Institut za mehanizaciju poljoprivrede - Zemun

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Report on Test in Accordance with O.E.C.D. STANDARD CODE for the Official Testing of Agricultural Tractors



Agricultural Tractor IMT — 5200

Manufactured by: IMT — Industrija Mašina i Traktora
Novi Beograd — Yugoslavija

Date of test: June 1980 – June 1981

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 aporoved by the O.E.C.D. Co–ordinating Centre (C.E.M.A.G.R.E.F., France) as being in accordance with the O.E.C.D. STANDARD – CODE.

Date of Approval: June 14th, 1982

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Tractor manufacturer:	IMT - Industrija Mašina i Traktora Novi Beograd, Yugoslavia
Submitted for test by:	The manufacturer
Selected by:	Representatives of IMP
Place of running-in:	Laboratory of IMP
Duration of running-in:	cca 5o hours

SPECIFICATION OF TRACTOR

TRACTOR

Make:	IMT-
Model:	IMT - 52oo
Type:	Articulated tractor, eight (dual) wheels, all - wheel drive
Serial N°:	o226

ENGINE

Make:	Daimler-Benz, Stuttgart
Model:	OM 4o2
Type:	Four stroke, water cooled diesel, direct injection
Serial N°:	9oo-ooo-181153
Cylinders:	8, V disposition - 9o°; bore 125 mm, stroke 13omm, displacement 12756 cm^3, compression ratio 17,5:1, overhead valves, replaceable wet cylinder liners
Fuel system:	Piston type fuel feed pump with hand primer and sediment bowl; two fuel filters MAN, first (groh) with textile element - change period 2oo hours, second (fine) with paper element - change period every 4oo hours, both filters on pressure side of feed pump; fuel tank capacity 56o l; Bosch in-line type injection pump, model PE 8P looA 32oLS819, Serial N° 241134410 manufacturer's production setting 88 mm^3 at rated engine speed (2ooo rev/min) and full load, injection timing 15° before T.D.C.; BOSCH four hole DLLA 144S485 injector nozzles, injection pressure 175 + lo bar

Governor:	BOSCH, mechanical, all range, incorporated in fuel injection pump, governed range of engine speed 7oo to 22oo rev/min, rated engine speed 2ooo rev/min
Air cleaner:	Main and pre-cleaner DONALDSON, dry, with paper elements, type PBG-12-oo36, capacity 1o,5 m^3/min
Cooling system:	Water cooling with impeller pump, pump capacity 5,5 l/sec; pressurized system set to o,7 bar overpressure; fan with 8 blades, 61o mm diameter; water capacity 5o l; temperature control by membrane type thermostat
Lubrication system:	Forced feed from gear pump with strainer in sump full flow paplaceable paper element filter; oil capacity 2o l; oil and paper element change period every 1oo h; recommended oil quality acc. to MIL-L-21o4C; recommended oil viscosities: winter SAE 2o summer SAE 3o
Starting system:	Electrical, BOSCH solenoid-engaged starter motor, 24 V, 4,8 kW; no aids for cold starting
Exhaust:	Vertical, above bannet, on the left hand side of the engine
Electrical system:	24 Volt, negative earth; BOSCH alternator 28V27A; two 12 V lead acid batteries, each with 18o Ah capacity at 2o-hour rating

TRANSMISSION

Elastic clutch: Stromag "Periflex" PD-34

Clutch: "Fichtel i Sachs" - GN 42o KR;
dry, friction disc type single acting clutch;
disc with 42o/22o mm diameter;
pneumatić - hydraulic control, pedal operated

Gearbox: ZAHNRADFABRIK FRIEDRICHSHAFEN A.G.
ZF - 5K - 11o GPA
Gearbox and front and rear axle drive divider are dane as an unit;
gearbox (speed change gear) with five speeds, all gears synchronized, first gear used as creep gear, other as working gears;
speed selector of epicyclic (planetary) type and pneumatic control;
torque divider of epyciclic type with pneumatic controlled lock;
N° of speeds (totally):
8 + 1 forward
1 reverse

Front and rear axles with final drives: "RADOJE DAKIĆ" - Titograd, type m 14o
front axle fixed to the tractor's body, rear axle with ±15° stroke;
both axles are with bevel gear drive with crown wheel and pinion;
differentials are of bevel gear type, with ZF type differential lock;
epyciclic final drives.

Oil capacities:

Gearbox: 21 l of hypoid oil acc. to MIL-L- 21o5 B viscosity SAE 8o

Front and rear axles: 2 x 6o l of hypoid oil acc. to MIL-L-21o5 B viscosity SAE 9o

Oil changing period: 4oo hours for all gears

Total ratios and speeds

Group	Gear	Total ratio engine: driving wheel	Nominal travelling speed at rated engine speed km/h
Forward speeds			
Creep	1	255,65	2,45
Low	1	169,22	3,69
	2	124,39	5,03
	3	91,38	6,85
	4	66,96	9,34
High	1	49,41	12,66
	2	36,25	17,26
	3	26,71	23,43
	4	19,46	32,16
Reverse speed			
	1	227,03	2,75

Calculated with the rolling radius 830 mm, given in the tyre manufacturer's specification

Power lift:

Main hydraulic system: PPT - TRSTENIK; gear pump with 66 l/min delivery at rated engine speed, located on the right side, in front of the gearbox, V - belt driven from the clutch shaft; Working pressure up to 160 bar; two double acting rams with 90 mm bore and adjustable stroke between 20 and 225 mm; oil capacity 120 l; recommended oil John Deere J14B, MF M-1135 or engine oil HD SAE 20 W/20 acc. to MIL-L-2104 c; oil changing intervals every 500 working hours; strainer in oil reverse line (on the tank up panel), every 500 working hours maintained by washing

External hydraulic system:	Two paars of external tappings, pump and tank common with main hydraulic system
Implement linkage:	Three point linkage category III; (acc. to I.S.O. 730/1) lift rods adjustable from 735 mm to 865 mm; lifting range above ground: with short lift rods from 335 to 1095 mm with long lift rods from 120 to 880 mm (rear wheel radius 840 mm)
Swinging drawbar:	With fixed height, 590 mm above ground; the horizontal adjusments: in median plane and five 70 mm steps to either side; horizontal distance of clevis hole centre to rear axle centre 1080 mm; clevis hole diameter 35 mm; pivot position relative to rear axle: horizontal: in front 1250 mm vertical: below 200 mm
Steering:	Own make; separate oil circuite; PPT gear pump with 66 l/min delivery, two double acting rams with 80 mm bore and 340 mm stroke; The maximum working pressure 120 bar; Oil tank in common with power lift; the maximum angle of articulation to either side 42°.
Brakes:	"Radoje Dakić" - Titograd;
Service brake:	Disc pneumatically - hydraulically acting brakes on all wheels;
Parking brake:	Mechanically acting on the rear axle drive shaft; Oil capacity (for service brake) 2 x 0,5 l; recommended fluid - commercially available fluid-for hydraulic brakes;
Pneumatic system:	An engine driven compressor with 90 mm bore and 46 mm stroke;

Pneumatic system (continuation)	compressor speed 252o rev/min at rated engine speed (2oocrev/min); compressor capacity 4oo 1/min (at atmospheric pressure); control valve opening pressure 6,8 - 7,3 bar Two air tanks, each with 2o 1 capacity
Wheels:	All wheels 18,4-38; inner wheels 12 PR; outher 8 PR; dyagonal type tyre casing; maximum permissible load 238o daN at 1,1 bar inflation pressure; rims W 14L 38; track width: - inner 18oo mm - outer 3o8o mm
Wheel base:	315o mm; the distance from the axis of articulation: - front and rear 1575 mm
Seat:	Own make; upholstered seat with back rest; adjustable spring (6o to 12o kg) with shock absorber; for and aft adjustable about 125 mm
Lighting equipment:	Electrical, 24 Volt, negative earth

	Height above ground to centre cm	Diameter cm	Distance from outside edge of tractor to centre cm
Head lights	92	1o,5	163/145
Rear lights	18o	9	3o/43
Side lights	97	9	24; 16/32
Reflectors	22o	14	1o5

unrestricted beam angle of head lights in plan view 32 ± 3^{o}

Number of grease points:	- with grease	22
	- with oil	5

CONDITIONS DURING TEST

Masses

Tractor with tanks full

	Without driver	With driver
Front	6.84o kg	6.895 kg
Rear	4.95o kg	4.97o kg
Total	11.79o kg	11.865 kg

Note:
For this type of tractor manufacturer does not recommend any ballast

Wheel track (fixed)

Front and rear
- inner wheels 1.8oo mm
- outer wheels 3.o8o mm

Overall dimensions

Total length:	7.olo mm with horizontal lower links
Total width:	3.57o mm
Total height:	3.46o mm
Ground clearence:	61o mm below front and rear axle differentials 5o5 mm below swinging drawbar

FUELS AND LUBRICANTS USED IN TESTS

Fuel:	INA - Diesel D_2-fuel acc.to JUS B.H.2.411 in all tests; Specific gravity at 15°C: o,825 kg/l Viscosity at 15 °C: 4,9 cSt Cetane number: 58
Engine oil:	GALAX SUPER HD S3, SAE 3o
Transmission oil:	Gearbox - GALAX HIPOL, SAE 8o Driving axles - GALAX HIPOL B, SAE 9o
Hydraulic oil:	GALAX TRAKTOL HT

COMPULSORY TESTS

(1) ENGINE TEST

Date and location of test: 03.06.1980.
Institut za mehanisaciju poljoprivrede - Zemun

Type of dynamometer: Hydraulic brake SCHENCK U1-30

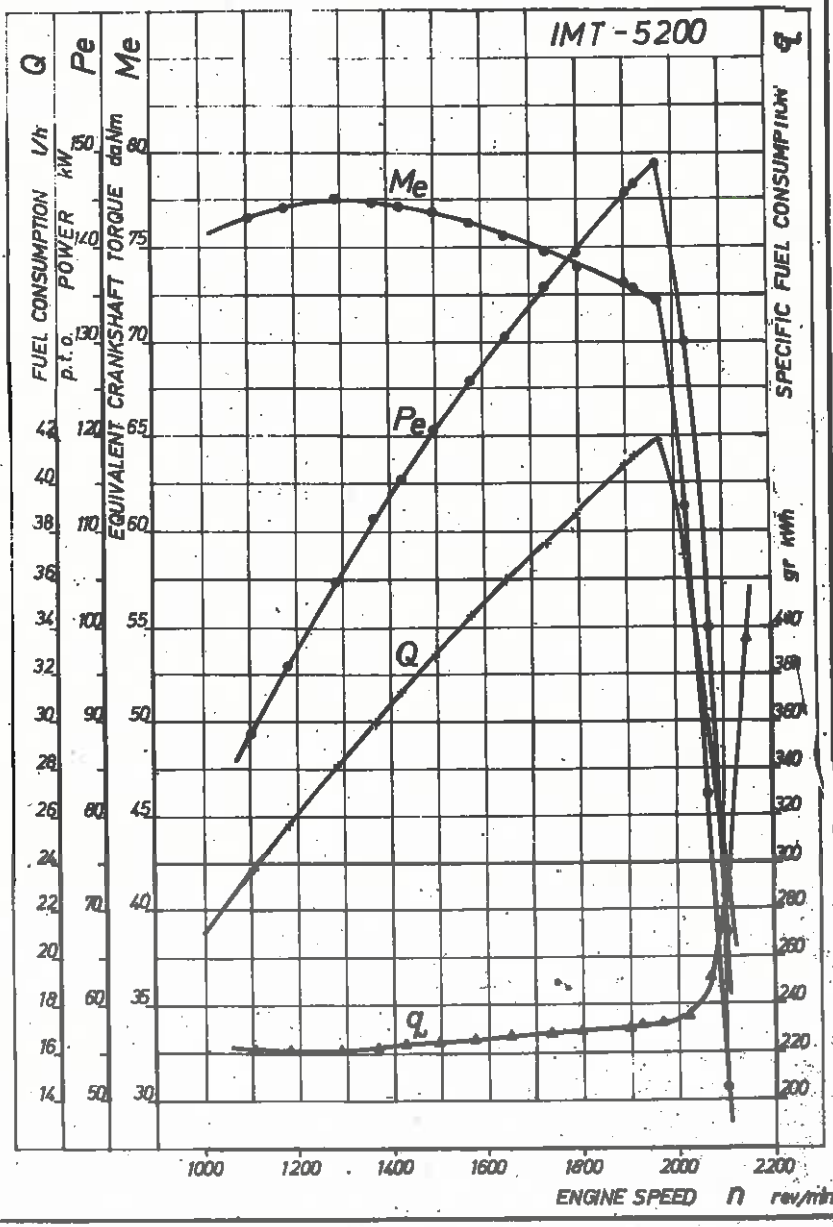
Power kW	Engine speed r.p.m.	Fuel consumption hourly l/h	Fuel consumption hourly kg/h	Fuel consumption specific kg/kWh	Specific energy kWh/l
MAXIMUM POWER - 2 hour test					
148,96	1971	41,87	34,50	0,232	3,56
THE SPEED RECOMENDED BY THE MANUFACTURER FOR DRAWBAR WORK					
148,96	1971	41,87	34,50	0,232	3,56
PART LOADS - with governor hand lever giving maximum power					
(i) 85 % of the torque at maximum power at 2-hour test					
129,95	2025	37,02	30,51	0,235	3,51
(ii) unloaded					
6,84	2162	11,46	9,44	-	-
(iii) 50 % of the load defined in (i)					
67,54	2105	23,57	19,42	0,288	2,87
(iv) maximum power					
148,96	1971	41,87	34,50	0,232	3,56
(v) 25 % of the load defined in (i)					
34,40	2154	16,47	13,57	0,394	2,09
(vi) 75 % of the load defined in (i)					
99,98	2071	30,41	25,06	0,251	3,29

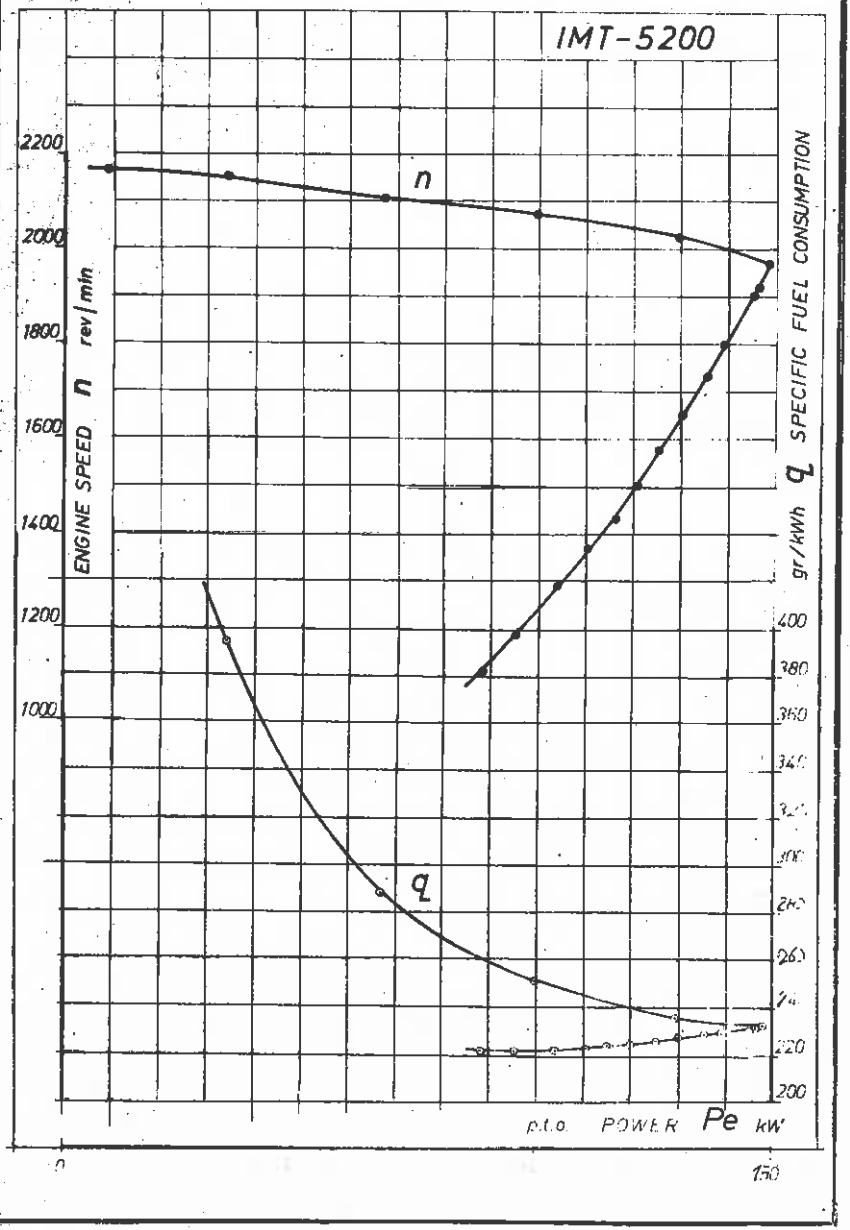
STANDARD SPECIFIC FUEL CONSUMPTION
0,235; 0,288 kg/kWh

No load, maximum engine speed:	2170 r.p.m.
Equivalent crankshaft torque at maximum power (2 hour test)	72,17 daNm
Maximum equivalent crankshaft torque:	77,57 daNm at 1290 r.p.m. of the engine
Mean atmospheric conditions:	
temperature	23 °C
pressure	1004 mbar
relative humidity	49 %
Maximum temperatures:	
coolant	83 °C
engine oil	90 °C
fuel	25 °C
intake air	27 °C

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10




IMT-5200
n
q
ENGINE SPEED n rev/min
SPECIFIC FUEL CONSUMPTION q gr/kWh
2200
2000
1800
1600
1400
1200
1000
400
380
360
200
p.t.o. POWER Pe kW
0
150

(2) DRAWBAR PERFORMANCE

Date of test 9. to 17. September 198o.

Type of track asphalt

Height of drawbar above ground 59o mm

Remark:

1. As recommended by the manufacturer, all test were done without additional ballast
2. The drawbar test was started with new, run-inn tyres

Gear No.	Speed km/h	Power kW	Drawbar pull daN	Engine speed r.p.m.	Wheel sleep %	Fuel kWh/l	consumpt. specific g/kWh	Temperatures Fuel °C	Co- olant °C	Oil °C	Atmospheric conditions Tempe- rature °C	Relati- ve hu- midity %	Pressure mbar
1	2	3	4	5	6	7	8	9	1o	11	12	13	14
			(1) MAXIMUM POWER					Front and rear tyre inflation pressure					1,o bar
1 L	3,1o	95,58	11.1oo	199o	15,o	2,36	o,35o	24	8o	85	21	63	1oo8
2 L	4,62	114,22	8.9oo	197o	6,3	2,71	o,3o3	24	82	84	21	63	1oo8
3 L	6,48	116,1o	6.45o	197o	3,9	2,76	o,297	27	85	9o	24	49	998
4 L	8,98	116,74	4.68o	197o	2,6	2,77	o,296	27	85	89	24	49	998
1 H	12,15	119,48	3,54o	197o	2,4	2,85	o,289	22	8o	85	2o	64	1oo7
2 H	16,8o	117,6o	2.52o	197o	1,6	2,81	o,294	22	8o	84	2o	64	1oo7
3 H	22,85	114,25	1.8oo	197o	1,1	2,73	o,3o2	24	8o	85	25	56	1oo5
4 H	31,45	1o6,58	1.22o	197o	o,8	2,54	o,324	24	8o	85	25	56	1oo5

1	2	3	4	5	6	7	8	9	1o	11	12	13	14
	(ii) FIVE HOUR TEST at 75 % of the drawbar pull at maximum power in 3 L gear												
3 L	6,72	9o,53	485o	2o3o	2,8	2,55	o,322	27	83	88	22	53	1oo3
	(iii) FIVE HOUR TEST at pull corresponding to 15 % wheel slip												
1 L	-	-	11.ooo	-	-	-	-	28	86	9o	23	5o	1oo3

Remark: Five hour test at pull corresponding to 15 % wheelslip (iii) was carried out with additional ballast. Therefore results of test for power, wheelslip, speed and fuel consumption would not have any practical importance.

Total oil consumption during ten hours duration of tests (ii) and (iii) was 79 g/h

(3) TURNING SPACE AND TURNING CIRCLE

Details of wheel equipment: Front nad rear dual tyres 18,4 - 38

Track of wheels: Front and rear
- inner 1800 mm
- outer 3080 mm

	Without brakes	
	Right land m	Left hand m
Radius of turning circle (outer wheels)	5,80	6,05
Radius of turning space	6,09	6,33

Remark: There is not possibility of separate braking of lefthand or righthand wheels.

(4) LOCATION OF CENTRE OF GRAVITY

Height above ground: not measured

Distance forward from the rear axle centre: 1831 mm

Distance from the tractor's median plane
- with parallel wheels 8 mm to the left
- with the wheels articulated to the left 25 mm to the right
- with the wheels articulated to the right 32 mm to the left

(5) BRAKING PERFORMANCE

Date of test: 2o. and 21. May 1981.

Type of track: asphalt

Tractor masses during brake tests

Front	Rear	Total
6.895 kg	4.97o kg	11.865 kg

Remark: The manufacturer does not recommend any ballast for this type of tractor

Type O (ordinary cold service braking device performance) test

Speed before application of brakes 32,2 km/h

Braking device control force daN	3o	32	36	4o	44	48
Mean deceleration m/s^2	1,82	2,o7	2,52	2,68	2,78	2,85

Type I (fade) test

Braking device control force daN	3o	35	4o	45	5o	6o
Mean deceleration m/s^2	1,75	2,o6	2,51	2,66	2,7o	2,7o

Maximum deviation of tractor from its original course: less than 1 m

The brakes were heated by: 2o brakings from maximum speed

Parking braking device test

Tractor facing up and down 18 % slope: Satisfactory, braking force 4o daN

Tractor facing up and down 12 % slope with 3 t trailer: satisfactory, braking force 36 daN

(6) MEASUREMENT OF EXTERNAL NOISE LEVEL

Date of test: 14th of May 1981.
Type of sound level meter: BRUEL &.KJAER mod.2209
Type of track: Tarmacadam

Results of test:

Gear: 4 h
Travelling speed before acceleration: 24 km/h
Sound level: 86,8 dB(A), at the right hand side of the tractor

(7) NOISE MEASUREMENT AT THE DRIVER'S EAR

Date of test: 14th of May 1981.
Type of sound level meter: BRUEL &.KJAER mod.2209
Type of track: Tarmacadam
Cab fitted: Yes

Results of test: (all openings closed)

Gear	Drawbar pull at which the tractor develops the maximum sound level	Measured travelling speed	Sound level
-	daN	km/h	dB(A)
1 L	11.000	3,1	84,8
2 L	8.500	4,7	84,9
3 L+)	6.200	6,6	85,8
4 L	4.500	9,0	85,9
1 H	3.500	12,2	85,6
2 H	2.450	16,9	85,8
3 H	1.750	23,0	86,3
4 H	light load	31,9	87,1

+) The 3rd low 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 - 12th June 1981.
Laboratory of IMP - Zemun

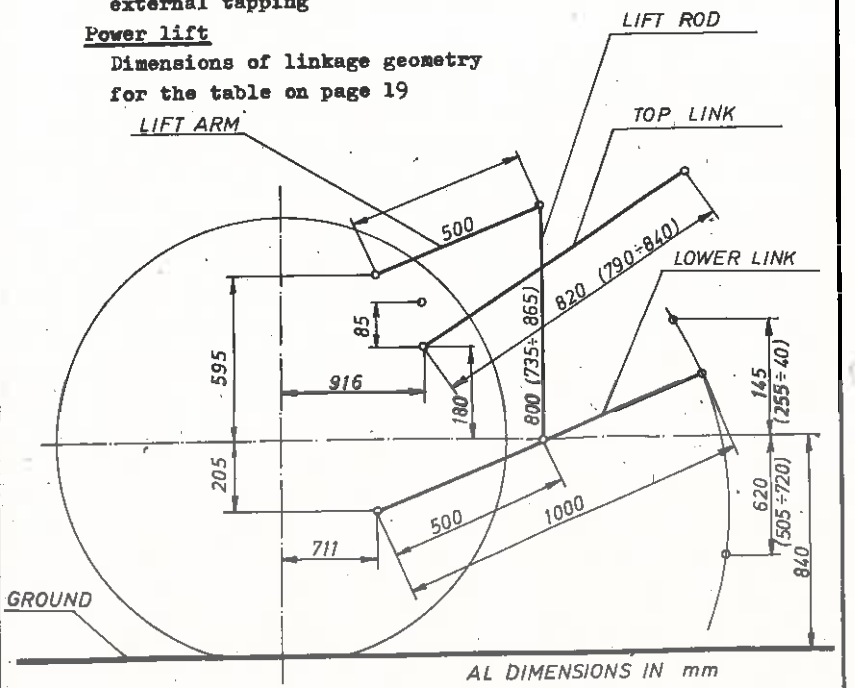
Hydraulic pump performance

(1) Opening pressure of the relief valve	159 bar
Pressure sustained by the open relief valve	155 bar
(2) Pump delivery rate at minimum pressure, governor control lever set for max. power	68 l/min
(3) Pump delivery rate at 90 % of relief valve opening pressure (0,9x160 = 144 bar)	64,5 l/min
(4) Hydraulic power at 90 % of relief valve setting	15,5 kW

Note:
All measurements are made on the first external tapping

Power lift

Dimensions of linkage geometry for the table on page 19



LIFTING FORCES

Lifting heights relative to horizontal lower links

mm	-485	-415	-4oo	-3oo	-2oo	-1oo	0	1oo	2oo	3oo	35o	4oo	455
	At hitch points												
daN	-	558o	557o	556o	555o	555o	555o	555o	554o	551o	548o	-	-
	At standard test frame												
daN	426o	-	423o	42oo	417o	415o	414o	414o	412o	41oo	-	4o9o	4o4o

Note:

1° The forces are measured with the relief valve fully open (pressure 155 bar) and calculated to the pressure 144 bar, which corresponds to 9o % of manufacturer's specification (16o bar)

2° During all power lift and hydraulic pump test the oil temperature was between 6o-67 °C

3° During the test with standard frame the top link pivot point was 916 mm behind and 18o mm above rear axle axis, and the tilting angle of mast over the range of tilt (measured from horizontal position of lower links) was about 12°

4° The calculated moment around rear axle, resulted from maximum lifting force (435o daN) exerted on the frame through the full range of movement and hydraulic pressure 155 bar, is 1o.o9o daNm.

LINKAGE GEOMETRY

When connected to the standard frame	Category III linkage	
Projected lenght in side view		
- lower links	1ooo mm	
- lift arms	5oo mm	
- lift rods	8oo mm	(735 - 865 mm)
- top link	82o mm	(79o - 84o mm)
Distance of lift rod connection point from pivot point of lower link	5oo mm	

The following dimensions are given relative to the rear wheel centre line, situated 84o mm above ground level:

- lower link pivot point	711 mm behind	2o5 mm below
- top link pivot point	916 mm behind	18o mm above (and 265 mm above)
- lift arm pivot point	711 mm behind	595 mm above
- maximum and minimum height of lower link hitch points	62o mm below (5o5/72o mm below),	145 mm above (255/4o mm above)

Height of lower link hitch points when locked in transport position: 985 mm (1o95/88o mm)