SILSOE RESEARCH INSTITUTE

Wrest Park, Silsoe,
Bedford MK45 4HS

Report No: OECD/6018/2000
OECD Approval No: 2/1950
Approval Date: 6 March 2001

Report on test in accordance with the OECD STANDARD CODE 2 (RESTRICTED CODE) for the Official Testing of Agricultural and Forestry Tractors

Massey Ferguson 4233 Four-Wheel Drive Tractor with 12-speed Transmission (40 km/h)



Manufactured by: AGCO Limited,
P.O Box 62,
Banner Lane,
Coventry,
West Midlands, CV4 9GF.

Submitted for test by: The Manufacturer

Reference No: 818

Date: December 2000

—— A Company limited by guarantee Registered in England No 473317 Registered Charity No 223365 ——

SILSOE RESEARCH INSTITUTE
Wrest Park, Silsoe, Bedford MK45 4HS, England
Tel: +44 (0)1525 860000 Fax: +44 (0)1525 860156
http://www.sri.bbsrc.ac.uk

8. MINOR MODIFICATION CERTIFICATE CODE 2

OECD approval number according to Code 2:	2/1950
Test station:	Silsoe Research Institute Wrest Park Silsoe Bedford United Kingdom
Date of tests:	December 2000
Reference number:	818
Date of approval:	March 2001
Modification number:	MC/6018/2000/REV 1

8.1 Specification of Tractor

Manufacturer:	AGCO Limited, Banner Lane, Coventry, United Kingdom
Submitted for test by:	The manufacturer
Make:	Massey Ferguson
Model:	4233
Type:	Four Wheel Drive
Serial Number from which the modification applies:	J01334
Transmission type:	12 x 12
Speed version:	40 km/h

8.2 Details of modifications

Since the original test report the following modifications have been made:
Correction of original specification details regarding bore and capacity of the engine.

8.3 Statement

The effect of the corrections on performance has been examined
Modifications are considered not to affect the results of the original test
The original test report therefore applies to the modified tractor.

Drafted on the responsibility of the national Designated Authority by the station which carried out the original test, this certificate is circulated as an annex to the original test reports and subject to the same circulation.

Modification carried out at Silsoe Research Institute by: JP Evans

Signed:

JP Evans

Senior Test Engineer
Test Engineering group

Officer in charge

Date: 11/10/01

Tractor manufacturer's name and address:	AGCO Limited, P.O Box 62, Banner Lane, Coventry, West Midlands, CV4 9GF.
Location of tractor assembly:	Coventry, England
Submitted for test by:	The manufacturer
Selected for test by:	The manufacturer
Place of running in:	Coventry, England
Duration of running in:	70 hours
Location of test:	Silsoe Research Institute, Wrest Park, Silsoe, MK45 4HS, United Kingdom.

1. SPECIFICATIONS OF TRACTOR

1.1 Identification

Make:	Massey Ferguson
Model:	Type ABE MF 4233 with 12 speed transmission with emissions compliant engine (40 km/h)
Type:	Four-wheel drive, unit construction
Serial No:	J01334
1st Serial No:	J01334
Tractor type code:	ABBD24JHXA

1.2 Engine

Make:	Perkins
Model:	1004-42
Type:	4 stroke direct injection, naturally aspirated diesel
Serial No:	U060437F
Type number:	1965/2200
1st Serial No:	J01334

1.2.1 *Cylinders*

Number/disposition:	4 vertical in-line
Bore/stroke:	103 mm/127 mm
Capacity:	4233 cm^3
Compression ratio:	17.25:1
Arrangement of valves:	Overhead
Cylinder liners:	Dry

1.2.2 *Supercharging*

Make:	None
Model:	---
Type:	---
Pressure:	---

TABLE OF CONTENTS

1.	SPECIFICATIONS OF TRACTOR		1
2.	TEST CONDITIONS		16
3.	COMPULSORY TEST RESULTS		19
	Compulsory tests		
	1	Main power take-off (1000 rev/min)	19
		Main power take-off (540 rev/min)	21
	2	Hydraulic power and lifting force	22
	3	Drawbar power and fuel consumption test (unballasted tractor, four-wheel drive) Drawbar power and fuel consumption test (unballasted tractor, four-wheel drive with front axle disengaged)	24
4.	Optional tests		26
5.	Repairs and adjustments during tests		26
6.	Remarks		26
7.	Annex 1 Main power take-off curves (1000 rev/min)		27
	Annex 2 Main power take-off cures (540 rev/min)		30

Tractor manufacturer's name and address:	AGCO Limited, P.O Box 62, Banner Lane, Coventry, West Midlands, CV4 9GF.
Location of tractor assembly:	Coventry, England
Submitted for test by:	The manufacturer
Selected for test by:	The manufacturer
Place of running in:	Coventry, England
Duration of running in:	70 hours
Location of test:	Silsoe Research Institute, Wrest Park, Silsoe, MK45 4HS, United Kingdom.

1. SPECIFICATIONS OF TRACTOR

1.1 Identification

Make:	Massey Ferguson
Model:	Type ABE MF 4233 with 12 speed transmission with emissions compliant engine (40 km/h)
Type:	Four-wheel drive, unit construction
Serial No:	J01334
1st Serial No:	J01334
Tractor type code:	ABBD24JHXA

1.2 Engine

Make:	Perkins
Model:	1004-42
Type:	4 stroke direct injection, naturally aspirated diesel
Serial No:	U060437F
Type number:	1965/2200
1st Serial No:	J01334

1.2.1 *Cylinders*

Number/disposition:	4 vertical in-line
Bore/stroke:	101 mm/127 mm
Capacity:	4070 cm^3
Compression ratio:	17.25:1
Arrangement of valves:	Overhead
Cylinder liners:	Dry

1.2.2 *Supercharging*

Make:	None
Model:	---
Type:	---
Pressure:	---

1.2.3 *Fuel system*

Fuel feed system:	Mechanical Fuel Feed Pump
Make, type and model of fuel filter:	Lucas/CAV Filter-Agglomerator type F.A.S - 1 off paper element filter with transparent bowl
Capacity of fuel tank:	186 litres
Make, type and model of injection pump:	Lucas, rotary, type DPA 1280 U2644G621YG/2350
Serial No:	30181 KSG
Manufacturer's production setting of injection pump:	62.3 to 66.1 mm^3 per stroke at 2200 min^{-1} (rev/min) rated engine speed and full load
Flow rate (rated engine speed and full load):	16.45 - 17.45 dm^3/h
Timing:	21° before B.T.D.C
Make, type and model of injectors:	LUCAS – Code HL
Injection pressure:	23.0 MPa

1.2.4 *Governor*

Make:	Lucas
Model:	Not Applicable
Type:	Mechanical incorporated in fuel injection pump
Governed range of engine speed:	750 to 2354 min^{-1}(rev/min)
Rated engine speed:	2200 min^{-1}(rev/min)

1.2.5 *Air cleaner*

Pre-cleaner	None
Main cleaner	
Make:	Mann and Hummel
Type:	3 stage, 2 stages are paper elements
Model:	44 211 92 921
Location of air intake:	Behind front grill in front of radiator
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:	Full flow, replaceable canister
Number:	1

1.2.7 *Cooling system*

Type of coolant:	Water or water and antifreeze solution
Type of pump:	Centrifugal
Specification of fan:	Belt driven pulley
Number of fan blades:	2
Fan diameter:	510 mm
Coolant capacity:	17.5 litres
Type of temperature control:	Thermostat
System pressure:	75 kPa

1.2.8 *Starting system*

Make:	Magneti Marelli
Model:	M 127
Type:	Electrical, pre-engaged, solenoid operated
Starter motor power rating:	2.8 kW
Cold starting aid:	ISKRA induction heater
Safety device:	Starting operable only when forward/reverse and PTO levers are in neutral

1.2.9 *Electrical system*

Voltage:	12 V
Generator:	Alternator
Make:	Magneti Marrelli
Model:	A 127-70
Type:	Belt driven
Power:	0.84 kW
Batteries:	2 Type 372, lead acid
Rating:	120 Ah at 20 hours

1.2.10 *Exhaust system*

Make:	Tecnov
Model:	Massey Ferguson type 131
Type:	Horizontal silencer
Location:	Under bonnet right hand side
Height of outlet above ground:	2575 mm

1.3 Transmission

1.3.1 *Clutch (Travel alone)*

Make:	LUK
Model:	None
Type:	Dry for transmission only
Number of plates:	1
Diameter of plates:	305 mm
Method of operation:	Mechanical by pedal

1.3.2 *Gear box*

Make:	Massey Ferguson
Model:	None
Description:	Mechanical manual synchromesh operation of 4 forward and reverse and 3 ranges, selected by single side mounted lever.

	Forward	Reverse
Number of gears	4	4
Number of ranges/groups	3	3
Total of arrangements	12	12

Available options:	8 x 8 Shuttle, 12 x 4, 12 x 4 with creep, 12 x 12 with creep, 12 x 12 Shuttle, 12 x 12 power shuttle, 18 x 6, 24 x 24 power shuttle

1.3.3 *Rear axle final drivers*

Make:	Own make
Model:	None
Type:	Crown wheel pinion with differential and outboard epicyclic reduction gear final drives
Differential lock:	
Type:	Mechanical dog clutch on differential gears
Method of engagement:	Hydraulically operated in response to right hand side console mounted electrical switch
Method of disengagement:	Reversal of above switch

1.3.4 *Front axle and final drives*

Make:	Dana Spicer Europe
Model:	AG 75
Type:	Crown wheel and pinion with differential and outboard epicyclic reduction gear final drives
Differential lock:	
Type:	None
Method of engagement:	Hydraulically actuated in unison with Rear differential in response to electrical signal from rear differential lock switch on side console
Method of disengagement:	Reverse of above switch

1.3.5 *Total ratios and travelling speeds*

Gear	Group Number	Number of engine revolutions for one revolution of the rear driving wheels	Nominal travelling speed at rated Engine speed *2200 rev/min km/h
Forward			
1	L	262.979	2.33
2	L	201.260	3.05
3	L	153.344	4.00
4	L	117.095	5.24
1	M	93.251	6.58
2	M	71.366	8.60
3	M	54.375	11.29
4	M	41.522	14.78
1	H	34.538	17.77
2	H	26.432	23.22
3	H	20.139	30.48
4	H	15.378	39.91
Reverse			
1	L	232.626	2.64
2	L	178.030	3.45
3	L	135.645	4.52
4	L	103.580	5.93
1	M	82.488	7.44
2	M	63.129	9.72
3	M	48.099	12.76
4	M	36.729	16.71
1	H	30.551	20.09
2	H	23.381	26.25
3	H	17.814	34.45
4	H	13.603	45.12

Range selection, (main gear lever) L=Low M=Medium H=High

(*) Calculated with a tyre dynamic radius index of 740 mm (ISO 4251/1-1992)

Number of revolutions of front wheels for one revolution of rear wheels: 1.38833:1

1.4 Power take-off

1.4.1 *Main power take-off*

Type:	Independent
Method of engagement:	By hand-lever, hydraulically engaging wet multi-plate clutch
Number of shafts:	1 (interchangeable for 6 or 21 splines To ISO 500/1991)
Method of changing power take-off speeds:	Manually by hand lever

Clutch

Make:	Own make
Model:	None
Type:	Hydraulic actuated wet multiplate
Number of plates:	5
Diameter of plates:	128 mm

1.4.1.1 Power take-off proportional to engine speed

Power take-off at 1000 min^{-1} (rev/min)

Location:	Rear of tractor
Diameter of power take-off shaft:	34.9 mm
Number of splines:	21 in conformity with ISO 500/1991
Height above ground:	605 mm
Distance from the median plane of the tractor:	Central
Distance behind rear wheel axis:	333 mm
PTO speed at rated engine speed:	1100 min^{-1}(rev/min)
Engine speed at standard power take-off speed:	2000 min^{-1}(rev/min)
Ratio of rotation speeds:	2.0
Power restriction:	None
Maximum torque:	None
Direction of rotation (viewed from behind tractor):	Clockwise

1.4.1.1 Power take-off proportional to engine speed

Power take-off at 540 min^{-1} (rev/min)

Location:	Rear of tractor
Diameter of power take-off shaft:	34.9 mm
Number of splines:	6 in conformity with ISO 500/1991
Height above ground:	605 mm
Distance from the median plane of the tractor:	Central
Distance behind rear wheel axis:	333 mm
PTO speed at rated engine speed:	625 min^{-1} (rev/min)
Engine speed at standard power take-off speed:	1903 min^{-1} (rev/min)
Ratio of rotation speeds:	3.5226
Power restriction:	None
Maximum torque:	None
Direction of rotation (viewed from behind tractor):	Clockwise

1.5 Hydraulic Power lift (as fitted to the test tractor)

Make:	Massey Ferguson
Model:	None
Type:	Hydraulic with inlet suction control, closed system
Type and number of cylinders:	1 single acting internal
Type of linkage lock for transport:	Hydraulic
Relief valve pressure setting:	20.7 MPa
Opening pressure of cylinder safety valve:	26.2-27.6 MPa
Lift pump type:	4 Cylinder, piston
Transmission between pump and engine:	Driven from PTO shaft which is independent of main clutch
Type and number filters:	Full flow with metal mesh strainer, 1
Site of oil reservoir:	Transmission housing
Type, number and location of tapping points:	Optional tapping port (Not fitted to test tractor), a valve allows flow to spool valve and quick release coupling
Maximum volume of oil available to external cylinders:	20 litres

1.5 Hydraulic Power lift (option with electro-hydraulic control)

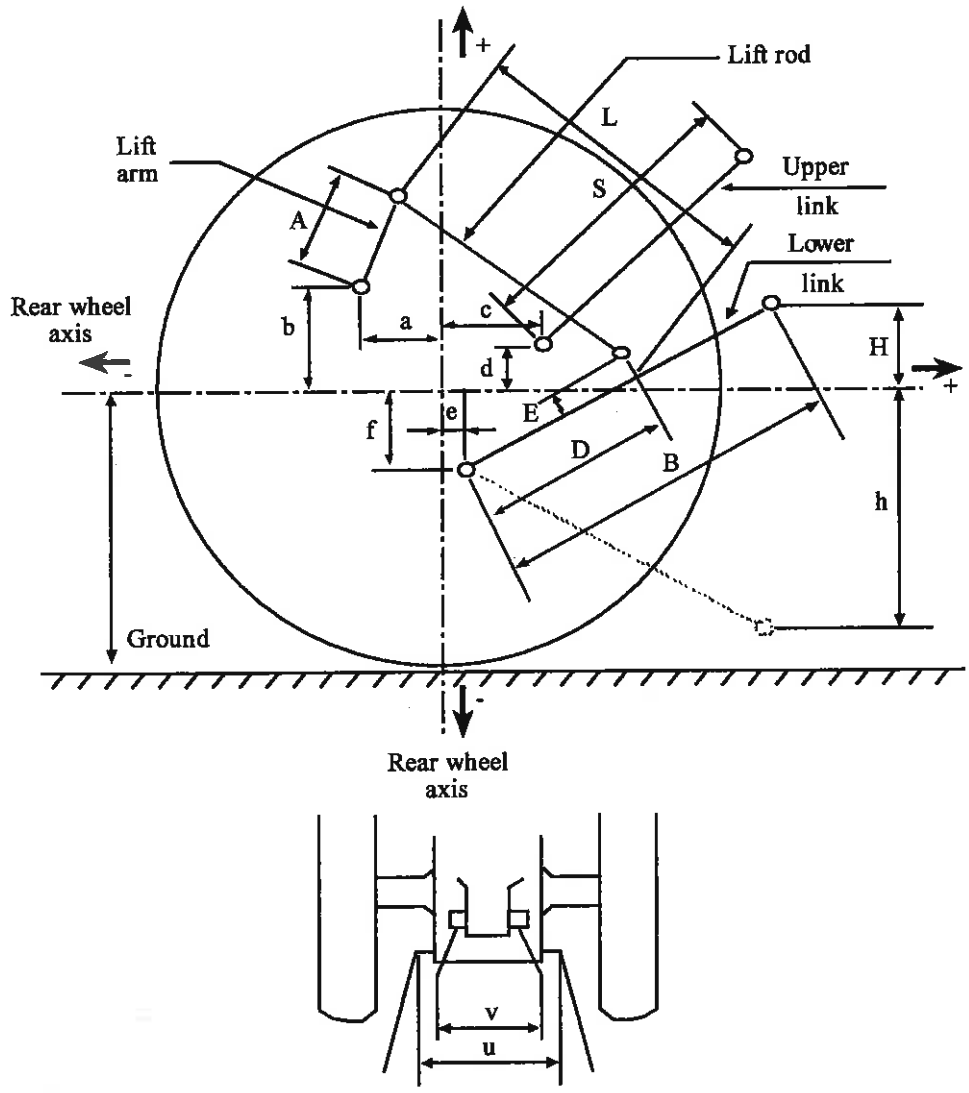
Make:	Massey Ferguson/Bosch
Model:	None
Type:	Electro-hydraulic with proportional solenoid valves, open centre, for both lift and drop
Type and number of cylinders:	1 single acting internal
Type of linkage lock for transport:	Hydraulic
Relief valve pressure setting:	21.4 - 24.0 MPa
Opening pressure of cylinder safety valve:	26.2 - 27.6 MPa
Lift Pump type:	Gear, Bosch or Sauer-Sundstrand
Transmission between pump and engine:	Driven from PTO shaft which is independent of main clutch
Type and number of filters:	Full flow with metal mesh strainer, 1
Site of oil reservoir:	Transmission housing
Type and number of tapping points:	Optional tapping port (not fitted to test Tractor), a valve allows flow to spool valve and quick release couplings
Maximum volume of oil available to external cylinders:	20.0 litres

1.5.1 *Auxiliary hydraulic system*

Make:	Sundstrand
Model:	SP 250
Type:	Gear
Relief valve setting:	19.0 - 21.6 MPa
Transmission between pump and engine:	Driven by chain from PTO shaft which is Independent of the main clutch
Type and number of tapping points:	2 spool valves, each with quick release coupling and separate return, to ISO. Note: 2 further spool valves may be fitted if required. A valve allows combination with main system up to the auxiliary relief valve pressure.
Maximum volume of oil available to external cylinders:	20.0 litres

1.6 Three-point linkage

Category:	2 in conformity with ISO 730-1:1994+Cor.1:1995
Category adapter:	None
Controls:	Draught or position control with top 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)

			Dimensions or range mm	Settings Used in Test
Length of lift arms:		(A)	310	310
Length of lower links:		(B)	1000	1000
Distance of lift arm pivot point from rear wheel centre line:	horizontally: vertically:	(a) (b)	196 233	196 233
Horizontal distance between the two lower link points:		(u)	492	492
Horizontal distance between the two lift arm end points:		(v)	584	584
Length of upper link:		(S)	665-918	805
Distance of upper link pivot point from rear wheel centre line:	horizontally: vertically:	(c) (d)	186-200-216 205-171-132	186 205
Distance of lower link pivot point from rear wheel centre line:	horizontally: vertically:	(e) (f)	32 forward 212	32 forward 212
Distance of lower link points to lift rod pivot points on lower link centre line:	horizontally:	(D)	545	545
Length of lift rods:		(L)	685-745	685
Height of lower hitch points (*) Relative to the rear wheel centre line, situated 740 mm above the ground level:				
- In low position		(h)	545-690	545
- In high position		(H)	127-200	178
Height of lower hitch points when locked in transport position (*)			Any height within lift range (hydraulic transport lock)	

*Assuming r = tyre dynamic radius index of 740 mm ISO 4251/1-1992

1.7 Swinging drawbar

Type:	Clevis
Height above ground:	
Unballasted Maximum:	525 mm
Minimum:	313 mm
Type of adjustment:	Inverting drawbar
Distance of hitch point from rear-wheel axis, horizontally:	583 mm 683 mm 733 mm
Distance of hitch point from power take-off shaft ends:	
Vertically:	80 mm 190 mm 233 mm 292 mm
Horizontally:	250 mm 350 mm 400 mm
Lateral adjustment (centre of Clevis):	
Right-hand:	135 mm 225 mm 238 mm
Left-hand:	135 mm 225 mm 238 mm
Distance of pivot point from rear axles horizontally:	30 mm forward
Width of Clevis:	70 mm
Diameter of drawbar pin hole:	33 mm
Maximum vertical permissible load:	
Clevis uppermost:	11.6 kN
Clevis underneath:	11.6 kN

1.8 Trailer hitch

Type:	None fitted

1.9 Holed drawbar

Type:	None fitted

Front towing hitch

Type:	Clevis in front weight frame
Vertical height to centre of Clevis:	780 mm
Width of Clevis:	50 mm
Diameter of pin hole:	33 mm

1.10 Steering

Make:	Own make
Model:	None
Type:	Hydrostatic
Method of operation:	
Pump:	Bosch/Sundstrand gear type mounted on transmission case in tandem with auxiliary hydraulic system pump
Motor:	Danfoss OSPC-100-0N
Ram:	1 double acting operating both track rods
Filter:	None
Working pressure:	14 MPa

1.11 Brakes

1.11.1 *Service brake*

Make:	Girling
Model:	None
Type:	Oil-immersed multi plate discs, 4 per side
Method of operation:	Independent on rear wheels or combined pedal giving compensated actuation and automatic engagement of 4WD providing 4-wheel braking
Trailer braking take-off:	None

1.11.2 *Parking brake*

Type:	Mechanical via cable
Method of operation:	Hand lever with ratchet, acts on all Four wheels due to automatic 4 WD engagement

1.12 Wheels

Number: 4

Front: 2 driving/steering

Rear: 2 driving

Wheelbase: 2350 mm

Track width adjustment:

	Minimum, mm	Maximum, mm	Adjustment method
Front *	1610	1915	Reversing wheels and offset lug rims
Rear	1535	2130	Reversing wheels and offset lug rims

* 55° steering angle available only on 1860 mm and larger track settings

1.13 Protective structure

Make: GKN Sankey Agricultural Products

Model: Type 1100

Type: Field Folding

Manufacturer's name and address: GKN Cab Systems,
Hadley Castle Works, P.O Box 86,
Telford, TF1 4RE.

Protective device: Frame

Tiltable/Not tiltable: Tiltable

OECD approval

Approval number: 4/0514/1

Date of approval: 07/05/1999

Nos. minor modification certificates, if any: OECD/7755/0199

1.14 Seat

1.14.1 *Driver's seat*

Make/model/Type:	Grammer MSG44/520
Seat and steering wheel reversible:	No
Type of suspension:	Spring
Type of damping:	Hydraulic
Range of adjustment:	
Longitudinal:	160 mm
Vertical:	75 mm
Safety belt:	No

1.14.2 *Optional driver's seat(s)* None

1.14.3 *Passenger seat*

Make:	None
Type:	

1.15 Lighting

In accordance with EEC directive 78/933/EEC

Unrestricted beam angle of headlight in plan view: 110°

	Height above ground to centre mm	**Size Mm**	**Distance from outside edge of lights to median plane of tractor mm**
Headlights	1110	160 x 100	195
Sidelights	1605	110 x 35	777
Rear lights	1640	95 x 52	605
Axle reflectors	780	80 dia	450
Rear fender reflectors	1640	43 x 52	650

2. TEST CONDITIONS

2.1 Overall dimensions

	Length	Width		Height at top of	
	mm	Minimum mm	Maximum mm	Protective Structure mm	Exhaust Pipe mm
Unballasted	3927	1990	2480	2610	2575

2.2 Ground clearance (unballasted tractor) 253 mm

Clearance-limiting part: Drawbar clevis in lowest position

2.3 Tractor mass

	Unballasted		Ballasted	
	Without driver kg	With driver kg	Without driver kg	With Driver kg
Front	1300	1310	---	---
Rear	1845	1910	---	---
Total	3145	3220	---	---

2.4 Track specifications Not applicable

2.5 Tyres and track width specification

	Front	Rear
Tyres Dimensions Ply rating Type	 12.4 R24 136A8 Radial	 13.6 R 38 153A8 Radial
Maximum load (tyre manufacturer's), kN	13.3	17.7
Maximum load (tractor manufacturer's), kN	14.3	18.9
Inflation pressure (tyre manufacturer's), kPa	160	160
Dynamic radius index, mm	540	740
Chosen track width (manufacturer's nominal), mm	1700	1640

2.6 Fuel

Type: Diesel oil to Class D, 1.5 to 5.5 cSt.

Density at 15°C: 0.8370 g/cm^3

2.7 Oils and lubrication

2.7.1 *Capacity and change interval*

	Capacity l	Oil change h	Filter change h
Engine	7.0	250	250
Front axle differential	5.0	1000	None
Front axle hub (each)	1.0	1000	None
Gearbox	50.0	1000	1000
Rear axle Hydraulic system Final drives (rear) Steering	Integral with gearbox		
Brakes	--	Top-up	None

2.7.2 *Specifications*

Oils	Recommended	Used during test
Engine oil Type: Viscosity: Classification:	SAE 15W/30,15W/50 or 10W/40 54 cSt at 50°C MIL-L-2104-2.C. API. CD. Mlin	SAE 15W/30
Transmission oils Type: Viscosity: Classification:	SAE 15W/30 54 cSt at 50°C MF 1139 or MF 1135	As recommended
Rear final drives Type: Viscosity: Classification:	SAE 15W/30 54 cSt at 50°C MF 1139 or MF 1135	As recommended
Front differential and final drives Type: Viscosity: Classification:	SAE 15W/30 54 cSt at 50°C MF 1139 or MF 1135	As recommended
Hydraulic brakes Type: Viscosity: Classification:	Mineral 7.2 cSt at 50°C MF CMS 1151A	As recommended
Hydraulic fluid Type: Viscosity: Classification:	SAE 15W/30 54 cSt at 50°C MF 1139 or MF 1135	As recommended
Steering oil Type: Viscosity: Classification:	SAE 15W/30 54 cSt at 50°C MF 1139 or MF 1135	As recommended

2.7.3 *Grease*

Grease Points Type	Consistency 2 Lithium Based	As recommended
Number of lubrication points:	19	

3. COMPULSORY TESTS RESULTS

3.1 Main power take-off

Date and location of tests: 9 October 2000
Silsoe Research Institute,
Wrest Park, Silsoe, Bedford.

Type of dynamometer bench: Eddy Current, Borghi and Saveri

Power	Speed		Fuel consumption			Specific energy
	Engine	P.T.O.	Hourly		specific	
kW	min^{-1} (rev/min)		kg/h	l/h	g/kWh	kWh/l
3.1.1 MAXIMUM POWER – TWO-HOUR TEST						
52.0	2200	1100	13.51	16.14	260	3.22
3.1.2 POWER AT RATED ENGINE SPEED						
52.0	2200	1100	13.51	16.14	260	3.22
3.1.3 STANDARD POWER TAKE-OFF SPEED [1000 ±25 min^{-1} (rev/min)]						
50.7	2000	1000	12.65	15.11	249	3.36
3.1.4 PART LOADS 3.1.4.1 the torque corresponding to maximum power at rated engine speed						
52.0	2200	1100	13.51	16.14	260	3.22
3.1.4.2 85% of torque obtained in 3.1.4.1						
45.2	2254	1127	11.92	14.24	264	3.17
3.1.4.3 75% of torque defined in 3.1.4.2						
34.3	2277	1139	9.68	11.57	282	2.97
3.1.4.4 50% of torque defined in 3.1.4.2						
23.0	2296	1148	7.60	9.08	330	2.53
3.1.4.5 25% of torque defined in 3.1.4.2						
11.6	2311	1155	5.58	6.67	481	1.74
3.1.4.6 unloaded						
0	2326	1163	3.88	4.63	-	-
3.1.5 PART LOADS AT STANDARD POWER TAKE-OFF SPEED [1000 ± 25 min^{-1} (rev/min)] 3.1.5.1 the torque corresponding to maximum power						
50.7	2000	1000	12.65	15.11	249	3.36
3.1.5.2 85% of torque obtained in 3.1.5.1						
44.9	2080	1040	11.30	13.50	252	3.33
3.1.5.3 75% of torque obtained in 3.1.5.2						
34.1	2109	1054	9.10	10.88	267	3.13
3.1.5.4 50% of torque obtained in 3.1.5.2						
23.0	2130	1065	7.06	8.44	308	2.72
3.1.5.5 25% of torque obtained in 3.1.5.2						
11.6	2151	1076	5.12	6.12	440	1.90
3.1.5.6 unloaded						
0	2169	1085	3.38	4.04	-	-

No load maximum engine speed: 2326 min^{-1} (rev/min)

Torque (equivalent crankshaft) at maximum power: 223.8 Nm

Torque (equivalent crankshaft) at rated engine speed: 223.8 Nm

Maximum torque (equivalent crankshaft): 267.8 Nm
(engine speed: 1401 rev/min)

Mean atmospheric conditions:	
Temperature	23°C
Pressure	99.9 kPa
Relative humidity	38%
Maximum temperatures:	
Coolant	84°C
Engine oil	102°C
Fuel	52°C
Engine air intake	28°C

3.1 Main power take-off

Date and location of tests: 9 October 2000
Silsoe Research Institute,
Wrest Park, Silsoe, Bedford.

Type of dynamometer bench: Eddy Current, Borghi and Saveri

Power	Speed		Fuel consumption			Specific Energy
	Engine	P.T.O.	Hourly		specific	
kW	min^{-1} (rev/min)		kg/h	l/h	g/kWh	kWh/l
3.1.1 MAXIMUM POWER						
51.0	2201	625	13.54	16.18	265	3.16
3.1.2 POWER AT RATED ENGINE SPEED						
51.0	2201	625	13.54	16.18	265	3.16
3.1.3 STANDARD POWER TAKE-OFF SPEED [540±10 min^{-1} (rev/min)]						
48.3	1903	540	12.14	14.50	251	3.33
3.1.5 PART LOADS 3.1.4.1 the torque corresponding to maximum power at rated engine speed						
51.0	2201	625	13.54	16.18	265	3.16
3.1.4.2 85% of torque obtained in 3.1.4.1						
44.4	2251	639	11.98	14.31	270	3.11
3.1.4.3 75% of torque defined in 3.1.4.2						
33.7	2275	646	9.72	11.61	289	2.90
3.1.4.4 50% of torque defined in 3.1.4.2						
22.7	2295	651	7.64	9.13	337	2.48
3.1.4.5 25% of torque defined in 3.1.4.2						
11.4	2310	656	5.61	6.70	492	1.70
3.1.4.6 unloaded						
0	2325	660	3.77	4.50	-	-
3.1.1 PART LOADS AT STANDARD POWER TAKE-OFF SPEED [540±10 min^{-1} (rev/min)] 3.1.5.1 the torque corresponding to maximum power						
48.3	1903	540	12.14	14.50	251	3.33
3.1.5.2 85% of torque obtained in 3.1.5.1						
42.9	1989	564	10.83	12.94	252	3.32
3.1.5.3 75% of torque obtained in 3.1.5.2						
32.6	2016	572	8.71	10.41	267	3.13
3.1.5.4 50% of torque obtained in 3.1.5.2						
22.0	2039	579	6.70	8.00	304	2.75
3.1.5.5 25% of torque obtained in 3.1.5.2						
11.2	2061	585	4.83	5.77	433	1.93
3.1.5.6 unloaded						
0	2083	591	3.11	3.72	-	-

No load, maximum engine speed: 2325 min^{-1} (rev/min)

Torque (equivalent crankshaft) at maximum power: 221.5 Nm

At rated engine speed: 221.5 Nm

Maximum torque (equivalent crankshaft): 259.9 Nm
(engine speed: 1103 min^{-1} (rev/min)

Mean atmospheric conditions	
Temperature	23°C
Pressure	99.5 kPa
Relative humidity	42%
Maximum temperatures:	
Coolant	84°C
Engine oil	101°C
Fuel	53° C
Engine air intake	28° C

3.2 Hydraulic power and lifting force

Date of tests: 31 October 2000

3.2.1 *Hydraulic power test*

	1 Lift system only	**2 Auxiliary only**	**3 Auxiliary Combination**
Sustained pressure with relief valve open:	22.6 MPa	22.4 MPa	22.4 MPa
Pump stalled:	No		
Pump delivery rate at minimum pressure:	28.7 l/min	42.8 l/min	70.1 l/min

	Test	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	1	24.2	20.3	8.19
	2	33.0	20.2	11.11
	3	47.3	20.2	15.92
Flow rate and hydraulic pressure corresponding to Maximum hydraulic power	1	27.1	19.5	8.81
	2	37.3	19.5	12.12
	3	61.8	19.3	19.88

Tapping point used for test:	1, 2 and 3	Tapping into trailer coupling (for test only) Auxiliary service connection
Temperature of hydraulic fluid if different From 65 ± 5°C		Not applicable
Opening pressure of the unloading valve:		Not applicable
Closing pressure of the unloading valve:		Not applicable

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

Linkage settings for test – see Table 2.1 and Figures 2.1 and 2.2.

	At the hitch point	on the frame
Height of lower hitch points above ground in down position	195 mm	195 mm
Vertical movement	723 mm	923 mm
Maximum corrected force exerted through full range	15.6 kN	11.9 kN
Corresponding pressure of hydraulic fluid	20.3 MPa	20.3 MPa
Moment about rear-wheel axis	15.1 kNm	18.8 kNm
Maximum tilt angle of mast from vertical	--	15 degrees

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	-411	-333	-300	-200	-100	0	100	200	250	390	512
Lifting forces (the values of force measured shall be corrected to correspond to a hydraulic pressure equivalent to 90% of the actual relief valve pressure setting of the hydraulic lift system):											
at the hitch points kN	--	15.6	16.5	18.0	19.1	20.3	21.2	21.8	22.5	22.8	--
Corresponding pressure: 20.3 MPa											
at the frame kN	11.9	13.0	13.2	13.8	14.4	14.7	14.8	14.7	14.6	14.3	14.0
Corresponding pressure: 20.3 MPa											

3.3 Drawbar power test (unballasted tractor)

Massey Ferguson 4233 (4WD)

Date and Location of tests: 20 November 2000
Silsoe Research Institute,
Wrest Park,
Silsoe,
Bedford, MK45 4HS.

Type of track: Concrete

	Height of drawbar above ground	Tyre inflation pressure	
		Front	Rear
	mm	kPa	kPa
Unballasted	275 mm	90	83

Gear and Range	Power	Drawbar Pull	Speed	Engine Speed	Slip of wheels or track	Specific fuel cons	Specific energy	Temperature			Atmospheric conditions		
								Fuel	Coolant	Engine oil	Temp	Relative humidity	Pressure
	kW	kN	km/h	min^{-1}	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.3.1 MAXIMUM POWER IN TESTED GEARS													
1L	17.5	31.1	2.02	2287	15.0	455	1.84	27	84	97	6	78	98.8
2L	22.7	31.0	2.64	2275	15.0	395	2.12	29	84	97	7	77	98.8
3L	29.4	30.6	3.47	2259	14.7	366	2.29	26	84	96	7	74	98.8
4L	37.9	29.9	4.56	2235	13.4	339	2.47	27	84	96	7	72	98.8
1M	43.3	26.2	5.96	2206	8.6	320	2.62	30	84	97	6	77	98.8
2M	44.5	20.0	8.03	2199	5.6	309	2.71	30	84	97	7	77	98.8
3M	44.9	15.1	10.69	2198	4.0	306	2.73	30	84	98	7	77	98.8
4M	43.8	11.2	14.15	2200	3.1	316	2.65	31	84	98	7	77	98.8
1H	44.2	9.4	17.03	2192	2.8	309	2.71	32	84	96	6	78	98.8
3.3.2 FUEL CONSUMPTION													
3.3.2.1 In selected gear, at maximum power at rated speed													
3M	44.9	15.1	10.69	2198	4.0	306	2.73	30	84	98	7	77	98.8
3.3.2.1.1 75% of pull at maximum power at rated speed													
3M	34.9	11.3	11.06	2252	3.2	324	2.58	28	84	96	6	76	98.8
3.3.2.1.2 50% of pull at maximum power at rated speed													
3M	23.5	7.5	11.28	2278	2.3	377	2.22	28	84	97	6	77	98.8
3.3.2.1.3 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.1.1													
4M	34.7	11.3	11.06	1719	3.1	285	2.94	31	82	94	6	78	98.8
3.3.2.1.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.1.2													
4M	23.4	7.5	11.31	1743	2.2	309	2.71	30	83	93	6	78	98.8
3.3.2.2 In selected gear nearest to 7.5 km/h, at maximum power at rated engine speed													
1M	43.3	26.2	5.96	2206	8.6	320	2.62	30	84	97	6	77	98.8
3.3.2.2.1 75% of pull at maximum power at rated speed													
1M	34.5	19.6	6.34	2264	5.3	327	2.56	28	84	97	7	74	98.8
3.3.2.2.2 50% of pull at maximum power at rated speed													
1M	23.5	13.1	6.49	2279	3.5	365	2.29	28	84	97	7	74	98.8
3.3.2.2.3 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.2.1													
2M	34.5	19.6	6.32	1730	5.4	279	3.00	29	82	96	6	75	98.8
3.3.2.2.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.2.2													
2M	23.5	13.1	6.48	1741	3.6	300	2.79	29	82	94	6	75	98.8

3.3 Drawbar power test (unballasted tractor)

Massey Ferguson 4233 (4WD with front axle disengaged)

Date and Location of tests: 11 December 2000
Silsoe Research Institute,
Wrest Park,
Silsoe,
Bedford, MK45 4HS.

Type of track: Concrete

	Height of drawbar above ground	Tyre inflation pressure	
		Front	Rear
	mm	kPa	kPa
Unballasted	466 mm	90	83

Gear and Range	Power	Drawbar Pull	Speed	Engine Speed	Slip of wheels or track	Specific fuel cons	Specific Energy	Temperature			Atmospheric conditions		
								Fuel	Coolant	Engine oil	Temp	Relative humidity	Pressure
	kW	kN	km/h	min^{-1}	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.3.1 MAXIMUM POWER IN TESTED GEARS													
1L	13.4	23.6	2.03	2292	14.5	500	1.68	32	84	97	14	73	100.5
2L	17.6	23.3	2.72	2285	12.4	439	1.91	32	84	96	14	74	100.5
3L	23.0	23.0	3.59	2275	11.3	386	2.17	32	84	96	14	74	100.5
4L	29.4	22.4	4.73	2262	10.2	353	2.37	33	84	97	14	72	100.5
1M	36.9	22.1	6.01	2242	8.5	326	2.56	34	84	97	14	71	100.5
2M	42.7	19.5	7.87	2201	6.5	319	2.62	37	85	96	14	70	100.5
3M	42.9	14.6	10.55	2199	4.3	320	2.62	38	85	98	14	70	100.5
4M	41.7	10.8	13.97	2198	3.3	327	2.56	38	85	98	14	70	100.5
1H	42.5	9.1	16.81	2189	2.8	320	2.62	38	84	98	14	70	100.5
3.3.2 FUEL CONSUMPTION													
3.3.2.1 In selected gear, at maximum power at rated speed													
3M	42.9	14.6	10.55	2199	4.3	320	2.62	38	85	98	14	70	100.5
3.3.2.1.1 75% of pull at maximum power at rated speed													
3M	33.6	11.0	10.94	2253	3.3	331	2.53	35	84	98	14	70	100.5
3.3.2.1.2 50% of pull at maximum power at rated speed													
3M	22.5	7.3	11.15	2275	2.3	388	2.16	35	84	98	14	71	100.5
3.3.2.1.3 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.1.1													
4M	33.6	11.0	10.94	1722	3.4	285	2.94	37	83	95	14	75	100.5
3.3.2.1.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.1.2													
4M	22.4	7.3	11.13	1736	2.4	317	2.64	36	83	93	14	76	100.5

Gear nearest 7.5 km/h is a slip gear

4. OPTIONAL TESTS RESULTS

4.1 Turning area and turning circle

Wheel equipment if several sets of tyres are tested.

	With brakes		Without brakes	
	Right-hand	Left-hand	Right-hand	Left-hand
	m	m	m	m
Radius of turning area	4.288	4.266	4.855	4.834
Radius of turning circle	4.138	4.116	4.705	4.684

4.1.1 Location of centre of gravity

-Height above ground: 900 mm
-Distance from the vertical plane containing the axis of the rear-wheels: 952 mm
-Distance from the median longitudinal plane of the tractor: 18 mm

5. REPAIRS AND ADJUSTMENTS DURING TESTS: None

6. REMARKS: None

Test carried out by: S J Devonshire

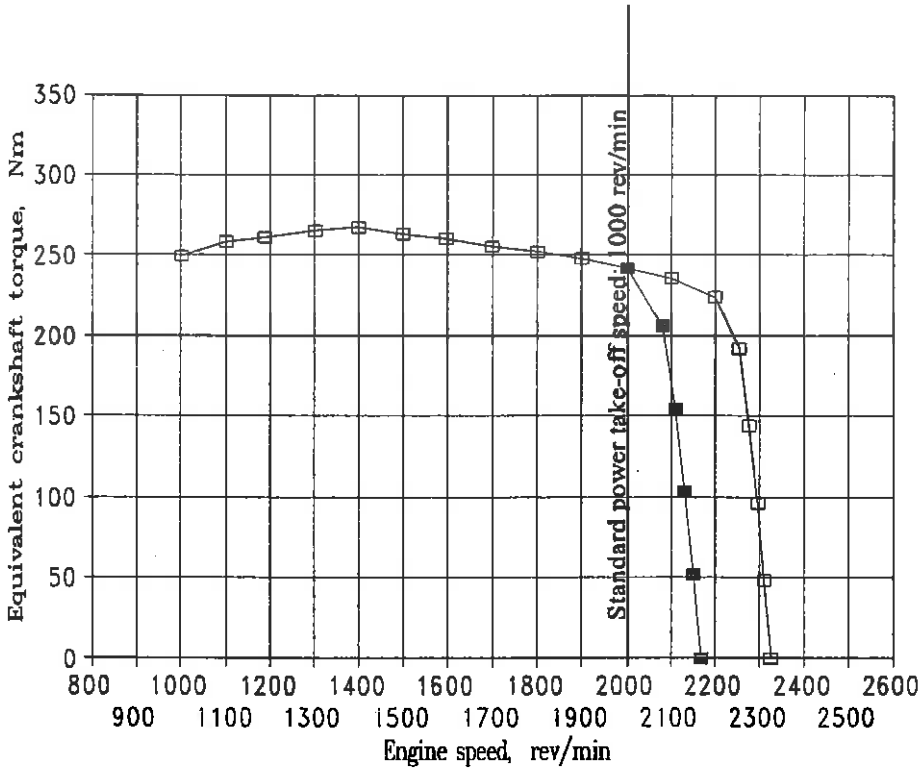
Signed: Officer in charge

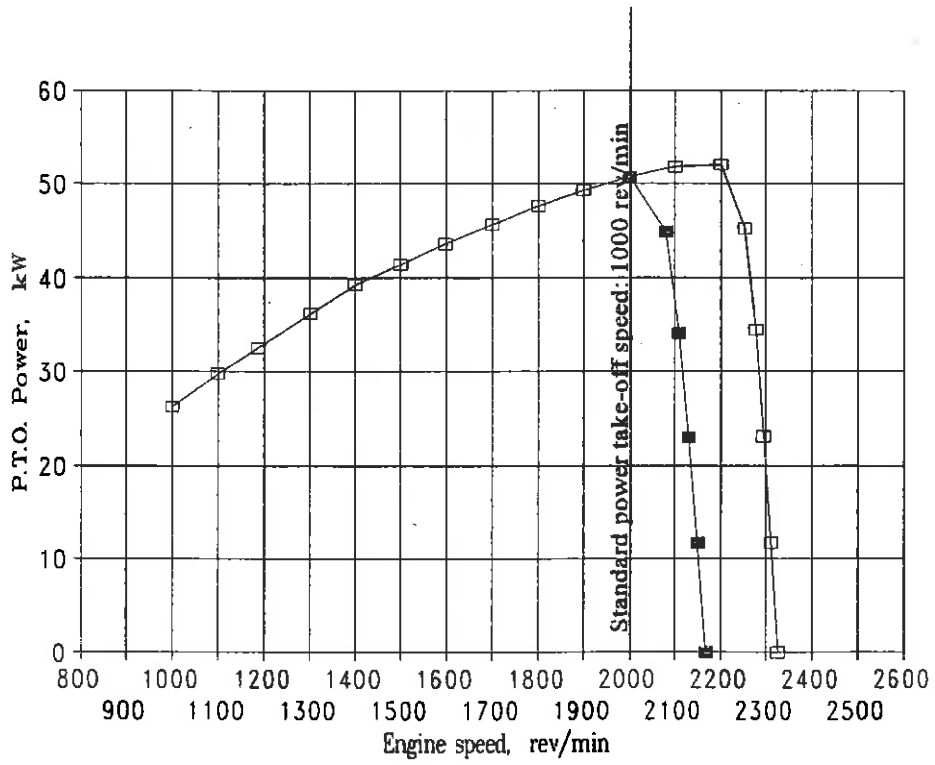
J P Evans
Senior Test Engineer
Test Engineering Group

Date: 8/2/01

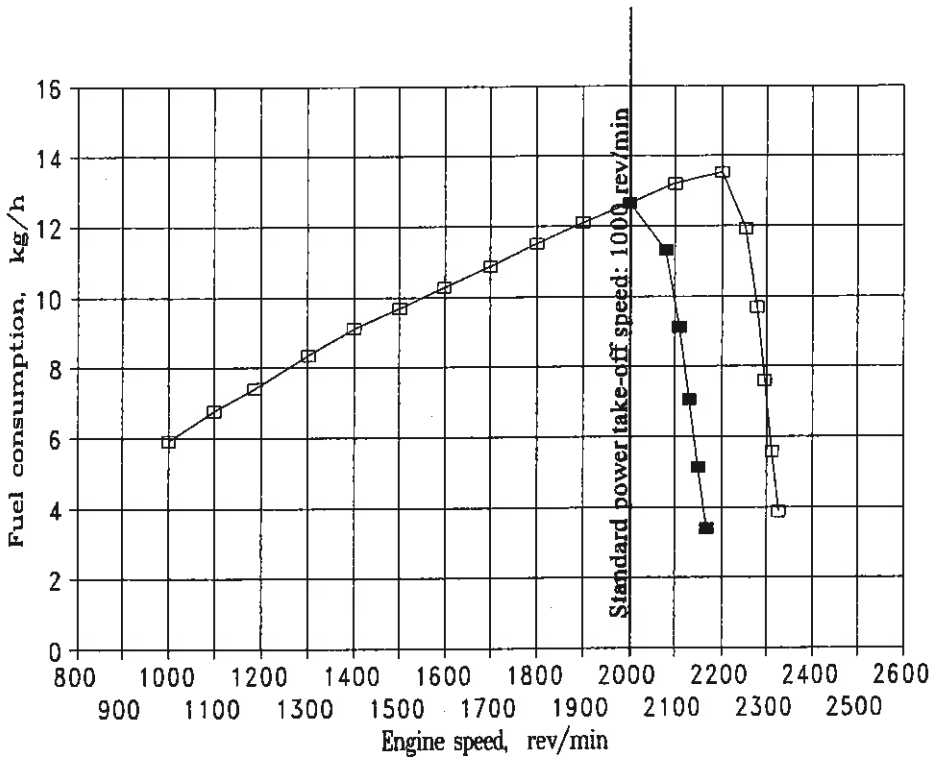
7. ANNEX 1 MAIN POWER TAKE-OFF CURVES

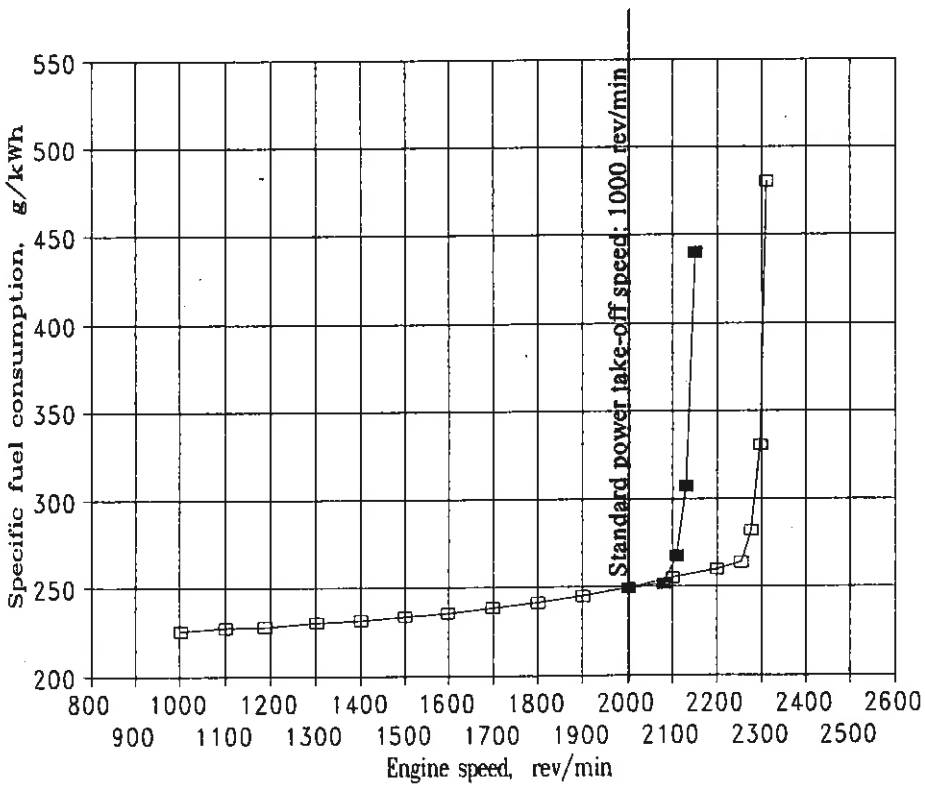
Massey Ferguson 4233 Four-Wheel Drive



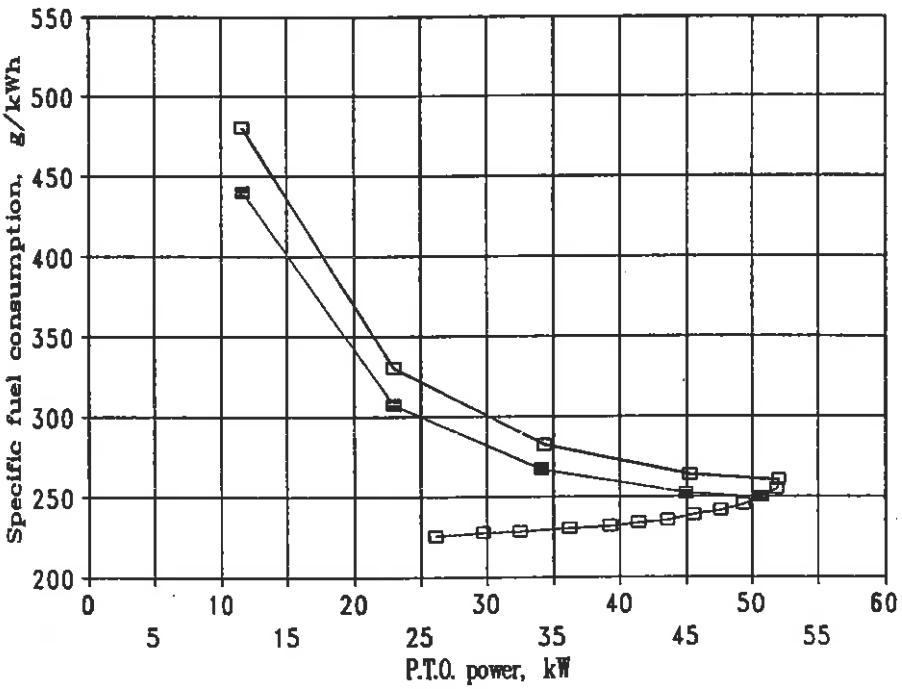


Massey Ferguson 4233 Four-Wheel Drive



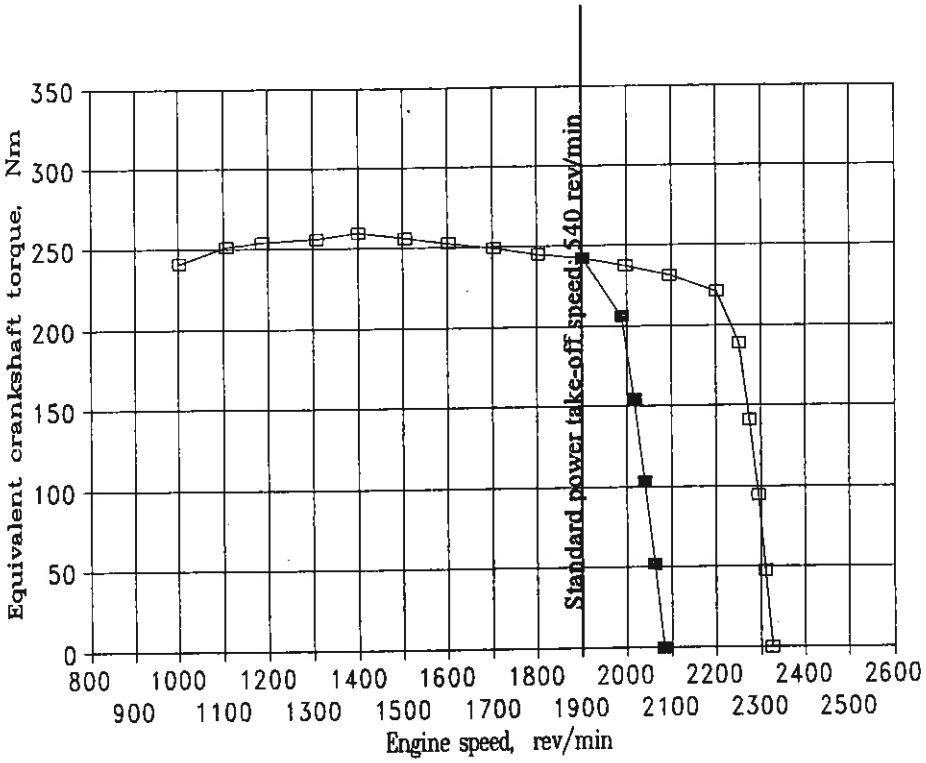


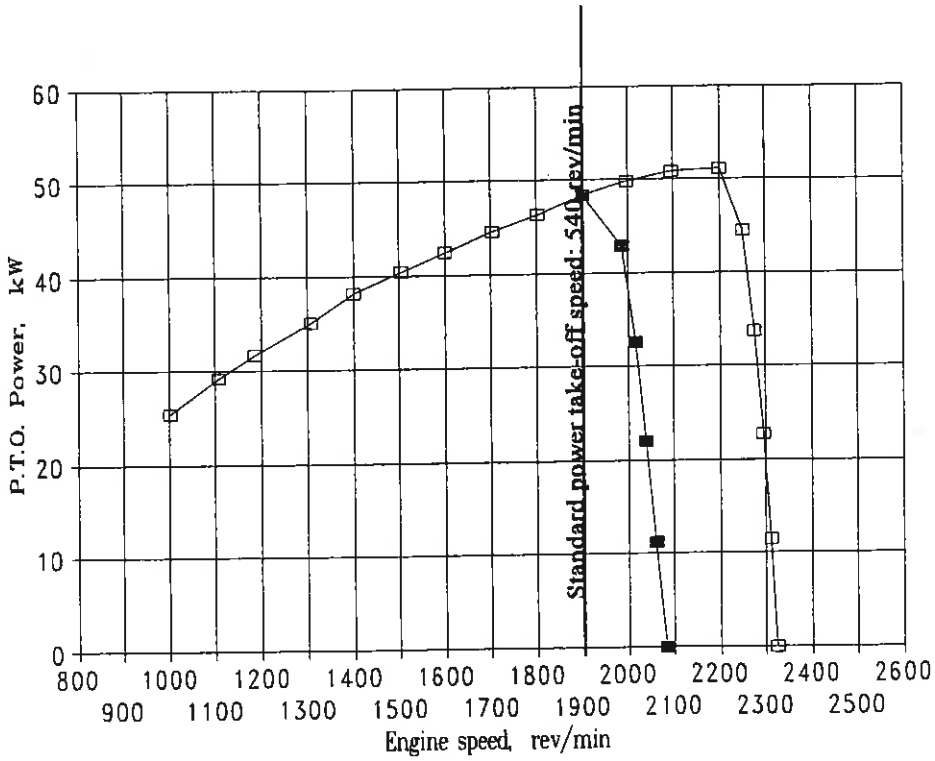
Massey Ferguson 4233 Four-Wheel Drive



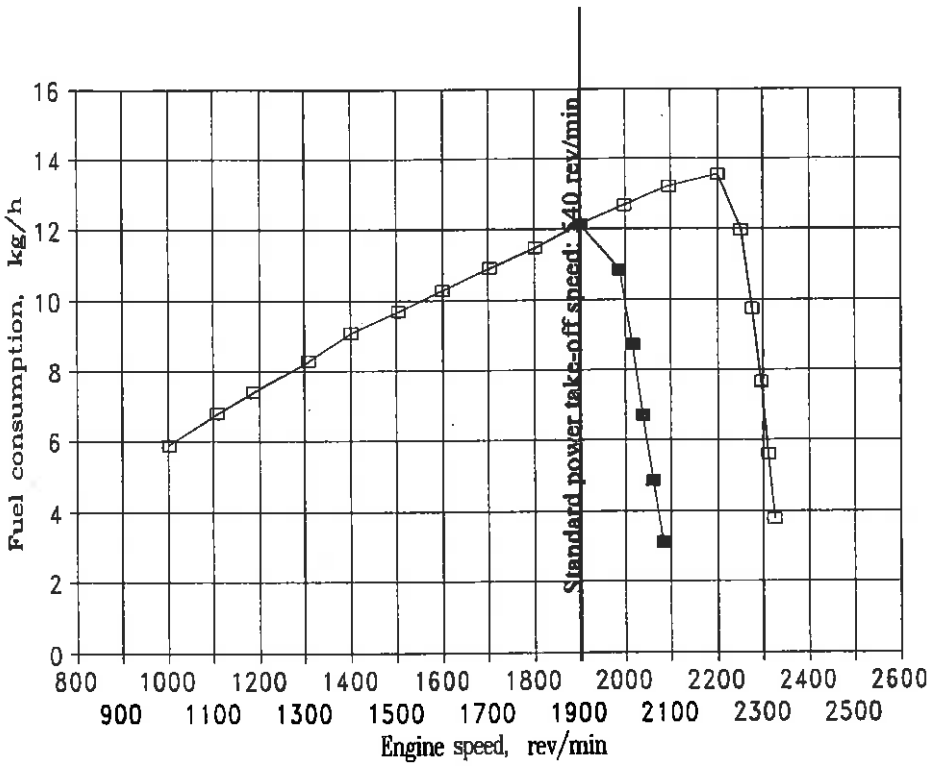
7. ANNEX 2 MAIN POWER TAKE-OFF CURVES

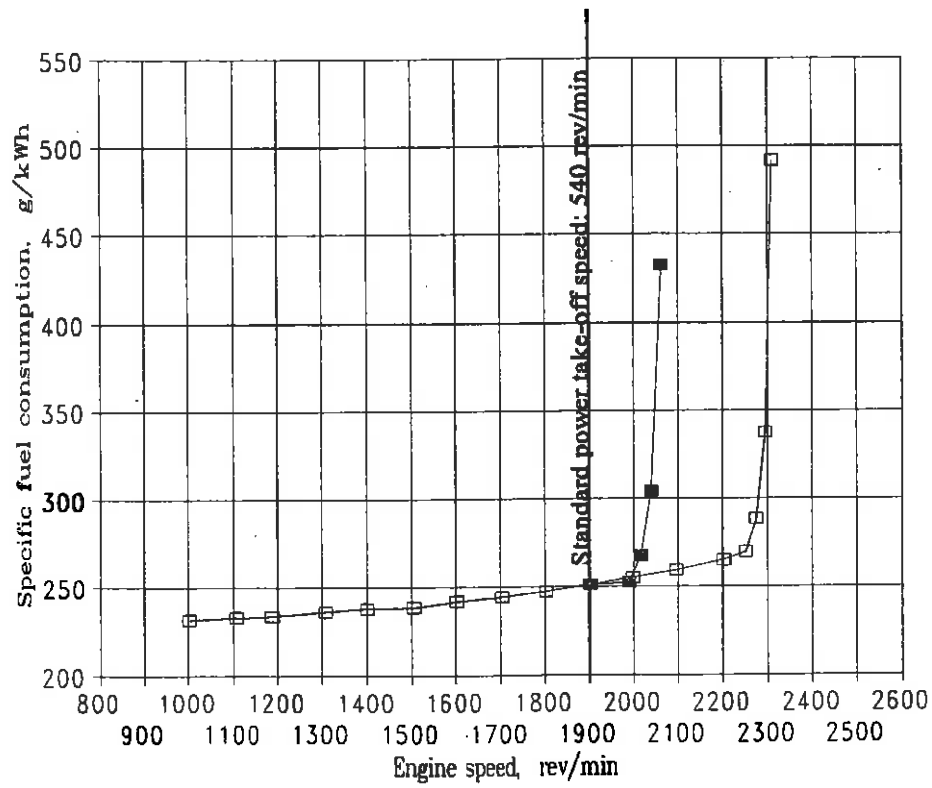
Massey Ferguson 4233 Four-Wheel Drive





Massey Ferguson 4233 Four-Wheel Drive





Massey Ferguson 4233 Four-Wheel Drive

