWER TAKE-OFF SPEED (540 ± 10 rev/min)						
3.1.5.1 The torque corresponding to maximum power						
72.5	1890	540	17.53	20.94	242	3.46
3.1.5.2 85% of the torque defined in 3.1.5.1						
64.4	1975	564	16.05	19.18	249	3.36
3.1.5.3 75% of the torque defined in 3.1.5.2						
49.5	2021	577	13.20	15.77	267	3.14
3.1.5.4 50% of the torque defined in 3.1.5.2						
33.3	2046	584	10.49	12.53	315	2.66
3.1.5.5 25% of the torque defined in 3.1.5.2						
16.7	2060	589	7.44	8.89	444	1.88
3.1.5.6 Unloaded						
0	2085	596	4.41	5.27	--	--

No load, maximum engine speed: 2230 rev/min

Torque (equivalent crankshaft) at maximum power: 349.8 Nm

Torque (equivalent crankshaft) at rated speed: 334.7 Nm

Maximum torque (equivalent crankshaft): *Nm
(engine speed --- rev/min)

Mean atmospheric conditions:

- Temperature 23 °C
- Pressure 100.7 kPa
- Relative humidity 45 %

Maximum temperatures:

- Coolant 87°C
- Engine oil 111°C
- Fuel 55 °C
- Engine air intake 25°C

*Maximum torque not measurable within limits of test equipment

3.2 Hydraulic power and lifting force

I. B 2.2 Power lift test - (To ISO 730-1: 1994, alternative rear tyre size 13.6 R38)

	At the hitch point	On the frame
Height of lower hitch points above ground in down position	196 mm	196 mm
Vertical movement	664 mm	904 mm
Maximum corrected force exerted through full range	46.9 kN	30.5 kN
Corresponding pressure of hydraulic fluid	17.0 MPa	17.0 MPa
Moment about rear-wheel axis	47.7 kNm	49.6 kNm
Maximum tilt angle of mast from vertical	--	14 degrees

Linkage settings for test - see Table 2.1 and Figure 2.1

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	-405	-315	250	150	50	0	100	200	300	349	499
Lifting forces (the values measured are corrected to correspond to a hydraulic pressure equivalent to 90% of the actual relief valve pressure delivered by the hydraulic system)											
at the hitch points kN	--	46.9	47.7	49.0	49.7	49.9	50.8	50.9	50.5	50.3	--
Corresponding pressure: 17.0 MPa											
at the frame kN	37.5	37.7	38.0	38.1	37.8	37.4	36.3	35.1	33.7	32.9	30.5
Corresponding pressure: 17.0 MPa											

II. B 2.3 Power lift test - (To manufacturers lift rod setting and original tyres)

	At the hitch point	On the frame
Height of lower hitch points above ground in down position	520 mm	520mm
Vertical movement	540 mm	664 mm
Maximum corrected force exerted through full range	58.3 kN	37.3 kN
Corresponding pressure of hydraulic fluid	17.0 MPa	17.0 MPa
Moment about rear-wheel axis	59.3 kNm	60.7 kNm
Maximum tilt angle of mast from vertical	--	14 degrees

Linkage settings for test - see Table 2.1 and Figure 2.1

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	-81	-71	0	100	200	250	300	400	469	500	583
Lifting forces (the values measured are corrected to correspond to a hydraulic pressure equivalent to 90% of the actual relief valve pressure delivered by the hydraulic system)											
at the hitch points kN	--	61.2	61.2	61.7	61.3	61.0	60.8	59.6	58.3	--	--
Corresponding pressure: 17.0 MPa											
at the frame kN	56.1	56.0	54.9	53.1	50.3	49.0	47.0	43.9	41.5	40.3	37.3
Corresponding pressure: 17.0 MPa											

III. B 2.4 Power lift test - (ASAE S349.2 /SAE J283 with 13.6 R38 tyres)

(1) No Assistor ram fitted
(2) 1 Assistor ram fitted (45mm)
(3) 2 Assistor rams fitted(45mm)
(4) 2 Assistor rams fitted(50mm)

* Lift rods readjusted to 775 mm to allow for lift force to be measured throughout the total lift range

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	-314	-200	-150	100	0	100	200	250	300	--	--
mm*	--	--	-148	100	0	100	200	250	300	344	410
ASAE S349.2											
(1)	27.7	26.1	26.6	25.2	24.5	23.2	21.8	20.8	20.1	--	--
(1)*	--	--	25.8	25.9	26.7	25.6	23.8	22.8	21.9	20.2	19.8
(2)	37.8	37.7	37.3	36.9	35.0	33.4	31.1	29.7	28.5	--	--
(2)*	--	--	38.3	38.8	38.0	36.1	34.2	32.6	31.0	29.2	27.1
(3)	50.4	49.4	48.7	48.1	46.3	43.4	40.7	38.7	36.4	--	--
(3)*	--	--	52.0	51.6	49.9	47.4	44.4	42.6	40.9	38.5	34.8
(4)	57.3	55.9	54.9	53.9	51.5	48.3	45.2	43.3	41.3	--	--
(4)*	--	--	58.0	57.8	56.1	53.2	49.1	47.2	45.4	43.0	39.9
Corresponding pressure:				17.6 MPa							

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	-314	-200	-150	100	0	100	200	250	300	--	--
mm	--	--	-148	100	0	100	200	250	300	344	414
SAE J283											
(1)	24.9	23.4	23.0	22.7	22.0	20.8	19.5	18.7	18.0	--	--
(1)*	--	--	23.1	23.3	23.9	23.0	21.4	20.5	19.6	18.6	17.8
(2)	33.9	33.8	33.4	33.1	31.4	30.0	27.9	26.7	25.6	--	--
(2)*	--	--	34.4	34.8	34.1	32.4	30.7	39.3	27.8	26.2	24.3
(3)	45.2	44.4	43.8	43.2	41.6	39.0	36.5	34.8	32.6	--	--
(3)*	--	--	46.7	46.3	44.8	42.6	39.9	37.8	36.7	34.6	31.3
(4)	51.4	50.2	49.0	48.3	46.2	43.4	40.5	38.8	37.1	--	--
(4)*	--	--	52.1	52.1	49.5	47.8	44.1	42.4	40.8	38.6	35.8
Corresponding pressure:				15.8 MPa							

3.3 Drawbar power test (unballasted tractor), 2 wheel drive

Date and Location of tests: 12 August 1998
Silsoe Research Institute
Wrest Park
Silsoe
Bedford MK45 4HS

Type of track: Concrete

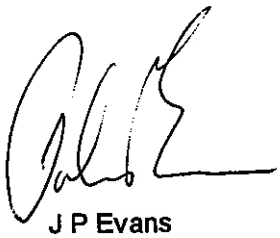
Height of drawbar above ground	Tyre inflation pressure (kPa)	
	Front	Rear
515 mm	90	90

Gear and Range	Power	Drawbar Pull	Speed	Engine Speed	Slip of wheels or track	Spec Fuel cons	Spec energy	Temperature			Atmospheric conditions		
								Fuel	Coolant	Eng oil	Temp	Rel Humidity	Pressure
	kW	kN	km/h	rev/min	%	g/kwh	kWh/l	Deg C	Deg C	Deg C	Deg C	%	kPa
3.3.1 MAXIMUM POWER IN TESTED GEARS													
1L	20.2	36.0	2.02	2187	14.9	486	1.72	57	83	106	19	51	101.0
2L	24.7	35.8	2.48	2178	15.0	432	1.94	55	82	105	23	33	100.9
3L	29.9	34.4	3.12	2171	11.3	393	2.13	58	83	107	25	32	100.9
4L	36.7	34.3	3.84	2160	10.6	353	2.37	57	84	107	24	34	100.9
5L	45.0	33.0	4.92	2139	9.9	325	2.58	58	84	107	23	36	100.9
6L	55.8	33.3	6.03	2109	8.7	318	2.64	60	87	109	19	51	101.0
7L	57.7	29.1	7.13	1995	6.1	306	2.73	60	86	108	23	38	100.9
1H	61.1	25.9	8.50	2004	5.2	295	2.84	55	84	108	22	43	101.0
8L	58.7	23.7	8.94	2002	4.6	304	2.75	55	86	108	23	39	101.0
2H	59.9	20.4	10.58	2007	3.9	296	2.83	57	86	110	22	43	101.0
3H	57.7	16.0	12.95	2003	3.2	305	2.75	59	86	110	22	44	101.0
4H	55.5	12.5	15.98	1999	2.5	319	2.62	57	85	110	19	49	101.0
3.3.2 FUEL CONSUMPTION 3.3.2.1 In selected gear , at maximum power at rated speed													
1H	58.6	23.9	8.83	2072	4.6	302	2.77	57	87	109	23	38	101.0
3.3.2.1.1 75% of pull at maximum power at rated speed													
1H	46.0	17.9	9.28	2151	3.4	321	2.61	58	86	110	23	38	101.0
3.3.2.1.2 50% of pull at maximum power at rated speed													
1H	31.3	11.9	9.48	2174	2.4	377	2.22	56	83	107	23	36	101.0
3.3.2.1.3 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.1.1													
2H	46.2	17.9	9.29	1752	3.4	298	2.81	56	83	106	23	36	101.0
3.3.2.1.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.1.2													
2H	31.3	11.9	9.49	1772	2.4	339	2.47	58	83	105	23	37	101.0
3.3.2.2 In selected gear nearest to 7.5 km/h, at maximum power at rated speed													
7L	56.6	27.2	7.48	2073	5.3	319	2.63	56	84	108	23	41	100.9
3.3.2.2.1 75% of pull at maximum power at rated speed													
7L	44.6	20.4	7.87	2148	3.8	339	2.47	57	87	108	23	40	101.0
3.3.2.2.2 50% of pull at maximum power at rated speed													
7L	30.6	13.6	8.10	2183	2.6	406	2.06	56	85	108	23	42	101.0
3.3.2.2.3 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.2.1													
1H	44.8	20.4	7.91	1841	4.0	300	2.79	56	85	107	23	37	100.9
3.3.2.2.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.2.2													
1H	30.8	13.6	8.15	1874	2.7	343	2.44	57	84	105	24	36	100.9

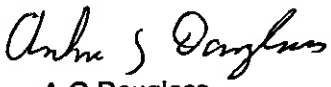
5. REPAIRS AND ADJUSTMENTS DURING TESTS: None

6. REMARKS: None

Test carried out by: S J Devonshire

Signed:  Officer in charge of tests

J P Evans

Signed:  for the Director

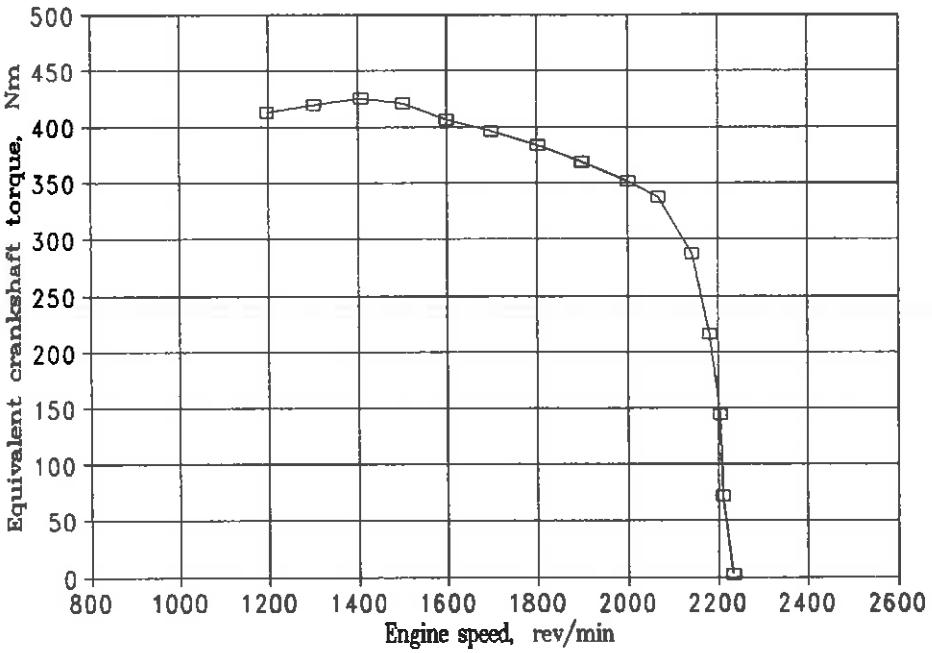
A G Douglass
Interim Manager - Test Engineering Group

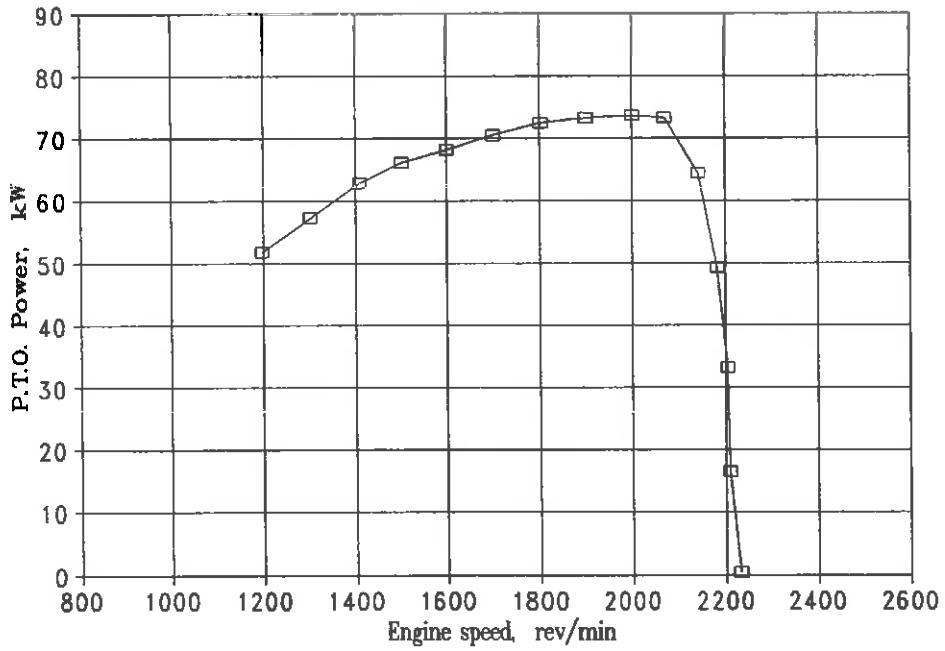
Date: 2/3/99

7. ANNEX 1 MAIN POWER TAKE-OFF CURVES

P.T.O. POWER TEST - NEW HOLLAND TS110 FOUR-WHEEL DRIVE (1000 rev/min)

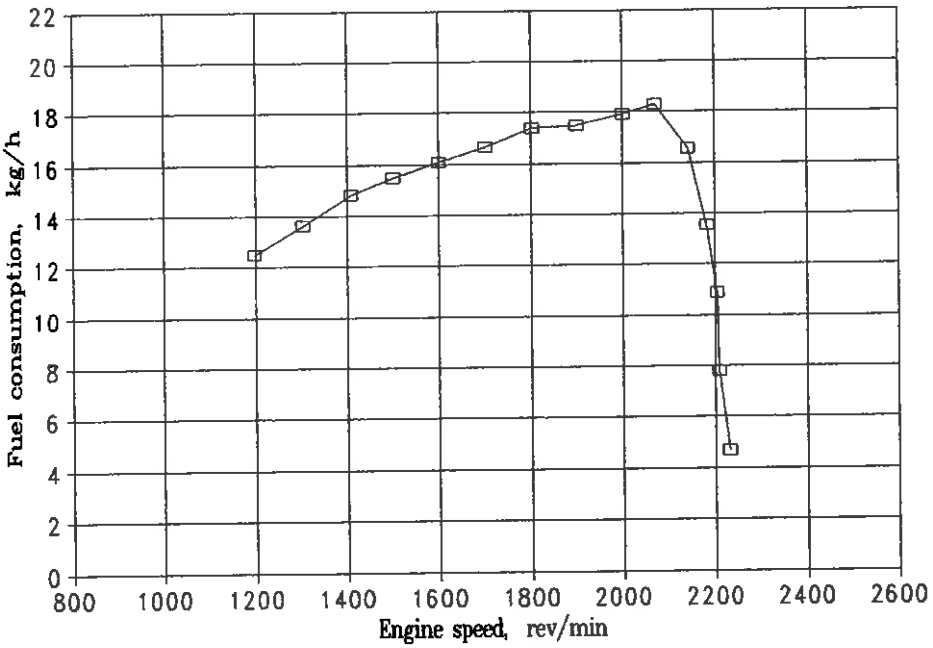
Governor set for maximum power at rated speed ☐
Governor set for maximum power at pto speed ■

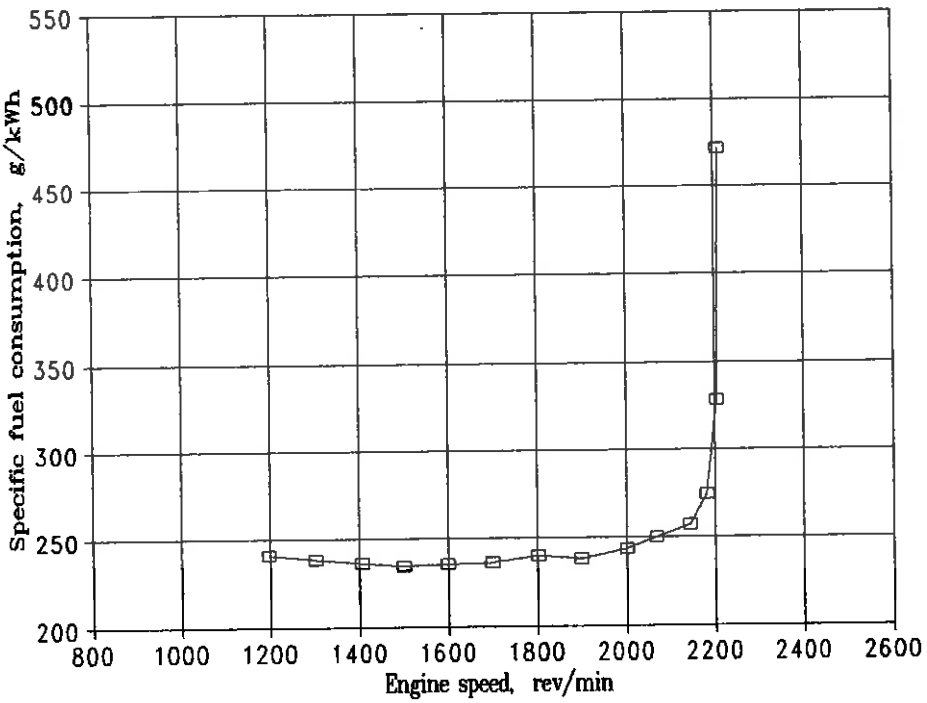




P.T.O. POWER TEST - NEW HOLLAND TS110 FOUR-WHEEL DRIVE (1000 rev/min)

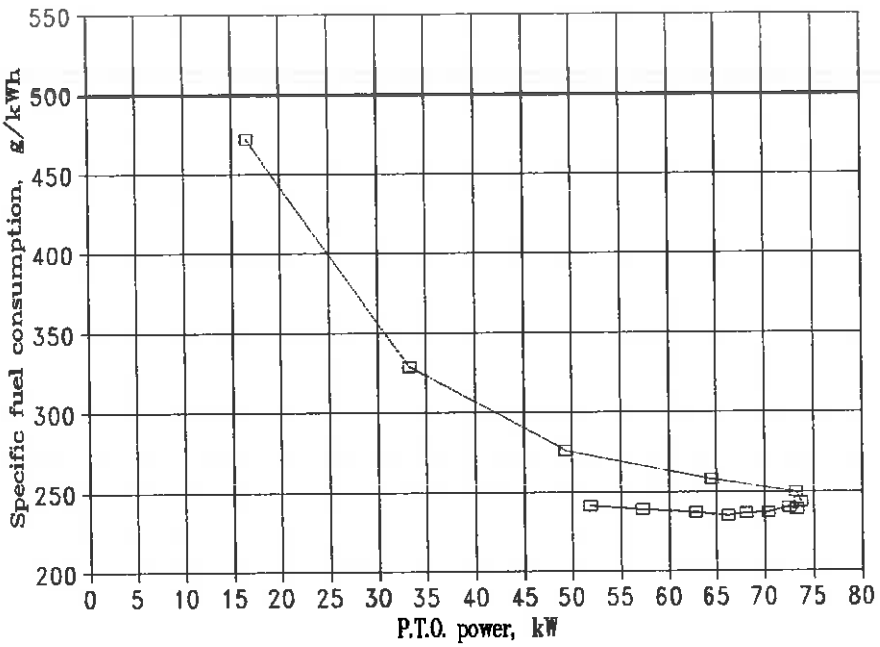
Governor set for maximum power at rated speed □
Governor set for maximum power at pto speed ■





P.T.O. POWER TEST - NEW HOLLAND TS110 FOUR-WHEEL DRIVE (1000 rev/min)

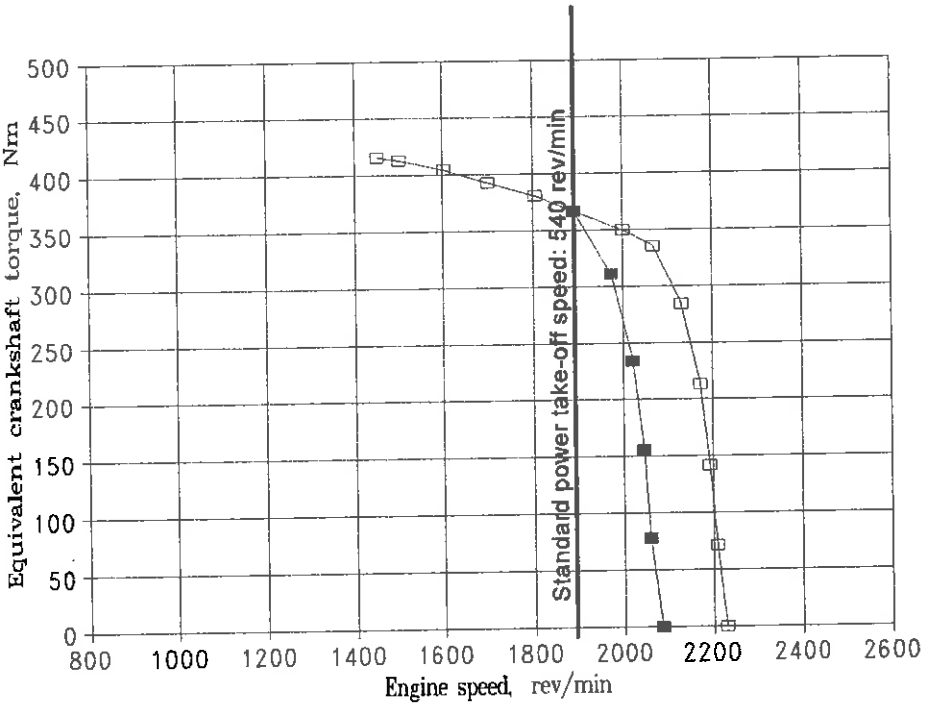
Governor set for maximum power at rated speed □
Governor set for maximum power at pto speed ■

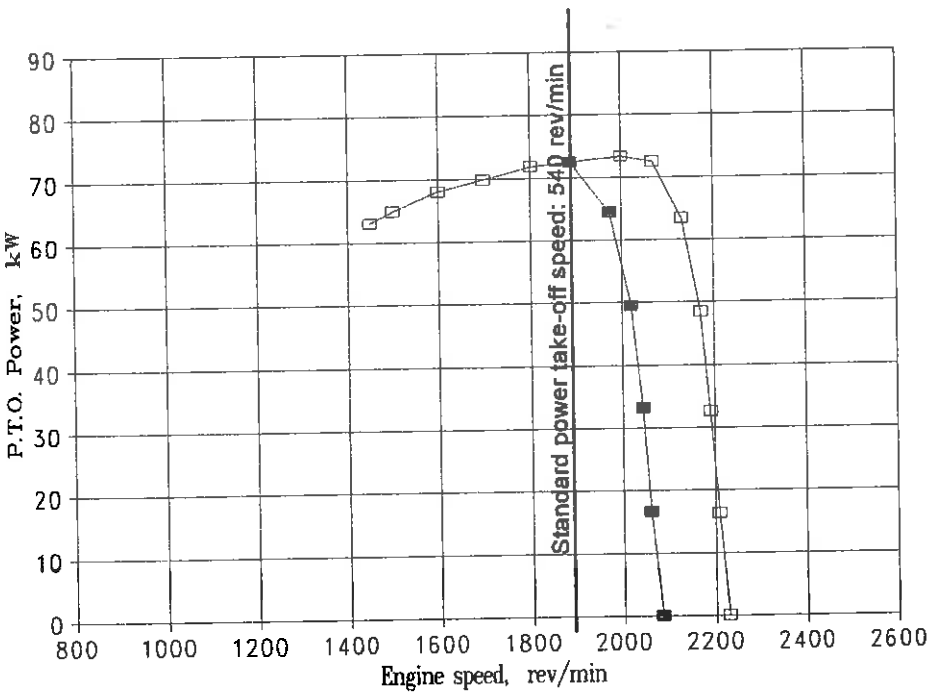


7. ANNEX 2 MAIN POWER TAKE-OFF CURVES

P.T.O. POWER TEST - NEW HOLLAND TS110 FOUR-WHEEL DRIVE (540 rev/min)

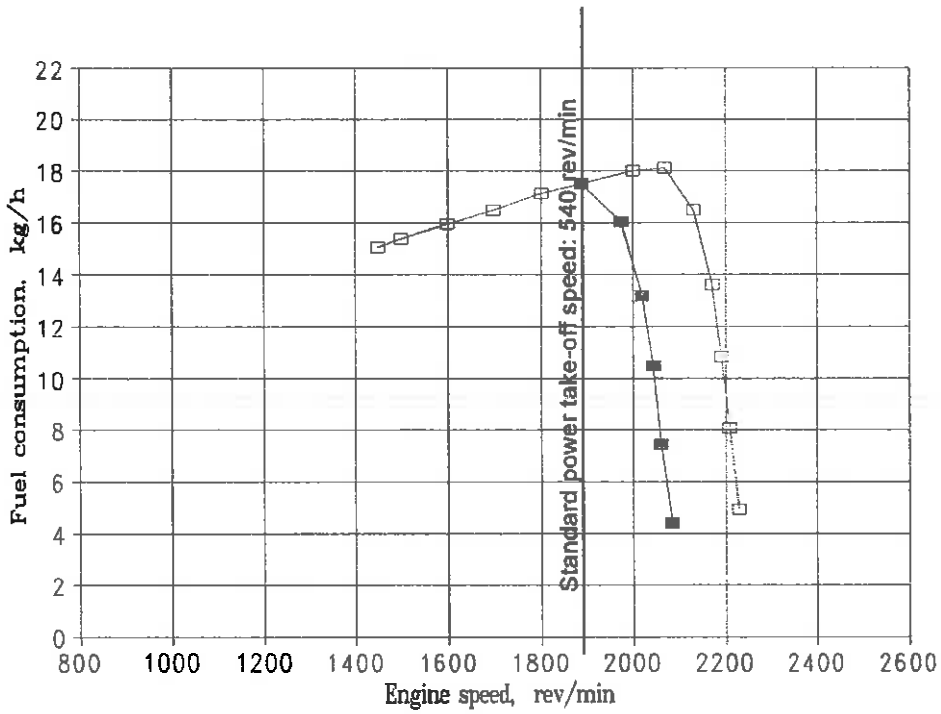
Governor set for maximum power at rated speed □
Governor set for maximum power at pto speed ■

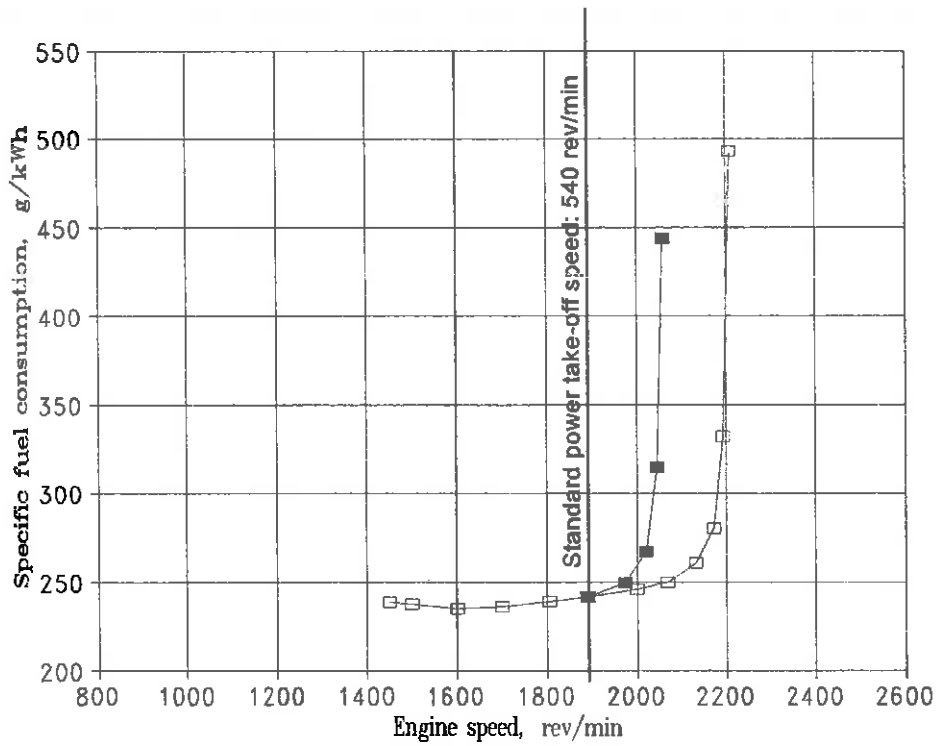




P.T.O. POWER TEST - NEW HOLLAND TS110 FOUR-WHEEL DRIVE (540 rev/min)

Governor set for maximum power at rated speed □
Governor set for maximum power at pto speed ■





P.T.O. POWER TEST - NEW HOLLAND TS110 FOUR-WHEEL DRIVE (540 rev/min)

Governor set for maximum power at rated speed □
Governor set for maximum power at pto speed ■

