SILSOE RESEARCH INSTITUTE
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Report No: R92/71566/OECD
OECD Approval No: 1414 Restricted Code
Approval Date: 17 December 1992

Test in accordance with the OECD Restricted Standard Code for the Official Testing of Agricultural Tractors

Massey-Ferguson 372 Four-Wheel Drive Tractor with 12-speed Shuttle and 4 Forward Creep Gear Transmission



Manufactured by: Massey-Ferguson Tractors Limited
Banner Lane
Coventry
Warwicks CV4 9GF
England

Submitted for test by: The manufacturer

Report No: 752

Date: September 1992

R92/71566/OECD

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Tractor manufacturer's name and address:	Massey-Ferguson Tractors Limited Banner Lane, Coventry, Warwicks, CV4 9GF
Location of tractor assembly:	Coventry, England
Submitted for test by:	The manufacturer
Selected for test by:	The manufacturer with the agreement of the testing station
Place of running in:	Coventry
Duration of running in:	65 hours
Location of test:	Silsoe Research Institute Wrest Park, Silsoe, England

I. SPECIFICATION OF TRACTOR

TRACTOR

Make:	Massey-Ferguson
Model:	MF-372 with 12-speed shuttle and 4 forward creep gear transmission
Type:	Four wheel drive, unit construction
Serial No:	9138 A16317
1st Serial No:	9138 A16317

ENGINE

Make:	Perkins
Model:	A4.236
Type:	4 stroke, direct injection naturally aspirated diesel
Serial No:	LD31259 U519058W
Ist Serial No:	LD31259 U519058W

Cylinders

Number/disposition:	4 vertical in-line
Bore/stroke:	98.5 mm/127 mm
Capacity:	3871 cm^3
Compression ratio:	16:1
Arrangement of valves:	Overhead
Cylinder liners:	Dry

Supercharging

Make:	None

Fuel system

Fuel feed system:	Superpar mechanical feed pump
Make, type and model of fuel filter:	CAV paper, dual element filter with transparent sediment bowl
Capacity of fuel tank:	75 litres
Make, type and model of injection pump:	CAV distributor, DPA3340F000, Perkins 2643C278LS/3/2310
Serial No:	00630DKG
Manufacturer's production setting of injection pump:	14.0 to 14.88 l/hr
. Flow rate	58.4-62.0 mm^3/stroke at 2000 rev/min engine speed at full load on 45°C pump inlet temperature
. Timing	Delivery starts 23° before T.D.C. static
Make, type and model of injectors:	CAV 4-hole, BDLL 150S6705
Injection pressure:	17.1 MPa

Governor

Make:	CAV
Model:	Not applicable
Type:	Mechanical incorporated in injection pump
Governed range of engine speed:	750 to 2310 rev/min
Rated engine speed:	2200 rev/min

Air cleaner

Pre-cleaner:	None
Main cleaner:	
. Make	Donaldson
. Type	2 stage, dry paper element
. Model	FL6-06
. Location of air intake	Under bonnet in front of radiator
Maintenance indicator:	Warning light on instrument panel

Lubrication system	
Type of feed pump:	Forced feed from gear pump
Type of filter:	Full flow replaceable element
Number:	1
Cooling system	
Type of coolant:	Water or water and antifreeze solution
Type of pump:	Centrifugal
Specification of fan:	Belt driven puller
Number of fan blades:	6
Fan diameter:	432 mm
Coolant capacity:	15 litres
Type of temperature control:	Thermostat
System pressure:	75 kPa
Starting system	
Make:	Magneti Marelli
Model:	M127
Type:	Electrical, pre-engaged, solenoid operated
Starter motor power rating:	2.8 kW
Cold starting aid:	ISKRA induction heater 12V
Safety device:	Operable only when console mounted gear lever and pto selector are in neutral position
Electrical system	
Voltage:	12
Generator: . Make . Model . Type . Power	Alternator Massey-Ferguson Powerpart A 127-70 Belt driven 0.84 kW
Batteries: . Rating	2 M-F Powerpart, type 372 lead acid maintenance free 420 CCA rating each or equivalent 70 Ah at 20 hour rating

Exhaust system

Make:	Nelson Burgess
Model:	MF70
Type:	Round baffle silencer
Location:	Vertical on right hand side
Height of outlet above ground:	2492 mm

TRANSMISSION TO WHEELS

Clutch

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

Gear box

Make:	M-F
Model:	None
Type:	Mechanical manual synchromesh operation, 4 speeds and 3 ranges selected with single side mounted lever. Console mounted hand lever selects forward or reverse for each combination. 4 forward creep gears engaged by push-pull knob on seat deck in combination with low range selection.
Number of gears:	16 forward, 12 reverse
Available options:	12 forward, 12 reverse (without creep gears)

Rear axle final drives

Make:	Own make
Model:	None
Type:	Crown wheel and pinion with outboard epicyclic reduction gear final drives

Differential lock:	
. Type	Mechanical dog clutch on differential gears
. Method of engagement	Hydraulically operated in response to panel mounted electrical switch
. Method of disengagement	Reverse of above

Front axle and final drives

Make:	M-F
Model:	None
Type:	Crown wheel and pinion with differential and outboard epicyclic reduction gear final drives
Differential lock:	
. Type	Mechanical dog clutch on differential gears
. Method of engagement	Hydraulically actuated in unison with rear differential in response to electrical signal from switch on side console
. Method of disengagement	Reverse of above

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:* 2200 rev/min km/h
Forward Creep Gears			
1C	L	1675.63	0.344
2C	L	1282.37	0.449
3C	L	977.04	0.590
4C	L	746.11	0.773
Forward			
1	L	353.87	1.63
2	L	270.82	2.13
3	L	206.34	2.79
4	L	157.57	3.66
1	M	125.48	4.59
2	M	96.03	6.00
3	M	73.17	7.88
4	M	55.87	10.32
1	H	46.47	12.40
2	H	35.57	16.21
3	H	27.10	21.27
4	H	20.69	27.86
Reverse			
1	L	345.24	1.67
2	L	264.21	2.18
3	L	201.31	2.86
4	L	153.72	3.75
1	M	122.42	4.71
2	M	93.69	6.15
3	M	71.38	8.08
4	M	54.51	10.57
1	H	45.34	12.71
2	H	34.70	16.61
3	H	26.44	21.80
4	H	20.19	28.55

Reverse with creep engaged is as low range reverse above.

C = Creep L = Low range M = Medium range H = High range

(*) Calculated with a tyre dynamic radius index of 695 mm (ISO 4251/1-1984)
Number of revolutions of front wheels for one revolution of rear wheels: 1.3578

POWER TAKE-OFF

Main power take-off

Type:	Independent
Method of engagement:	By hand lever hydraulically engaging wet multi-plate clutch
Number of shafts:	1
Method of changing power take-off speeds:	Manually by hand lever in cab

Clutch

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

Power take-off proportional to engine speed
(Main Test)

540 rev/min

Location:	Rear of tractor
Diameter of power take-off shaft:	34.9 mm
Number of splines:	6 to ISO 500
Height above ground:	572 mm
Distance from the median plane of the tractor:	Central
Distance behind rear wheel axis:	296 mm
Pto speed at rated engine speed:	600 rev/min
Engine speed at standard power take-off speed:	1979 rev/min
Ratio of rotation speeds:	3.6654:1
Power restriction and maximum torque:	ISO recommendation 48 kW
Direction of rotation (viewed from behind tractor):	Clockwise

540 rev/min (Economy)
(Supplementary Test)

Location:	Rear of tractor
Diameter of power take-off shaft:	34.9 mm
Number of splines:	6, to ISO 500
Height above ground:	572 mm
Distance from the median plane of the tractor:	Central
Distance behind rear-wheel axis:	296 mm
PTO speed at rated engine speed:	836 rev/min
Engine speed at standard power take-off speed:	1421 rev/min
Ratio of rotation speeds:	2.632:1
Direction of rotation (viewed from behind tractor):	Clockwise

POWER LIFT

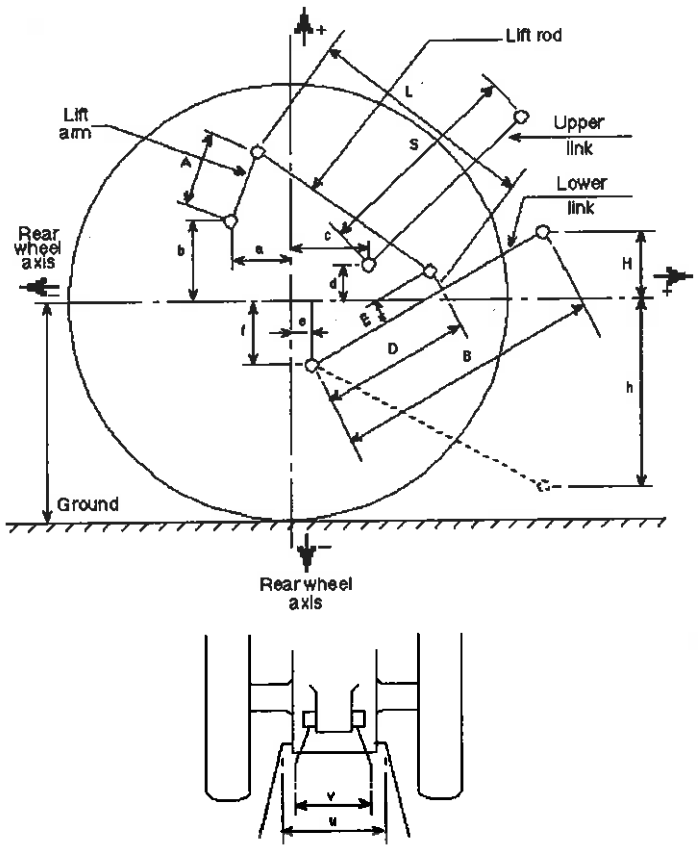
Make:	Massey-Ferguson
Model:	None
Type:	Hydraulic, with inlet suction control closed system
Type and number of cylinders:	1 single acting, internal
Type of linkage lock for transport:	Hydraulic
Relief valve pressure setting:	21.4 - 24.0 MPa
Opening pressure of cylinder safety valve:	None fitted
Lift pump type:	4 cylinder, piston
Transmission between pump and engine:	Driven from PTO shaft independent of main clutch
Type and number of filters:	Full flow with metal mesh strainer, 1
Site of oil reservoir:	Transmission housing
Type, number and location of tapping points:	One on centre housing top cover, a valve allows flow to spool valves and quick release couplings
Maximum volume of oil available to external cylinders:	23.0 litres

AUXILIARY HYDRAULIC SYSTEM

Make:	Sundstrand
Model:	None
Type:	Gear
Relief valve pressure setting:	17.0 - 20.6 MPa
Lift pump type:	Gear
Transmission between pump and engine:	Engine mounted in tandem with steering pump
Type and number of filters:	Metal mesh strainer and Parker Hannifin replaceable canister in shared circuit with steering system
Site of oil reservoir:	Main transmission housing
Type and number of tapping points:	2 quick release couplings with own spool valves and separate returns to ISO. A valve allows combination with main system up to auxiliary relief valve pressure.
Maximum volume of oil available to external cylinders:	23.0 litres

THREE-POINT LINKAGE

Category:	2 to ISO standard 730-1:1990
Category adaptor:	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 730-1:1990 CAT 2)

			Dimensions or range	Setting used in Main Test
Length of lift arms:		(A)	267 mm	267 mm
Length of lower links:		(B)	959 mm	959 mm
Distance of lift arm pivot point from rear wheel centre line:	horizontally: vertically:	(a) (b)	196 mm 233 mm	196 mm 233 mm
Horizontal distance between the two lower link points:		(u)	492 mm	492 mm
Horizontal distance between the two lift arm end points:		(v)	534 mm	534 mm
Length of upper link:		(S)	681 - 831 mm	765 mm
Distance of upper link pivot point from rear wheel centre line:	horizontally: vertically:	(c) (d)	186, 200, 216 mm 205, 171, 132 mm	186 mm 205 mm
Distance of lower link pivot point from rear wheel centre line:	horizontally: vertically:	(e) (f)	32 mm forward 212 mm	32 mm 212 mm
Distance of lower link points to lift rod pivot points on lower link centre line:	horizontally: vertically:	(D) (E)	428 mm on centre line	428 mm 0 mm
Length of lift rods:		(L)	600 - 635 mm	625 mm
Height of lower hitch points (*) relative to the rear wheel centre line, situated 695 mm above the ground level:				
- in low position		(h)	430 mm 523 mm	500 mm
- in high position		(H)	190 mm 250 mm	205 mm
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 695 mm ISO 4251/1-1984

SWINGING DRAWBAR

Type:	Clevis
Height above ground, maximum:	503 mm
minimum:	356 mm
Type of adjustment:	Inverting drawbar and clevis
Distance of hitch point from rear-wheel axis, horizontally:	545 - 660 mm
Distance of hitch point form power take-off shaft ends:	
. Vertically:	69 - 216 mm
. Horizontally:	249 - 364 mm
Lateral adjustment (centre of clevis):	
. Right-hand:	215 mm drawbar in 250 mm out
. Left-hand:	215 mm drawbar in 250 mm out
Distance of pivot point from rear axles horizontally:	130 mm forward
Width of clevis:	65 mm
Diameter of drawbar pin hole:	26 mm
Maximum vertical permissible load:	7.6 kN

TRAILER HITCH

Type:	None fitted

LINKAGE DRAWBAR

Type:	None fitted

FRONT TOWING HITCH

Type:	Clevis in front weight frame
Vertical height to centre of clevis:	592 mm
Width of clevis:	63 mm
Diameter of pin hole:	33 mm

STEERING

Make:	Own make
Model:	None
Type:	Hydrostatic
Method of operation:	
. Pump	Sundstrand gear type mounted on engine in tandem with auxiliary hydraulic system pump
. Motor	Danfoss OSPC-100-ON
. Ram	1 double acting operating both track rods
. Filter	1 replaceable canister in shared circuit with auxiliary hydraulics
Working pressure:	17.0 MPa

BRAKES

Service brake

Make:	Girling
Model:	None
Type:	Oil-immersed multiplate 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 fitted

Parking brake

Type:	Mechanical via cable
Method of operation:	Hand lever with ratchet

WHEELS

Number:	4
. Front	2 steering and driving
. Rear	2 driving
Wheelbase:	2217 mm

Track width adjustment:

	Minimum, mm	Maximum, mm	Adjustment method
Front	1424	1628	By reversing wheels and offset lug rims
Rear	1430	1860	By reversing wheels and offset lug rims

PROTECTIVE STRUCTURE

Make:	GKN Sankey Industrial Products
Model:	Lo-Line
Type:	Safety cab
Manufacturer's name and address:	GKN Sankey Industrial Productions, Hadley Castle Works, P O Box 86, Telford TF1 4RE
Protective device:	
. Rollguard	Safety cab
. Tiltable/Not tiltable	Non tiltable
OECD approval number:	CSS 0211/3

DRIVER'S SEAT

Make/Model/Type:	KAB303 LB
Type of suspension:	Spring
Type of damping:	Hydraulic
Range of adjustment:	
. Longitudinal	140 mm
. Vertical	60 mm

LIGHTING

Unrestricted beam angle of headlight in plan view: 110°

	Height above ground to centre, mm	Size, mm	Distance from outside edge to median plane of tractor, mm
Headlight	1135	90 x 150	220
Sidelights	1575	30 x 110	710
Rear lights	1515	85 x 65	715
Axle reflectors	706	80 dia	475
Cab reflectors	1515	42 x 50	738

II. TEST CONDITIONS

Overall dimensions (overall width at 1524 measured front track)

Length mm	Width		Height at top of	
	Minimum mm	Maximum mm	Protective structure mm	Exhaust pipe mm
3734	1910	2340	2517	2492

Ground clearance (unballasted tractor) 295 mm

Clearance-limiting part: Drawbar clevis in lowest position

Tractor mass (with safety cab)

	Unballasted		Ballasted	
	Without driver kg	With driver kg	Without driver kg	With driver kg
Front	1264	1279	--	--
Rear	1811	1871	--	--
Total	3075	3150	--	--

Tyres and track width specification

	Front	Rear
Tyres . dimensions . ply rating . type	 11.2 x 24 A8 Radial	 16.9 x 30 A8 Radial
Maximum load (tyre manufacturer's), kg	1262	2460
Maximum load (tractor manufacturer's), kg	1045	2245
Inflation pressure (tyre manufacturer's), Bar	1.8	1.7
Dynamic radius index, mm	515	695
Chosen track width (manufacturer's nominal), mm	1524	1430

Oils and lubrication

Capacity and change interval

	Capacity l	Oil change h	Filter change h
Engine	7.5	250	250
Front axle	9	1000	None
Final drive (front)	0.6 per side	1000	None
Gearbox	47.4	1000	250
Rear axle Hydraulic system) Final drives (rear)) Steering	Integral with rear axle		
Brakes	--	Top-up	None

Fuels and lubricants used in tests

Fuel

Type: Diesel oil with cetane index of 54.5 and kinematic viscosity of 2.9 cSt at 40°C within the specification limits of Class A2 British Standard 2869/1983.

Specific gravity: 0.8380 kg/l at 15°C

Oils	Recommended	Used during test
Engine oil		
Type:	SAE 15W/30	As recommended
Viscosity:	54 cSt at 50°C	
Classification:	MIL-L-2104-C	
Transmission oils		
Type:	SAE 15W/30	As recommended
Viscosity:	54 cSt at 50°C	
Classification:	MIL-L-2104-C	
Rear final drives		
Type:	SAE 15W/30	As recommended
Viscosity:	54 cSt at 50°C	
Classification:	MIL-L-2104-C	
Front differential and final drives		
Type:	SAE 15W/30	As recommended
Viscosity:	54 cSt at 50°C	
Classification:	MIL-L-2104-C	
Hydraulic brakes		
Type:	Mineral	As recommended
Viscosity:	7.2 cSt at 50°C	
Classification:	M-F CMS 1151A	
Hydraulic fluid		
Type:	SAE 15W/30	As recommended
Viscosity:	54 cSt at 50°C	
Classification:	MIL-L-2104-C	
Steering oil		
Type:	SAE 15W/30	As recommended
Viscosity:	54 cSt at 50°C	
Classification:	MIL-L-2104-C	
Recommended grease:	Consistency 2 lithium	As recommended
Number of lubrication points:	13	

III. TEST RESULTS

A. COMPULSORY TEST RESULTS

1. MAIN POWER TAKE-OFF (540)

Date and location of tests: 23 July 1992
Silsoe Research Institute,
Wrest Park, Silsoe, Bedford

Type of dynamometer: Water brake, Heenan & Froude

Power kW	Speed		Fuel consumption			Specific energy kWh/l
	Engine rev/min	P.T.O. rev/min	Hourly kg/h	l/h	Specific g/kWh	
1.1 MAXIMUM POWER - TWO HOUR TEST						
46.2	2197	599	13.05	15.57	282	2.97
1.2 POWER AT RATED ENGINE SPEED						
46.2	2197	599	13.05	15.57	282	2.97
1.3 STANDARD POWER TAKE-OFF SPEED (540 ± 10 rev/min)						
45.7	1976	539	12.36	14.75	271	3.10
1.4 PART LOADS 1.4.1 The torque corresponding to maximum power at rated engine speed						
46.2	2197	599	13.05	15.57	282	2.97
1.4.2 85% of the torque defined in 1.4.1						
39.4	2212	603	11.29	13.48	287	2.92
1.4.3 75% of the torque defined in 1.4.2						
30.0	2227	607	9.18	10.95	306	2.74
1.4.4 50% of the torque defined in 1.4.2						
20.0	2237	610	7.26	8.67	364	2.30
1.4.5 25% of the torque defined in 1.4.2						
9.9	2245	612	5.54	6.61	561	1.49
1.4.6 Unloaded						
0	2271	619	4.06	4.85	--	--

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	
1.5 1.5.1	PART LOADS AT STANDARD POWER TAKE-OFF SPEEDS (540 ± 10 rev/min) The torque corresponding to maximum power					
45.7	1976	539	12.36	14.75	271	3.10
1.5.2	85% of the torque obtained in 1.5.1					
38.8	1989	542	10.21	12.19	263	3.18
1.5.3	75% of the torque obtained in 1.5.2					
29.7	2009	548	8.32	9.93	280	2.99
1.5.4	50% of the torque obtained in 1.5.2					
19.9	2021	551	6.50	7.76	327	2.56
1.5.5	25% of the torque obtained in 1.5.2					
10.1	2042	557	4.84	5.78	481	1.74
1.5.6	Unloaded					
0	2056	560	3.32	3.96	--	--

No load, maximum engine speed: 2271 rev/min

Torque (equivalent crankshaft) at maximum power: 200.5 Nm

Maximum torque (equivalent crankshaft) (engine speed 1255 rev/min): 245.6 Nm*

Mean atmospheric conditions:

- Temperature 25°C
- Pressure 1021 m bar
- Relative humidity 53%

Maximum temperatures:

- Coolant 89°C
- Engine oil 121°C
- Fuel 49°C
- Engine air intake 29°C

* Maximum torque was obtained but unable to go 15% below due to limits of test equipment.

2. HYDRAULIC POWER AND LIFTING FORCE

Date of tests: 2 September 1992

2.1 Hydraulic power test

Sustained pressure with relief valve open: 23.4 MPa

Pump delivery rate at minimum pressure: 23.1 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	19.7	21.1	6.93
Flow rate and hydraulic pressure corresponding to maximum hydraulic power	20.0	21.0	7.00

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

2.2 Power lift test - (To ISO 730-1:1990)

	At the hitch point	On the frame
Height of lower hitch points above ground in down position	200 mm	200 mm
Vertical movement	705 mm	930 mm
Maximum corrected force exerted through full range	17.5 kN	14.6 kN
Corresponding pressure of hydraulic fluid	21.1 MPa	21.1 MPa
Moment about rear-wheel axis	16.2 kNm	22.4 kNm
Maximum tilt angle of mast from vertical	--	18 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	-346	-288	-200	-100	0	80	140	220	300	417	584
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	--	17.5	19.1	20.3	21.4	22.1	22.6	23.5	23.8	24.9	--
Corresponding pressure: 21.1 MPa											
at the frame kN	14.6	15.2	15.7	16.2	16.5	16.5	16.5	16.6	16.5	16.1	15.2
Corresponding pressure: 21.1 MPa											

3. DRAWBAR POWER AND FUEL CONSUMPTION TEST (UNBALLASTED TRACTOR, 4 WHEEL DRIVE)

Date and location of tests: 9 September 1992
Silsoe Research Institute
Wrest Park
Silsoe

Type of track: Concrete

	Tyre inflation pressure (kPa)	
Height of drawbar above ground	Front	Rear
335 mm	83	83

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
3.1 MAXIMUM POWER IN TESTED GEARS													
3L*	21.2	31.6	2.42	2242	15.0	421	1.99	36	79	109	18	64	101.3
4L*	28.1	32.1	3.15	2233	15.1	394	2.13	37	79	106	18	63	101.3
1M	35.2	30.8	4.11	2204	10.6	374	2.24	36	80	101	18	64	101.3
2M	37.9	24.1	5.65	2204	6.0	342	2.45	38	79	111	17	69	101.3
3M	38.5	18.4	7.54	2200	4.3	337	2.49	38	82	111	17	69	101.3
4M	38.2	13.8	9.97	2199	3.3	342	2.45	39	81	107	16	74	101.3
1H	39.2	11.7	12.07	2203	2.8	340	2.46	40	81	113	16	73	101.3
2H†	38.4	8.7	15.86	2200	2.2	344	2.44	40	81	111	17	64	101.3
3.2 FUEL CONSUMPTION 3.2.1 In selected gear, at maximum power at rated speed													
1H	39.2	11.7	12.07	2203	2.8	340	2.46	40	81	113	16	73	101.3
3.2.1.1 75% of pull at maximum power at rated speed													
1H	29.9	8.7	12.36	2240	2.2	350	2.39	38	80	112	16	72	101.3
3.2.1.2 50% of pull at maximum power at rated speed													
1H	19.8	5.7	12.53	2255	1.4	413	2.03	38	79	112	17	69	101.3
3.2.1.3 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.2.1.1													
2H	29.7	8.7	12.36	1715	2.2	301	2.78	40	80	105	17	64	101.3
3.2.1.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.2.1.2													
2H	20.0	5.8	12.49	1720	1.4	326	2.57	36	78	101	17	64	101.3
3.2.2 In selected gear nearest to 7.5 km/h, at maximum power at rated engine speed													
3M	38.5	18.4	7.54	2200	4.3	337	2.49	38	82	111	17	69	101.3
3.2.2.1 75% of pull at maximum power at rated speed													
3M	29.9	13.9	7.75	2238	3.3	358	2.34	41	81	112	17	69	101.3
3.2.2.2 50% of pull at maximum power at rated speed													
3M	20.2	9.2	7.90	2255	2.1	406	2.06	40	80	112	17	69	101.3
3.2.2.3 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.2.2.1													
4M	29.9	13.9	7.75	1709	3.3	303	2.77	41	79	102	18	63	101.3
3.2.2.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.2.2.2													
4M	20.1	9.1	7.92	1726	2.2	327	2.56	38	78	100	18	63	101.3

* Maximum power limited by wheelslip and bounce
† Highest gear measurable within speed limits of test equipment

B. SUPPLEMENTARY TEST RESULTS

B1. MAIN POWER TAKE-OFF (540 "Economy")

Date and location of tests: 20 August 1992
Silsoe Research Institute,
Wrest Park, Silsoe, Bedford

Type of dynamometer: Water brake, Heenan & Froude

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	
1.1 MAXIMUM POWER						
46.5	2199	835	13.14	15.68	283	2.96
1.2 POWER AT RATED ENGINE SPEED						
46.5	2199	835	13.14	15.68	283	2.96
1.3 STANDARD POWER TAKE-OFF SPEED (540 ± 10 rev/min)						
36.6	1426	542	9.59	11.44	262	3.20
1.4 PART LOADS 1.4.1 The torque corresponding to maximum power at rated engine speed						
46.5	2199	835	13.14	15.68	283	2.96
1.4.2 85% of the torque defined in 1.4.1						
39.7	2217	842	11.11	13.26	280	2.99
1.4.3 75% of the torque defined in 1.4.2						
30.0	2234	849	9.23	11.01	307	2.73
1.4.4 50% of the torque defined in 1.4.2						
20.3	2244	852	7.31	8.73	361	2.32
1.4.5 25% of the torque defined in 1.4.2						
9.9	2256	857	5.56	6.64	564	1.49
1.4.6 Unloaded						
0	2271	862	4.02	4.80	--	--

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	
1.5 PART LOADS AT STANDARD POWER TAKE-OFF SPEEDS (540 ± 10 rev/min)						
1.5.1 The torque corresponding to maximum power						
36.6	1426	542	9.59	11.44	262	3.20
1.5.2 85% of the torque obtained in 1.5.1						
32.0	1471	559	7.97	9.51	249	3.37
1.5.3 75% of the torque obtained in 1.5.2						
24.5	1493	567	6.23	7.43	254	3.30
1.5.4 50% of the torque obtained in 1.5.2						
16.6	1520	577	4.73	5.65	284	2.95
1.5.5 25% of the torque obtained in 1.5.2						
8.5	1537	584	3.37	4.02	397	2.11
1.5.6 Unloaded						
0	1579	600	2.09	2.49	--	--

No load, maximum engine speed: 2271 rev/min

Torque (equivalent crankshaft) at maximum power: 201.9 Nm

Maximum torque (equivalent crankshaft)
(engine speed 1272 rev/min): 246.1 Nm

Mean atmospheric conditions:

- Temperature 18°C
- Pressure 1009 m bar
- Relative humidity 75%

Maximum temperatures:

- Coolant 88°C
- Engine oil 117°C
- Fuel 48°C
- Engine air intake 24°C

B2. DRAWBAR POWER AND FUEL CONSUMPTION TEST (UNBALLASTED TRACTOR, 2 WHEEL DRIVE)

Date and location of tests: 14 September 1992
Silsoe Research Institute
Wrest Park
Silsoe

Type of track: Concrete

Height of drawbar above ground	Tyre inflation pressure (kPa)	
	Front	Rear
450 mm	83	83

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
3.1 MAXIMUM POWER IN TESTED GEARS													
1L*	22.4	25.5	3.15	2234	15.1	411	2.04	38	79	108	18	73	100.7
1M*	27.9	25.5	3.94	2223	15.1	388	2.16	37	79	108	17	72	101.7
2M	36.1	24.5	5.31	2204	11.8	364	2.30	37	81	104	17	72	100.7
3M	37.7	18.4	7.38	2204	6.6	344	2.44	40	82	110	16	72	100.6
4M	37.7	13.8	9.80	2199	5.1	349	2.40	39	81	109	16	71	100.6
1H	38.6	11.7	11.87	2200	4.3	342	2.45	41	82	112	17	72	100.6
2H†	37.3	8.6	15.65	2199	3.4	348	2.41	40	81	110	17	73	100.7
3.2 FUEL CONSUMPTION 3.2.1 In selected gear, at maximum power at rated speed													
1H	38.6	11.7	11.87	2200	4.3	342	2.45	41	82	112	17	72	100.6
3.2.1.1 75% of pull at maximum power at rated speed													
1H	29.6	8.8	12.16	2236	3.6	358	2.34	42	82	113	17	68	100.6
3.2.1.2 50% of pull at maximum power at rated speed													
1H	20.2	5.9	12.37	2252	2.6	409	2.05	41	80	113	17	69	100.6
3.2.1.3 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.2.1.1													
2H	29.5	8.7	12.18	1710	3.4	299	2.80	41	80	107	18	68	100.7
3.2.1.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.2.1.2													
2H	20.4	5.9	12.36	1721	2.5	341	2.46	38	78	103	18	67	100.7
3.2.2 In selected gear nearest to 7.5 km/h, at maximum power at rated engine speed													
3M	37.7	18.4	7.38	2204	6.6	344	2.44	40	82	110	16	72	100.6
3.2.2.1 75% of pull at maximum power at rated speed													
3M	29.3	13.8	7.62	2239	5.0	355	2.36	42	80	111	17	70	100.6
3.2.2.2 50% of pull at maximum power at rated speed													
3M	19.9	9.2	7.78	2253	3.6	413	2.03	38	78	111	16	71	100.6
3.2.2.3 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.2.2.1													
4M	29.2	13.7	7.63	1708	4.8	307	2.73	39	80	101	17	70	100.7
3.2.2.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.2.2.2													
4M	19.9	9.2	7.78	1718	3.4	330	2.54	38	78	100	18	67	100.7

Maximum power limited by wheelslip and bounce
Highest gear measurable within speed limits of test equipment

REPAIRS AND ADJUSTMENTS DURING TESTS: None

REMARKS: None

Test carried out by: S J Devonshire

Officer in charge: P C Seward

Signed: H M R Proctor — Head of Test Engineering Group

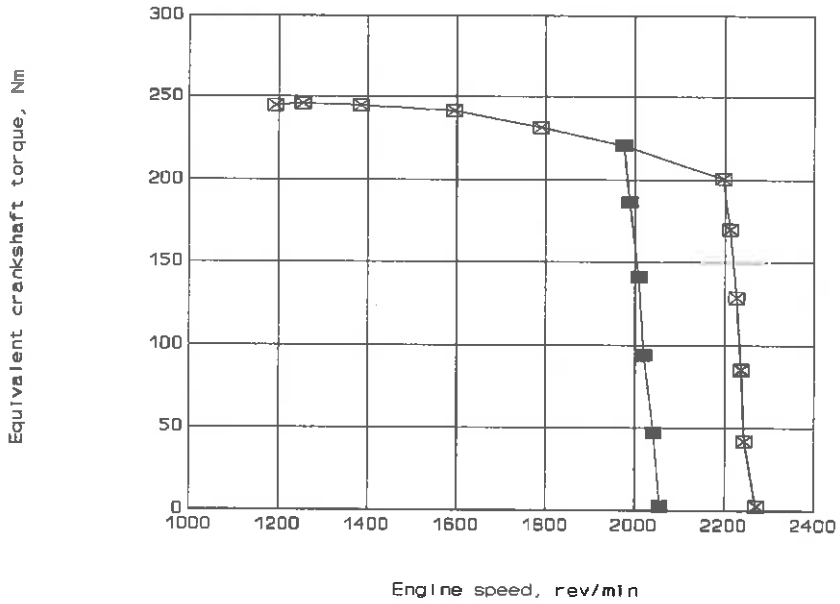
H M R Proctor — for the Director

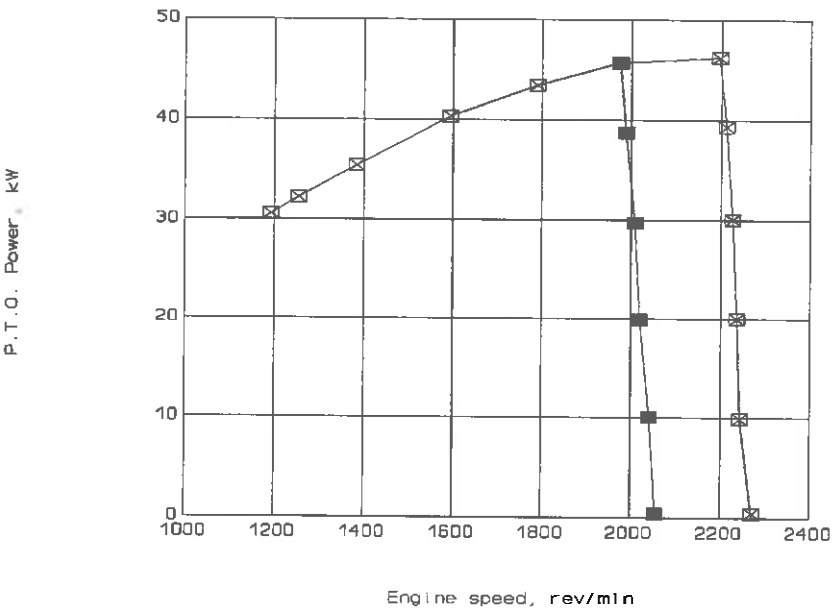
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ANNEX 1 Main Power Take-off Curves (540)

P.T.O. POWER TEST - MASSEY FERGUSON 372, 4 WHEEL DRIVE (540)

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

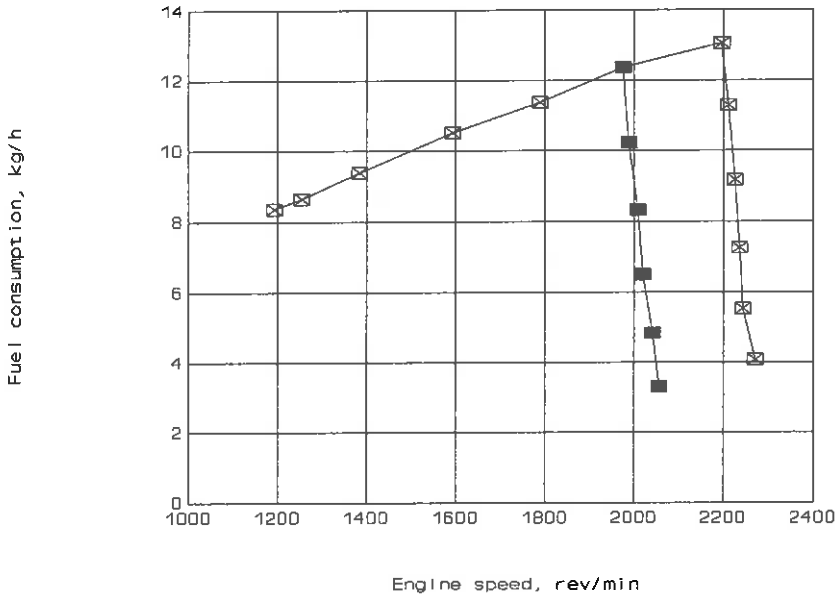


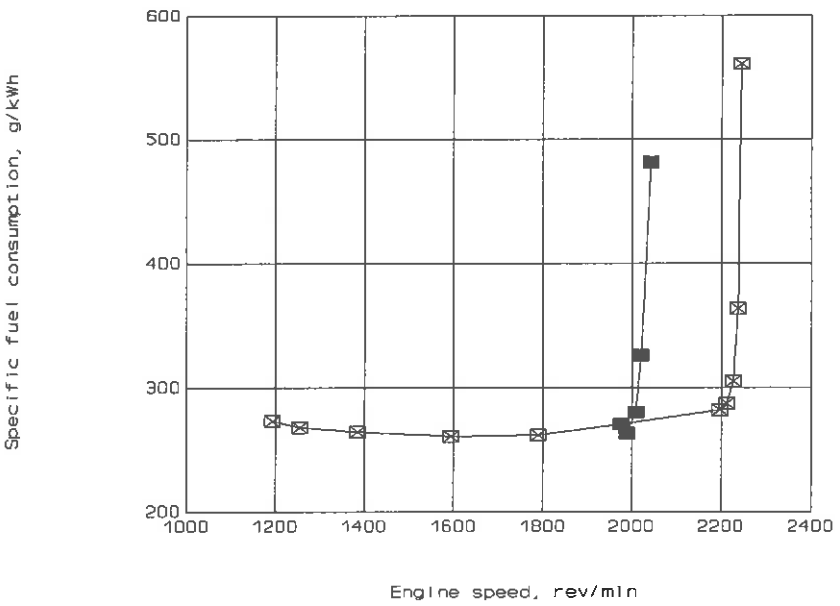


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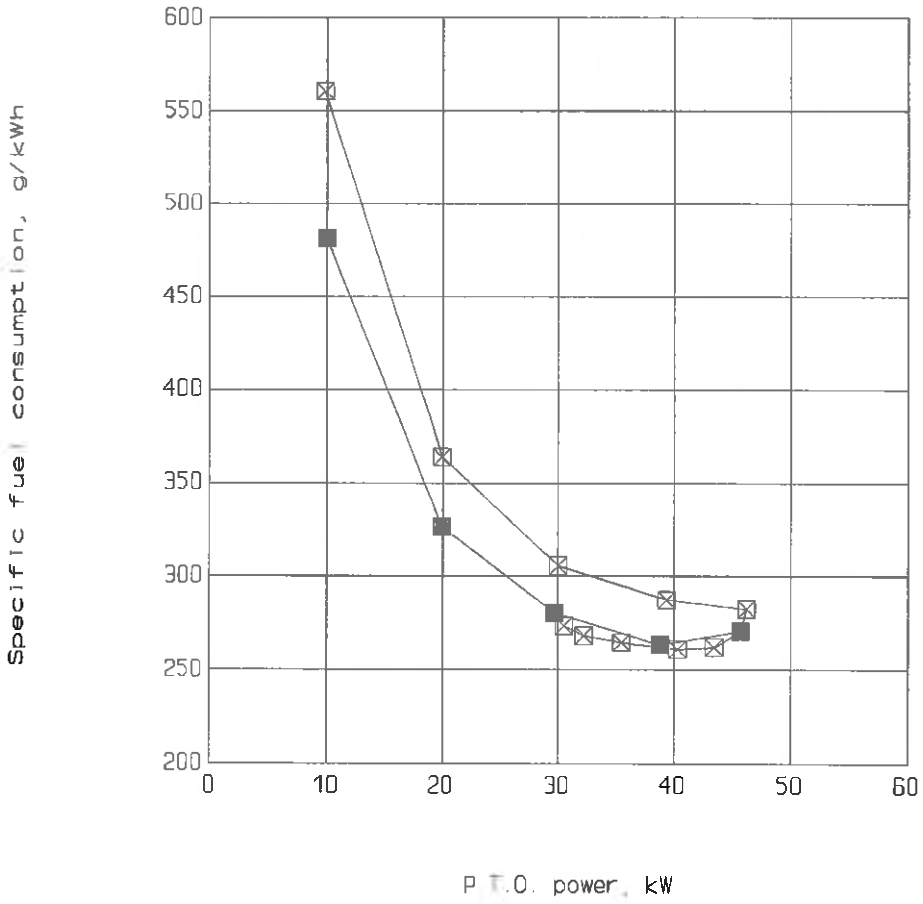




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P.T.O. POWER TEST - MASSEY FERGUSON 372, 4 WHEEL DRIVE (540)

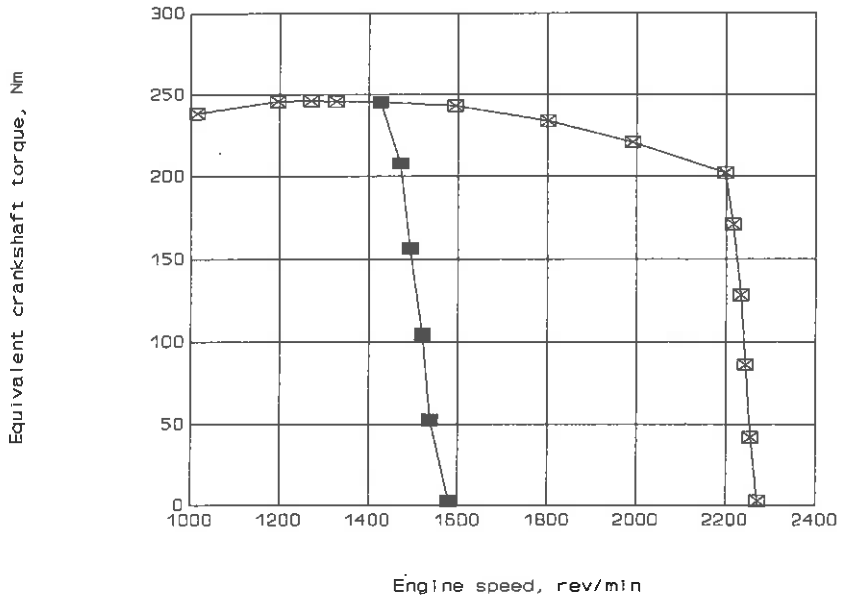
Governor set for maximum power at rated speed ⊠
Governor set for maximum power at pto speed ■

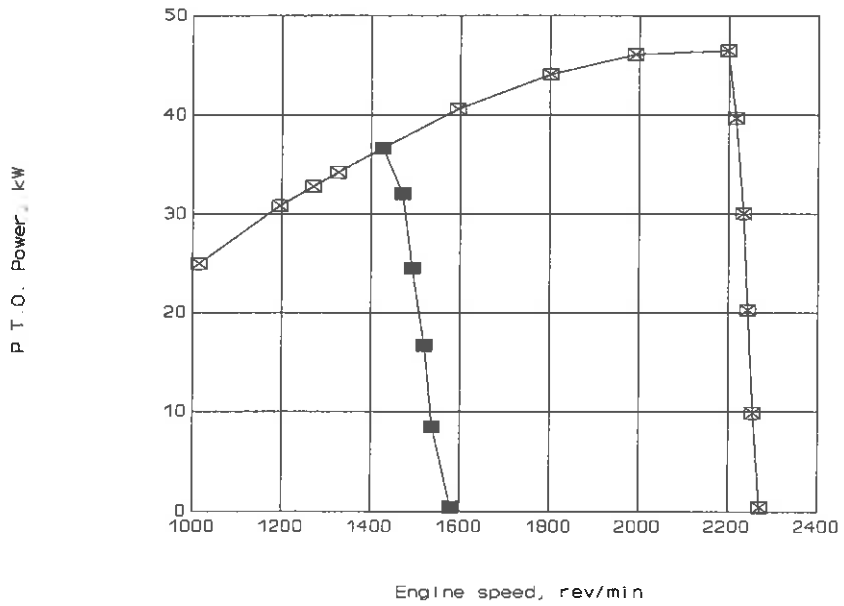


ANNEX 2 Main Power Take-off Curves (540 "Economy")

P.T.O. POWER TEST - MASSEY FERGUSON 372, 4 WHEEL DRIVE (540 "ECONOMY")

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

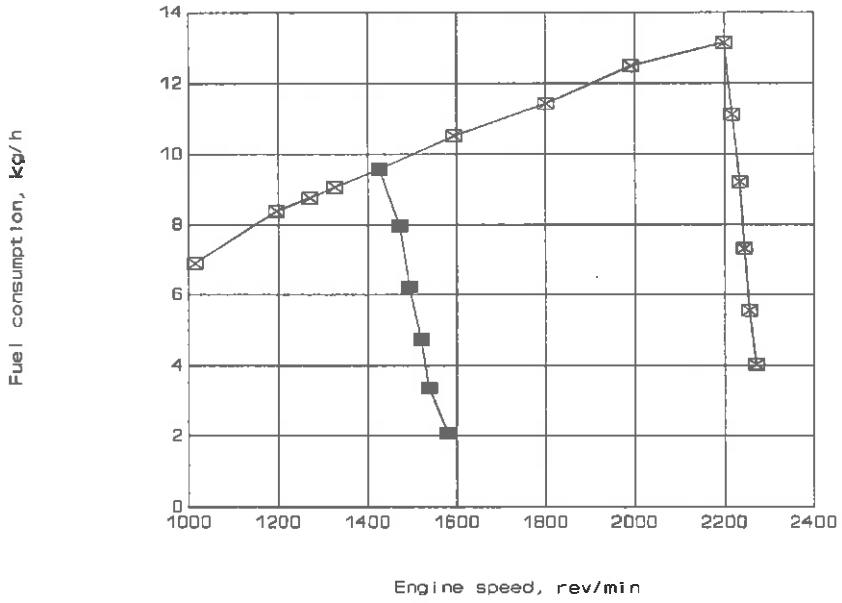


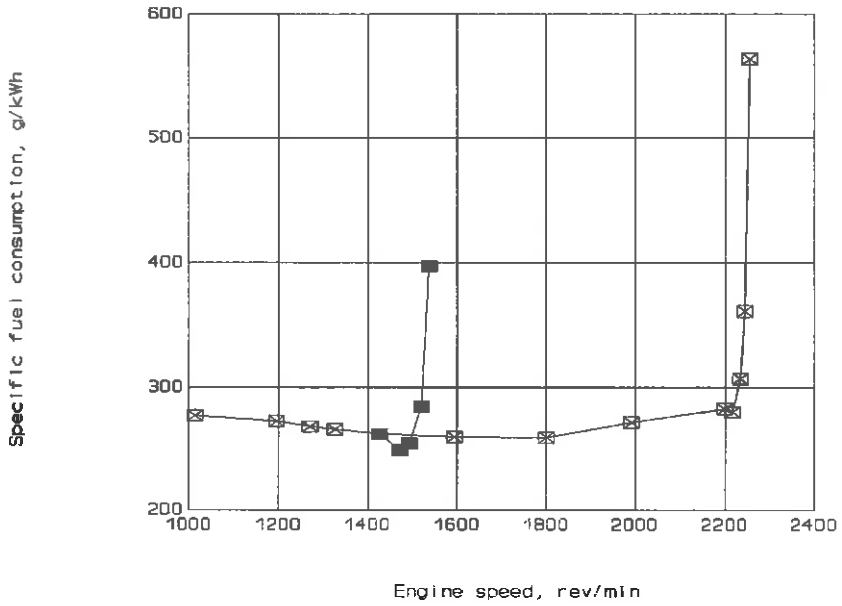


ANNEX 2 Main Power Take-off Curves (540 "Economy")

P.T.O. POWER TEST - MASSEY FERGUSON 372, 4 WHEEL DRIVE (540 "ECONOMY")

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





ANNEX 2 Main Power Take-off Curves (540 "Economy")

P.T.O. POWER TEST - MASSEY FERGUSON 372, 4 WHEEL DRIVE (540 "ECONOMY")

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

