SILSOE RESEARCH INSTITUTE

OECD Report

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CODE 2

Tests in accordance with the OECD RESTRICTED STANDARD CODE for the Official Testing of Agricultural and Forestry Tractors

Case IH MFC7CG2 (MXM190) Four-Wheel Drive Tractor with
19-speed Full Power Shift Transmission (50 km/h)



Manufactured by: CNH UK Limited
Basildon
Essex SS14 3AD
United Kingdom

Reference No: 835

Date: April 2004

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ENGINEERING for Life

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Statement

The information opposite each item has been validated by the Testing Station. An item marked [C] indicates to the test report user that the information declared by the manufacturer has been checked; an item marked [D] indicates that the manufacturer's declaration has been endorsed.

[C]	Tractor manufacturer's name and address:	CNH UK Limited Basildon, Essex, SS14 3AD United Kingdom
[C]	Location of tractor assembly:	Basildon, Essex
[D]	Submitted for test by:	The manufacturer
[C]	Selected for test by:	The manufacturer with the agreement of the testing station
[D]	Place of running in:	Basildon. Essex
[D]	Duration of running in:	140 hours
[C]	Location of test:	Silsoe Research Institute Wrest Park, Silsoe, MK45 4HS United Kingdom

1. SPECIFICATIONS OF TRACTOR

1.1 Identification

1.1.1

[C]	Make of tractor:	Case IH
[C]	Model (trade name):	MXM 190
[C]	Type:	Four- wheel drive, unit construction

1.1.2 *Numbers*

[D]	1st Serial No or prototype:	ACM186090
[C]	Serial No:	171080B

1.1.3 *Other specifications (if applicable)*

[D]	Model(s) for other countries:	None
[C]	Transmission type or gears x ranges:	19-Speed Full Power Shift
[C]	Speed version:	30/40/50 km/h
[C]	Manufacturer identification or Technical type number:	MFC7CG2

1.2 Engine

[C]	Make:	CNH
[C]	Model:	675TA/FA
[C]	Type:	4 stroke turbocharged direct injection and after cooled diesel, electronically controlled
[C]	Serial No:	963806

1.2.1 *Cylinders*

[C]	Number/disposition:	6 vertical in-line
[D]	Bore/stroke:	111.8mm/127.0mm
[D]	Capacity:	7480 cm^3
[D]	Compression ratio:	17.5 : 1
[D]	Arrangement of valves:	Overhead
[D]	Cylinder liners:	None, monobloc construction

1.2.2 *Supercharging*

[D]	Make/Model:	Borg Warner/K27
[C]	Type:	Exhaust driven
[D]	Pressure:	0.144 MPa at rated speed/load

1.2.3 *Fuel system*

[D]	Fuel feed system:	Stanadyne electronic lift pump
[C]	Make, type and model of fuel filter:	One disposable canister filter with sediment bowl and water separator plus plastic strainer in tank
[D]	Capacity of fuel tank:	389 dm^3
[D]	Make, type and model of injection pump:	Bosch, VP Rotary Electronic, 0 470 006 001
[D]	Serial No:	87802531
	Manufacturer's production setting of injection pump	
[C]	Flow rate (rated engine speed and full load):	119 mm^3 ±3% per stroke at 2200 min^{-1} (rev/min) 45.71 – 48.54dm^3/h
[D]	Timing:	T.D.C
[D]	Make, type and model of injectors:	Bosch, differential needle, DSLA 143 PV 338 5300
[D]	Injection pressure:	27.0-28.2 MPa

1.2.4 *Governor*

[C]	Make:	Bosch
[D]	Model:	None
[C]	Type:	Electronically controlled
[C]	Governed range of engine speed:	895 to 2405 min^{-1} (rev/min)
[C]	Rated engine speed:	2200 min^{-1} (rev/min)

1.2.5 *Air cleaner*

[C]	Pre-cleaner	
[C]	Type:	Spin tube
[C]	Location:	Air cleaner canister inlet
	Main cleaner	
	Make:	Locker Filtration
[C]	Type:	3 stage dry paper element with replaceable cartridge Exhaust Aspirated
[D]	Model:	None
[C]	Location of air intake:	Under engine bonnet on front and above radiator.
[C]	Maintenance indicator:	Warning light on instrument

1.2.6 *Lubrication system*

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

1.2.7 *Cooling system*

[C]	Type of coolant:	Water and antifreeze (50% solution)
[D]	Type of pump:	Belt driven centrifugal impeller
	Specification of fan	
[C]	Number of fan blades:	7
[C]	Fan diameter:	550 mm
[D]	Coolant capacity:	26 dm^3
[D]	Type of temperature control:	Thermostat with full flow bypass
[D]	System pressure:	100 kPa

1.2.8 *Starting system*

[D]	Make:	Bosch JF / Iskra
[D]	Model:	JF
[C]	Type:	Electrical, positive engagement, solenoid operated
[D]	Starter motor power rating:	3.1/3.6 kW 3.0 kW (Reduction geared)
[D]	Cold starting aid:	Lucas – Type 357-33
[C]	Safety device:	Starting inoperable unless shuttle lever in neutral, clutch pedal depressed and seat presence switch is activated

1.2.9 *Electrical system*

[C]	Voltage:	12 V
	Generator:	Alternator
[C]	Make:	Magneti Marrelli / Denso
[C]	Model:	MME / A 127
[C]	Type:	Belt driven
[C]	Power:	100/120 amps at 6000 min^{-1} (rev/min)
	Batteries	
[C]	Number:	1 Exide lead acid, mounted on RHS fuel tank
[D]	Rating:	176 Ah at 20 hours

1.2.10 *Exhaust system*

[C]	Make:	COR.TUBI
[D]	Model:	None
[C]	Type:	Under bonnet horizontal silencer with vertical stack pipe
[C]	Location:	Rear left hand side above engine, under bonnet
[C]	Height of outlet above ground:	3190 mm

1.3 Transmission

1.3.1 *Clutch (Travel alone)*

[D]	Make:	CNH
[D]	Model:	None
[D]	Type:	Wet multiplate in gearbox, for travel only
[D]	Number of plates:	12
[D]	Diameter of plates:	150 mm
[C]	Method of operation:	Electro-hydraulic with pedal override

1.3.2 *Gear box*

[D]	Make:	CNH
[C]	Model:	Range command (full power shift)
[C]	Description:	Electro/Hydraulic, 19 forward and 6 reverse powershift speeds,selected by 2 buttons on an adjustable lever mounted on the RH console Forward/reverse is actuated by a steering column mounted shuttle lever.

		Forward	Reverse
[C]	Number of gears	19	6
[C]	Number of ranges/groups	1	1
[C]	Total of arrangements	19	6

Available options:

17 x 6 with creep (30 km/h)
18 x 6 with creep (40 km/h)
19 x 6 with creep (50 km/h)

1.3.3 *Rear axle and final drivers*

[D]	Make:	CNH
[D]	Model:	None
[D]	Type:	Crown wheel pinion with differential and inboard epicyclic reduction gear final drive
	Differential lock:	
[D]	Type:	Multi-plate clutch
[C]	Method of engagement:	Electro-hydraulic actuation in response to signal from switch on right-hand control panel
[C]	Method of disengagement:	Via panel switch or in response to signal from brakes on application, or steering movement, or axle lift

1.3.4 *Front axle and final drives*

[D]	Make:	CNH
[D]	Model:	None
[D]	Type:	Crown wheel and pinion with differential and outboard epicyclic reduction gear final drives
	Drive engagement:	
[D]	Type:	Multi-plate clutch – located within the gearbox
[C]	Method of operation:	Electro-hydraulic actuation in response to signal from switch on right-hand control panel
	Differential lock:	
[D]	Type:	Multi-plate clutch
[C]	Method of engagement:	Electro-hydraulic actuation in response to signal from switch on right-hand control panel
[C]	Method of disengagement:	Via panel switch or in response to signal from brakes on application, or steering movement, or axle lift

1.3.5 *Total ratios and travelling speeds*

	Gear	Group or range	Number of engine revolutions for one revolution of the driving wheels	Nominal travelling speed at rated engine speed:* 2200 rev/min km/h
	Forward			
[C]	1		396.08	1.90
[C]	2		329.38	2.28
[C]	3		274.21	2.74
[C]	4		228.03	3.29
[C]	5		189.58	3.96
[C]	6		157.65	4.76
[C]	7		136.44	5.50
[C]	8		113.47	6.62
[C]	9		94.46	7.95
[C]	10		78.55	9.56
[C]	11		65.31	11.49
[C]	12		54.31	13.82
[C]	13		47.25	15.87
[C]	14		39.29	19.10
[C]	15		32.71	22.95
[C]	16		27.20	27.60
[C]	17		22.62	33.19
[C]	18		18.81	39.91
[C]	19		16.39	45.80
	Reverse			
[C]	1		178.88	4.20
[C]	2		148.75	5.05
[C]	3		123.84	6.06
[C]	4		102.98	7.29
[C]	5		85.62	8.77
[C]	6		71.20	10.54

Range selection: None

(*) Calculated with a tyre dynamic radius index of 905 mm (Not in conformity with ISO 4251/1-1998)

[C] Number of revolutions of front wheels for one revolution of rear wheels: 1.343

1.4 Power take-off

1.4.1 *Main power take-off*

[C]	Type:	Independent
[C]	Method of engagement:	Electro – hydraulic operated multi-plate clutch in response to a signal from switch on the right – hand control panel
[C]	Number of shafts:	1 interchangeable shaft, 6 or 21 splines to ISO 500/1991
[C]	Method of changing power take-off speeds:	Two speed shiftable, 540E or 1000 min^{-1} (rev/min) by lever on right-hand console
	Clutch	
[D]	Make:	CNH
[D]	Model:	None
[D]	Type:	Multiplate, wet
[D]	Number of plates:	8
[D]	Diameter of plates:	140.0 mm

1.4.1.1 Power take-off proportional to engine speed

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

[C]	Location:	Rear of tractor
[C]	Diameter of power take-off shaft:	34.9 mm
[C]	Number of splines:	6 in conformity with ISO 500/1991 (available option 21)
[C]	Height above ground:	875 mm
[C]	Distance from the median plane of the tractor:	Central
[C]	Distance behind rear wheel axis:	637 mm
[C]	PTO speed at rated engine speed:	757 min^{-1} (rev/min)
[C]	Engine speed at standard power take-off speed:	1569 min^{-1} (rev/min)
[C]	Ratio of rotation speeds:	2.90
[D]	Power restriction:	None
[D]	Maximum torque transmissible:	None
[C]	Direction of rotation (viewed from behind tractor):	Clockwise

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

[C]	Location:	Rear of tractor
[C]	Diameter of power take-off shaft:	34.9 mm
[C]	Number of splines:	21 in conformity with ISO 500/1991 (available option 6)
[C]	Height above ground:	875 mm
[C]	Distance from the median plane of the tractor:	Central
[C]	Distance behind rear wheel axis:	637 mm
[C]	PTO speed at rated engine speed:	1021 min^{-1} (rev/min)
[C]	Engine speed at standard power take-off speed:	2154 min^{-1} (rev/min)
[C]	Ratio of rotation speeds:	2.154
[D]	Power restriction	None
[D]	Maximum torque transmissible:	None
[C]	Direction of rotation (viewed from behind tractor):	Clockwise

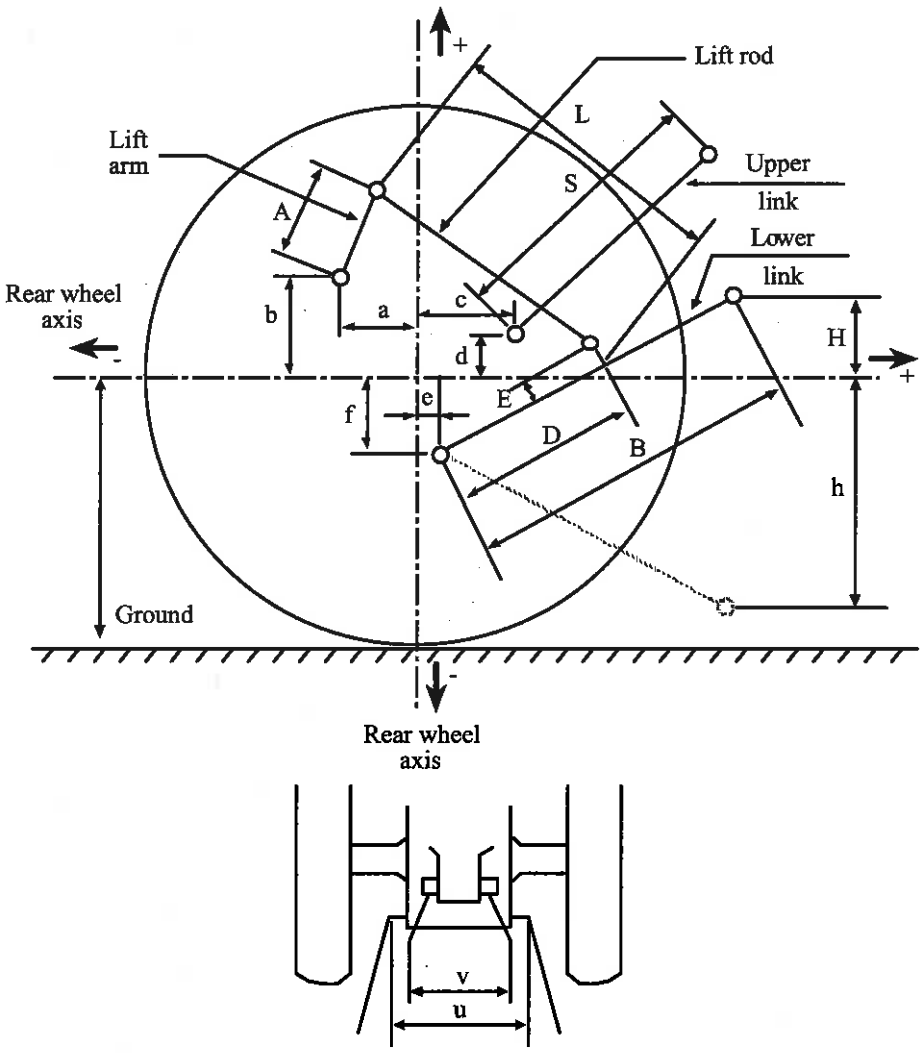
1.4.1.2 Power take-off proportional to ground speed — Not applicable

1.5 Hydraulic power lift

[C]	Make:	CNH
[D]	Model:	None
[D]	Type:	Electro-hydraulic closed centre load sensing
[C]	Type and number of cylinders:	2 single acting, externally mounted
[C]	Type of linkage lock for transport:	Hydraulic
[D]	Pump maximum pressure / Relief valve pressure setting:	20.5 – 21.5 MPa
[D]	Opening pressure of cylinder safety valve:	22.0 – 23.0 MPa
[D]	Lift pump type:	Variable displacement piston pump
[D]	Transmission between pump and engine:	Gear driven from PTO shaft, independent of main and PTO clutches
[C]	Type and number filters:	1 disposable canister filter and 1 element filter
[C]	Site of oil reservoir:	Rear axle housing
[C]	Type, number and location of tapping points:	4 or 5 remote couplers at rear of tractor (5 Remote valves fitted on test tractor)
[D]	Maximum volume of oil available to external cylinders:	28 litres max under normal conditions (flat fields) 40 litres max when operating stationary on level ground

1.6 Three-point linkage

[C]	Category:	2 in conformity with ISO 730-1:1994 + Cor.1:1995
[C]	Category adapter:	None
[C]	Controls:	Electronic draught/ 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)

				Dimensions or ranges	Settings used in tests		
					3.2.2	7.1	7.2
				mm	mm	mm	mm
[C]	Length of lift arms:		(A)	450	450	450	450
[C]	Length of lower links:		(B)	974	974	974	974
[C]	Distance of lift arm pivot point from rear wheel centre line:	horizontally: vertically:	(a) (b)	92 372	92 372	92 372	92 372
[C]	Horizontal distance between the two lower link points:		(u)	644	644	644	644
[C]	Horizontal distance between the two lift arm end points:		(v)	560	560	560	560
[C]	Length of upper link:		(S)	690 – 915	740	790	790
[C]	Distance of upper link pivot point from rear wheel centre line:	horizontally: vertically:	(c) (d)	440 – 500 217 – 277	500 217	440 277	440 277
[C]	Distance of lower link pivot point from rear wheel centre line:	horizontally: vertically:	(e) (f)	250 270	250 270	250 270	250 270
[C]	Distance of lower link points to lift rod pivot points on lower link centre line:		(D)	612 – 682	612	682	682
[C]	Length of lift rods:		(L)	870 – 990	978	990	990/945
	Height of lower hitch points (*) Relative to the rear wheel centre line, situated 905 mm above the ground level:						
[C]	- in low position		(h)	422 – 720	705	635	635/550
[C]	- in high position		(H)	75 – 260	80	100	83/163
[C]	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 905 mm

1.7 Swinging drawbar
(Incorporating Slider Germany and Swinging drawbar EEC)

[C]	Type:		Clevis		
[C]	Height above ground:	Unballasted Maximum:	600 mm		
		Minimum:	485 mm		
[C]	Type of adjustment:		Inverting drawbar		
[C]	Distance of hitch point from rear-wheel axis, horizontally:		877 mm	993 mm	1043 mm
[C]	Distance of hitch point from power take-off shaft end:				
		Vertically:	275 mm	390 mm	
		horizontally:	240 mm	356 mm	406 mm
[C]	Lateral adjustment (centre of clevis):				
		Right-hand:	-- --	180 mm	192 mm
		Left-hand:	-- --	180 mm	192 mm
[C]	Distance of pivot point from rear axles	horizontally:	115 mm	in front of rear axle	
[C]	Width of clevis:		70 mm		
[C]	Diameter of drawbar pin hole:		33 mm		
[D]	Maximum vertical permissible load:	Clevis uppermost:	2575 kg	1680 kg	1440 kg
		Clevis underneath:	1305 kg	1225 kg	1045 kg

1.8 Trailer hitch

[C]	Type:	Coupling	
[C]	Hole diameter:	33 mm	
[C]	Height above ground:	535 mm to 1055mm	
[C]	Distance of hitch point from rear wheel axis, horizontally:	830 mm	
[C]	Distance of hitch point from power take-off shaft end		
	Vertically:	-337 mm to +200 mm	
	Horizontally:	204 mm	
[D]	Maximum vertical permissible load:	2000 kg	

1.9 Holed drawbar

Type:	None fitted

1.10 Steering

[D]	Make:	CNH
[D]	Model:	None
[D]	Type:	Hydrostatic
	Method of operation	
[C]	Pump:	Bosch Rexroth
[C]	Motor:	Sauer Danfoss OSPQ 125-250 (Dynamic)
[C]	Ram:	2, balanced system with double acting cylinders one operating each steering arm
[D]	Filter:	Integral with hydraulic power lift system
[D]	Working pressure:	17 MPa

1.11 Brakes

1.11.1 *Service brake*

[D]	Make:	CNH
[D]	Model:	None
[D]	Type:	Oil-immersed two plate disc
[C]	Method of operation:	Hydraulic boosted, independent on rear wheels (On 4 WD models. When the service brakes are activated the front wheel drive is automatically engaged providing 4-wheel braking)
[C]	Trailer braking take-off:	Hydraulic connector fitted to ISO 5676-1983

1.11.2 *Parking brake*

[D]	Type:	Fully independent six plate disc operating on bevel pinion shaft
[C]	Method of operation:	Hand lever with ratchet

1.12 Wheels

Number

[C] Front: 2 driving/steering

[C] Rear: 2 driving

[C] Wheelbase: 2818 mm

Track width adjustment:

		Minimum mm	Maximum mm	Adjustment method
[C]	Front*	1538/1560	2238/2260	Reversing wheels and offset lug rims
[C]	Rear	1530	2230	Reversing wheels and offset lug rims/ Optional bar axle fitted

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

1.13 Protective structure

[C] Make: CNH

[C] Model: SLTV 10

[C] Type: Cab safety frame - suspended

[C] Manufacturer's name and address: CNH UK Ltd
Cranes Farm Road
Basildon
Essex
SS14 3AD

Protective device

[C] Cab/frame/rollguard/ other: Cab

[C] Tiltable/Not tiltable: Not tiltable

OECD approval

[C] Approval number: 4/0699

[C] Date of approval: 19 October 2001

Nos. minor modification certificates, if any: 2

The certificates for minor modifications established by and under the responsibility of the Danish Institute of Agricultural Sciences, Bygholm, Denmark

1.14 Seat

1.14.1 *Driver's seat*

[C]	Make/model/Type:	Sears SST 1503 EEC approved to 78/764/EEC – e11-1294
[C]	Seat and steering wheel reversible:	No
[C]	Type of suspension:	Low frequency, parallelogram suspension air spring
[C]	Type of damping:	Double acting, hydraulic
	Range of adjustment	
[C]	Longitudinal:	± 100 mm
[C]	Vertical:	± 68 mm
[C]	Safety belt:	Yes

1.14.2 *Optional driver's seat(s)*

1.14.3 *Passenger seat*

[C]	Make:	CNH (instructional seat)
[C]	Location:	Soft plastic moulding, folding, on left hand side of inner fender.
[C]	Type:	EEC approved to76/763/EEC – e11 1383
[C]	Capacity (numbers):	1

1.15 Lighting

		Height above ground to centre	Size	Distance from outside edge of lights to medium plane of tractor
		mm	mm	mm
[C]	Headlights	1420	150 x 90	210
[C]	Sidelights	2035	105 x 30	870
[D]	Rear lights	2055	50 x 75	900
[D]	Rear fender reflectors	2055	30 x 75	930
[C]	Rear axle reflectors	875	100 x 35	640

2 TEST CONDITIONS

2.1 Overall dimensions

	length	Width		Height at top of	
		minimum	maximum	Protective structure	Exhaust pipe
	mm	mm	mm	mm	mm
Unballasted	5190	2490	2490	3070	3190

2.2 Ground clearance (unballasted tractor) 410 mm

Clearance-limiting part: Drawbar clevis in lowest position

2.3 Tractor mass

Mass (with or without frame/roll guard/cab/other): With cab

	Unballasted	
	Without driver	With driver
	kg	kg
Front	3289	3291
Rear	4636	4709
Total	7925	8000

2.4 Track specifications Not applicable

2.5 Tyres and track width specification

	Front	Rear
Tyres Dimensions ply rating type	 540/65 R 30 143 A8 Radial	 650/65 R 42 158 A8 Radial
Maximum load (tyre manufacturer's) 30/40/50 km/h	28.6/26.7/24.3 kN	44.6/40.5/37.9 kN
Maximum load (tractor manufacturer's) 30/40/50	28.6/26.7/24.3 kN	44.6/40.5/37.9 kN
Inflation pressure (tyre manufacturer's)	160 kPa	160 kPa
Dynamic radius index	695 mm	905 mm
Chosen track width (manufacturer's nominal)	1820 mm	1810 mm

2.6 Fuel

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

Density at 15° C: 0.8413 g/cm^3

2.7 Oils and lubrication

2.7.1 *Capacity and change interval*

	Capacity	Oil change	Filter change
	dm^3	h	h
Engine	19.0	300	300
Front axle differential	9.0	1200	None
Front axle hub (each)	1.7	1200	None
Gearbox	100.0	1200	1200
Rear axle Hydraulic system Final drives (rear) Steering	Integral with gearbox		
Brakes	0.5	Top-up	None

2.7.2 *Specifications (SAE, APL, CCMC, ACEA, MILL, ISO)*

	Case spec	Recommended	Used during test
Engine oil Type: Viscosity Classification:	MS 1121	SAE 10W/30 11.5 cSt at 100° C API CH – 4	As recommended
Transmission oils Type: Viscosity Classification:	MAT 3525	SAE 10W/30 9 cSt at 100° C API GL – 4	As recommended
Rear final drives Type: Viscosity: Classification:	MAT 3525	SAE 10W/30 9 cSt at 100° C API GL – 4	As recommended
Front differential and final drives Type: Viscosity: Classification:	MAT 3525	SAE 10W/30 9 cSt at 100° C API GL – 4	As recommended
Hydraulic brakes Type: Viscosity: Classification:	LHM fluid	No equivalent 6 cSt at 100° C ISO 7308	As recommended
Hydraulic fluid Type: Viscosity: Classification:	MAT 3525	SAE 10W/30 9 cSt at 100° C API GL – 4	As recommended
Steering oil Type: Viscosity: Classification:	MAT 3525	SAE 10W/30 9 cSt at 100° C API GL – 4	As recommended

2.7.3 *Grease*

Type:	251 HEP	Lithium Based	As recommended

Number of lubrication points: 14

3. COMPULSORY TESTS RESULTS

3.1 Main power take-off

Date and location of tests: 14 and 27 November 2003
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						
128.3	1790	831	30.77	36.57	240	3.51
3.1.2 POWER AT RATED ENGINE SPEED						
122.0	2199	1021	32.24	38.32	264	3.18
3.1.3 STANDARD POWER TAKE-OFF SPEED [1000 ± 25 min^{-1} (rev/min)]						
124.8	2153	1000	32.47	38.60	260	3.23
3.1.4 PART LOADS						
3.1.4.1 the torque corresponding to maximum power at rated engine speed						
122.0	2199	1021	32.24	38.32	264	3.18
3.1.4.2 85% of torque obtained in 3.1.4.1						
107.3	2277	1057	29.25	34.77	273	3.09
3.1.4.3 75% of torque defined in 3.1.4.2						
81.3	2303	1069	23.64	28.10	291	2.89
3.1.4.4 50% of torque defined in 3.1.4.2						
54.8	2325	1079	18.19	21.62	332	2.53
3.1.4.5 25% of torque defined in 3.1.4.2						
27.6	2345	1089	12.83	15.25	466	1.81
3.1.4.6 unloaded						
0	2367	1099	7.82	9.29	-	-
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						
124.8	2153	1000	32.47	38.60	260	3.23
3.1.5.2 85% of torque obtained in 3.1.5.1						
109.5	2230	1035	29.57	35.14	270	3.12
3.1.5.3 75% of torque obtained in 3.1.5.2						
83.2	2255	1047	23.58	28.02	283	2.97
3.1.5.4 50% of torque obtained in 3.1.5.2						
55.9	2276	1057	17.86	21.23	320	2.63
3.1.5.5 25% of torque obtained in 3.1.5.2						
28.1	2298	1067	12.52	14.88	445	1.89
3.1.5.6 unloaded						
0	2320	1077	7.59	9.02	-	-

* In the PTO test fan speed was not measured because we do not have the facility to do so at present

No load maximum engine speed: 2367 min^{-1} (rev/min)

Torque (equivalent crankshaft) at maximum power

At rated engine speed: 529.7 Nm

At 2-hour test: 684.8 Nm

Maximum torque (equivalent crankshaft): 750.7 Nm
(engine speed:1505 min^{-1} (rev/min)

Mean atmospheric conditions:	
Temperature	23 °C
Pressure	100.2 kPa
Relative humidity	33 %
Maximum temperatures:	
Coolant	97 °C
Engine oil	122 °C
Fuel	62 °C
Engine air intake	33 °C

Boosted power take-off

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						
154.1	2000	928	40.13	47.69	260	3.23
3.1.2 POWER AT RATED ENGINE SPEED						
143.0	2200	1022	37.33	44.37	261	3.22
3.1.3 STANDARD POWER TAKE-OFF SPEED [1000 ± 25 min^{-1} (rev/min)]						
147.1	2154	1000	37.76	44.88	257	3.28
3.1.4 PART LOADS 3.1.4.1 the torque corresponding to maximum power at rated engine speed						
143.0	2200	1022	37.33	44.37	261	3.22
3.1.4.2 85% of torque obtained in 3.1.4.1						
125.0	2263	1051	33.64	39.79	268	3.14
3.1.4.3 75% of torque defined in 3.1.4.2						
94.9	2293.	1065	26.53	31.53	279	3.01
3.1.4.4 50% of torque defined in 3.1.4.2						
64.0	2315	1075	20.41	24.26	319	2.64
3.1.4.5 25% of torque defined in 3.1.4.2						
32.4	2343	1088	13.62	16.19	420	2.00
3.1.4.6 unloaded						
0	2368	1099	7.77	9.24	-	-
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						
147.1	2154	1000	37.76	44.88	257	3.28
3.1.5.2 85% of torque obtained in 3.1.5.1						
128.5	2211	1027	34.55	41.06	269	3.13
3.1.5.3 75% of torque obtained in 3.1.5.2						
97.8	2244	1042	27.04	32.15	277	3.04
3.1.5.4 50% of torque obtained in 3.1.5.2						
65.9	2268	1053	19.99	23.76	303	2.77
3.1.5.5 25% of torque obtained in 3.1.5.2						
33.3	2292	1064	14.55	17.30	437	1.93
3.1.5.6 unloaded						
0	2320	1077	7.59	9.02	-	-

* In the PTO test fan speed was not measured because we do not have the facility to do so at present

No load maximum engine speed: 2368 min^{-1} (rev/min)

Torque (equivalent crankshaft) at maximum power

At rated engine speed: 620.6 Nm

At 2-hour test: 735.8 Nm

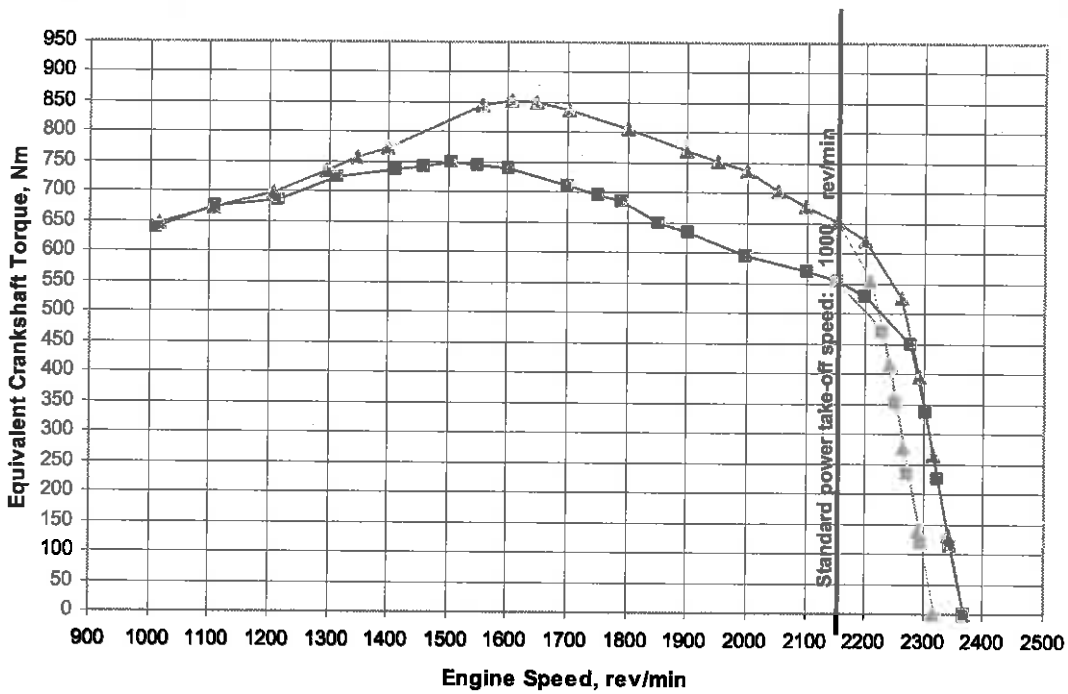
Maximum torque (equivalent crankshaft): 853.3 Nm
(engine speed:1606 min^{-1} (rev/min)

Mean atmospheric conditions:	
Temperature	23 °C
Pressure	100.6 kPa
Relative humidity	36 %
Maximum temperatures:	
Coolant	95 °C
Engine oil	124 °C
Fuel	62 °C
Engine air intake	30 °C

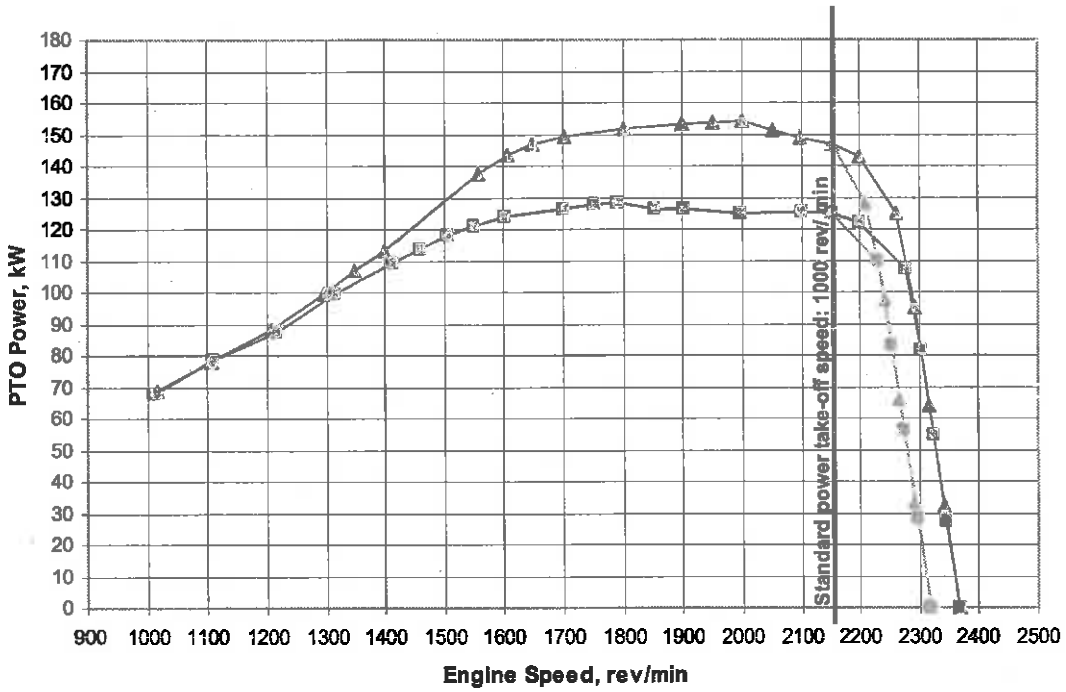
■ Main power take-off curve

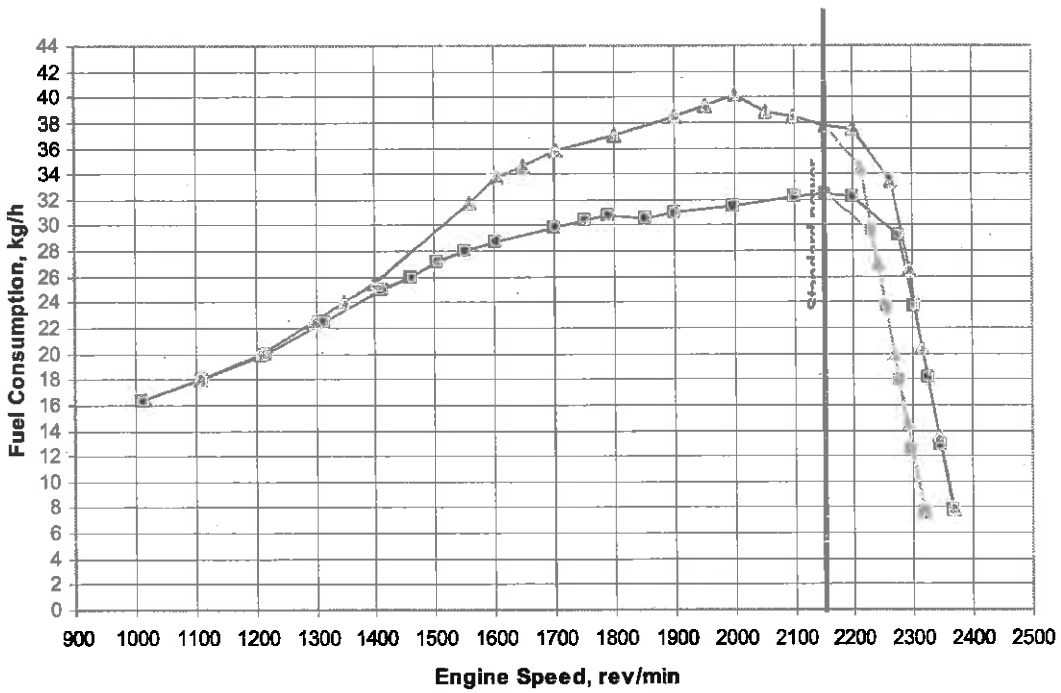
▲ Boosted power take-off curve

Power take-off curves

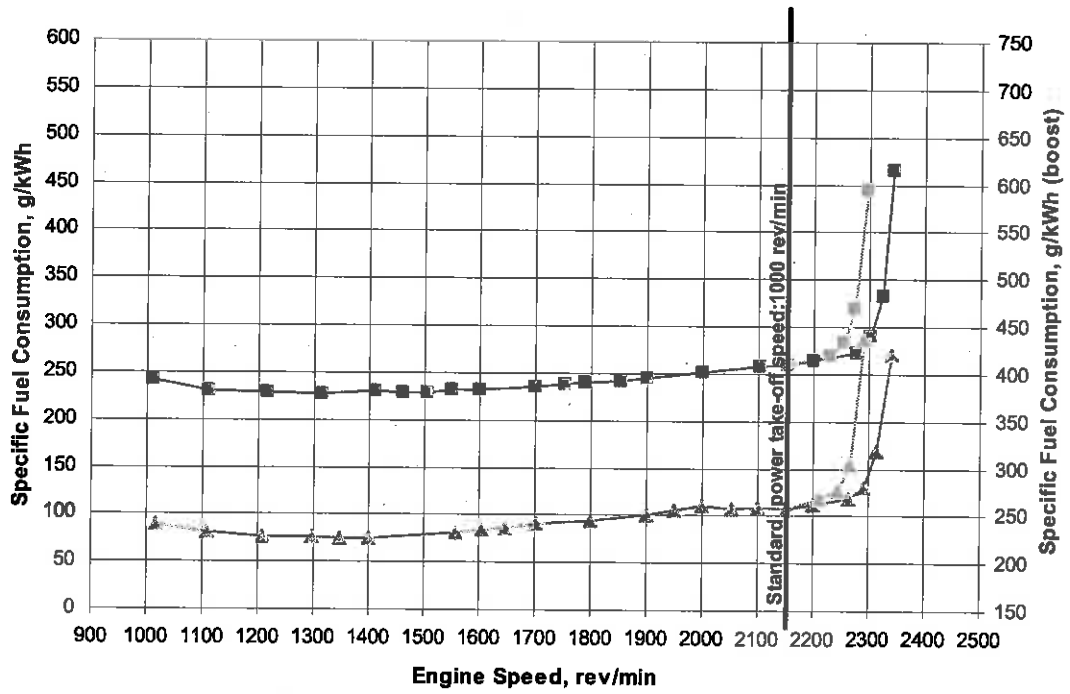


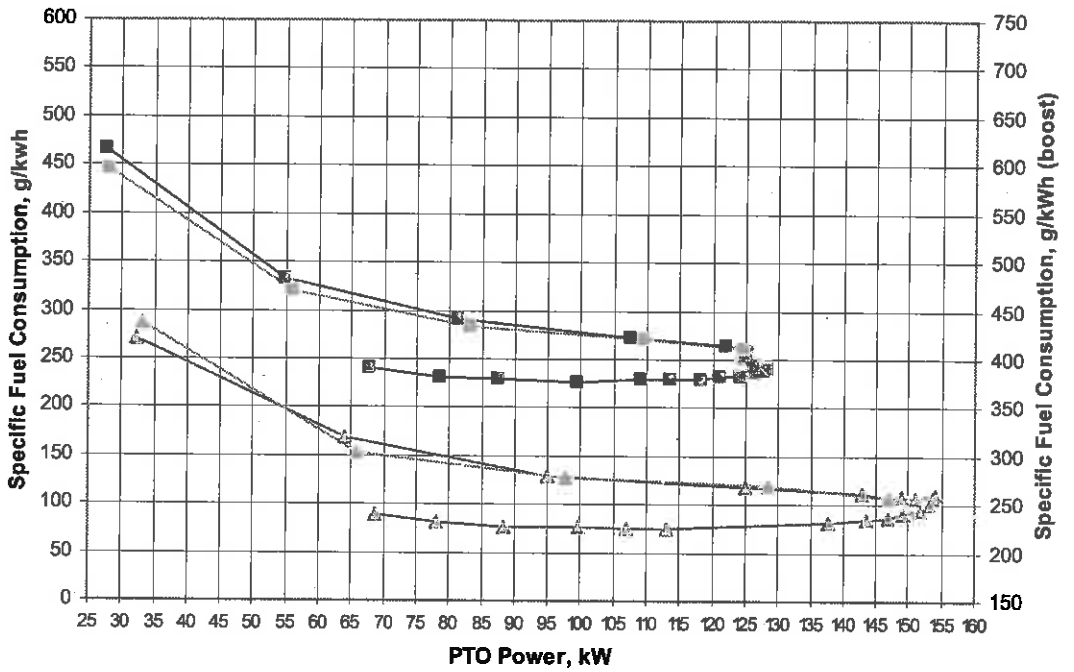
Power take-off curves





Power take-off curves





3.2 Hydraulic power and lifting force

Date of tests: 14 and 22 April 2004

3.2.1 *Hydraulic power test*

3.2.1.1 Hydraulic fluid data

Hydraulic fluid type: See Specification

3.2.1.2 Compulsory Reporting (Test Results):

	Pressure	Reservoir oil Temperature °C (65 °C target)		Engine Speed	Flow rate	Power
	MPa	Min.	Max.	Rev/min	l/min	kW
Rated Engine Speed				2200		
3.2.1.2.1 Maximum (sustained) pressure with relief valve open as measured at the coupler Pump stalled: Yes	21.5	65	69	2367		
3.2.1.2.2 Flow rate corresponding to a hydraulic pressure equivalent to 90% of the actual relief valve pressure setting and corresponding hydraulic power	19.4	65		2350	71.7	23.18
3.2.1.2.3 Maximum available flow and maximum power from one coupler pair:	17.5	66		2332	94.5	27.56
3.2.1.2.4 Maximum available flow and maximum power from coupler pairs operating simultaneously (flow through two or more coupler pairs if required):	19.4	67		2367	102.0	32.98

Tapping point used for test: Remote/Auxiliary service connection

Temperature of hydraulic fluid if different from 65 ± 5°C —°C

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	200 mm	200 mm
Vertical movement	785 mm	905 mm
Maximum corrected force exerted through full range	62.6 kN	50.2 kN
Corresponding pressure of hydraulic fluid	19.4 MPa	19.4 MPa
Moment about rear-wheel axis	76.6 kNm	92.1 kNm
Maximum tilt angle of mast from vertical	—	10 degrees

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	-475	-435	-310	-215	-135	0	+78	+175	+300	+350	+430
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	--	62.6	62.8	64.7	66.0	68.5	70.8	71.5	72.0	71.7	--
Corresponding pressure: 19.4 MPa											
at the frame kN	60.6	--	59.5	59.3	59.2	59.3	57.5	55.6	52.4	--	50.2
Corresponding pressure: 19.4 MPa											

3.3 Drawbar power test (unballasted tractor)

(Four-Wheel Drive) 17 and 22 March 2004

Date and Location of tests: 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	435	85	85

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
3.1	MAXIMUM POWER IN TESTED GEARS												
1	38.1	77.4	1.77	2326	12.4	482	1.75	62	98	119	13	78	101.9
2	46.0	77.7	2.13	2318	12.0	411	2.05	61	97	119	16	61	101.9
3	55.8	77.2	2.60	2309	10.4	400	2.11	63	98	119	14	74	101.9
4	65.3	75.0	3.13	2299	10.0	371	2.28	64	92	120	15	70	101.9
5	78.0	74.7	3.76	2284	9.6	377	2.24	64	91	120	16	56	101.9
6	93.7	74.3	4.54	2254	7.9	325	2.60	64	91	121	16	57	101.9
7	102.7	73.2	5.05	2169	7.9	320	2.64	62	90	122	16	57	101.9
8	112.0	70.9	5.69	1999	6.5	302	2.80	63	94	122	17	55	101.9
9	112.8	61.1	6.65	1898	4.1	276	3.07	63	96	123	16	56	101.9
10	111.4	50.0	8.02	1879	2.8	296	2.84	61	96	121	16	56	101.9
11	111.7	41.5	9.70	1873	2.0	298	2.84	61	96	123	16	54	102.0
12	109.5	33.1	11.93	1908	1.7	304	2.78	61	95	123	17	49	101.9
13	111.5	29.4	13.66	1897	1.4	299	2.83	61	93	124	16	48	101.9
3.2	FUEL CONSUMPTION												
3.2.1	In selected gear, at maximum power at rated speed												
9	102.6	47.3	7.80	2205	3.2	324	2.61	62	98	124	16	57	102.0
3.2.1.1	75% of pull at maximum power at rated speed												
9	80.9	35.5	8.19	2289	2.1	346	2.44	60	93	120	16	56	101.9
3.2.1.2	50% of pull at maximum power at rated speed												
9	54.8	23.7	8.32	2312	1.5	407	2.08	62	90	120	16	57	101.9
3.2.1.3	Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.1.1												
10	81.2	35.5	8.24	1908	1.7	316	2.67	61	98	123	16	50	102.0
3.2.1.4	Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.1.2												
10	55.2	23.7	8.37	1922	0.9	337	2.51	61	97	120	15	51	101.9
3.2.2	In selected gear nearest to 7.5 km/h, at maximum power at rated engine speed												
9	102.6	47.3	7.80	2205	3.2	324	2.61	62	98	124	16	57	102.0
3.2.2.1	75% of pull at maximum power at rated speed												
9	80.9	35.5	8.19	2289	2.1	346	2.44	60	93	120	16	56	101.9
3.2.2.2	50% of pull at maximum power at rated speed												
9	54.8	23.7	8.32	2312	1.5	407	2.08	62	90	120	16	57	101.9
3.2.2.3	Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.2.1												
10	81.2	35.5	8.24	1908	1.7	316	2.67	61	98	123	16	50	102.0
3.2.2.4	Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.2.2												
10	55.2	23.7	8.37	1922	0.9	337	2.51	61	97	120	15	51	101.9

3.3.1 *Drawbar power test (unballasted tractor)*

(Four-Wheel Drive disengaged)

	Height of drawbar above ground	Tyre inflation pressure	
		Front	Rear
	mm	kPa	kPa
Unballasted	560	85	85

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	Pressu
	kW	kN	km/h	min^{-1}	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.3.1 MAXIMUM POWER IN TESTED GEARS													
1	27.3	55.1	1.78	2339	12.6	558	1.52	58	96	117	11	59	100.4
2	32.8	54.8	2.15	2334	12.1	508	1.66	58	95	117	10	60	100.4
3	39.2	54.4	2.59	2326	11.5	467	1.81	54	96	118	10	61	100.4
4	46.2	53.8	3.09	2317	11.7	452	1.87	60	90	119	11	59	100.4
5	55.8	53.2	3.77	2310	10.1	380	2.23	57	92	119	11	61	100.4
6	65.3	51.9	4.53	2301	10.0	393	2.15	53	90	120	10	59	100.4
7	76.3	52.2	5.26	2290	9.2	356	2.38	55	96	119	10	56	100.5
8	91.5	52.2	6.30	2270	8.7	335	2.52	57	98	118	10	60	100.5
9	102.3	51.0	7.22	2158	8.4	314	2.70	62	90	117	12	55	100.4
10	109.4	48.0	8.21	2001	6.6	312	2.71	57	96	118	10	61	100.4
11	109.5	40.6	9.70	1940	5.4	309	2.74	54	99	121	10	60	100.4
12	106.2	32.7	11.68	1922	4.4	314	2.70	55	95	123	10	58	100.4
13	110.5	29.5	13.48	1924	4.0	301	2.81	54	97	123	11	56	100.4
3.3.3 FUEL CONSUMPTION													
3.3.2.1 In selected gear, at maximum power at rated speed													
13	95.2	22.0	15.56	2203	3.1	336	2.52	53	95	123	11	54	100.4
3.3.2.1.1 75% of pull at maximum power at rated speed													
13	74.6	16.5	16.24	2287	2.8	375	2.26	54	97	124	10	60	100.4
3.3.2.1.2 50% of pull at maximum power at rated speed													
13	50.8	11.1	16.49	2309	2.1	441	1.92	59	96	122	11	55	100.4
3.3.2.1.3 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.1.1													
14*													
3.3.2.1.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.1.2													
14*													
3.3.2.2 In selected gear nearest to 7.5 km/h, at maximum power at rated engine speed													
9	98.0	47.1	7.48	2198	6.7	331	2.55	57	98	118	11	57	100.4
3.3.2.2.1 75% of pull at maximum power at rated speed													
9	78.3	35.3	7.98	2291	4.6	322	2.62	57	97	119	12	60	100.4
3.3.2.2.2 50% of pull at maximum power at rated speed													
9	53.6	23.6	8.16	2312	3.4	418	2.02	59	99	120	12	56	100.4
3.3.2.2.3 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.2.1													
10	78.5	35.3	8.01	1911	4.6	303	2.79	56	96	116	11	54	100.5
3.3.2.2.4 Next higher gear at reduced engine speed; same pull and travelling speed as in 3.3.2.2.2													
10	53.4	23.5	8.17	1922	3.2	335	2.52	53	96	115	11	54	100.5

* Shutdowns were not possible in gear 14 as speed was to fast to control test load vehicle

* In the drawbar test(s) fan speed was not measured because we do not have the facility to do so at present

4. OPTIONAL TESTS RESULTS None

5. REPAIRS AND ADJUSTMENTS DURING TESTS: None

6. REMARKS: Boosted Power Take-Off (P.T.O.) Operation

This vehicle is equipped with an electronically – controlled engine Power Management™ system that monitors and boosts engine power output in certain circumstances, as engine load increases. This is achieved by electronically changing the characteristics of the engine power-speed curve.

The engine Power Management function ("boosted" power level) becomes active in higher transmission gears (16th and above), for road transport applications. The system is also activated once power transfer through the rear P.T.O. exceeds a pre-set level (and forward speed exceed 0.5 km/h), for mobile P.T.O. – driven implement applications.

An over-ride system is provided to enable P.T.O. operation at the "boosted" power level whilst the vehicle is stationary, for test purposes. The results of such a P.T.O. power output test are presented in this report.

The test results for this report were obtained from a test carried out on a New Holland TM190 which is identical to the Case IH MXM190 in all practical aspects relating to the tests.

Test carried out by: S J Devonshire

Signed:  Officer in charge

J.P. Evans
Senior Test Engineer
Field Machinery Centre

Date: **23/08/04**

7. APPENDIX 1 ADDITIONAL TESTS

7.1 *Power lift test – (To Manufacturers lift rod setting)*

"Not covered by the approval"

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	270 mm	270 mm
Vertical movement	730 mm	783 mm
Maximum corrected force exerted through full range	68.9 kN	57.1 kN
Corresponding pressure of hydraulic fluid	19.4 MPa	19.4 MPa
Moment about rear-wheel axis	84.3 kNm	104.7 kNm
Maximum tilt angle of mast from vertical	----	5 degrees

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	- 375	- 365	- 235	- 110	0	+ 65	+ 150	+ 228	+ 290	+ 370	+ 408
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	--	68.9	69.5	72.0	73.5	74.6	75.1	75.6	75.9	74.2	--
Corresponding pressure: 19.4 MPa											
at the frame kN	68.8	--	67.7	67.7	67.7	66.5	65.4	63.4	61.5	--	57.1
Corresponding pressure: 19.4 MPa											

7.2 *Power lift test – (To SAE J283)*

Linkage settings for test – see Table 2.1

* Lift rods readjusted to 945 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	- 365	- 280	- 175	- 50	0	+ 125	+ 213	+ 285	+ 353	---	---
*mm	---	- 280	- 175	- 50	0	+ 125	+ 213	+ 285	+ 353	+ 395	+ 433
SAE J283											
kN	82.1	82.1	80.8	77.6	76.4	72.9	70.1	65.8	62.2	---	---
*kN	---	80.5	80.5	79.0	78.5	74.0	72.3	69.3	65.9	62.8	60.9
Corresponding pressure: 18.5 MPa											

TEST RESULTS (OECD Code 5)

"Not covered by the approval"

Make and type of sound level meter: Bruel and Kjaer 2260

Type of test track: Concrete

Date of tests: 15 April 2004

Four wheel drive engaged Windows closed

Gear	Test Condition	Measured travelling speed km/h	Sound level dB(A)
9	Light Load	8.6	76

Four wheel drive engaged Windows open

Gear	Test Condition	Measured travelling speed km/h	Sound level dB(A)
9	Light Load	8.6	84

Four wheel drive dis-engaged Windows closed

Gear	Test Condition	Measured travelling speed km/h	Sound level dB(A)
9	Light Load	8.5	76

Four wheel drive dis-engaged Windows open

Gear	Test Condition	Measured travelling speed km/h	Sound level dB(A)
9	Light Load	8.5	84