Consiglio Nazionale delle Ricerche
IMAMOTER
Istituto per le Macchine Agricole e Movimento Terra

Report No. 3061*2*CASE*PUMA155*0*2009
OECD Approval No. 2/2 471 on 20th May 2009

TEST IN ACCORDANCE WITH THE OECD STANDARD CODE FOR THE OFFICIAL TESTING OF AGRICULTURAL AND FORESTRY TRACTOR PERFORMANCE

Make:	**CASE IH**
Trade Name:	**PUMA 155**
Type:	**4 WD, 50 km/h, 19+6 speeds, full powershift**



Manufactured by:	CNH Europe Holding S.A. 13, Rue Aldringen L-1118 Luxembourg
Date and location of the tests:	2008 TORINO (Italy)

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OREWORD

his vehicle is equipped with an electronically-controlled **Engine Power Management** (EPM) system that onitors and boosts power output in certain circumstances as engine load increases.
his is achieved by electronically changing the characteristics of the engine power-speed curve.

he **EPM** function (boosted power level) becomes active in these two following operation conditions:

) in PTO operations when
- Engine speed is above 1300 rpm
- Tractor forward speed is above 0.5 kmh^{-1}
- PTO driveline torque is above 150 Nm

Vith the tractor moving and the engine speed above 1300 rpm engaging the PTO will put the EPM into tandby mode. As the torque and load on the PTO reaches or exceed the above levels, the EPM will be ctive and a warning light will illuminate

) in road transport application when
- 16th gear, or above, is selected
- engine speed between is 1800 and 2200 rpm

PM does not allow operate boosted mode with tractor stationary.
or test purpose an over ride system has been provide by the manufacturer of the tractor to enable PTO peration mode whilst the tractor is stationary.
or this reason the results of the test in chapter *3.1.A Optional power take-off test (with power boost)* can be chieved ONLY when PTO operation conditions are satisfied.

NOTE

The information opposite each item has been validated by the testing station as follows

C data declared and checked by the testing station

D data declared by the manufacturer

C	Tractor manufacturer's name and address:	CNH Europe Holding S.A. 13, Rue Aldringen L-1118 Luxembourg
D	Location of tractor assembly:	Basildon – United Kingdom St. Valentin - Austria
D	Submitted for test by:	the Manufacturer
C	Selected for test by:	manufacturer with the agreement of IMAMOTER
D	Place of running-in:	Modena - Italy
D	Duration of running-in:	appr. 50 hours
C	Location of test:	IMAMOTER – Torino, Italy

1 SPECIFICATIONS OF TRACTOR

1.1 Identification

1.1.1 Denomination

C	Make of the tractor:	CASE IH
C	Model (trade name):	PUMA 155
C	Type:	4WD

1.1.2 Numbers

D	1st serial N° or prototype:	not announced
C	Serial N°:	Z7BL52684

1.1.3 Other specification (if applicable)

D	Model(s) for other countries:	PUMA 155 MULTICONTROLLER
C	Transmission type or gears x ranges:	19+6 speeds, full powershift
C	Speed version:	50 km/h
D	Manufacturer identification or technical type number :	BLPCFC

1.2 Engine

C	Make:	CNH
C	Model:	667TA/EEJ
C	Type:	4 stroke Diesel engine, common rail injection, supercharged with intercooler
C	Serial N°:	442837

.2.1 Cylinders

C	Number and disposition:	6, vertical, in line
D	Bore and stroke:	104x132 mm
D	Capacity:	6728 cm^3
D	Compression ratio:	17.5:1
D	Arrangement of valves:	4 overhead per cylinder
D	Cylinder liners (wet or dry):	none, monobloc construction

.2.2 Supercharging

C	Make, model and type:	HOLSET, HX35, exhaust driven
D	Pressure:	0.132 MPa

.2.3 Fuel system

C	Fuel feed system:	gear pump
C	Make, model and type of fuel filter(s)	plastic strainer in tank, 1 glass glow sediment and water separation pre-filter, and 2 disposable canister filters (FLEETGUARD, 2830359 and 4897897 drawings, spin on cartridge)
D	Capacity of fuel tank:	300 dm^3, placed under the tractor platform, on the left side
C	Make, model and type of injection pump:	BOSCH, Common Rail CP3, radial plunger high pressure pump
C	Serial N°:	not available

Manufacturer's production setting of injection pump

C	Flow rate (rated engine speed and full load):	81.82 mm^3/stroke at rated speed and full load corresponding 32.40 dm^3/h without power boost 84.24 mm^3/stroke at rated speed and full load corresponding 33.36 dm^3/h with power boost
D	Timing:	electronically controlled
D	Make, model and type of injectors:	BOSCH, CRIN2 (DSLA143PV3 388), high pressure electronically controlled
D	Injection pressure:	160 MPa
C	Make, model and type of carburettor:	not applicable

.2.4 Governor

C	Make, model and type:	BOSCH, EDC16, electronic type
C	Governed range of engine speed from-to:	900–2344/2341 (unboosted/boosted) rev/min
C	Rated engine speed:	2200 rev/min

.2.5 Air cleaner

Pre-cleaner

C	Make model and type:	None
C	Location of air intake:	None

Main cleaner

C	Make, model and type:	CNH, 3 stage dry paper element with 2

		replaceable cartridge, inner (82028151 drawing) and outer (82028150 drawing)
	C Location of air intake (in case of no pre-cleaner):	above the radiator under the bonnet cowling inside the pre-cleaner
	C Maintenance indicator:	warning lamp on the dashboard
1.2.6	Lubrication system	
	D Type of feed pump:	forced feed from concentric rotor pump
	C Type of filter(s):	mesh strainer in sump on suction line and full flow disposable canister on pressure line
	C Number of filters:	1
1.2.7	Cooling system	
	C Type of coolant:	50% water and 50% antifreeze
	D Type of pump:	centrifugal blade pump with visco-fan belt driven by engine shaft
	Specification of fan or blower	
	C Number of fan blades:	9
	C Fan diameter:	510 mm
	D Coolant capacity:	25 l
	C Type of temperature control:	thermostat with full flow bypass
	D Over-pressure system:	100 kPa
1.2.8	Starting system	
	C Make, model and type:	ISKRA, 11131464, positive engagement, solenoid operated, geared reduction
	D Starter motor power rating:	4.2 kW
	C Cold starting aid:	PHILIPS & TEMRO, electrical glow plug
	C Safety device:	starting inoperable unless shuttle lever in neutral, clutch pedal depressed and operator seat presence switch is activated
1.2.9	Electrical system	
	C Voltage:	12 V, negative earth
	Generator:	alternator
	C Make model and type:	ISKRA, AAK 5592, belt driven
	D Power:	1440 VA
	Battery of accumulators	
	C Number:	1, lead acid type
	D Rating:	12 V, 176 Ah at 10 hours
1.2.10	Exhaust system	
	C Make, model and type:	ARVIN MERITOR, 1.15.1 40AA, vertical stack pipe with integrated silencer
	C Location:	on the right hand side of engine, with the vertical exhaust pipe on right of the bonnet cowling

.3 Transmission

.3.1 Clutch (travel alone)

D	Make model and type:	CNH, own drawing model, multidisc wet plate clutch
D	Number of plates:	9
D	Diameter of plates:	160 mm
C	Method of operation:	electro hydraulic operated by pedal

.3.2 Gear box

D Make model and type: CNH make, own drawing model, mechanical

Description: 19+6 speeds (50 km/h), electronically controlled full powershift, 3 ranges (Low, Medium and High) with 6 gears for Low and Medium range and 7 gears for High range for forward speeds and 1 range (Medium) with 6 gears for reverse speeds, with 1 switch for up/down powershifting, forward/reverse shuttle lever on steering column. Optional additional 10+6 creeper speed, switch acted, not fitted on tested tractor

		Forward	Reverse
C	Number of ranges	3	1
C	Number of group	None	none
C	Number of gears	6 (Low and Medium) and 7 (High)	6
C	Total of arrangements	19	6

D Available options:

19+6 speeds (40 km/h) electronically controlled full powershift, 3 ranges (Low, Medium and High) with 6 gears for Low and Medium range and 7 gears for High range for forward speeds and 1 range (Medium) with 6 gears for reverse speeds, with 1 switch for up/down powershifting, forward/reverse shuttle lever on steering column. Maximum speed in 19th speed at reduced maximum engine speed. Optional additional 10+6 creeper speed, switch acted

18+6 speeds (40 km/h) electronically controlled full powershift, 3 ranges (Low, Medium and High), 6 gears for range, with 1 switch for up/down powershifting, forward/reverse shuttle lever on steering column. Optional additional 10+6 creeper speed, switch acted

19+6 speeds (50 km/h) mechanical semi-powershift, 3 ranges (Low, Medium and High) with 6 gears for Low and Medium range and 7 gears for High range for forward speeds and 1 range (Medium) with 6 gears for reverse speeds, shiftable with 1 lever and with 1 switch for up/down powershifting, forward/reverse shuttle lever on steering column. Optional additional 10+6 creeper speed, switch acted

		19+6 speeds (40 km/h) mechanical semi-powershift, 3 ranges (Low, Medium and High) with 6 gears for Low and Medium range and 7 gears for High range for forward speeds and 1 range (Medium) with 6 gears for reverse speeds, shiftable with 1 lever and with 1 switch for up/down powershifting, forward/reverse shuttle lever on steering column. Maximum speed in 19th speed at reduced maximum engine speed. Optional additional 10+6 creeper speed, switch acted
		18+6 speeds (40 km/h) mechanical semi-powershift, 3 ranges (Low, Medium and High) with 6 gears for range, shiftable with 1 lever and with 1 switch for up/down powershifting, forward/reverse shuttle lever on steering column. Optional additional 10+6 creeper speed, switch acted
1.3.3	Rear axle and final drives	
	D Make model and type:	CNH, own drawing, crown wheel and pinion with differential and inboard epicyclical reduction gear final drive
	Differential lock:	
	D Type:	multi-plate wet discs
	C Method of engagement:	electro-hydraulic actuation in response to signal from switch on right-hand control panel or auto differential lock actuation
	C Method of disengagement:	via panel switch or in response to signal from brakes on application, or auto differential lock disengagement
1.3.4	Front axle and final drives	
	D Make model and type:	CNH, own drawing oscillating axle with suspension, jointed cross shaft axle, crown wheel and pinion with differential and outboard epicyclical reduction gear final drive
	Drive engagement	
	D Type:	dog clutch
	C Method of operation:	electro-hydraulic actuation in response to signal from switch on right-hand control panel or auto 4WD engagement
	Differential lock	
	D Type:	multi-plate wet discs
	C Method of engagement:	electro-hydraulic actuation in response to signal from switch on right-hand control panel or auto differential lock actuation
	C Method of disengagement:	via panel switch or in response to signal from brakes on application, or auto differential lock disengagement

3.5 Total ratios and travelling speeds

	Speed No.[1]	Gear	Range	Number of engine revolutions for one revolution of the driving wheels	Nominal travelling speed at rated engine speed of 2200 min^{-1} (rev/min)[2] km/h
	Forward				
C	1	1	Low	387.956	1.871
C	2	2	Low	322.625	2.249
C	3	3	Low	268.585	2.702
C	4	4	Low	223.356	3.249
C	5	5	Low	190.019	3.819
C	6	6	Low	158.020	4.593
C	7	1	Medium	133.642	5.430
C	8	2	Medium	111.137	6.530
C	9	3	Medium	92.521	7.844
C	10	4	Medium	76.961	9.430
C	11	5	Medium	65.457	11.087
C	12	6	Medium	54.434	13.332
C	13	1	High	46.281	15.680
C	14	2	High	38.487	18.856
C	15	3	High	32.041	22.649
C	16	4	High	26.645	27.236
C	17	5	High	22.668	32.015
C	18	6	High	18.851	38.497
C	19	7	High	15.017	48.326
	Reverse				
C	1	1	Medium	145.488	4.988
C	2	2	Medium	120.988	5.998
C	3	3	Medium	100.723	7.205
C	4	4	Medium	83.761	8.664
C	5	5	Medium	71.260	10.184
C	6	6	Medium	59.260	12.246

[1] *As displayed on dashboard*

[2] *Calculated with a tyre speed radius index of 875 mm (ETRTO Standard Manual, 2005 Ed.)*

C Number of revolution of front wheels for one revolution of rear-wheels: 1.323

1.4 Power take-off

1.4.1 Main power take-off

C	Type:	fully independent
C	Method of engagement:	engaged/disengaged by pulling/pushing a knob on the right-hand control panel, driven by electro-hydraulic operated multi-plate clutch
C	Number of shafts:	1
C	Method of changing power take-off shaft ends and speeds:	remove circlip, insert appropriate shaft replace circlip for changing shaft ends, hand lever selector on the right hand side of the driving position for speed selection

1.4.1.1 Power take-off proportional to engine speed

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

C	Location:	at the rear of the tractor, in the median plane
C	Diameter of power take-off shaft end:	35 mm
C	Number of splines:	6, in conformity with ISO 500-1:2005, ISO 500-2:2004 and ISO 500-3:2004
C	Height above ground:	858.5 mm
C	Distance from the median plane of the tractor:	0 mm
C	Distance behind rear-wheel axis:	570 mm
C	PTO speed at rated engine speed:	603 rev/min
C	Engine speed at standard power take-off speed:	1969 rev/min
C	Ratio of rotation speeds (engine speed/p.t.o. speed):	3.646
D	Power restriction:	none
D	Maximum torque transmissible:	engine torque
C	Direction of rotation (viewed from behind tractor):	clockwise

Power take-off at 750 min^{-1} rev/min (540E)

C	Location:	at the rear of the tractor, in the median plane
C	Diameter of power take-off shaft end:	35 mm
C	Number of splines:	6 or 21, in conformity with ISO 500-1:2005, ISO 500-2:2004 and ISO 500-3:2004
C	Height above ground:	858.5 mm
C	Distance from the median plane of the tractor:	0 mm
C	Distance behind rear-wheel axis:	570 mm
C	PTO speed at rated engine speed:	768 rev/min
C	Engine speed at standard power take-off speed:	2148 rev/min
C	Ratio of rotation speeds (engine speed/p.t.o. speed):	2.864
D	Power restriction:	None
D	Maximum torque transmissible:	engine torque
C	Direction of rotation (viewed from behind tractor):	clockwise

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

C	Location:	at the rear of the tractor, in the median plane
C	Diameter of power take-off shaft end:	35 mm
C	Number of splines:	21, in conformity with ISO 500-1:2005, ISO 500-2:2004 and ISO 500-3:2004
C	Height above ground:	858.5 mm
C	Distance from the median plane of the tractor:	0 mm
C	Distance behind rear-wheel axis:	570 mm
C	PTO speed at rated engine speed:	1038 rev/min
C	Engine speed at standard power take-off speed:	2120 rev/min
C	Ratio of rotation speeds (engine speed/p.t.o. speed):	2.120
D	Power restriction:	none
D	Maximum torque transmissible:	engine torque
C	Direction of rotation (viewed from behind tractor):	clockwise

.4.1.2 Power take-off proportional to ground speed

Optional, not fitted on tested tractor

.4.2 Optional power take-off

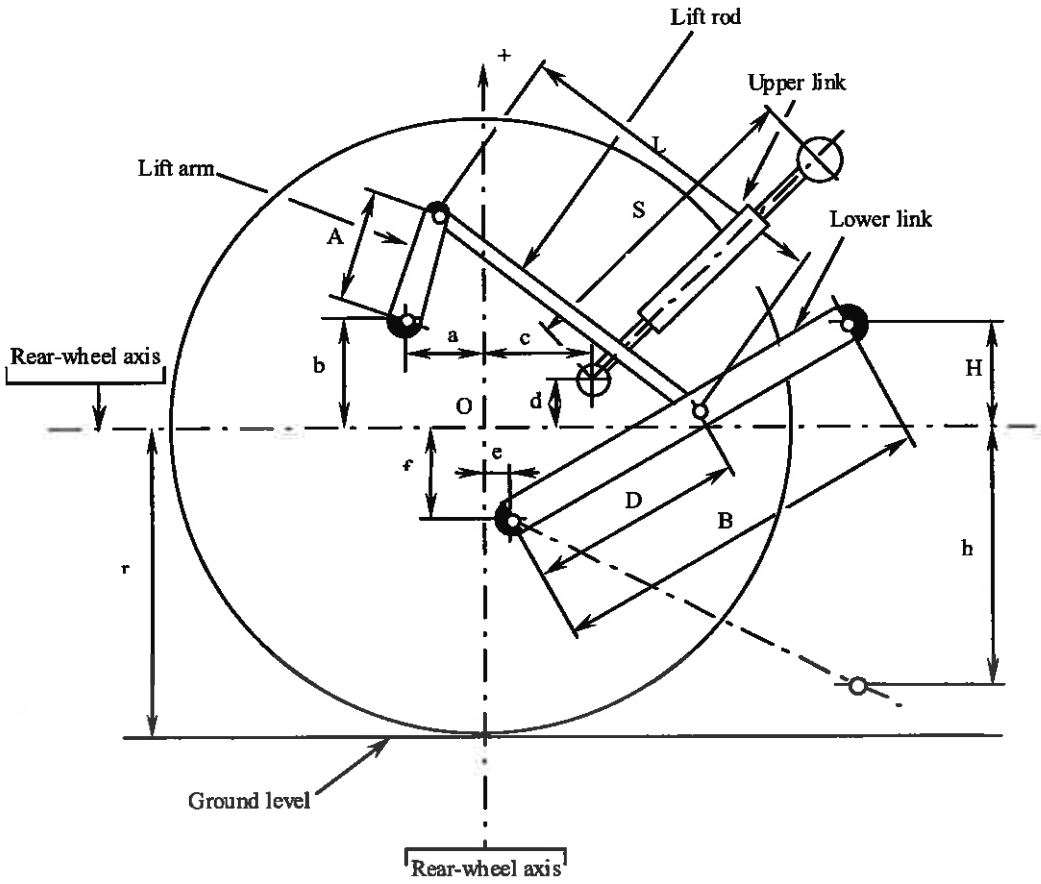
Optional, not fitted on tested tractor

.5 Hydraulic power lift

C	Make, model and type:	CNH, own drawing, draft and position control and float function; electronically controlled
C	Type of hydraulic system:	closed centre system
C	Type and number of cylinders (single or double-acting):	2 single acting Ø 100 mm external
C	Type of linkage lock for transport:	hydraulic
D	Relief valve pressure setting (tolerance):	21.0±1 MPa
D	Opening pressure of cylinder safety valve (if fitted):	22±0.5 MPa
D	Lift pump type:	load sensing variable displacement pump driven by the engine shaft
D	Transmission between pump and engine:	mechanical
C	Type and number of filters:	2, replaceable canister filters
C	Site of oil reservoir:	in common with transmission and rear axle
C	Type, number and location of tapping points:	3 control valves, double acting, 3 couple of couplers at rear of tractor
D	Maximum volume of oil available to external cylinders:	38 dm^3

.6 Three point linkage

C	Category:	2nd, in conformity with categories 2 ISO 730-1:1994+Cor.1:1995
C	Category adapter:	3rd



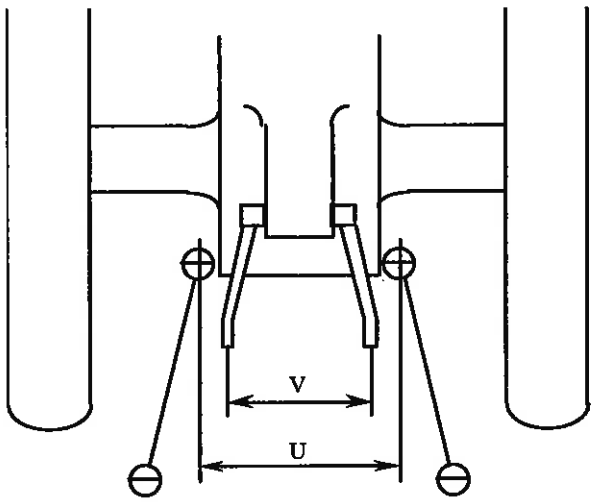


Figure 1. Lift test- Rear linkage geometry

Table 1.1. Dimension of rear linkage geometry when connected to the standard frame

		Dimension or range	Settings used in test[1]		
			OECD		SAE[2]
			Main[1]	Additional[1]	
		mm	mm	mm	
Length of lift arms:	(A)	310	310	310	310
Length of lower links:	(B)	974	974	974	974
Distance of lift arm pivot point from rear wheel axis:					
- horizontally (rearward)	(a)	160	160	160	160
- vertically	(b)	364	364	364	364
Horizontal distance between the 2 lower link points:	(u)	560	560	560	560
Horizontal distance between the 2 lift arm end points:	(v)	550	550	550	550
Length of upper link:	(S)	650→915	748	765	754
Distance of upper link pivot point from rear wheel axis:					
- horizontally (rearward)	(c)	410-427-445	445	410	427
- vertically	(d)	319-263-208	208	319	263
Distance of lower link pivot point from rear wheel axis:					
- horizontally	(e)	220	220	220	220
- vertically	(f)	250	250	250	250
Distance of lower link pivot points to lift rod pivot points on lower links:	(D)	440-505	440	505	505
Length of lift rods:	(L)	715→850	822	850	850-780
Height of lower hitch points (corresponding to travel of the lift without power) relative to the rear wheel axis[3]:					
- in low position	(h)	-750→-345	-675	-645	-645/-489
- in high position	(H)	30→305	90	56	56/179
Height above ground of lower hitch points when locked in transport position		Any height within lift range			

[1] *Main and additional settings are in accordance with OECD Code and manufacturer specifications*

[2] *SAE setting is in accordance with SAE Standard and manufacturer specifications*
SAE setting tests' results are not covered by OECD approval

[3] *Assuming r=875 mm tyre speed radius index of* 650/65R38 *tyres on rear axle (ETRTO Standard Manual, 2005 Ed.)*

1.7	**Swinging drawbar**		
	C	Optional, not fitted:	
1.8	**Trailer hitch**		
	C	Type:	frame and adjustable height towing coupling
	C	Hole diameter:	38 mm
	C	High above ground	min 520 mm → max 1042 mm
	C	Distance of hitch point from rear-wheel axis, horizontally:	768 mm
		Distance of hitch point from power-take-off shaft end:	
	C	Vertically:	338.5 mm below → 183.5 mm above
	C	Horizontally:	198 mm
	D	Maximum vertical permissible load:	20 kN
1.9	**Holed drawbar**		
		Optional, not fitted	
1.10	**Steering**		
	D	Make model and type:	DANFOSS make, OSPC 160 OR model, hydrostatic type with independent circuit
		Method of operation	
	D	Pump(s):	BOSCH, hydraulic gear pump
	D	Ram(s):	2 steering cylinders, one for each steering stub, acting directly on front axle
	D	Working pressure:	17.0±0.5 MPa
1.11	**Brakes**		
1.11.1	Service brake		
	D	Make model and type:	CNH make, oil bath disc, total 2 discs, 1 per side at rear axle, independently acting on the rear axle, additionally automatic 4WD engagement.
	C	Method of operation:	hydraulically actuated with 2 pedals
	C	Trailer braking take-off (hydraulic or air brake):	hydraulic brake system and air brake system
1.11.2	Parking brake		
	C	Type:	4 oil immersed discs acting on bevel pinion shaft
	C	Method of operation:	mechanical cable linked by means of hand lever

.12 Wheels

Number

C Front: 2, driving and steering
C Rear: 2, driving
C Wheelbase: 2786 mm

Track width adjustment:

		Minimum mm	Maximum mm	Adjustment method
D	Front	1325	2285	Changing the position of the rims with respect to the disc
D	Rear	1430	2230	Changing the position of the rims in respect to the disc

.13 Protective structure

C Make model and type: CNH, SLTV 16, cab
C Manufacture's name and address: CNH Europe Holding S.A.
13, Rue Aldringen
L-1118 Luxemburg

Protective device

C Cab, frame, rollguard or other: 4 post cab
C Tiltable or not tiltable: not tiltable

OECD Approval

C Approval number: 4/0 981/3
C Date of approval: 7th January 2008
C Nos. of minor modification certificates, if any: none

1.14 Seat

1.14.1 Driver's seat

C	Make model and type:	GRAMMER, MSG 95G/741, air suspended type
C	Seat and steering wheel reversible:	no
C	Type of suspension:	parallelogram linkage
C	Type of damping:	hydraulic
	Range of adjustment:	
C	Longitudinally:	210 mm
C	Vertically:	80 mm
C	Safety belt:	yes
C	Type:	pelvic

1.14.2 Optional driver's seat(s)

Make	Model	Type of suspension	Type of damping	Range of adjustment	
				Longitudinal	Vertical
				mm	mm
GRAMMER	MSG 95GL/741	Air	Hydraulic	210	80

1.14.3 Passenger seat

C	Location:	on the left side of the driver's seat
C	Capacity (number):	1

1.15 Lighting

		Height above ground of centre	Size (lxh)	Distance from outside edge of lights to median plane of tractor
		mm	mm	mm
C	Headlights	1375	80x150	110
C	Side light	1785	80x75	975
C	Font direction light	1865	80x90	975
C	Front lower working light[1]	1375	50x150	160
C	Front middle working light	2180[2]	135x85	1045
C	Front higher working light	2900	150x75	525
C	Rear direction lights	1955	265x55	1120
C	Stop/rear position	1900	265x55	1120
C	Reflectors	875	105x45	570
C	Rear middle working light	2335	135x85	850
C	Rear higher working light	3000	150x75	530

[1] *Round shaped, front projection*

[2] *Adjustable height*

TEST CONDITIONS

.1 Overall dimensions

	Length	Width		Height at top of	
		minimum	maximum	protective structure	exhaust pipe
	mm	mm	mm	mm	mm
Unballasted	4665	2165	2900	3155	3075

.2 Ground clearance (unballasted tractor): 475 mm

Clearance-limiting part: towhook frame

.3 Tractor mass

	Unballasted	
	without driver	with driver
	kg	kg
Front	2570	2580
Rear	4045	4110
Total	6615	6690

.4 Ballast

Not applicable

.5 Track specifications

Not applicable

.6 Tyres and track width specifications

	Front	Rear
Tyres:		
- dimensions (equivalent)	540/65R28	650/65R38
- ply rate	none	none
- load index	142 A8-139 D	157 A8-154 D
- type	radial	radial
- maximum load (tyre manufacturer's)	17.9 kN	27.4 kN
- maximum load (tractor manufacturer's)	17.9 kN	27.4 kN
- inflation pressure (tyre manufacturer's)	60 kPa	60 kPa
- speed radius index[1]	675 mm	875 mm
Chosen track width:	1850 mm	1920 mm

[1] *ETRTO Standard Manual, 2005 Ed.*

2.7 Fuel

Type: Diesel oil, in conformity with UNI EN 590 July 2004.

Density at 15 °C: 840 kg/m^3

2.8 Oils and lubricants

2.8.1 Capacity and change interval

	Capacity	Oil change	Filter change
	dm^3	h	h
Engine	15.0	600	600
Gear box, rear axle, final drive, hydraulic system and steering	78.0	1200 or annually	1200 or annually
Front axle	9.0	1200 or annually	None
Final drive (front)	1.5	1200 or annually	None
Brakes	0.5	Max. level	None

2.8.2 Specifications (SAE, API, CCMC, ACEA, Mil.L, ISO)

	Recommended	Used during test
Engine oil - Type: - Viscosity: - Classification:	15W-40 ELA No.1 14.6 cSt at 100 °C (ASTM D 445) API CI-4/CH-4 ACEA E7/E5	As recommended
Transmission oils - Type: - Viscosity: - Classification	SAE 10W-30 9.95 cSt at 100 °C (ASTM D 445) API GL 4	As recommended
Hydraulic fluid - Type: - Viscosity: - Classification	SAE 10W-30 9.95 cSt at 100 °C (ASTM D 445) API GL 4	As recommended
Steering oil - Type: - Viscosity: - Classification:	SAE 10W-30 9.95 cSt at 100 °C (ASTM D 445) API GL 4	As recommended
Grease - Type: - Viscosity: - Classification:	Lithium based Not applicable NLGI 2	As recommended
Brake fluid - Type: - Viscosity: - Classification:	No equivalent Min 6 cSt at 100 °C (ASTM D 445) ISO 7308	As recommended

2.8.3 Grease

Number of lubrication points: 16

TEST RESULTS

1 Main power take-off (without power boost)

Date and location of tests: 15th July 2008, I.M.A.MO.TER, TORINO, ITALY
Type of dynamometer: parasitic currents, BORGHI&SAVERI FA300-30SP

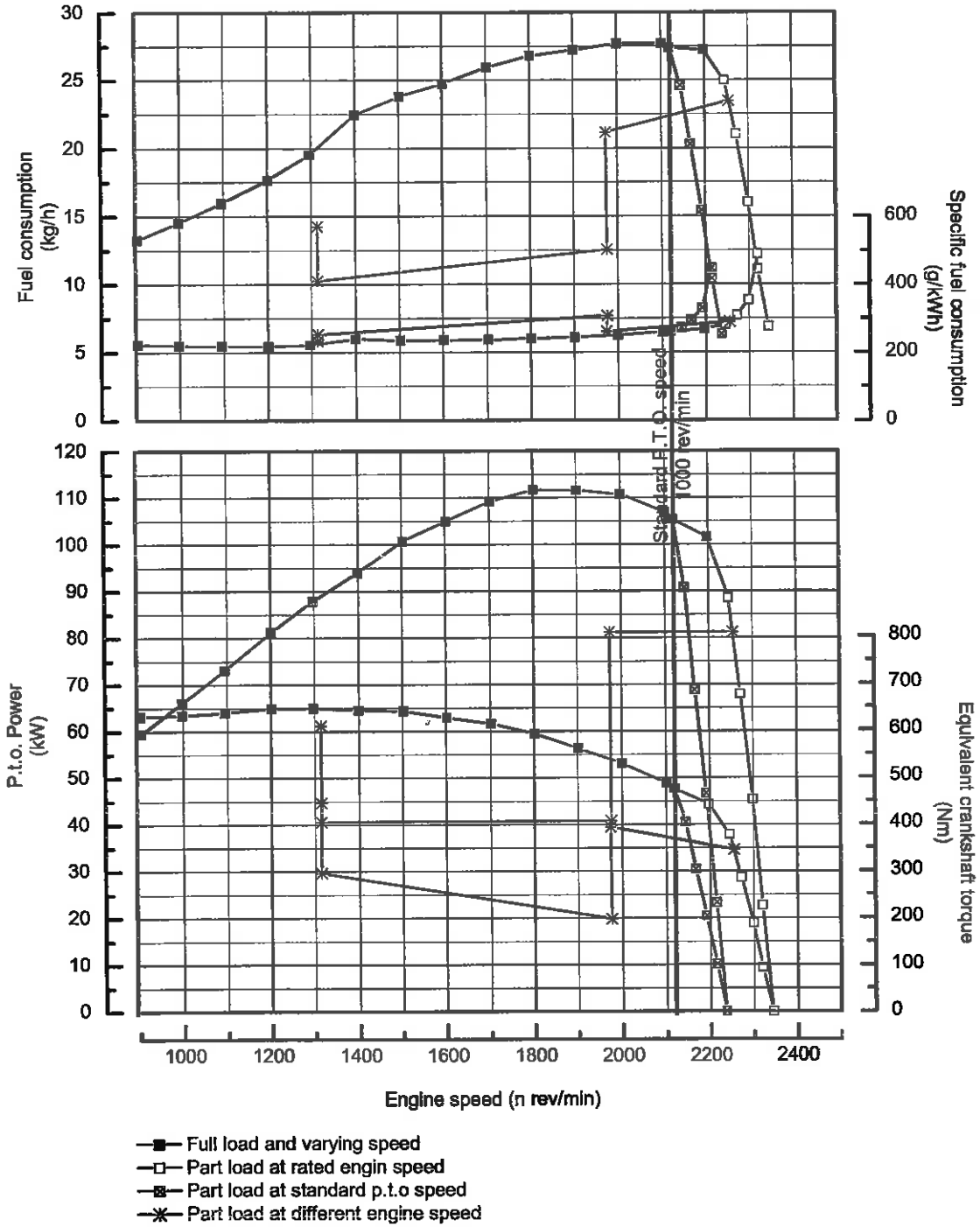
Power	Speed			Fuel consumption			Specific energy
	Engine	P.T.O.	Fan	Hourly		Specific	
kW	min^{-1} (rev/min)			kg/h	l/h	g/kWh	kWh/l
3.1.1 MAXIMUM POWER-ONE - HOUR TEST							
111.6	1801	850	2440	26.77	31.87	240	3.50
3.1.2 POWER AT RATED ENGINE SPEED							
101.5	2197	1037	2935	27.22	32.40	268	3.13
3.1.3 POWER AT STANDARD PTO SPEED [1000 ± 25 min^{-1}]							
105.3	2119	1000	2813	27.37	32.58	260	3.23
3.1.4 PART LOADS							
3.1.4.1 The torque corresponding to maximum power at rated engine speed							
101.5	2197	1037	2935	27.22	32.40	268	3.13
3.1.4.2 85% of torque obtained in 3.1.4.1							
88.6	2244	1059	3014	24.99	29.75	282	2.98
3.1.4.3 75% of torque defined in 3.1.4.2							
67.9	2272	1072	3033	21.00	25.00	309	2.72
3.1.4.4 50% of torque defined in 3.1.4.2							
45.4	2299	1085	2451	16.03	19.08	353	2.38
3.1.4.5 25% of torque defined in 3.1.4.2							
22.7	2320	1095	2376	11.11	13.23	489	1.72
3.1.4.6 Unloaded							
-	2344	1106	2186	6.87	8.18	-	-
3.1.5 PART LOADS AT STANDARD PTO SPEED [1000 ± 25 min^{-1})]							
3.1.5.1 the torque corresponding to maximum power							
105.3	2119	1000	2813	27.37	32.58	260	3.23
3.1.5.2 85% of torque obtained in 3.1.5.1							
90.7	2144	1012	2858	24.59	29.27	271	3.10
3.1.5.3 75% of torque defined in 3.1.5.2							
68.8	2166	1022	2875	20.26	24.12	294	2.85
3.1.5.4 50% of torque defined in 3.1.5.2							
46.7	2191	1034	2220	15.42	18.36	330	2.54
3.1.5.5 25% of torque defined in 3.1.5.2							
23.3	2214	1045	2163	10.42	12.40	447	1.88
3.1.5.6 Unloaded							
-	2236	1055	2143	6.31	7.51	-	-

Power	Speed			Fuel consumption			Specific energy
	Engine	P.T.O.	Fan	Hourly		Specific	
kW	min^{-1} (rev/min)			kg/h	l/h	g/kWh	kWh/l
3.1.6 PART LOADS AT DIFFERENT ENGINE SPEEDS 3.1.6.1 Maximum power at rated engine speed							
101.5	2197	1037	2935	27.22	32.40	268	3.13
3.1.6.2 80% of power obtained in 3.1.6.1 at max speed setting							
81.2	2255	1064	2991	23.47	27.94	289	2.91
3.1.6.3 80% of power obtained in 3.1.6.1 with governor control set to 90% of rated engine speed							
81.2	1973	931	2667	21.17	25.20	261	3.22
3.1.6.4 40% of power obtained in 3.1.6.1 with governor control set to 90% of rated engine speed							
40.8	1975	932	2202	12.55	14.94	308	2.73
3.1.6.5 60% of power obtained in 3.1.6.1 with governor control set to 60% of rated engine speed							
61.2	1314	620	1803	14.27	16.99	233	3.60
3.1.6.6 40% of power obtained in 3.1.6.1 with governor control set to 60% of rated engine speed							
40.6	1314	620	1803	10.25	12.20	253	3.33

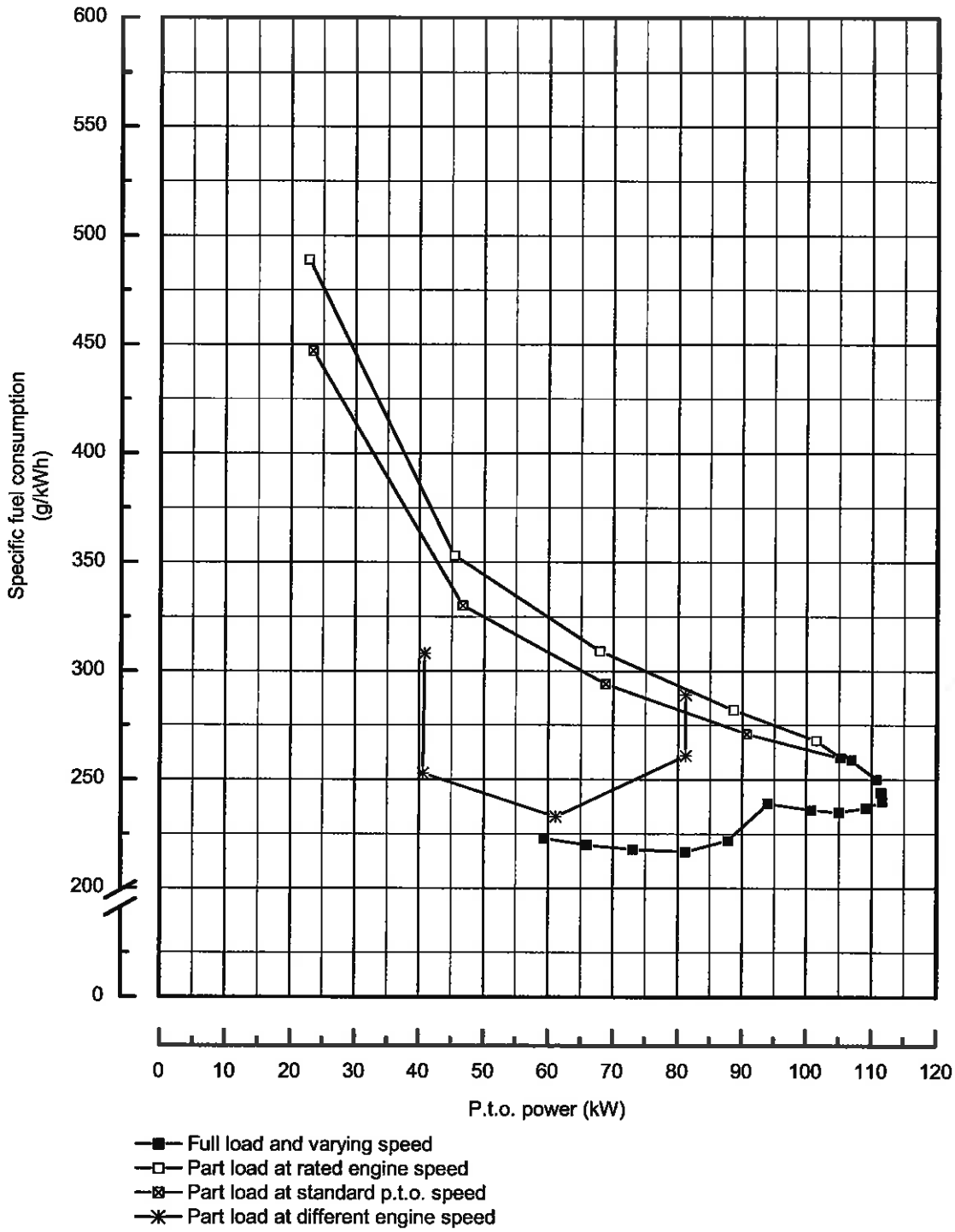
- No load maximum engine speed: 2344 min^{-1} (rev/min)
- Torque (equivalent crankshaft) at maximum power
  - At rated engine speed 441.2 Nm
  - At 1-hour test 591.8 Nm
- Maximum torque (equivalent crankshaft): 646.5 Nm at 1297 min^{-1} (rev/min)

Mean atmospheric conditions:	
Temperature	27.0 °C
Pressure	99.6 kPa
Relative humidity	42%
Maximum temperatures:	
Coolant	89.7 °C
Engine oil	106.7 °C
Fuel	50.6 °C
Engine air intake	34.0 °C

raph 1. Power take-off test (without power boost)



Graph 2. Power take-off test (without power boost)



1.A Optional power take-off test (with power boost) (see [1] next page)

Date and location of tests: 15th July 2008, I.M.A.MO.TER, TORINO, ITALY

Type of dynamometer: parasitic currents, BORGHI&SAVERI FA300-30SP

Power	Speed			Fuel consumption			Specific energy
	Engine	P.T.O.	Fan	Hourly		Specific	
kW	min^{-1} (rev/min)			kg/h	l/h	g/kWh	kWh/l
3.1.1.A.	MAXIMUM POWER-ONE - HOUR TEST						
117.0	1801	850	2442	28.02	33.36	240	3.51
3.1.2.A	POWER AT RATED ENGINE SPEED						
108.3	2197	1037	2373	28.02	33.36	259	3.25
3.1.3.A	POWER AT STANDARD PTO SPEED [1000 ± 25 min^{-1}]						
111.0	2119	1000	2843	28.56	34.00	257	3.26
3.1.4.A	PART LOADS						
3.1.4.1.A	the torque corresponding to maximum power at rated engine speed						
108.3	2197	1037	2373	28.02	33.36	259	3.25
3.1.4.2.A	85% of torque obtained in 3.1.4.1						
94.1	2240	1057	2453	25.27	30.08	269	3.13
3.1.4.3.A	75% of torque defined in 3.1.4.2						
71.8	2272	1072	2455	21.28	25.33	296	2.84
3.1.4.4.A	50% of torque defined in 3.1.4.2[1]						
48.8	2297	1084	2062	15.90	18.93	326	2.58
3.1.4.5.A	25% of torque defined in 3.1.4.2[1]						
24.9	2318	1094	2029	11.52	13.71	463	1.81
3.1.4.6.A	unloaded						
-	2341	1105	2012	6.85	8.15	-	-
3.1.5.A	PART LOADS AT STANDARD PTO SPEED [1000 ± 25 min^{-1})]						
3.1.5.1.A	the torque corresponding to maximum power						
111.0	2119	1000	2843	28.56	34.00	257	3.26
3.1.5.2.A	85% of torque obtained in 3.1.5.1						
96.5	2168	1023	2587	25.41	30.25	263	3.19
3.1.5.3.A	75% of torque defined in 3.1.5.2						
73.4	2195	1036	2236	20.47	24.37	279	3.01
3.1.5.4.A	50% of torque defined in 3.1.5.2[1]						
50.3	2216	1046	2145	16.16	19.24	321	2.61
3.1.5.5.A	25% of torque defined in 3.1.5.2[1]						
24.4	2240	1057	2022	10.72	12.76	440	1.91
3.1.5.6.A	unloaded						
-	2263	1068	2011	6.46	7.69	-	-

[1] *Engine running unsteadily. Impossible to obtain requested percentage of torque*

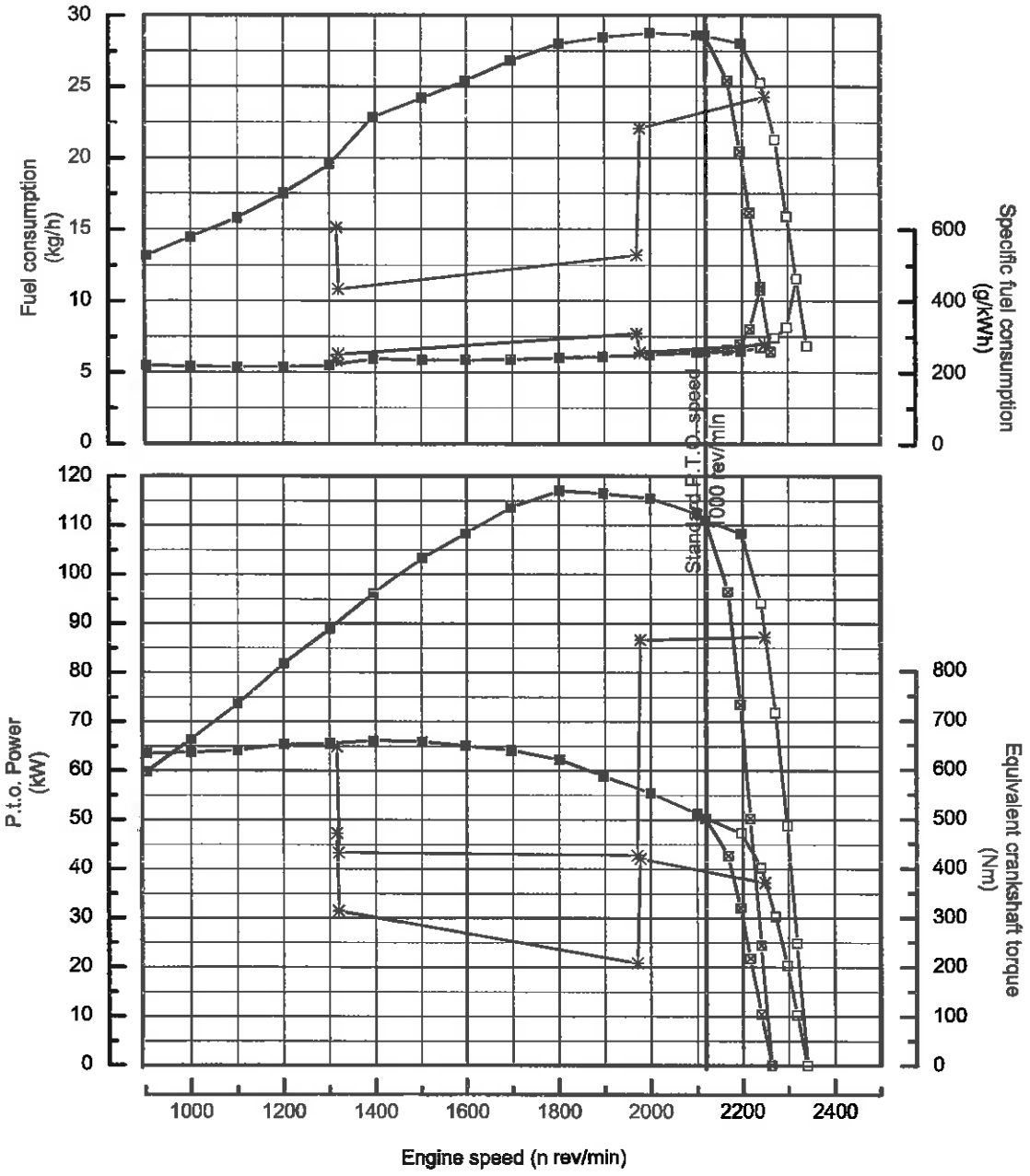
Power	Speed			Fuel consumption			Specific energy
	Engine	P.T.O.	Fan	Hourly		Specific	
kW	min^{-1} (rev/min)			kg/h	l/h	g/kWh	kWh/l
3.1.6.A 3.1.6.1.A	PART LOADS AT DIFFERENT ENGINE SPEEDS maximum power at rated engine speed						
108.3	2197	1037	2373	28.02	33.36	259	3.25
3.1.6.2.A	80% of power obtained in 3.1.6.1 at max speed setting						
87.2	2248	1061	2501	24.26	28.88	278	3.02
3.1.6.3.A	80% of power obtained in 3.1.6.1 with governor control set to 90% of rated engine speed						
86.7	1977	933	2254	22.06	26.26	255	3.30
3.1.6.4.A	40% of power obtained in 3.1.6.1 with governor control set to 90% of rated engine speed						
42.8	1971	930	2068	13.20	15.71	309	2.72
3.1.6.5.A	60% of power obtained in 3.1.6.1 with governor control set to 60% of rated engine speed						
64.9	1316	621	1803	15.12	18.00	233	3.61
3.1.5.6.A	40% of power obtained in 3.1.6.1 with governor control set to 60% of rated engine speed						
43.3	1320	623	1806	10.81	12.87	250	3.36

- No load maximum engine speed: 2341 min^{-1} (rev/min)
- Torque (equivalent crankshaft) at maximum power
  - At rated engine speed 470.5 Nm
  - At 1-hour test 620.1 Nm
- Maximum torque (equivalent crankshaft): 657.9 Nm at 1396 min^{-1} (rev/min)

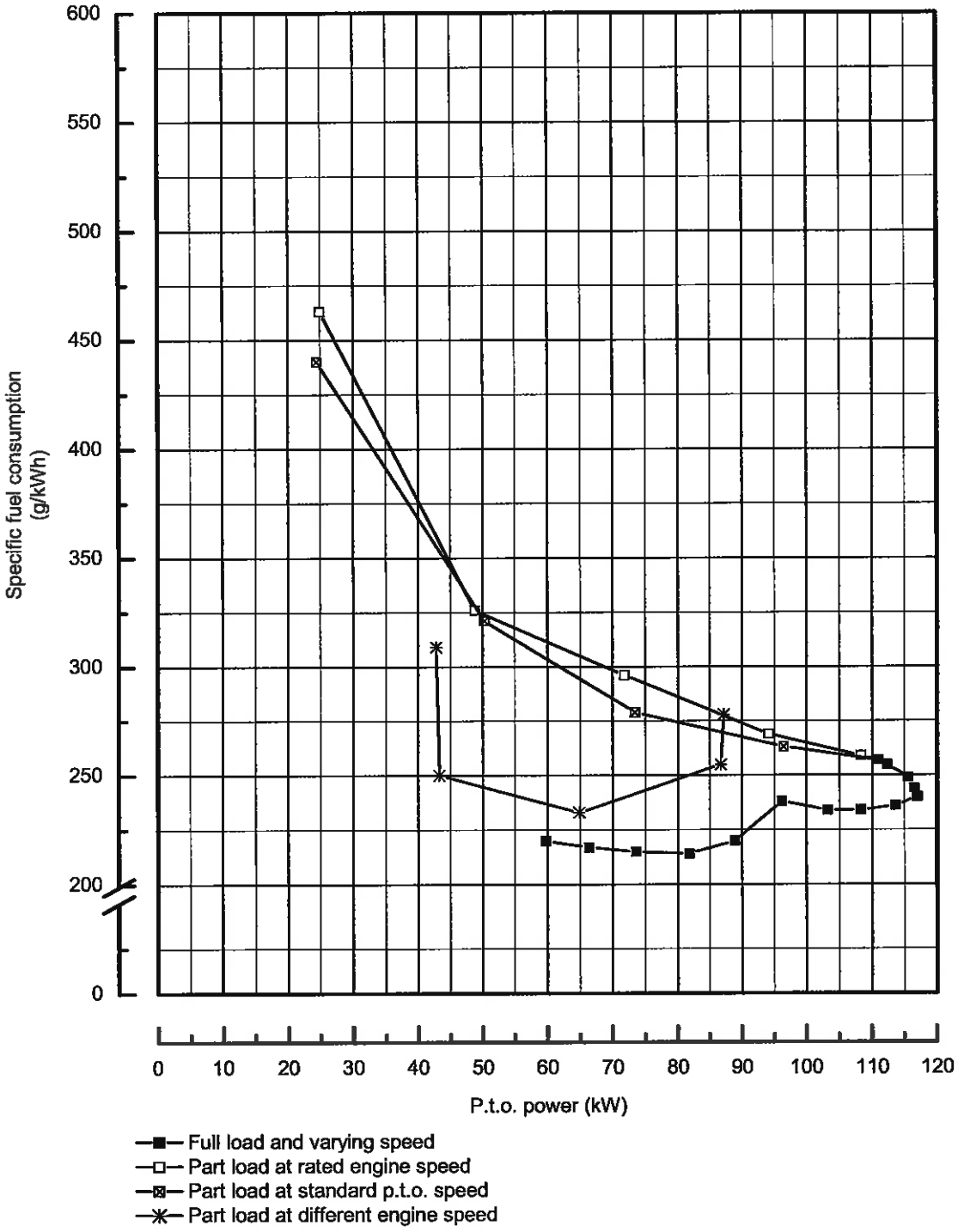
Mean atmospheric conditions:	
Temperature	21 °C
Pressure	99.6 kPa
Relative humidity	85%
Maximum temperatures:	
Coolant	89.1 °C
Engine oil	107.0 °C
Fuel	45.5°C
Engine air intake	26.5 °C

[1] In operation conditions of power take-off test the EPM system makes the engine operate in un-boosted mode.
For this test an over ride system has been provide by the manufacturer of the tractor to enable engine operate in boosted mode when tractor is stationary.
Results of this test can be achieved ONLY when EPM system makes the engine operate in PTO operation mode.
See Foreword on page 2 for more details on EPM operation modes.

raph 3. Power take-off test (with power boost)



Graph 4. Power take-off test (with power boost)



2 Hydraulic power and lifting force

Date of tests: 19th November 2008

2.1 Hydraulic Power Test

2.1.1 Hydraulic fluid data

Viscosity index (ASTM D 2270): 147
Viscosity at 65°C (ASTM D 341): 25 mm^2/s

2.1.2 Compulsory reporting

	Pressure[1]	Reservoir oil Temperature °C (65°C target)		Engine speed	Flow rate	Power
	MPa	Min.	Max.	min^{-1}	l/min	kW
tated Engine Speed				2200		
.2.1.2.1.A 'ump delivery rate at minimum ressure through a single coupler air		60	65	2320	94.6	
.2.1.2.1.B 'ump delivery rate at minimum ressure through three couplers		60	65	2310	104.4	
.2.1.2.2 Maximum (sustained) pressure with elief valve open as measured at the oupler 'ump stalled: Yes	20.6	60	65	2320		
.2.1.2.3 A low rate corresponding to a ydraulic pressure equivalent to 0% of the actual relief valve ressure setting and corresponding ydraulic power measured at one oupler	18.5	60	65	2320	70.9	21.9
.2.1.2.3 B low rate corresponding to a ydraulic pressure equivalent to 0% of the actual relief valve ressure setting and corresponding ydraulic power measured at three ouplers	18.5	60	65	2310	83.8	25.8
.2.1.2.4 Maximum available hydraulic power vith flow through a single coupler air, and corresponding flow and vailable coupler outlet pressure	17.0	60	65	2320	91.3	25.9
.2.1.2.5 Maximum available hydraulic power vith coupler pairs operating imultaneously (flow through three ouplers), and corresponding flow nd available coupler outlet ressure	18.0	60	65	2310	94.3	28.3

Pressure as measured at the outlet coupler (pressure near coupler where oil is exiting from tractor)

3.2.1.3 Supplementary Reporting:

	Pressure[2]	Reservoir oil Temperature °C		Engine speed	Flow rate	Power
	MPa	min.	max.	min^{-1}	l/min	kW
3.2.1.3.1 Pump delivery rate at minimum pressure from one couple pair		60	62	2200	94.1	
3.2.1.3.2 Maximum available flow and maximum useable (*continuous*) power from one coupler	14.9	60	62	2200	87.5	21.7
3.2.1.3.3 Maximum available flow and maximum useable (*continuous*) power from three coupler pairs operating simultaneously	16.4	60	62	2200	89.6	24.5
3.2.1.3.4 Maximum differential pressure Category 1 Tractor						
3.2.1.3.5 Maximum differential pressure Category 2 or 3 Tractor	19.0	60	62	2200	50	
3.2.1.3.6 Peak Pressure						
3.2.1.3.7 Maximum sump return pressure with coupler	2.4	60	62	2200		
3.2.1.3.8 Maximum return pressure without coupler						

[2] *Differential pressure (pressure near coupler where oil is exiting from tractor – pressure near coupler where oil is re-entering the tractor)*

2.2 Compulsory Power lift test

Linkage settings for test - see Table 1.1 and Figure 1.1 and 1.2

	at the hitch point	on the frame
Height of lower hitch points above ground in down position	200 mm	200 mm
Vertical movement: - With lifting force - Without lifting force	 745 mm 765 mm	 877 mm 930 mm
Maximum corrected force exerted through full range	50.8 kN	41.0 kN
Corresponding pressure of hydraulic fluid	18.5 MPa	18.5 MPa
Moment about rear-wheel axis	60.6 kNm	74.0 kNm
Maximum tilt angle of mast from the vertical	none	10 degrees

Lifting heights relative to the horizontal plane including the lower link pivot points										
mm	-486	-425	-375	-275	-175	0	175	275	320	391
Lifting forces (the values of force measured shall be corrected to correspond to a hydraulic pressure equivalent to a 90% of the actual relief valve pressure setting of the hydraulic lift system):										
at the hitch points kN	-	56.0	56.4	57.6	58.6	60.6	62.4	63.4	50.8	-
Corresponding pressure: 18.5 MPa										
at the frame kN	50.5	49.9	49.8	49.7	49.4	48.7	47.4	46.4	45.8	41.0
Corresponding pressure: 18.5 MPa										

3.2.3 Optional Power lift test

Tests have been performed in accordance with setting requested by manufacturer.

Linkage settings for test - see *"Additional"* column in Table 1.1 and Figure 1.1 and 1.2

	at the hitch point	on the frame
Height of lower hitch points above ground in down position	230 mm	230 mm
Vertical movement - With power travel of the lift - Without power travel of the lift	 684 mm 701 mm	 690 mm 734 mm
Maximum corrected force exerted through full range	50.8 kN	40.7 kN
Corresponding pressure of hydraulic fluid	18.5 MPa	18.5 MPa
Moment about rear-wheel axis	60.7 kNm	73.4 kNm
Maximum tilt angle of mast from the vertical	none	3.9 degrees

Lifting heights relative to the horizontal plane including the lower link pivot points									
mm	-395	-387	-275	-175	0	175	275	289	303
Lifting forces (the values of force measured shall be corrected to correspond to a hydraulic pressure equivalent to a 90% of the actual relief valve pressure setting of the hydraulic lift system):									
at the hitch points kN	62.1	-	61.2	63.5	64.0	64.1	62.6	50.8	-
Corresponding pressure: 18.5 MPa									
at the frame kN	-	64.1	63.5	63.0	61.6	59.5	52.2	-	40.7
Corresponding pressure: 18.5 MPa									

3 Compulsory drawbar power and fuel consumption test (unballasted tractor)

Date of tests: 25th September 2008
Type of track: asphalt

Height of drawbar above ground	Tyre inflation pressure	
	Front	Rear
445 mm	60 kPa	60 kPa

Speed No.[1]	Power	Drawbar pull	Speed	Engine speed	Fan speed	Slip of wheels	Specific fuel consumption	Specific energy	Temperature			Atmospheric conditions		
									Fuel	Coolant	Engine oil	Temperature	Relative humidity	Pressure
	kW	kN	km/h	min^{-1}	min^{-1}	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.1 MAXIMUM POWER IN TESTED GEARS/SPEED SETTINGS														
1	29.3	62.81	1.68	2300	2224	11.83	502	1.67	30	88	96	24	36	98.2
2	35.5	62.68	2.04	2297	2102	10.98	469	1.79	31	88	97	24	37	98.2
3	42.1	61.89	2.45	2286	2120	10.42	436	1.93	33	88	97	26	30	98.2
4	50.2	61.05	2.96	2275	2221	9.77	410	2.05	34	88	97	27	28	98.2
5	55.4	56.95	3.50	2262	2217	9.12	403	2.09	36	88	98	26	29	98.2
6	66.2	57.58	4.14	2236	2317	8.99	384	2.19	37	87	98	30	22	98.2
7	77.6	57.11	4.89	2203	2461	8.33	345	2.43	37	87	97	23	34	98.2
8	83.2	56.28	5.32	2017	2408	8.69	334	2.52	41	86	98	25	27	98.2
9	87.5	51.90	6.07	1857	2271	6.59	312	2.70	42	86	99	29	24	98.2
10	88.1	43.73	7.25	1792	2278	3.66	305	2.75	44	86	100	29	26	98.2
11	89.5	35.97	8.96	1855	2273	2.78	298	2.82	45	86	99	27	27	98.2
12	87.1	28.80	10.89	1855	2281	1.87	310	2.71	46	86	98	26	27	98.2
13	89.3	25.29	12.71	1846	2296	1.58	301	2.79	47	86	99	29	29	98.2
14	87.7	20.52	15.39	1851	2380	1.24	311	2.71	48	86	100	28	28	98.2

As displayed on dashboard

Speed No.[1]	Power	Drawbar pull	Speed	Engine speed	Fan speed	Slip of wheels	Specific fuel consumption	Specific energy	Temperature			Atmospheric conditions		
									Fuel	Coolant	Engine oil	Temperature	Relative humidity	Pressure
	kW	kN	km/h	min^{-1}	min^{-1}	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.3.2 FUEL CONSUMPTION														
3.3.2.1 In selected gear/speed setting nearest 7.5 km/h, at maximum power at rated engine speed														
9	77.2	36.7	7.6	2207	2338	2.61	346	2.43	47	87	95	22	37	98.2
3.3.2.1.1 75% of pull corresponding to maximum power at rated engine speed														
9	59.7	27.6	7.8	2254	2422	1.83	393	2.14	48	87	98	23	33	98.2
3.3.2.1.2 50% of pull corresponding to maximum power at rated engine speed														
9	40.4	18.4	7.9	2283	2333	1.12	462	1.82	48	87	98	22	35	98.2
3.3.2.1.3 Highest gear/speed setting at reduced engine speed able to achieve both 3.3.2.1.1 and 3.3.2.1.2; same pull and travelling speed as in 3.3.2.1.1														
10	59.5	27.5	7.8	1889	2205	1.79	355	2.37	48	87	98	22	35	98.2
3.3.2.1.4 Same gear/speed selection as 3.3.2.1.3 at reduced speed; same pull and travelling speed as in 3.3.2.1.2														
10	40.4	18.5	7.9	1898	1980	1.10	406	2.07	47	85	96	21	37	98.2
3.3.2.2 In selected gear/speed setting nearest between 7 and 10 km/h at rated engine speed														
10	76.6	30.1	9.2	2210	2533	1.94	347	2.42	49	85	99	23	33	98.2
3.3.2.2.1 75% of pull corresponding to maximum power at rated engine speed														
10	58.5	22.4	9.4	2255	2587	1.32	402	2.09	49	87	100	22	36	98.2
3.3.2.2.2 50% of pull corresponding to maximum power at rated engine speed														
10	39.5	15.0	9.5	2279	2339	0.70	483	1.74	49	87	99	22	39	98.2
3.3.2.2.3 Highest gear/speed setting at reduced engine speed able to achieve both 3.3.2.2.1 and 3.3.2.2.2; same pull and travelling speed as in 3.3.2.2.1														
11	58.7	22.5	9.4	1920	2284	1.34	355	2.36	50	87	98	23	38	98.2
3.3.2.2.4 Same gear/speed setting as 3.3.2.2.3 at reduced speed; same pull and travelling speed as in 3.3.2.2.2														
11	39.9	15.1	9.5	1939	2127	0.78	418	2.01	49	85	96	21	40	98.2

[1] *As displayed on dashboard*

4 REPAIRS

None

5 REMARKS

Tests results of this report have been obtained from tests carried out on a prototype identical to the tractor CASE IH PUMA 155 in all practical aspects relating to the tests.

It has been checked that the series production conforms to the tested tractor.

ANNEX

Other tests results not covered by OECD approval

1 Test in accordance with SAE J 283. Nov. 1999: Test procedure for measuring hydraulic lift capacity on agricultural tractors equipped with three-point hitch

1.1 Test conditions

Tests have been performed in accordance with Section 4 of SAE J283: Static lift force test. Setting of the three-point hitch is specified in *"SAE"* column the table 1.1 and more details on linkage geometry are in figure 1.1 and 1.2.

ifting heights relative to the horizontal plane including the lower link pivot points											
ft rods length 850 mm	-395	-380	-280	-	-180	0	180	280	288	-	-
ft rods length 780 mm	-	-	-	-239	-180	0	180	280	-	380	396
ifting forces corrected to correspond to a hydraulic pressure equivalent to a 90% of the minimum relief alve setting of the hydraulic lift system											
N	83.8	81.1	74.5	-	71.3	67.9	64.6	57.5	50.1	-	-
N	-	-	-	73.8	71.2	68.7	66.4	64.4	61.3	49.8	-
orresponding pressure: 18.5 MPa											

his report has been approved by the O.E.C.D. Co-ordinating Centre (CEMAGREF. France) as being in ccordance with the O.E.C.D. Standard Code for the official testing of agricultural and forestry tractor erformance.

The Head of the Section

E. CAVALLO

The Director

G.L. ZAROTTI

orino, 29th January 2009