COMITATO PER L'OMOLOGAZIONE
DELLE MACCHINE AGRICOLE

No. 601/O.E.C.D.

REPORT ON TEST IN ACCORDANCE WITH O.E.C.D.
TEST CODE FOR AGRICULTURAL TRACTORS

GOLDONI 928



Manufactured by: GOLDONI S.p.A.
Migliarina di Carpi—MODENA (ITALY)

Date of tests: January — June 1978

CENTRO DI OMOLOGAZIONE DELL'ISTITUTO DI MECCANICA AGRARIA
UNIVERSITA' DEGLI STUDI DI BOLOGNA — ITALIA

GOLDONI 928 TRACTOR

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Tractor manufacturer:	GOLDONI S.p.A. Migliarina di Carpi (Modena)
Submitted for test by:	Manufacturer
Selected by:	Manufacturer with the agreement of Istituto di Meccanica agraria - University of Bologna
Place of running-in:	GOLDONI S.p.A. Workshop, Migliarina di Carpi
Duration of running-in:	80 hrs for engine, 60 hrs for the tractor

SPECIFICATION OF TRACTOR

Tractor

Make:	GOLDONI S.p.A.
Model:	928
Type:	Four wheels drive, articuled steering frame
Serial No.:	143127

Engine

Make:	LOMBARDINI MOTORI S.p.A. - Reggio Emilia
Model:	904
Type:	Four-stroke direct injection Diesel
Serial No.:	1340955
Cylinders:	2, vertical, dry, in line; bore 90 mm, stroke 94 mm, total capacity 1196 cm^3; compression ratio 17.8; overhead valves
Fuel system:	Forced with diaphragm pump CORONA BCD 1772; FIAAM IN 4746 replaceable paper cartridge-type filter; BOSCH PFR 2 K 70 injection pump, manufacturer's production setting for injection pump 37 mm^3 for stroke at 314.1 rad/s (3000 rev/min) of engine; OMAP OLL 160 injection nozzles, injection pressure 196 + 206 bar (200-210 kp/cm^2); advanced admission: 27° (fly wheel measured); capacity of fuel tank 10 l
Governor:	LOMBARDINI mechanical type with centrifugal weights governed range of engine speeds 104.7 - 335.0 rad/s (1000-3200 rev/min); rated engine speed 314.1 rad/s (3000 rev/min)
Air cleaner:	LOMBARDINI 9043703-55 oil filter with cyclone pre-cleaner; flow 800 l/min

Lubrication system:	LOMBARDINI forced feed from lobe-type pump: sieve filter in suction and paper cartridge replaceable filter FIAAM FT 4756 at delivery; oil capacity 3.0 l; recommended oil: according to MIL-L 2104 C/ class CD/SAE 40; recommended filter change period 200 hrs
Cooling system:	Air forced with 10 blades flywheel axial impeller; flywheel diameter 189.5 mm; flow 1550 m^3/h at 314.1 rad/s (3000 rev/min) of engine
Starting system:	Electric BOSCH CFO-0314-001 solenoid engaged type, 12 V, 1.1 kW motor; low temperature starting aid: manual operated fuel supplementary ratio device on injection pump
Muffler system:	LOMBARDINI DGM-SA 553 motor left side located, lateral discarge
Electrical equipement:	12 V; DUCATI 4035025100 alternator, 0.24 kW; one battery, capacity 80 Ah

Transmission

Clutch:	PITTERI and VIOLINI F 187.2; single dry plate type, plate diameter 187 mm; driving both gear box and p.t.o.; pedal operated
Gear box:	Own make, mechanical; sliding gear countershaft change gear with 3 gears and one group gear with 2 forward and 1 reverse gears. Total: 6 forward and 3 reverse speeds selected by means of 2 hand levers
Front and rear axles and final transmission:	Own make model GOLDONI type 500 differential operated by bevel gear (ratio 1:4.778) and bull gears final drives (ratio 1:3.143). Rear foot operated differential lock and hand operated front, self disengaging. The front and rear axles are couples by an universal joint and is costantly mechanically connected
Oil capacities:	Gear box and front transmission 8.9 l; rear transmission 5.2 l; recommended oil change period: 1000 working hrs; recommended oil: according to MIL-L 2105 B/SAE 80/90

Total ratios and speed

Gear	No of engine revolutions for one revolution of driving wheels	Theoretical travelling speed for 314.1 rad/s (3000 rev/min) rated speed of engine	
		m/s	km/h
1st lower	347.094	0.31	1.11
2nd lower	166.181	0.64	2.31
3rd lower	110.452	0.97	3.48
1st high	64.574	1.65	5.95
2nd high	30.921	3.45	12.43
3rd high	20.544	5.20	18.71
1st reverse	264.454	0.32	1.45
2nd reverse	126.610	0.84	3.04
3rd reverse	84.157	1.27	4.57

Calculated with the tyre rolling circumference of 2136 mm in accordance to tyre manufacturer's specification

Power take-off

Main p.t.o.: Located at the rear of tractor, central position;
height above ground 410 mm;
dimensions 34.8x27.9x8.6 mm (1.3/8", ISO R 500), 6 splines;
hand lever engaged.
Speeds proportional at engine speed:
two, 60.4 or 92.0 rad/s (577 or 879 rev/min) at 314.1 rad/s (3000 rev/min) rated engine speed;
293.8 or 193.0 rad/s (2807 or 1843 rev/min) of engine at p.t.o. 56.5 rad/s (540 rev/min).
Direction of rotation, clockwise viewed from tractor rear.
Speeds proportional to traveling speed;
one, one p.t.o. revolution for 0.14 m;
15 p.t.o. rev/min for one revolution of driving wheels.
Direction of rotation, clockwise in forward speeds, anti-clockwise in reverse speeds.

Accessory p.t.o.: Located at the rear of tractor, central position under the main p.t.o.;
height above ground 335 mm;
dimensions 30x26x6 mm; 6 splines; hand lever engaged.
Speeds proportional at engine speed:
two; 60.4 or 92.0 rad/s (577 or 879 rev/min) at 314.1 rad/s (3000 rev/min) rated engine speed;
293.8 or 193.0 rad/s (2807 or 1843 rev/min) of engine at p.t.o. 56.5 rad/s (540 rev/min).
Speeds proportional to travelling speed:
one, one p.t.o. revolution for 0.14 m;
15 p.t.o. rev/min for one revolution of driving wheels.
Direction of rotation, anti-clockwise in forward speeds, clockwise in reverse speeds.

Power lift: Own make;
hydraulic power line in disintegrated construction;
floating position, no controls;
two single acting rams, 45 mm bore, 145 mm stroke;
SALAMI 2 PA 6.2/S - hydraulic pump directly driven by engine;
maximum pressure 100 bar (102 kp/cm^2);
oil capacity 4.7 l
(2 oil tapping for two remote ram optional, non fitted on tractor tested)

Three point linkage: In special non unificated construction (cat. 1N, ISO tab. 730 II proposal);
balls of links acc. to ISO I cat.
Lifting rods lenght: 556 mm;
lift height above ground from 50 to 530 mm

Holed drawbar: Fitted on clevis of lower links;
lenght between the ball joints 380 mm;
thickness of holed bar 25 mm, width 65 mm;
7 holes, diameter 20 mm
Height above ground level adjustable from 50 to 530 mm
Distance of centre hole:
to rear axle centre 660 mm
to end of p.t.o. - shaft 300 mm

Hitch: Own make;
height above ground 245-460-620 mm;
adjustable by shifting hitch;
diameter of clevis hole 28 mm;
distance to rear axle centre 405 mm;
distance referred to the main p.t.o. - shaft:
horizontal 50 mm, vertical 3 position, 40 or 210 mm (over) and 165 mm (under)

Steering: Own make;
mechanical type working on centre, pivot of the tractor by mean of: steering wheels, worm gear box, connecting rod

Brakes: Own make;
foot brake: mechanically operated internal shoe type brake acting on 2 brake drums in the rear wheels;
pedal operated.
Parking brake: mechanically operated internal shoe type brake acting on 2 brake drums in the front wheels, operated by hand lever with ratchet

Drive wheels: In front and rear;
4 radial tyres 6.00 - 16, 4 ply rating pneumatic;
maximum permissible weight on each tyre 400 kg at 1.4 bar internal air pressure.
Track width 615, 730, 795, 915 mm changeable by reversing wheels centres and offset lugs on rims;
wheelbase 1050 mm

Weight: With full fuel tank, oil

Weights	No driver			With driver		
	on front wheels	on rear wheels	total	on front wheels	on rear wheels	total
Without additional weight	520	250	770	530	315	845
With maximum additional weight	580	310	890	590	375	965

Ballast: four, 30 kg each, one for wheel

Seat: Own make;
elastic rubber mounting;
range of adjustement 20 mm, fore and aft in median plane of tractor

Number of grease points: (whole tractor) 5

Dimensions:

Overall dimensions	Lenght m	Width m	Height m
Without ballast	2.44 (1)	0.795-0.910-0.975-1.095	1.09 (2)
With ballast	2.44 (1)	0.795-0.910-0.975-1.095	1.09 (2)

(1) With three points linkage 2.68 m
(2) To top of steering wheel
Maximum ground clearance 0.20 m (under the hitch)

Lighting:

	Height above ground of centre cm	Diameter cm	Distance of centre from outside edge of tractor cm
Headlights	66.5	11.5x11.5	34.5 (1)
Side lights	66.5	11.5x11.5	34.5 (1)
Rear lights	76.0	4.5x5.2	15.9 (1)
Reflectors	63.0	5.0x4.3	13.0 (1)

(1) With track width of 0,795 m

FUEL AND LUBRICANTS USED IN TEST

Fuel:	Agricultural Diesel oil; density 15°C: 0.825 kg/l cetane number: 69
Engine oil:	ESSO TRACTORLUBE 80W90 viscosity index: 124
Transmission oil:	ESSO GEAR OIL GX 80 W 90 viscosity index: 99
Hydraulic fluid:	ESSO NUTO H 68 viscosity index: 103

COMPULSORY TEST

1) MAIN POWER TAKE-OFF PERFORMANCE

Date and location of test: 24th January 1978 - Experimental Centre of Cadriano - University of Bologna

Type of dynamometer: electrical, type I.M.A. Bo 65

Power kW (metric h.p.)	Speed engine rad/s (rev/min)	Speed p.t.o. rad/s (rev/min)	Fuel consumption hourly l/h	hourly kg/h	specific g/kWh (g/h.p.h)	kWh for liter kWh/l (h.p.h/l)
At maximum power 2-hours test						
17.99 (24.46)	313.3 (2998)	60.4 (577)	6.57	5.42	301 (222)	2.74 (3.72)
At standard p.t.o. speed 56.5 ± 1 rad/s (540 ± 10 rev/min)						
17.13 (23.30)	292.7 (2795)	56.3 (538)	6.06	5.00	292 (215)	2.83 (3.84)
At the speed recommanded by the manufacturer for drawbar work						
17.99 (24.46)	313.3 (2998)	60.4 (577)	6.57	5.42	301 (222)	2.74 (3.72)
At part loads						
I) 15.78 (21.46)	324.3 (3097)	62.4 (596)	5.57	4.60	292 (215)	2.83 (3.85)
II) -	330.8 (3159)	63.7 (608)	1.82	1.50	-	-
III) 8.02 (10.91)	329.7 (3149)	63.5 (606)	3.64	3.00	374 (275)	2.20 (3.00)
IV) 17.99 (24.46)	313.3 (2998)	60.4 (577)	6.57	5.42	301 (222)	2.74 (3.72)
V) 4.02 (5.47)	330.8 (3159)	63.7 (608)	2.42	2.00	498 (366)	1.66 (2.26)
VI) 11.93 (16.22)	327.0 (3123)	62.9 (601)	4.48	3.70	310 (228)	2.66 (3.62)

No load maximum engine speed: 332.0 rad/s (3170 rev/min)

Equivalent crankshaft torque at maximum power: 57.3 mN (5.84 mkp)

Maximum equivalent crankshaft torque: 61.6 mN (6.28 mkp) at 228.0 rad/s (2177 rev/min) of the engine

Mean atmospheric conditions: temperature 18 °C

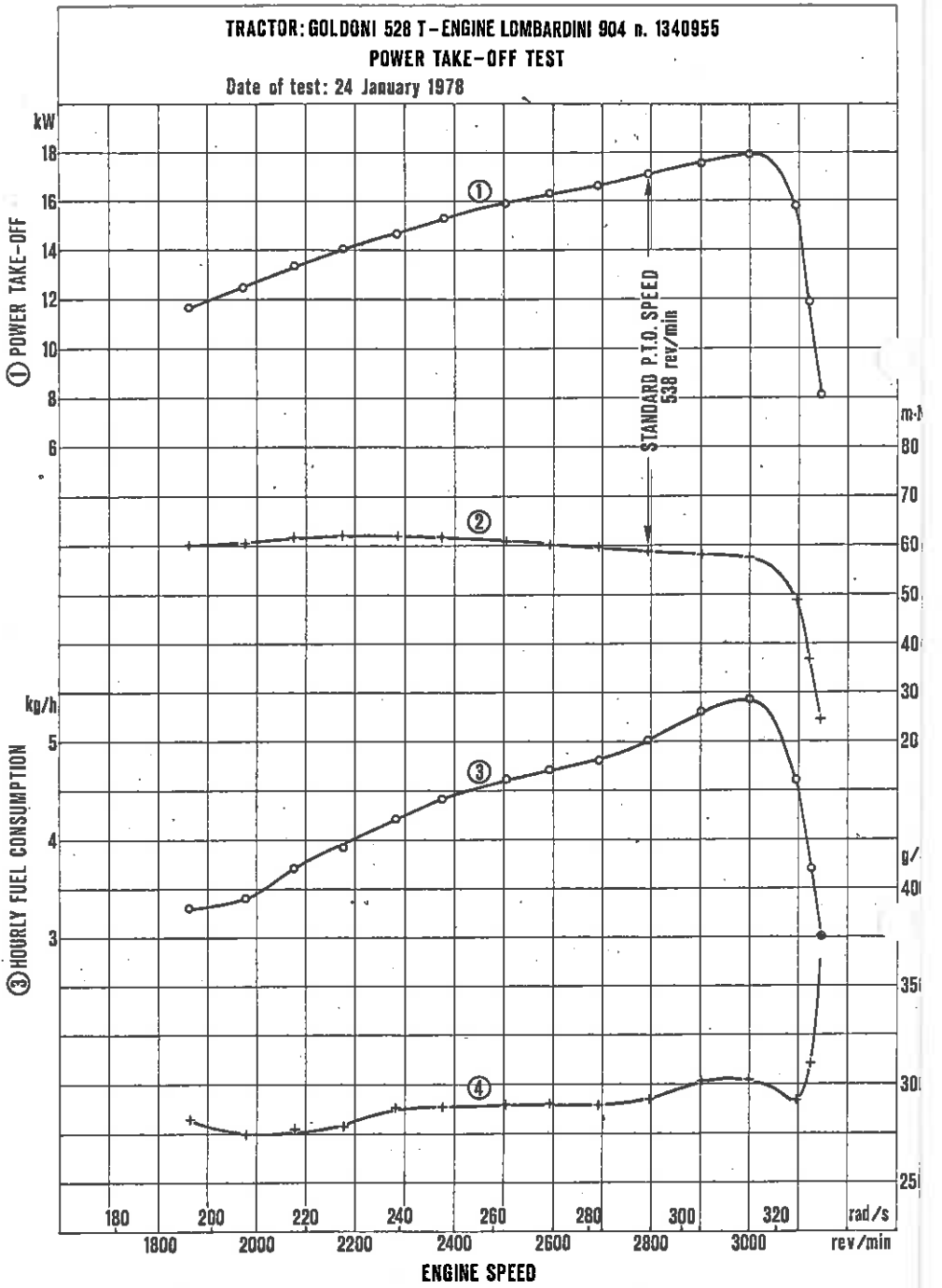
pressure 1.011 bar

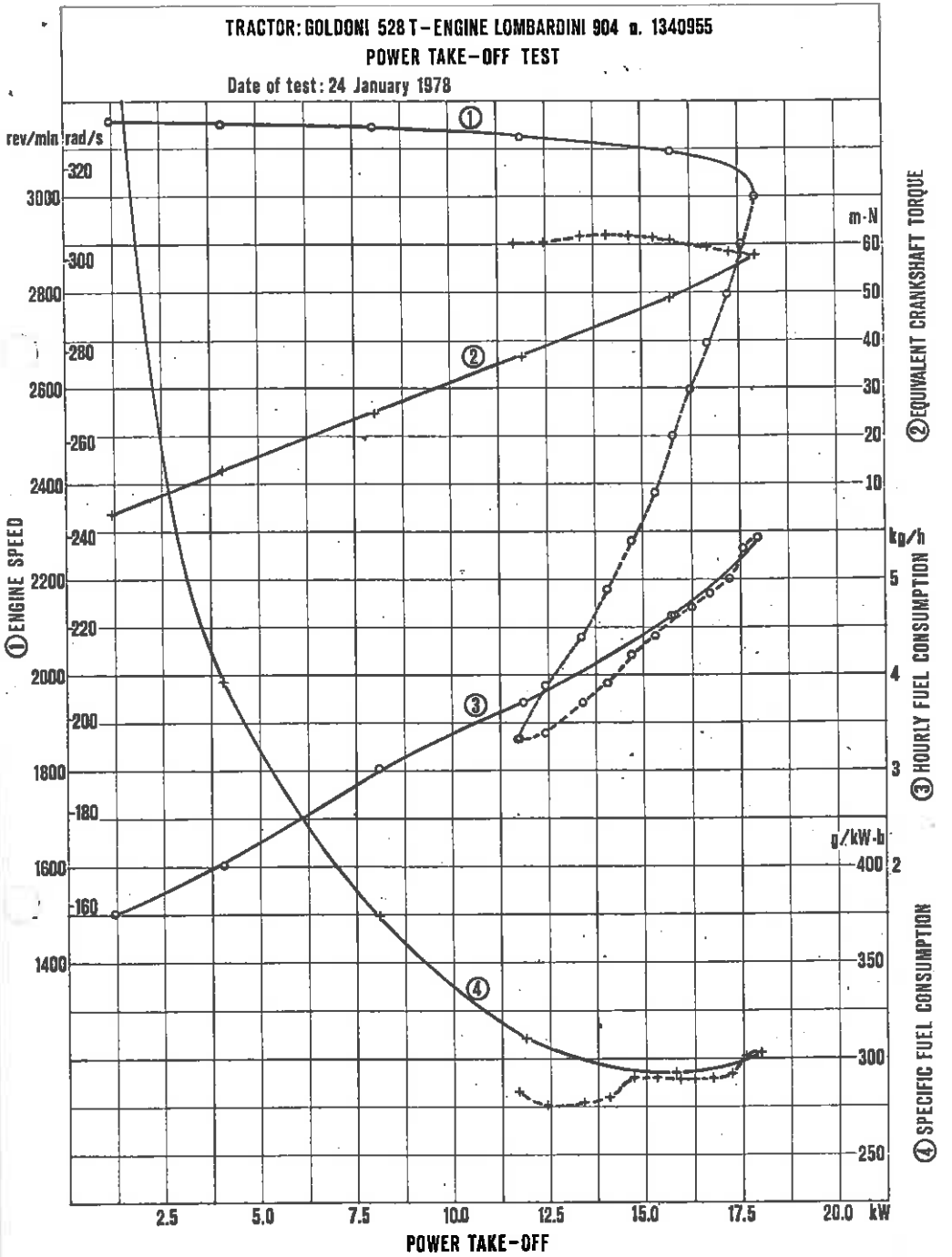
relative umidity 52 %

Maximum temperature: coolant 98 °C

engine oil 88 °C

fuel 16 °C


TRACTOR: GOLDONI 528 T – ENGINE LOMBARDINI 904 n. 1340955
POWER TAKE-OFF TEST
Date of test: 24 January 1978
kW
① POWER TAKE-OFF
STANDARD P.T.O. SPEED
538 rev/min
m·N
kg/h
③ HOURLY FUEL CONSUMPTION
g/
rad/s
rev/min
ENGINE SPEED


TRACTOR: GOLDONI 528 T – ENGINE LOMBARDINI 904 n. 1340955
POWER TAKE-OFF TEST
Date of test: 24 January 1978
rev/min
rad/s
① ENGINE SPEED
m·N
② EQUIVALENT CRANKSHAFT TORQUE
kg/h
③ HOURLY FUEL CONSUMPTION
g/kW·h
④ SPECIFIC FUEL CONSUMPTION
POWER TAKE-OFF
kW

2) DRAWBAR PERFORMANCE

Date of test: 18th - 20th April 1978

Type of track: concrete

Gear	Speed km/h	Power kW (h.p.)	Drawbar pull N (kp)	Engine speed rad/s (rev/min)	Slip of wheels %	Drawbar fuel consumption kWh/l (h.p.h/l)
i) Maximum power (with ballast)						
1st l	1.01	2.42 (3.29)	8630 (880)	329 (3140)	14.8	0.98 (1.33)
2nd l	2.09	5.10 (6.93)	8780 (895)	327 (3125)	15.2	1.58 (2.15)
3rd l	3.15	7.72 (10.50)	8830 (900)	328 (3135)	15.2	2.16 (2.94)
1st h	5.38	13.18 (17.93)	8830 (900)	323 (3085)	13.8	2.54 (3.46)
2nd h	12.30	17.08 (23.23)	5000 (510)	320 (3060)	4.0	2.66 (3.62)
3rd h	18.88	15.94 (21.68)	3040 (310)	315 (3010)	1.0	2.57 (3.50)
ii) Five hour test at 75% of pull at maximum power (in the 1st h gear)						
1st h	5.82	10.62 (14.44)	6570 (670)	327 (3120)	7.2	2.22 (3.02)

Height of drawbar above ground: 245 mm

Drawbar fuel consumption g/kWh (g/h.p.h.)	Temperatures °C			Atmospheric conditions		
	Fuel	Coolant	Engine oil	Temperature °C	Relative umidity %	Pressure bar
843 (620)	10	54	70	13	62	1.013
522 (384)	11	53	70	13	65	1.013
381 (280)	10	54	72	12	68	1.013
324 (238)	10	55	74	12	60	1.015
310 (228)	11	58	78	13	55	1.015
321 (236)	10	58	78	13	50	1.015
371 (273)	15	54	81	13	40	1.011

Gear	Speed km/h	Power kW (h.p.)	Drawbar pull N (kp)	Engine speed rad/s (rev/min)	Slip of wheels %	Drawbar fu consumption kWh/l (h.p.h/l)
iii) Five hour test at pull corresponding to 15% wheelslip in test i)						
1st h	5.65	13.85 (18.83)	8830 (900)	325 (3100)	9.0	2.67 (3.63)
v) Maximum power (without ballast)						
1st l	0.97	2.14 (2.91)	7940 (810)	327 (3125)	14.8	0.92 (1.24)
2nd l	2.05	4.57 (6.22)	8040 (820)	325 (3100)	15.0	1.63 (2.21)
3rd l	3.10	7.01 (9.53)	8140 (830)	325 (3100)	15.2	2.05 (2.78)
1st h	5.25	11.43 (15.56)	7840 (800)	323 (3080)	15.0	2.34 (3.19)
2nd h	12.20	16.28 (22.14)	4800 (490)	319 (3050)	4.5	2.67 (3.63)
3rd h	18.20	15.86 (21.57)	3140 (320)	311 (2970)	2.6	2.56 (3.48)

Oil consumption during ten hours duration of test ii) and iii): 11.5 g/h

Awbar fuel consumption g/kWh (g/h.p.h.)	Temperatures °C			Atmospheric conditions		
	Fuel	Coolant	Engine oil	Temperature °C	Relative umidity %	Pressure bar
309 (227)	16	60	83	14	35	1.011
902 (663)	11	58	72	14	45	1.015
507 (373)	12	58	72	15	40	1.015
403 (296)	12	61	74	14	48	1.015
352 (259)	11	60	77	13	52	1.015
309 (227)	11	60	78	13	58	1.015
322 (237)	11	61	76	12	60	1.015

Test iii) was carried out with 120 kg over ballast

3) TURNING SPACE AND TURNING CIRCLE

Details of wheels equipment: Front and rear 6.00-16, 4 p.r. pneumatic; no ballast; track width, front and rear axles, 795 mm

	Without brakes	
	right hand	left hand
Radius of turning space, m	2.41	2.37
Radius of turning circle, m	2.32	2.28

No "with brakes" test has been carried out since tractor is not provided with steering brakes

4) LOCATION OF CENTRE OF GRAVITY

- Height above ground	460 mm
- Distance forward from the vertical plane containing the axis of the rear wheels	659 mm
- Distance of the median plane of the tractor to the right hand side	0 mm

5) BRAKING PERFORMANCE

Date of tests: 22nd May 1978

Type of track: Concrete

Type of decelerometer: Moto Meter, at maximum, recorder

Weight of ballasted tractor: 965 kg, with driver

A) Foot brake

Cold brakes

		With ballast	Without ballast
Travelling speed	km/h	19.4	19.4
Deceleration	m/s^2	6.4	7.3
Stopping distance	m	3.60	3.40
Force on pedal	N (kp)	400 (41)	400 (41)
Force on pedal for maximum deceleration of 2.5 m/s^2	N (kp)	100 (10)	80 (8)

Brake fade characteristics (hot tests)

			With ballast	Without ballast
Deceleration	hot/cold	%	101	89
Stopping distance	cold/hot	%	108	100
Force on pedal	hot/cold	%	90	90

B) Park brake

Tractor facing up slope (16%):
Pull on hand brake 290 N (30 kp), tractor does not roll

Tractor facing down slope (16%):
Pull on hand brake 290 N (30 kp), tractor does not roll

6) AMBIENT NOISE EMITTED BY THE TRACTOR

Date of test: 19th April 1978
Type of track: Concrete
Type of sound level meter: Brüel and Kjaer, type 2203

Results of test

Gear: 3rd h
Maximum travelling speed: 19.5 km/h
Travelling speed before acceleration: 14.7 km/h
Sound level: 87.8 dB(A)

7) NOISE AT THE DRIVER'S EAR LEVEL

Date of test: 19th April 1978
Type of track: Concrete
Type of sound level meter: Brüel and Kjaer, type 2209
Type of frequency analyser: Brüel and Kjaer, type 1613

No cab or safety frame fitted on tractor

Results of test

Gear	Drawbar pull at which the tractor develops the maximum sound level N (kp)	Travelling speed km/h		Sound level	
		nominal	effective	dB(A)	Sones
1st h*	7300 (745)	5.95	5.65	103.2	181.7

* The 1st h gear corresponds to the travelling speed nearest to 7.25 km/h

8) POWER LIFT PERFORMANCE

Date and location of test:	26th June 1978 - Experimental Centre of Cadriano
Hydraulic fluid:	Esso Nuto H 68 - Viscosity index: 103
Type of linkage lok for transport:	Hydraulic
Opening pressure of the cylinder over pressure relief valve:	88 bar (90 kp/cm^2)

Hydraulic pump

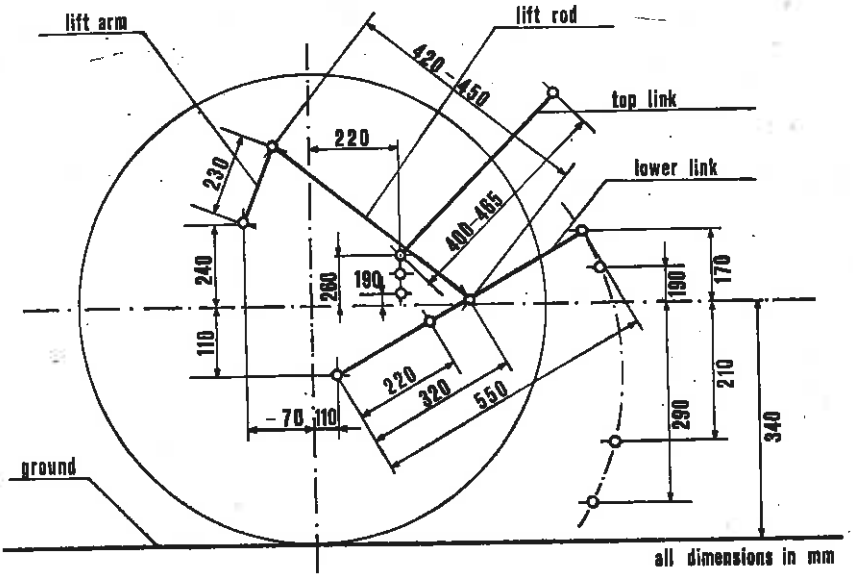
i) Opening pressure of relief valve: 88 bar (90 kp/cm^2)
Sustained pressure by open relief valve: 86 bar (88 kp/cm^2)

ii) Pump delivery rate at minimum pressure and maximum engine speed: 14.0 l/min

iii) Pump delivery rate: 10.2 l/min
Delivery pressure: 64 bar (65 kp/cm^2)
Hydraulic power: 1.09 kW (1.48 metric h.p.)

Power lift

Dimensions of implement linkage for the table on pag. 20



Linkage geometry (*)

		Maximum mechanical advantage	Minimum mechanical advantage
Projected length in side view			
lower links,	mm	550	550
lift arms,	mm	230	230
lift rods,	mm	450	450
top link, (*)	mm	400–465	400–465
Distance of lift rod connection point from pivot point of lower link,	mm	320	220
The following dimensions are given relative to the rear wheel centre line, situated 387 mm above the ground level			
Lower link pivot point	mm	110 behind, 110 below	110 behind, 110 below
Top link pivot point (*)	mm	220–230–240 behind, 260–225–190 above	220–230–240 behind, 260–225–190 above
Lift arm pivot point	mm	70 behind, 240 above	70 behind, 240 above
Maximum and minimum height of lower link hitch points	mm	170 above, 210 below	190 above, 290 below
Height of lower link hitch points when locked in transport position	mm	100 above, -	- -

(*) The standard test frame cannot be fitted because of the special construction of the implement linkage.

Lifting forces

Lifting height in relation to a horizontal line through the lower link pivoting point, cm		- 18	- 15	- 10	- 5	0	+ 5	+ 10	+ 15	+ 20	+ 25	+ 28	+ 30
Lifting force at the hitch points N (kp) (Values for the pressure at maximum hydraulic horsepower, calculated from measurements made at maximum pressure)	max. mech. advantage	-	-	10800 (1100)	10230 (1050)	9800 (1000)	9500 (970)	9160 (935)	8620 (880)	8330 (850)	7590 (775)	2650 (270)	-
	min. mech. advantage	7940 (810)	7840 (800)	7840 (800)	7790 (795)	7500 (765)	7300 (745)	7200 (735)	7100 (725)	6960 (710)	6860 (700)	-	3630 (370)
	Maximum force exerted throughout whole range 2650 N (270 kp) Force at wich front of tractor is calculated to lift with maximum allowable front ballast 9210 N (940 kp)												

The standard test frame cannot be fitted because of the special construction of the implement linkage.

Bologna, July 1978

DIRECTOR OF ISTITUTO OF
MECCANICA AGRARIA
UNIVERSITY OF BOLOGNA

Prof.Ing. E. Manfredi

HEAD OF TRACTOR TEST CENTER

Prof.Dott. G. Casini-Ropa

This bulletin is based on engineering tests in accordance with the O.E.C.D. STANDARD CODE for the Official Testing of Agricultural Tractors. It does not contain an evaluation of the performance of the tractor on practical work.

This report has been approved by the O.E.C.D. Coordinating Center (C.N.E.E.M.A., France) as being in accordance with the O.E.C.D. STANDARD CODE.

Date of Approval: 12nd January 1979

Serial No.: 601

In this report all performance characteristics are given according to the International System of Units and to the Technical System.

Equivalences

Forces:	1 N	= 0.102	kp	or	1 kp	= 9.81	N
Powers:	1 kW	= 1.36	h.p.	or	1 h.p.	= 0.736	kW
Pressures:	1 bar	= 1.02	kp/cm^2	or	1 kp/cm^2	= 0.981	bar
Angular velocity:	1 rad/s	= 9.554	rev/min	or	1 rev/min	= 0.1047	rad/s