SOCIALISTIC REPUBLIC OF CROATIA
INSTITUTE FOR MECHANIZATION, TECHNOLOGY AND BUILDINGS IN AGRICULTURE
ZAGREB

TEST BULLETIN: O. E. C. D. No. 834

Report on test in accordance with O. E. C. D. Standard Code for the official testing of Agricultural Tractors

Date of Approval: 30th June 1982

TOMO VINKOVIĆ TV 731

ARTICULATED FOUR-WHEEL-DRIVE DIESEL TRACTOR

Manufactured by: TOMO VINKOVIĆ, tvornica traktora i ljevaonica
43000 Bjelovar, Yugoslavia

Date of Tests: July 1981 — October 1982

This report has been approved by the O. E. C. D. Coordinating Centre (C. N. E. E. M. A., Antony, France) as being in accordance with the O. E. C. D. Standard Code.

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

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In this report all measurements are given in SI units.

The relation with former Technical System of Units is given by the following relations

Forces:	1 N = 0.102 kp	or 1 kp = 9.81 N
Powers:	1 kw = 1.36 hp	or 1 hp = 0.736 kW
Pressures:	100 kPa = 1.02 kp/cm² = 750.1 mmHg	or 1 kp/cm² = 98.1 kPa

Tractor manufacturer:	TOMO VINKOVIĆ, Tvornica traktora i ljevaonica, Bjelovar
Submitted for test by:	Manufacturer
Selected by:	Manufacturer in agreement with the Institute
Place of running-in:	Zagreb
Duration of running-in:	50 hours

SPECIFICATION OF TRACTOR

Tractor	
Make:	TOMO VINKOVIĆ
Model:	TV—731
Type:	Articulated four-wheel-drive design
Serial No.:	182
Engine	
Make:	LOMBARDINI — DMB
Model:	LDA—672
Type:	4-stroke diesel engine, air cooled, direct injection
Serial No.:	608155
Cylinders:	2 cylinders, vertical; bore 95 mm, stroke 95 mm, capacity 1346 cm^3; compression ratio 17.5:1; overhead valves
Fuel sistem:	SAVARA type 6007/330 diaphragm fuel pump; FIAMM FNA 32/01 fuel filter with replaceable cartridge; capacity of fuel tank 17 l; CONDIESE CPF 2 R 70C0662 in line injection pump, serial No. 596 UX; manufacturer's production setting 41 mm^3 per cycle at rated engine speed and full load; BOSCH type OKLL 886470 injection nozzles; injection pressure 20.6 MPa; injection 28° before TDC
Governor:	LOMBARDINI, mechanical, centrifugal, variable speed type governor, governed range of engine speed 1000 rev/min to 3200 rev/min; rated engine speed 3000 rev/min
Air cleaner:	FISPA oil bath type with pre-cleaner incorporated; oil capacity 0.55 l
Exhaust silencer:	Expansion type silencer; 100 × 60 mm oval, 350 mm long; mouth on the left-hand side of the tractor, 420 mm above ground.
Lubrication system:	Forced feed from gear type pump; FIAM oil filter with replaceable cartridge, oil capacity (engine sump) 4.5 l, oil change period 100 hours, oil filter change period 300 hours Recommended oil type acc, MIL-L-45199A Recommended oil viscosities: Below 0°C — SAE 10 Below 10°C — SAE 20 Over 20°C — SAE 40
Cooling system:	Air cooling from belt driven axial blower with 10 blades, 200 mm diameter
Starting system:	Electrical; ISKRA type AZJ 0101 12 V pre-engaged-drive starting motor 1.4 kW
Aid for cold starting:	Decompressor
Electrical equipment:	Voltage 12 V DUCATI, 3-phase alternator 12 V, 190 W MUNJA lead-acid battery 12 V, 84 Ah at 20 hours rating

Transmission

Clutch: Make: POBEDA, Novi Sad, dry single plate clutch, 190 mm dia plate, pedal operated

Gearbox: Own make; sliding gear type with 3 forward speeds plus a 2 forward and 1 reverse range transfer box at the input end; total number of speeds 6 forward + 3 reverse

Axle and final drive: Own make; crown and pinion with differential; differential lock fitted on front axle, operated by hand lever, not self-disengaging; spur gear final drive

Transmission lubrication: Gearbox and front axle housing 10 l; Rear axle housing 8 l; recommended oil changing period 500 hours
Recommended oil type acc. API service classification: service GL 3; viscosity SAE 90

Total ratios and speeds:

Speed range	Gear	Number of engine revolutions for one revolution of driving wheel	Nominal traveling speed for rated speed of engine[1] 3000 rev/min (km/h)
low	1	251.4	1.78
	3	92.89	4.81
	5	34.6	12.91
high	2	171.4	2.61
	4	63.36	7.05
	6	23.59	18.94
reverse	1	171.4	2.61
	2	63.36	7.05
	3	23.59	18.94

[1] Calculated with a tyre dynamic radius index of 395 mm

Power take-off

Main power take-off: Non independent proportional to engine speed; p.t.o. directly driven from the transfer box output

Location: At rear of tractor, in median plane 330 mm above ground, 155 mm behind rear axle centre; 21.5 mm dia — with 10 splines (not ISO standard)

Speeds: Anticlockwise 2 speeds (656.02 rev/min) and 1153.8 rev/min at rated engine speed);
Clockwise and anticlockwise 2 speeds (961.5 rev/min and 1693 rev/min at rated engine speed)
540 p.t.o. rev/min at 2470 engine rev/min; 1000 p.t.o. rev/min at 2600 engine rev/min

Power lift: Make: PRVA PETOLETKA, Trstenik; disintegrated construction, type 311.5.422.29 gear type pump directly driven by engine supplies oil to a single ram cylinder; maximum oil pressure 11.8 MPa; separate hydraulic oil reservoir with 7.2 l capacity;
Recommended oil type: oil for hödraulic circuits viscosity 6.75°E/50°C; oil change period 500 hours
Oil filter with replaceable cartridge, filter change interval 1000 hours
Position control: Hydraulic linkage lock for transport

Implement linkage: Category 1 N in accordance with ISO standard, single acting ram cylinder, with position control

The length of:

Lower links	550 mm
Top link	390—580 mm
Lift rods	290—360 mm

Lift range: 540 mm

Holed bar: Fitted on the clevis of lower links; length between the ball joints 580 mm, thickness 25 mm, width 60 mm;
Centre hole and 3 holes 23 mm dia on either side with 80 mm distance each. Height above ground adjustable by power lift in the range 120—160 mm
With lower link in horizontal position distance of holes centre line to:

Rear axle	620 mm
P.t.o. shaft end	465 mm

Hitch: Height above ground 460—670 mm; horizontal distance from gear axis 220 mm; 130—340 mm above the p.t.o.

Steering: ORSTA — PRVA PETOLETKA. Hydrostatic steering assisted by pressure from hydraulic system
Two double-acting hydraulic cylinders between front and rear half of tractor

Brakes

Service brake: Own make: internal expanding brakes, mechanically acting on rear wheels, operated by foot pedal. All four wheels are always mechanically engaged

Parking brake: Lever operated service brakes

Wheels Two at front, two at rear, all tyres 7.50—16 diagonal, 4-ply pneumatic; maximum permissible weight on each tyre 5 kN at 120 kPa; track width 820 or 980 mm by shifting the hub on the axle shaft

Wheelbase: 1185 mm

Seat: Make: PROGRES, Jastrebarsko upholstered seat with back rest; mechanical suspension adjustable to driver's mass, damping by hydraulic shock absorber.
Range of vertical adjustment 80 mm

Number of grease points: 12 (whole tractor)

Lighting

	Heigh from ground to centre mm	Dimensions mm	Distance from outside edge of tractor to centre* mm
Headlights	900	100 ∅	280
Side lights	830	50 ∅	70
Rear lights	845	90 × 110	105

* At track setting 980 mm

Unrestricted beam angle of headlight in plan wiew 29°.

Overall dimensions:

	Length m	With m		Maximum height* m
		max	min	
With ballast	2.72	1.2	1.05	1.015
Without ballast	2.72	1.2	1.05	1.015

* To the top of steering wheel

Ground clearance: 235 mm (at brakes' drums).

CONDITIONS DURING TEST

Masses:

Tractor without driver but with tanks full

	Front kg	Rear kg	Total kg
Without ballast	728	302	1030
With ballast	816	390	1206

Ballast:

	No. of weights	Total mass kg	Water kg
Front	2	88	—
Rear	2	88	—

Track setting

During test Front & rear 980 mm

FUELS AND LUBRICANTS USED IN TESTS

Laboratory and track tests:

Fuel:	INA D-2	
	Density at 15°C	0,845 kg/l
	Viscosity at 50°C	2.6 cSt
	Cetane number	53
	Conforms to standard	JUS B. H2. 411.
Engine oil:	INA Super 3 SAE 30	
	Viscosity at 50°C	8°E
Transmission oil:	INA Hypenol 90 (SAE 90)	
	Viscosity at 50°C	15°E
Hydraulic oil:	INA Hydraol 70	
	Viscosity at 50°C	6.8°E

COMPULSORY TESTS

(1) Main power take-off performance

Date and location of tests: 1981. 09. 07. Zagreb

Type of dynamometer: SCHENK hydraulic dynamometer U1—40

Power kW	Speed Engine rev/min	Speed p. t. o rev/min	Fuel consumption hourly l/h	Fuel consumption Specific kg/kWh	Specific energy kWh/l
Maximum power — 2 hour test					
19.0	3036	664	7.42	0.329	2.56
The speed recommended by manufacturer for drawbar work					
19.0	3036	664	7.42	0.329	2.56
Part loads at rated engine speed					
(i) 85 per cent of the torque obtained at maximum power					
16.9	3160	691	6.26	0.313	2.70
(ii) unloaded					
0	3220	704	2.12	—	—
(iii) half the torque defined in (i)					
8.6	3146	688	3.93	0.385	2.19
(iv) the torque corresponding to maximum power					
19.0	3036	664	7.42	0.329	2.56
(v) one — quarter of the torque defined in (i)					
4.3	3210	702	3.02	0.596	1.18
(vi) three — quarters of the torque defined in (i)					
12.6	3146	688	5.03	0.337	2.50
Part loads — standard speed of the p.t.o. (540 rev/min) (i) 85% of the torque obtained at maximum power					
15.9	2716	594	5.55	0.297	2.86
(ii) unloaded					
0	2805	613	1.65	—	—
(iii) half the torque defined in (i)					
8.1	2744	600	3.43	0.359	2.36
(iv) the torque corresponding to maximum power available					
16.8	2470	540	6.05	0.304	2.78
(v) one — quarter of the torque defined in (i)					
4.1	2780	608	2.49	0.516	1.64
(vi) three — quarters of the torque defined in (ii)					
11.9	2735	598	4.37	0.310	2.72

STANDARD SPECIFIC FUEL CONSUMPTION (kg/kWh)

a (i)	0.313
a (iii)	0.385
b (i)	0.297
b (iii)	0.359

No load maximum engine speed: 3210 rev/min

Equivalent crankshaft torque at maximum power: 59,8 Nm

Maximum torque: 67.6 Nm at 2000 rev/min of the engine

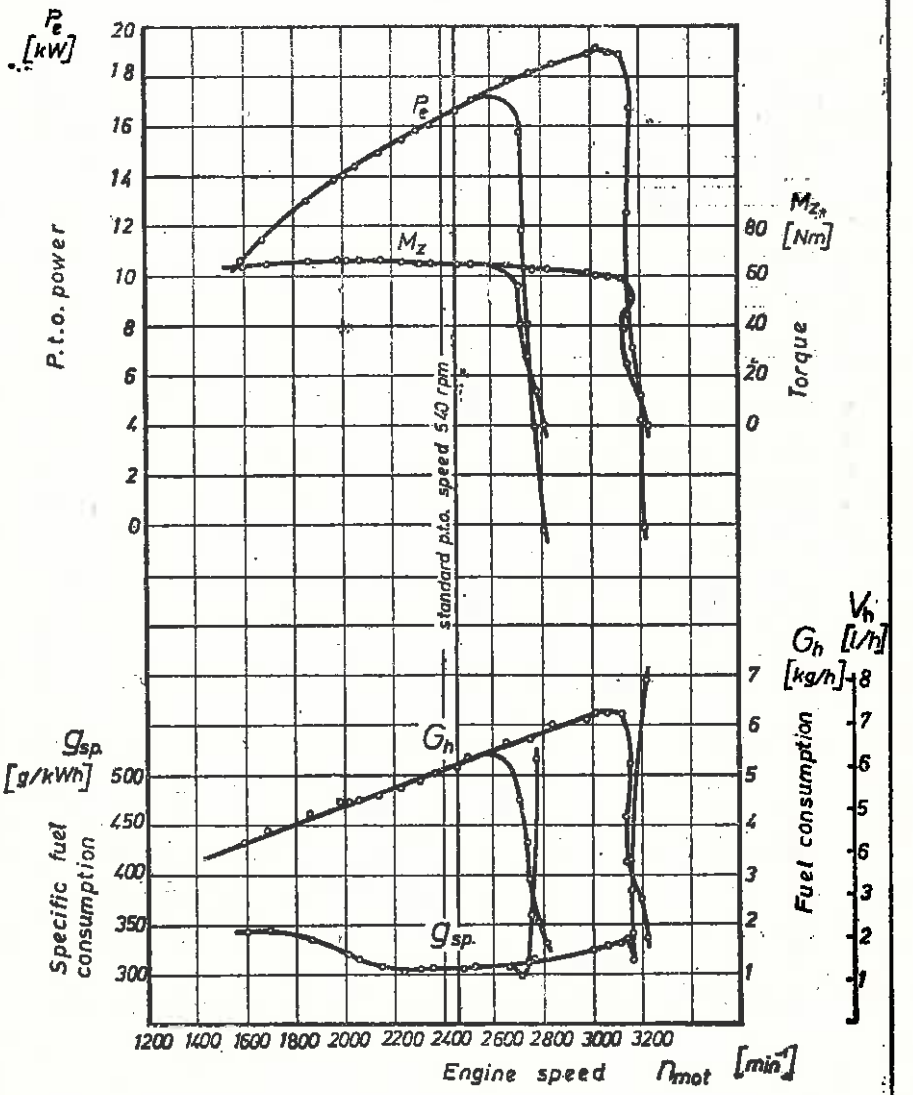
Mean atmospheric conditions :

Temperature	25°C
Pressure	101.7 kPa
Relative humiditiy:	64 per cent

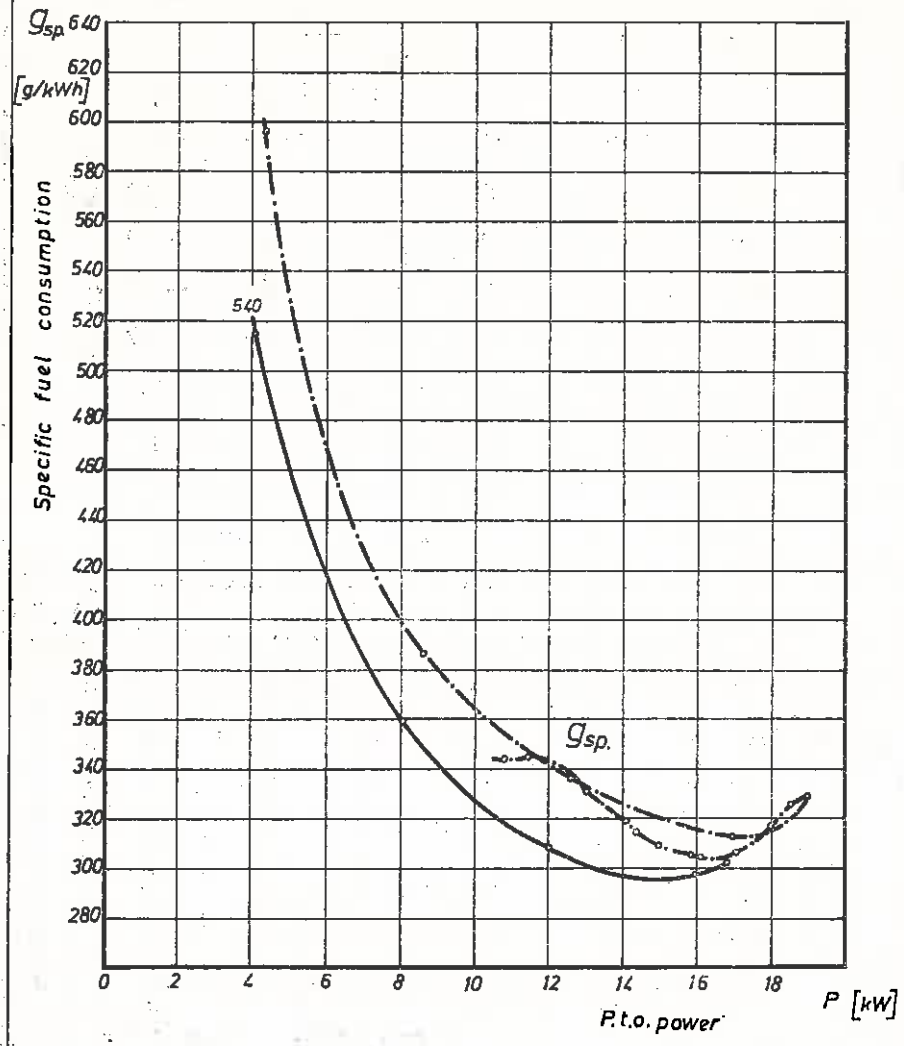
Maximum temperatures:

Cylinder head	160°C
Engine oil	135°C
Fuel	25°C
Engine air intake	25°C

Tractor „TOMO VINKOVIĆ" TV 731



Tractor „TOMO VINKOVIĆ" TV 731



(2) Drawbar performance

Date of tests: 1982. 10. 19.—22. Type of track: Tarmacadam Height of hitch above ground: 330 mm

Tyre inflation pressure: 120 kPa

Gear	Speed	Power	Drawbar pull	Engine speed	Wheel-slip percent	Specific fuel consumption	Specific energy	Temperature			Atmospheric conditions		
								fuel	coolant	oil	temperature	relative humidity	pressure
	km/h	kW	N	rev/min		kg/kWh	kWh/l	°C	°C	°C	°C	percent	kPa
	(i) Maximum power (unballasted)												
1	1.52	3.81	9025	3110	15.0	0.645	1.31	12	—	80	13	67	100.8
2	2.24	5.56	8930	3085	15.0	0.503	1.68	12	—	83	14	67	100.8
3	4.25	10.6	8975	3050	15.0	0.415	2.03	13	—	86	14	63	100.8
4	6.20	14.9	8630	3020	15.0	0.392	2.15	13	—	89	15	62	100.8
5	12.13	17.8	5290	2990	5.8	0.360	2.34	13	—	80	15	62	100.8
6	18.76	17.4	3340	2975	3.0	0.355	2.38	14	—	84	16	62	100.8
	(ii) Maximum power (ballasted)												
1	1.51	4.24	10100	3090	15.0	0.590	1.43	14	—	85	16	60	100.8
2	2.26	6.40	10200	3065	15.0	0.473	1.78	15	—	89	17	60	100.8
3	4.18	12.0	10300	3030	15.0	0.390	2.16	15	—	90	17	58	100.8
4	6.27	16.7	9615	3012	12.0	0.368	2.29	16	—	92	17	58	100.8
5	12.21	17.6	5200	3000	5.0	0.352	2.40	16	—	92	17	56	100.8
6	17.82	17.0	3430	2985	3.2	0.360	2.34	16	—	92	17	56	100.8
	(iii) Five hour test at 75 per cent of pull at maxi mum power												
4	6.70	13.4	7210	3060	7.0	0.378	2.23	18	—	94	18	58	101.3
	(iv) Five hour test at pull corresponding to 15 per cent wheelslip in test (ii)												
3	4.21	11.8	10100	—	—	—	—	15	—	98	16	68	100.8

Oil consumption during ten hours' testing (iii) and (iv): 18 g/h

(3) **Turning space and turning circle**

Details of wheel equipment:	Tractor with ballast
Tyres:	7,50—16 4ply
Track of wheels:	Front/rear: 980 mm

	Without brakes	
	Right-hand	Left-hand
Radius of turning space	3.20	3.22
Radius of turning circle	3.02	3.04

Separate braking of wheels is not possible.

(4) **Location of centre of gravity**

Height above ground:	514 mm
Distance forward from the vertical plane:	780 mm
Containing the axis of rear wheels:	
Distance from the median plane:	3 mm to left
Distance from the vertical plane containing the mind points of the front and rear axes with maximum articulation (27°)	to left: 13 mm to left to right: 10 mm to right

(5) **Braking**

Date of tests: 1981. 06. 10.

Tractor masses during brake tests

	Front kg	Rear kg	Total kg
Ballasted	820	470	1290
Unballasted	732	385	1117

Type 0 (ordinary cold service braking device performance) test

Speed before application of brakes 19.5 km/h

Ballasted	Braking device control force	N	140	190	270	330	Locked 390
	Mean deceleration m/s²		2.30	3.25	4.30	5.25	6.70
Unballasted	Braking device control force	N	140	180	260	320	Locked 350
	Mean deceleration m/s²		2.20	2.70	3.60	9.20	5.20

Type I (fade) test

Braking device control force	N	140	240	300	340	Locked 415
Mean deceleration	m/s²	2.40	3.75	5.10	5.25	6.30

Maximum deviation of tractor from its original course:	0 m
Abnormal vibration:	None
The brakes were heated by:	**The first method**

Parking braking device test

Braking device control force N	18 per cent slope		12 per cent slope with trailer of 1.1 tonne	
	Up	Down	Up	Down
	215	240	220	260

(6) Measurement of external noise level

Date of tests: 1981. 11. 02.
Type of sound level meter: Brüel & Kjaer Type 2203
Type of track: Tarmacadam
Results of tests:
Gear: 6
Travelling speed before acceleration: 15.0 km/h
Sound level: 94.5 dB(A)

(7) Noise measurement at the driver's ear

Date of tests: 1981. 11. 12.
Type of sound level meter: Brüel & Kjaer Type 2203
Type of track: Tarmacadam
Cab fitted: No.
Results of tests:

Gear	Drawbar pull at which the tractor develops the maximum sound level kN	Measured traveling speed km/h	Sound level dB(A)
4*	9.0	6.0	102
4*	light load	7.44	96
6	light load	19.6	98.2

* The 4th 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: 1981. 10. 08. Zagreb
Hydraulic fluid
Make and type: INA Hidraol 70
Viscosity: 6.6—6.9°E/50°C
Viscosity index: min 100
Type of linkage lock for transport: Hydraulic
Power lift

	Height of lower hitch point above ground in down position mm	Vertical movement* mm	Maximum force exerted through full range* kN	Corresponding pressure of hydraulic fluid MPa	Moment about rear axle* kNm	Maximum tilt angle of mast over range of lift degrees
At hitch points	210	405	6.72	10.55	3.85	—
On the frame	205	425	3.24	10.55	3.84	2

* Measured with lift rod length of 325 mm
Temperature of hydraulic fluid at start of test: 64°C

Hydraulic pump performance:

Opening pressure of the relief valve:	11.77 MPa
Sustained pressure with relief valve open:	10.55 MPa
Pump delivery rate at minimum pressure, the governor control lever being set for maximum power:	13.5 l/min
Hydraulic power at 90% of relief valve setting:	1.46 kW
Corresponding: delivery rate	9.2 l/min
pressure	9.50 MPa

Linkage geometry when connected to the standard frame
Projected length in side view:

Lower links	550 mm
Lift arms	278 mm
Lift rods	290—360 mm
Top link	390—580 mm
Distance of lift rod connection point from pivot point of lower link	415 mm

The following dimensions are given relative to the rear wheel centre line, situated 400 mm above the ground level

Lower link pivot point	68.5 mm behind	105 mm below
Top link pivot point	198 mm behind	319 mm above
Lift arm pivot point	75 mm behind	203 mm above
Maximum and minimum height of lower link hitch points	215 mm above	190 mm below
Height of lower link hitch points when locked in transport position*	615	

* Measured with lift rod length of 325 mm

Date: 26th March 1982.

Head of Testing Division: Dr Ivan Piria

Director: Dr Ivo Todorić