COMITATO PER L'OMOLOGAZIONE
DELLE MACCHINE AGRICOLE

O.E.C.D. Approval No. 1136

TEST IN ACCORDANCE WITH THE OECD STANDARD
CODE FOR THE OFFICIAL TESTING OF AGRICULTURAL TRACTORS

TRACTOR: Make: PASQUALI
Model: 488 ARTICULATED
Type: 4 W.D.



Manufactured by: PASQUALI MACCHINE AGRICOLE S.p.A. – Via Nuova, 30
CALENZANO - Firenze - Italy

Date and location of tests: May-September 1986

This report has been approved by the O.E.C.D. Coordinating Center CEMAGREF, France) as being in accordance with the O.E.C.D. Tractor Test Code.

Date of approval: 17th March 1988

CONSIGLIO NAZIONALE DELLE RICERCHE
ISTITUTO PER LA MECCANIZZAZIONE AGRICOLA
TORINO – Italy

This bulletin is based on engineering tests in accordance with O.E.C.D. Tractor Code. It does not contain an evaluation of performance of the tractor on pratical farm work.

In this report all performance characteristics are given corresponding to the International System of Units.

The reference to the former used Technical System of Units is given by the following relations:

Forces:	1 N = 0.10197 kg	or 1 kg	= 9.80665 N
Powers:	1 kW = 1.35962 metric hp	or 1 metric hp	= 0.73550 kW
Pressures:	1 bar = 1.01972 kg/cm^2	or 1 kg/cm^2	= 0.980665 bar
Torques:	1 mN = 0.10196 mkg	or 1 mkg	= 9.80665 mN

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PERFORMANCE CURVES

	Fig. No.
Power take-off test	
Curves of power, torque, hourly and specific fuel consumption/ crankshaft speed	1
Curves of specific fuel consumption/crankshaft power p.t.o.	2

Tractor manufacturer:	PASQUALI MACCHINE AGRICOLE S.p.A. Via Nuova, 30 CALENZANO - Firenze - Italy
Submitted for test by:	Manufacturer
Selected by:	Manufacturer with agreement by Istituto per la Meccanizzazione Agricola - Torino (Italy)
Place of running-in:	Istituto per la Meccanizzazione Agricola - Torino
Duration of running-in:	Engine and tractor appr. 70 hours

SPECIFICATION OF TRACTOR:

TRACTOR:	
Make:	PASQUALI
Model:	488 ARTICULATED
Type:	four wheel drive tractor, articulated construction
Serial No.:	3306
Its serial No.:	0006
ENGINE:	
Make:	LOMBARDINI
Model:	8LD 665-2
Type:	4-stroke Diesel engine, direct injection, air forced cooled
Serial No.:	2689987
Cylinders:	2 cylinders, vertical, in-line, 95 mm bore x 94 mm stroke, capacity 1332 cm^3 compression ratio 17.8:1, overhead in-line valves, replaceable cast-iron dry cylinder liners
Fuel system:	gravity feed; one LOMBARDINI filter (drawing 273.2175.009) with replaceable cartridge in the fuel tank; one standard fuel tank capacity 24 l; BOSCH PFR 2K70 alternate injection pump (optionally CIPA CPFR 2K 70 alternate injection pump or CONDIESEL CPF 2R 70 alternate injection

	pump); manufacturer's production setting 35:37 mm^3 /stroke at rated engine speed and full load; injection timing 10° before TDC; BOSCH multihole injectors drawing 710.6531.033 (optionally OMAP or CIPA, drawing 710.6531.033), injection pressure 206:216 bar - Serial No. of injection pump: 36.241.052
Governor:	LOMBARDINI centrifugal variable speed governors, mechanical type, governed range of engine speed from 1000 to 3300 rev/min; rated engine speed 3000 rev/min.
Air cleaner:	LOMBARDINI make, oil bath air filter, 488 model. Oil capacity: 0.38 l. Air intake under bonnet in front of engine. Maintenance indicator: none.
Lubrication system:	Forced-feed lubrication with gear pump; one replaceable cartridge type filter drawing 904.3740.043 on pressure side pump of oil to the engine; cartridge change every 250 operating hours; oil capacity including filter 3 l; recommended oil AGIP F1 SAE classification 40 W/40, satisfied MIL-L-2104 C specifications; oil change period every 125 operating hours.
Cooling system:	Air cooled through axial turbo bowler: 189 mm dia, 10 blades, belt driven fan;
Starting system:	Electrical BOSCH GF 12 V CL. 1.5, 1.10 kW; starting motor pinion coupling, solenoid operated. Cold starting aid: optional, by means of glow plugs. Safety device operable only when the pedal clutch is fully depressed.
Electrical system	12 V, negative earth. Alternator SAPRISA type 12 V 21A, 6381 model or DUCATI type 12 V 21A, 435045400 model. Battery: one lead acid type; FIAMM 6M P6 capacity 77 Ah at 20 hours rating.
Exhaust system:	LOMBARDINI, drawing S21.5461.47, DGM-SA 642 italian approval sigle, interferance type with internal perforated pipe; oval shape 110 x 80 mm, 285 mm length; vertical on left side of engine; maximum height above ground 1085 mm.

TRANSMISSION:

Clutch: Own make, dry single disc clutch; disc 186 mm dia; pedal operated for gear box drive and for P.T.O. drive.

Gearbox: Own make. Mechanical type, constant mesh gear with total 9 forward and 3 reverse speeds. The transmission consists of 2 mechanical in series gear units: the first with 4 speeds (3 forward and 1 reverse speeds); the second with 3 positions to select the gear group (low, medium, high); each unit is operated by own lever.

Rear axle and final drive: Own make, mechanical type with crown wheel and pinion; bevel gear type differential with hand lever operated having a position of engaging lock.

Front axle and final drive: Own make, mechanical type with crown wheel and pinion; bevel gear type differential with hand lever operated having a position of engaging lock.

Gear lubrication: Capacity final rear drives: 4 l; capacity gear box and final front drives: 12 l; change period 1000 operating hours; no filter. Recommended oil AGIP SAE 140 or any oil conforming MIL L 2104.

Total ratios and speeds (tyres 7.50-16 and pressure 1.2 bar)

Gear	Group	Number of engine revolutions for one revolution of the driving wheel	Nominal travelling speed (*) from rated engine speed (3000 rev/min) km/h
I		450.845	0.94
II	Low	288.538	1.47
III		140.947	3.01
I		192.423	2.20
II	Medium	90.206	4.70
III		40.661	10.43
I		60.156	7.05
II	High	26.023	16.29
III		17.351	24.43
I		230.832	1.84
II	Reverse	72.166	5.87
III		20.819	20.36

(*) Calculated with the radius index of 375 mm

POWER TAKE OFF:

not independent, p.t.o. driven by single disc clutch; one shaft, hand lever operated.
Position: rear of tractor, in median plane; height above ground 425 mm (with tyre 7.50-16).

Proportional engine speed p.t.o.:
- 540 rev/min p.t.o.: distance behind rear axle 270 mm; diameter of p.t.o. shaft end 34.8 mm; 6 splines, according to ISO 500; no power restriction; 571 rev/min at rated engine speed; standard p.t.o. speed 540 rev/min at engine speed 2837 rev/min; p.t.o. shaft rotates clockwisely, viewed from tractor rear.
Ratio of rotation speed:

$$\frac{\text{engine speed}}{\text{p.t.o. speed}} = \frac{3000}{571} = 5.2539$$

Proportional ground speed p.t.o.:
- 540 rev/min p.t.o.: travelling distance for one revolution of p.t.o. shaft 137 mm with tyre 7.50-16; number of p.t.o. shaft revolutions for one revolution of rear wheels 17.2 rev.; p.t.o. shaft rotates clockwisely viewed from tractor rear.

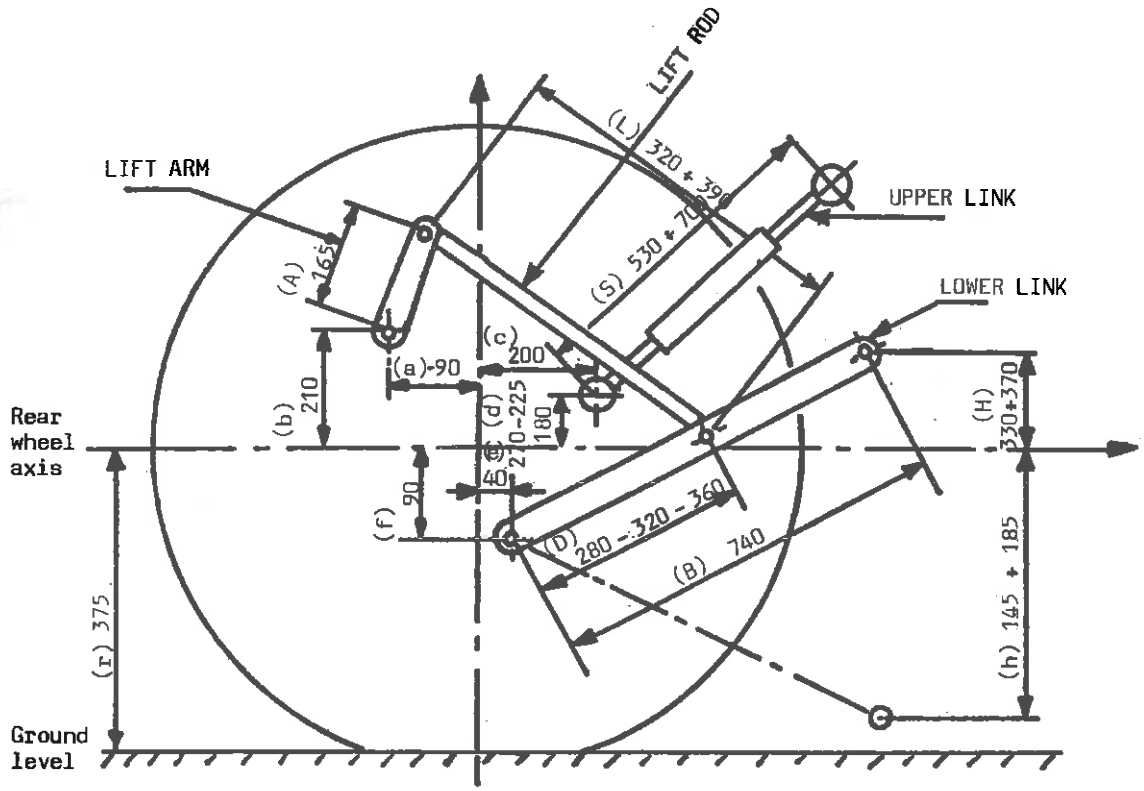
POWER LIFT:

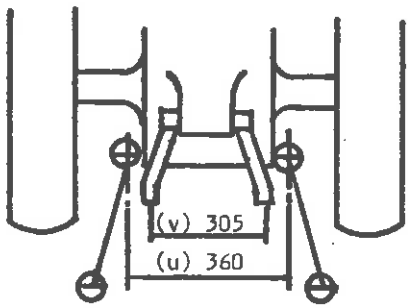
Own make; hydraulic power lift in unit construction, operated by one lever.

Hydraulic system:
Open centre system; Hidroirma gear pump, AM 2/24 S100, directly driven by engine; delivery 16.5 l/min at rated engine speed; no filter.
Maximum working pressure 105 bar. One single acting cylinder with 97 mm bore and 187 mm stroke. Relief valve pressure setting: 105 bar. There are no cylinder safety valves. Type of linkage lock for transport: mechanical. Oil capacity: 4 l.
Site of oil reservoir: in the central part of the tractor near the battery.
Recommended oil: AGIP SAE 70. Oil change period 500 operating hours.

Implement linkage:
three point linkage, joint balls category 1 according to I.S.O. STANDARD 730/II; dimensions see on pag. 8.

POWER LIFT


LIFT ROD
(L) 320 + 390
LIFT ARM
UPPER LINK
(S) 530 + 700
LOWER LINK
(A) 165
(c) 200
(a)-90
(b) 210
(d) 210-225
180
(H) 330+370
Rear wheel axis
40
90
(f)
(D) 280 - 320 - 360
(B) 740
(r) 375
(h) 145 + 185
Ground level


(v) 305
(u) 360

Dimensions of linkage geometry

			Dimensions or range mm	Setting used in test mm
- Rear tyres (size 7.50-16) radius index		(r) :	375	375
- Front tyres (size 7.50-16) radius index		(r'):	375	375
- Length of lift arms		(A) :	165	165
- Length of lower links		(B) :	740	740
- Distance of lift arm pivot point				
from rear wheel centre line	horizontally	(a) :	-90	-90
	vertically	(b) :	210	210
- Horizontal distance between the 2 lower				
link points		(u) :	360	360
- Horizontal distance between the 2 lift				
- arm end points		(v) :	305	305
- Length of upper link		(S) :	from 530 to 700	580
- Distance of upper link pivot point				
from rear wheel centre line	horizontally	(c) :	200	200
	vertically	(d) :	270-225-180	225
- Distance of lower link pivot points				
from rear wheel centre	horizontally	(e) :	40	40
	vertically	(f) :	90	90
- Distance of lower link pivot points to lift				
rod pivot points on lower links		(D) :	280-320-360	360
- Length of lift rods		(L) :	from 320 to 390	320
- Height of lower hitch points:				
- in low position		(h) :	from 145 to 185	185
- in high position relative to the rear wheel				
centre line, situated 375 mm above the				
ground level		(H) :	from 330 to 370	370
- Height of lower link hitch points when locked				
in transport position			from 705 to 745	745

PULL ATTACHMENT:

Trailer hitch:
own make, clevis type; height above ground, with tyres 7.50-16, 545 mm max and 270 mm min; distance of hitch point from rear axle 325 mm horizontally; distance of hitch point from main p.t.o. shaft end: vertically from 155 mm below to 120 mm above, horizontally 55 mm behind; max vertical load 410 dN (with tyres 7.50-16; 4 ply) according to Italian legislation; one hitch pin hole: 28.5 mm dia.

STEERING:

Own make, hydrostatic control with indipendent hydraulic circuit; DANFOSS make, OSPC 50 LS; gear pump delivery 16.5 l/min, two double acting cylinder directly acting on center tractor pivot, axially mounted, bore 45 mm, stroke 200 mm, piston rod 45 mm dia, working pressure 105 bar; hydrostatic system uses the same oil of hydraulic system; oil filter: none.
Recommended oil: see Hydraulic oil.

BRAKES:

Service brakes:
own make, dry disc brake type with drums and expanding shoes, 230 mm dia, 40 mm thickness, with mechanical transmission, acting on rear axle, operated by two indipendent pedals locked together for road drive.
Trailer braking take-off not available.
Parking brake:
hand lever operated with mechanical transmission; it operates the same brakes as service brakes but through different linkage.

WHEELS:

Driving wheels:
two at front and two at rear; diagonal type tyres PIRELLI AG10 7.50-16, 4 ply; maximum permissible load per tyre 525 kg at 1.2 bar inflation pressure and max 25 km/h speed, track width adjustments: 860 mm and 1020 mm at front; 880 mm and 1040 mm at rear, rotating the wheels on hub.

Wheelbase: 1180 mm

SEAT:

Driver's seat:
own make, upholstered seat with back rest; one spring under seat; height of unloaded seat above driver's platform 450 mm, longitudinal adjustment 45 mm.

Passenger seat: not available.

Number of grease points: 6

OVERALL DIMENSIONS (tyres size 7.50-16 front and 7.50-16 rear)

	Length	Width		Height to top of exhaust silencer
		mini	maxi	
	m	m	m	m
With ballast	2.85	0.94	1.12	1.085
Without ballast	2.85	0.91	1.09	1.085

Ground clearance: 180 mm below lower link pivot points

Lighting equipment: Electrical 12 V, in accordance with Italian legislation.

	Height above ground of centre with tyres: 7.50-16 front 7.50-16 rear	Size	Distance from outside edge of tractor to centre (°)
	mm	mm	mm
Headlights	715	140 x 90	440
Side lights	720	Ø 35	318
Rear lights	820	60 x 55	238
Reflectors: 1st pair	820	50 x 40	190

(°) Track setting: 860 mm at front
880 mm at rear

TEST CONDITIONS

Track setting: 860 mm at front
880 mm at rear

Weights: Tractor (with tank fuel, without driver).

	Front kg	Rear kg	Total kg
without ballast	610	380	990
with ballast	710	480	1190

Ballasts:

	Weight		Water (kg)
	Number	Total mass (kg)	
Front wheels	2	100	-
Front weight	-	-	-
Rear wheels	2	100	-
Additional	-	-	-

Fuel and lubricants used in tests

Fuel: Esso Diesel oil; specific gravity: 0.845 kg/l at 15 °C; cetane number: not recorded; which is in conformity with our National Standard.

Engine oil: AGIP F1 SAE 40 W 40

Transmission oil: AGIP SAE 140

Hydraulic oil, steering oil: AGIP SAE 70

Grease: AGIP GREASE

COMPULSORY TEST

(1) MAIN POWER TAKE-OFF PERFORMANCE

Date and location of tests: 14 th May 1986 - I.M.A. Torino (Italy)

Type of dinamometer: parasitic currents, BORGHI SAVERI FA 300-30 SP

	Speed		Fuel consumption			Specific
Power	Engine	p.t.o.	hourly		specific	energy
kW	rev/min	rev/min	l/h	kg/h	g/kWh	kWh/l
MAXIMUM POWER - 2 hour test						
18.16	3000	571	6.45	5.45	300	2.82
POWER AT RATED ENGINE SPEED						
18.16	3000	571	6.45	5.45	300	2.82
STANDARD POWER TAKE OFF SPEED (540 ± 10 rev/min)						
17.71	2837	540	6.15	5.20	294	2.88
PART LOADS						
(1) The torque corresponding to maximum power at rated engine speed						
18.16	3000	571	6.45	5.45	300	2.82
(2) 85% of torque obtained in 1)						
15.94	3100	590	5.74	4.85	304	2.78
(3) 75% of torque defined in 2)						
12.10	3140	598	4.73	4.00	331	2.56
(4) 50% of torque defined in 2)						
8.16	3168	603	3.70	3.13	384	2.21
(5) 25% of torque defined in 2)						
4.12	3195	608	2.78	2.35	570	1.48
(6)unloaded						
-	3215	612	-	-	-	-

Power	Speed		Fuel consumption			Specific
	Engine	p.t.o.	hourly		specific	energy
kW	rev/min	rev/min	l/h	kg/h	g/kWh	kWh/l

PART LOADS AT STANDARD POWER TAKE OFF SPEED (540 rev/min)

(1) the torque corresponding to maximum power available						
17.83	2837	540	6.19	5.23	293	2.88
(2) 85% of torque obtained at maximum power in 1)						
15.52	2906	553	5.38	4.55	293	2.88
(3) 75% of torque defined in 2)						
11.84	2953	562	4.28	3.62	306	2.77
(4) 50% of torque defined in 2)						
7.97	2984	568	3.44	2.91	365	2.32
(5) 25% of torque defined in 2)						
4.05	3021	575	2.54	2.15	531	1.59
(6) unloaded						
-	3063	583	-	-	-	-

Standard specific fuel consumption (g/kWh): 304/384/293/365
No load maximum engine speed: 3215 rev/min
Equivalent crankshaft torque at maximum power (2 hours): 57.82 Nm
Maximum equivalent crankshaft torque: 65.06 Nm at 2000 rev/min of the engine

Mean atmospheric conditions: temperature 25.0 °C
pressure 1001.3 mbar
relative humidity 63%

Maximum temperature: coolant 85 °C
engine oil 130 °C
fuel 28.5 °C
engine air intake 28.0 °C

DRAWBAR PERFORMANCE

	with ballasts	without ballasts
Tyre size- front: 7.50-16; 4 ply; inflation pressure:	1.2	1.2
- rear: 7.50-16; 4 ply; inflation pressure:	1.2	1.2

Date and location of tests: 26th September and 2nd October 1986 Torino
Type of track: concrete
Height of drawbar above ground: 350 mm with and without ballasts.

Gear no. and group	Driving speed	Power	Drawbar pull	Engine speed	Slip of wheels	Specific fuel consumption	Specific energy	Temperatures			Atmospheric conditions		
								Fuel	Coolant	Engine oil	Temperature	Relative humidity	Pressure
	km/h	kW	daN	rev/min	%	g/kWh	kW/l	°C	°C	°C	°C	%	mbar
1 - MAXIMUM POWER (unballasted)													
I Low	0.89	2.10	848	3230	15.0	-	-	28.0	65	110	13.0	97	993.5
II Low	1.39	3.21	834	3200	14.8	-	-	28.0	68	112	13.0	97	993.5
I Medium	2.04	4.81	848	3158	15.0	-	-	28.5	70	115	13.0	95	993.5
III Low	2.77	6.41	834	3122	14.6	607	1.39	28.5	72	117	14.0	90	993.5
II Medium	4.27	9.94	838	3087	14.9	457	1.85	28.5	75	119	14.5	87	993.5
I High	6.43	14.02	785	2995	11.9	384	2.20	29.0	80	120	14.5	84	993.5
III Medium	10.36	14.82	515	3004	4.3	361	2.34	29.0	83	122	15.0	80	993.5
II High	16.51	12.16	265	3005	2.4	436	1.94	29.0	88	125	15.0	78	993.5
2 - MAXIMUM POWER (ballasted)													
I Low	0.88	2.52	1030	3222	14.9	-	-	28.5	70	108	12.0	90	1000.0
II Low	1.37	3.90	1030	3187	14.8	-	-	28.5	73	111	13.0	87	1000.0
I Medium	2.00	5.73	1030	3126	15.0	-	-	28.5	74	114	14.0	84	1000.0
III Low	2.72	7.80	1030	3100	14.6	592	1.43	29.0	78	118	15.0	81	1000.0
II Medium	4.22	11.90	1015	3055	14.1	420	2.01	29.0	81	120	16.0	77	1000.0
I High	6.73	14.76	789	3000	6.9	362	2.33	30.0	84	123	17.0	74	1000.0
III Medium	10.39	13.88	481	3007	3.1	385	2.19	30.0	88	124	17.0	72	1000.0
II High	16.40	11.16	245	2998	1.8	473	1.79	30.0	90	127	17.5	69	1000.0
3 - FIVE HOUR TEST at 75% of pull at maximum power													
II Medium	4.65	9.81	760	3112	7.1	489	1.73	29.0	90	126	18.5	65	1000.0
4 - FIVE HOUR TEST at pull corresponding to 15% of wheelslip in test (2)													
III Low	2.70	7.73	1030	3092	-	-	-	30.0	92	127	20.0	57	993.5

Oil consumption during ten hours duration of tests (3) and (4): 14 g/h

(3) TURNING SPACE AND TURNING CIRCLE:

Wheel equipment: front 7.50-16 (4 ply)
rear 7.50-16 (4 ply)
Track of wheels: front 860 mm
rear 880 mm

	With brakes		Without brakes	
	Right-hand	Left-hand	Right-hand	Left-hand
	m	m	m	m
Radius of turning space	2.42	2.30	2.64	2.40
Radius of turning circle	2.25	2.06	2.40	2.23

(4) LOCATION OF CENTRE OF GRAVITY:

Height above ground	mm 520
Distance forward from the vertical plane containing the axis of the rear wheels	mm 679
Distance from the median plane of the tractor	mm 0

(5) BRAKING

Date and location of tests: 30th May and 5th June 1986 - I.M.A. - Torino (Italy)

Tractor masses during tests with driver:

	Front kg	Rear kg	Total kg
Without ballast	610	450	1060
With ballast	710	550	1260

Speed before application of brakes: 24.43 km/h

Type 0 test (cold brakes)

BALLASTED TRACTOR:

Braking device control force	daN	13.7	25.5	33.3	44.1	49.0	53.9
Mean deceleration	m/s^2	1.6	2.5	3.2	3.3	3.4	3.5

UNBALLASTED TRACTOR:

Braking device control force	daN	15.7	19.6	27.5	29.4	33.3	35.3
Mean deceleration	m/s^2	1.8	2.1	2.5	3.3	3.2	3.3

Type I test (fade):

Braking device control force	daN	7.9	15.5	19.6	29.4	34.3	42.2
Mean deceleration	m/s^2	1.6	2.5	2.6	3.3	4.0	4.2

Maximum deviation of tractor from its original course: none

Abnormal vibration: none

The brakes were heated by towing of the tractor from 1 km

PARKING BRAKING DEVICE TEST

	Ballasted tractor		Unballasted tractor	
	on slope of 18%		on slope of 12% with trailer of 3000 kg	
	Up	Down	Up	Down
Braking device control	18	16	25	30

(6) MEASUREMENT OF EXTERNAL NOISE LEVEL

Date and location of tests: 8th September 1986 - I.M.A. - Torino (Italy)

Type of sound level meter: BRUEL & KJAER mod. 2209

Type of track: concrete

Position of the exhaust pipe: vertical on the left hand of the engine

Results of tests:

Gear: III high

Travelling speed before acceleration: 20.30 km/h

Sound level: 88.0 dB (A)

(7) NOISE MEASUREMENT AT THE DRIVER'S EAR LEVEL

Date and location of tests: 8th September 1986 - I.M.A. - Torino (Italy)

Type of sound level meter: BRUEL & KJAER mod. 2209

Type of track: concrete

Results of tests

Gear	Drawbar pull at which the tractor develops the maximum sound level	Measured travelling speed		Sound level
		Nominal	Effective	
	daN	km/h	km/h	dB (A)
1. H (*)	780	7.05	6.80	103.0
1. H (*)	light load	7.05	7.90	97.0
top gear	light load	24.43	27.07	102.0

(*) The 1. H gear corresponds to the nominal travelling speed nearest to 7.5 km/h

(8) POWER LIFT AND HYDRAULIC PUMP PERFORMANCE:

Date and location of tests: 10th September 1986 - I.M.A. - Torino (Italy)

POWER LIFT

	Height of lower hitch point above ground in down position	Vertical movement	Maximum force exerted through full range	Corresponding pressure of hydraulic fluid	Moment about rear axle	Maximum tilt angle of mast over range of lift
	mm	mm	daN	bar	daNm	degrees
At the hitch points	190	515	490	95	-	-
On the frame	170	670	368	95	512	18°

Temperature of hydraulic fluid at start of test: 65 °C

Lifting heights relative to horizontal links

mm	-115	-95	-50	0	+50	+100	+200	+300	+400	+500	+535

Lifting forces at hitch points

mm	-	490	505	540	582	625	690	740	640	-	-

Lifting forces at test frame

mm	368	378	397	410	420	425	445	451	435	405	390

HYDRAULIC PUMP PERFORMANCE:

- Sustained pressure with relief valve open: 105 bar
- Pump delivery rate at mimimum pressure: 20.4 l/min
- Hydraulic pressure corresponding to 90% of the minimum setting of the opening pressure of the relief valve: 94.5 bar
  - Delivery: 19.5 l/min
  - Power: 3.01 kW
- Flow rate and hydraulic pressure corresponding to maximum hydraulic power:
  - Pressure: 100 bar
  - Delivery: 19.4 l/min
  - Power: 3.17 kW
  - Temperature of hydraulic fluid: 65 °C
- Tapping point used for test: at rear of tractor

(9) - REPAIRS AND ADJUSTMENT DURING TEST = none

(10) - REMARKS = none

TEST CARRIED OUT BY:

W. Faccio

M. Gianguaiano

HEAD OF I.M.A.
TEST DEPARTMENT

R. Gioia

DIRECTOR OF I.M.A.

L. Lisa

Turin, 16th January 1987

PASQUALI 488 ARTICULATED (4 WD)



Fig. 1 - POWER TAKE-OFF TEST

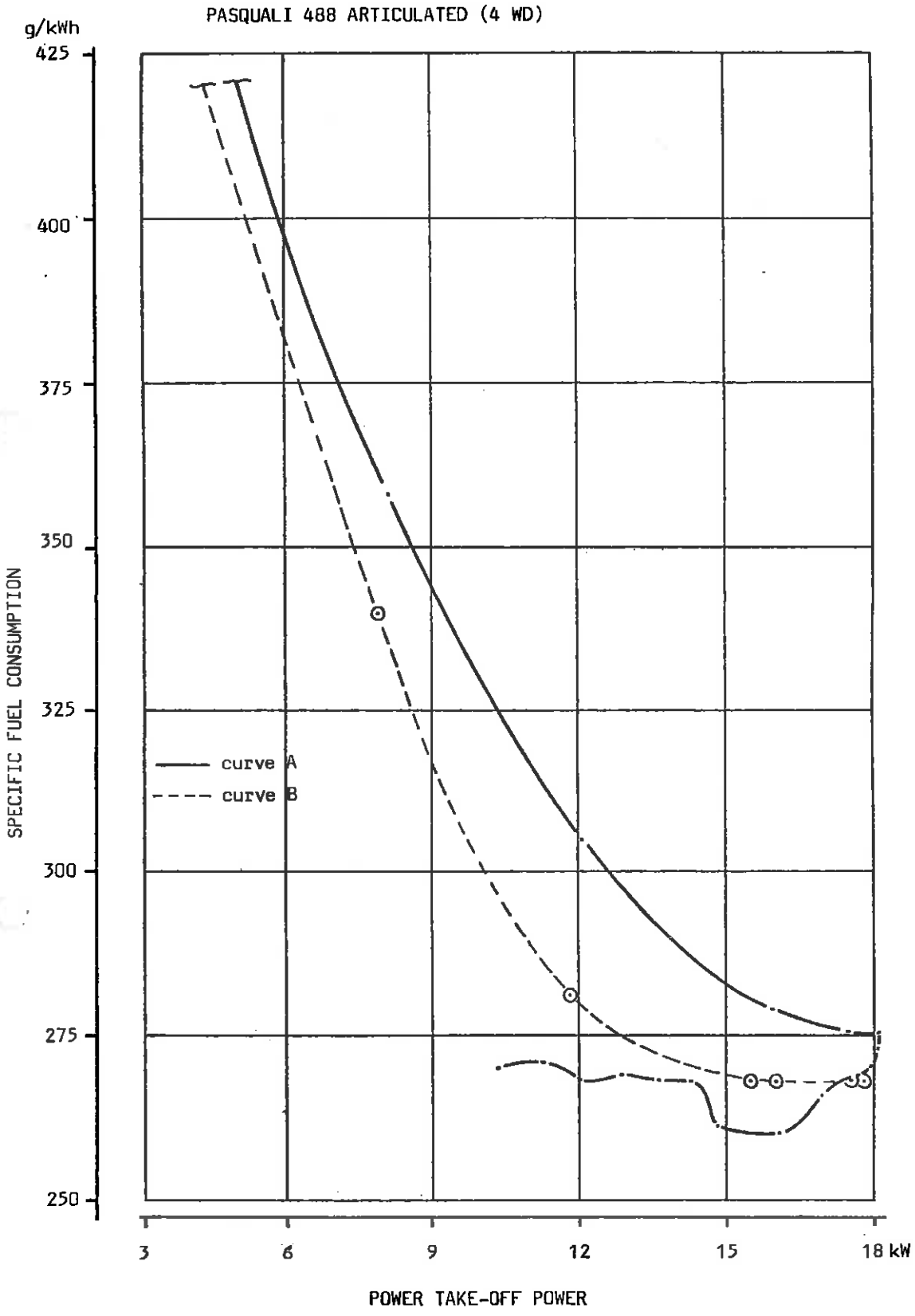


Fig. 2 - POWER TAKE-OFF TEST