Report on test in accordance with O.E.C.D STANDARD CODE

Restricted Code

O.E.C.D. No. **1095**



Agricultural Tractor JOHN DEERE 2355 CS (2WD)

Manufacturer

John Deere Werke Mannheim
D-6800 Mannheim

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This bulletin is based on engineering tests in accordance with the O.E.C.D. RESTRICTED STANDARD CODE for the Official Testing of Agricultural Tractor Performance, C (84) 163 (Final), Appendix IV.

Duration of Tests: June till August 1987
DLG-Testing-Station for Agricultural Machinery, Max-Eyth-Weg 1,
D-6114 Groß-Umstadt

This report has been approved by the O.E.C.D. Coordinating 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: 16th October 1987

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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 daN = 10 N	=	1,02 kp	or 1 kp	= 0,981 daN
Powers	1 kw	=	1,36 PS	or 1 PS	= 0,376 kW
Pressure	1 bar	=	1,02 kp/cm^2	or 1 kp/cm^2	= 0,981 bar
	1000 mbar	=	750,10 mm Hg		

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PRÜFUNGS-ABTEILUNG
JOHN DEERE 2355 CS

Test No. 87-146

Tractor manufacturer:	John Deere Werke Mannheim D-6800 Mannheim
Submitted for test by:	Manufacturer
Selected by:	Manufacturer with agreement by DLG
Place of running-in:	Mannheim and Groß-Umstadt
Duration of running-in:	Engine appr. 60 hours tractor appr. 30 hours

SPECIFICATION OF TRACTOR

Tractor

Make:	JOHN DEERE
Trade denomination:	2355 CS
Type:	Wheel tractor, unit construction, 2WD
Serial No.:	610 679
Start of series:	600 001

Engine

Make:	JOHN DEERE
Model:	4.239 DL 007
Type:	Watercooled 4-stroke Diesel-engine with direct injection
Serial No.:	CD 4.239 D 732 696
Cylinders:	4, vertical in line, bore 106,5 mm, stroke 110 mm, displacement 3920 cm^3; compression ratio 17,8:1; wet cylinder liners, replaceable.
Valves:	Overhead
Fuel system:	SOFABEX fuel supply pump; CAV-ROTO DIESEL distributor pump RE 11803/R 3448 FO40, serial no. 26509 BEG, with injection timing device; manufacturer's production setting 45±2 mm^3 per stroke at rated engine speed and full load; injection timing 13+7° before TDC; STANADYNE multihole injection nozzles 27333, injection pressure 210±3 bar; STANADYNE fuel filter with replaceable two-stage paper element; fuel tank with 84 l capacity

Governor:	CAV-ROTO DIESEL centrifugal variable speed governor, governed range of engine speed 800 to 2620 r/min, rated engine speed 2500 r/min
Air cleaner:	Cyclone precleaner, incorporated in main cleaner, PUROLATOR dry paper element filter with main cartridge AZ 20623 and safety cartridge AF 3588; maintenance indicator lamp; air intake below bonnet
Exhaust silencer:	EBERSPÄCHER, AL 31492 multi-chamber absorption-expansion type, 160x220 mm oval, 383 mm long, below bonnet; mouth showing upwards, 2595 mm above ground
Lubrication system:	Forced-feed lubrication with gear pump, PUROLATOR oil filter T 19044 in full flow, replaceable; oil capacity 10 l, specified oil viscosities: winter SAE 10W/30, summer SAE 15W/40, tropics SAE 20W/40 oil and filter change every 200 operating hours; engine oil-cooling water heat exchanger between oil filter and filter socket
Cooling system:	Water cooling with impeller pump, overpressure relief valve set to 0,6±0,1 bar, cooling circuit with thermostat and by-pass; V-belt driven fan, 482 mm dia, 5 blades; water capacity 13 l
Starting system:	Electrical; BOSCH solenoid pre-engaged-drive starting motor 2,7 kW; BERU heating spiral in intake pipe; range gear shift lever in neutral position as safety device

Electrical equipment:	12 Volt, negative earth, BOSCH 3-phase alternator K1-14V 23/55 A, 770 W; 2 lead acid batteries, 55 Ah each at 20 hours rating

Transmission

Clutch:	F & S dry single-plate clutch for travel drive, 320 mm dia, mechanically actuated by pedal
Gear box:	JOHN DEERE, model CST; collar shifted speed change gear with 4 speeds; collar shifted range gear with 2 forward ranges (I and II) and 1 reverse range (R); total 8 forward and 4 reverse speeds, 2 shift levers
Rear axle with final drives:	JOHN DEERE bevel gear, bevel gear differential with lever or pedal operated lock, self-disengaging; planetary final drives
Front axle:	JOHN DEERE, not propelled
Lubrication:	Gear box, rear axle, rear final drives and hydraulic system have oil in common; transmission with forced feed lubrication; internal-gear pump within gear box, 2 oil filters, oil radiator in front of water radiator; filter change every 600 hours

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Transmission oil:

	Oil quality API MIL-L-	Oil viscosity SAE	Oil volume l	Change interval h
Gear box, rear axle, hydraulic system, rear final drives	JOHN DEERE specif. J 20 A	75	43	1200

Total ratios and speeds

Range	Gear	Total ratio engine : driving wheel	Nominal travelling speed *) at rated engine speed km/h
I	1	267,85	2,45
	2	187,49	3,49
	3	126,35	5,18
	4	90,40	7,25
II	1	68,25	9,60
	2	47,78	13,71
	3	32,20	20,34
	4	23,04	28,44
R	1	230,49	2,84
	2	161,34	4,06
	3	108,73	6,02
	4	77,79	8,42

*) calculated with the radius index 695 mm

Main p.t.o.

Independent,
driven by wet multi-plate clutch with 133 mm dia, hydraulically operated by lever and control valve, hydraulically operating p.t.o. brake;
1 p.t.o. shaft at rear of tractor, 624 mm above ground, 25 mm to the left of tractor's median plane;
direction of rotation clockwise, viewed facing tractor's rear;
p.t.o. 422 mm behind rear wheel centre line, 35 mm dia, 6 splines, DIN 9611/ISO 500 type 1

P.t.o. type	P.t.o. speed r/min	Engine speed r/min	Ratio engine : P.t.o.	Power restriction kW
540	540	2382	4,4118	-
	567	2500		

Power lift

JOHN DEERE
hydraulic power lift, unit construction;
draft- and position-control, both mixable in steps, floating position;
lowering throttle; lower link sensing

Hydraulic system:

Closed centre system;
JOHN DEERE RP 2023 COE 0100
variable-capacity radial-piston pump, directly driven by engine, feeds power lift and steering system,
max. delivery 51 l/min at rated engine speed; the transmission oil pump (see page 6) offers hydraulic pressure for actuating of p.t.o. clutch and feeds the radial-piston pump;

JOHN DEERE control valve,
relief valve pressure setting 160±3 bar;
single acting cylinder with 126 mm stroke and 100 mm bore;
safety valve set to 230 bar

1 double acting JOHN DEERE additional control valve with 2 couplings at tractor's rear;
up to 10 l oil may be taken off working travelling and 14 l stationary

Hydraulic oil: In common with gear box, see page 6

Implement linkage: See page 10 and 11

Pull attachments

Trailer hitch: Not fitted

Holed drawbar: Not fitted

Swinging drawbar:

Shiftable and turnable		
height above ground		390 or 520 mm
pivot point before rear wheel centre line		51 mm
hitch point behind rear wheel centre line	634,	782 or 824 mm
behind p.t.o. shaft	212,	360 or 402 mm
swingable to both sides about max.		290 mm
hitch hole diameter		33 mm
max. permissible vertical load (fully retracted)		1000 kg

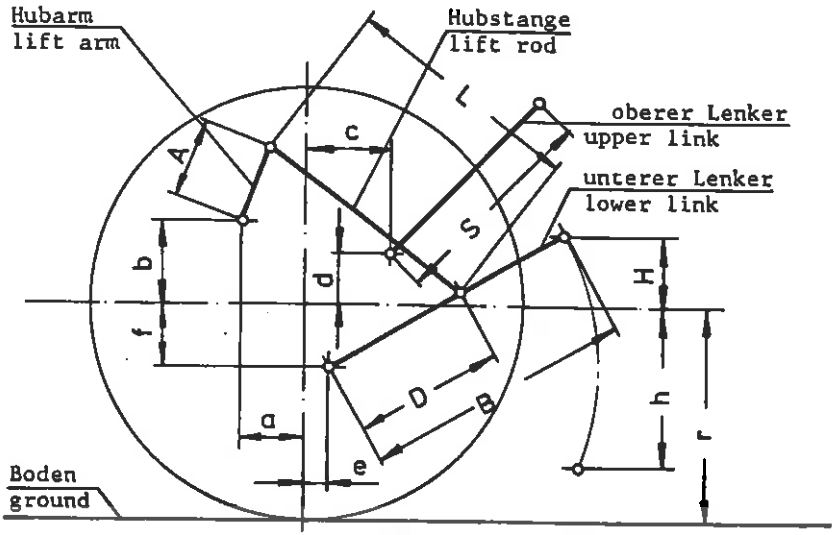
Towing hitch: Not fitted

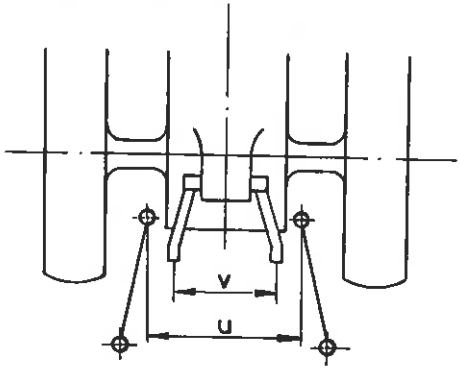
Steering: JOHN DEERE, POWER STEERING
mechanically acting,
hydraulically assisted;
connected by sequence valve to the hydraulic system of the tractor;
max. pressure 160±3 bar

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Implement linkage: Three point linkage couplers category 2 acc. to ISO 730/I DIN 9674, category 1 is possible by turning the lower links





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Dimensions of rear implement linkage (projected lengths in mm, underlined dimensions are valid for power lift measurements p. 19)

Rear tyres	radius index	(r)	695
Front tyres	radius index	(r')	376
Length of lift arms		(A)	254
Length of lower links		(B)	858
Distance of lift arm pivot points from rear axle centre	horizontal	(a)	-7
	vertical	(b)	277
Horizontal distance between lower link pivot points		(u)	395
Horizontal distance between lift arm end points		(v)	495
Length of upper link		(S)	540 to 780, <u>675</u>
Distance of upper link pivot point from rear axle centre	horizontal	(c)	321
	vertical	(d)	163
Distance of lower link pivot point from rear axle centre	horizontal	(e)	115
	vertical	(f)	200
Distance of lower link pivot points from lift rod pivot points on lower links		(D)	465
Length of lift rods		(L)	566 to 684, <u>670</u>

Height of lower link hitch points relative to rear axle centre line (situated 695 mm above ground), these data are valid for unloaded power lift:

Length of lift rods	(L)	<u>670</u>	566	684
Linkage distance of lift rods	(D)	465		
Lowest position	(h)	495	265	530
Highest position	(H)	113	275	80
Transport position	(H')	113	275	80

Type of transport lock: Lowering throttle and latching of control valve lever

Brakes

Service brake:	JOHN DEERE pedal operated muscle power brake with hydraulic transmission, using oil from gear box, acting on rear wheels; oil-immersed disc brake with 1 ring-piston on each differential half shaft, self readjusting; disc diameter 304 mm
Parking brake:	Mechanical wet V-band brake, acting on bevel wheel of differential, drum diameter 238 mm, width 20 mm, operated by lever with ratchet
Steering brake:	Divided pedal of service brake, for normal use locked together
Trailer braking take-off:	Not provided

Wheels

Steered wheels:	At front, 2 cross-ply tyres 7.50-16 6ply GOODYEAR; max. permissible load per tyre 748 kg at 3,0 bar and 30 km/h; track width 1450 mm, adjustable from 1450 to 2000 mm in steps of 50 mm each by extending telescopic front axle and reversing the wheels; rims 5.5 F x 16
Driving wheels:	At rear, 2 cross-ply tyres 16.9-30 6ply FIRESTONE; max. permissible load per tyre 1900 kg at 1,3 bar and 30 km/h; track width 1635 mm, infinitely adjustable by rack-and-pinion axle and reversing the rims or the wheel discs, from 1520 mm to 2440 mm; rims DW 15 x 30
Wheel base:	2279 mm

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Protective frame — JOHN DEERE, model ROLL-GARD
2 post frame, not O.E.C.D. tested

Seat — GRAMMER, model DS 44/2H-4
upholstered seat with back rest and integral arm rests, adjustable spring suspension and hydraulic shock absorber; driver's platform 790 mm above ground, height of unloaded seat above platform steplessly adjustable from 540 to 640 mm, longitudinal adjustment 150 mm;
1 step, 530 mm above ground;

Lighting equipment — Electrical, 12 Volt,
as per US legislation

	Dimensions mm	Height above ground of centre mm	Distance from outside edge of tractor to centre mm
Headlights	100 dia	1490	455
Side-(Warning) lights	100 dia	1640	520
Rearlights *)	100 dia	1450	760
Reflectors (ring-shaped)	135/100 dia	1640	520

additional SMV-sign

*) only 1 rearlight on the left hand side

Running time meter — Electronic, counts real operating hours if engine is running

Overall dimensions

Total length:	3683 mm
Total width:	2270 mm
Total height:	2310 mm to top of frame 2595 mm to top of exhaust
Ground clearance:	400 mm below swinging drawbar bracket

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Permissible tyre combinations

x permissible - unauthorized

Rear tyres	Front tyres					
	27/9.5-15	9.5L-15	11L-15	6.50-16	7.50-16	10.00-16
18.4-16.1	x	-	-	-	-	-
21.5L-16.1	x	-	-	-	-	-
14.9-24	x	x	x	x	x	-
16.9-24	x	x	x	x	x	-
18.4-26	x	x	x	x	x	-
14.9-28	-	x	x	x	x	-
16.9-28	x	x	x	x	x	-
16.9-30	x	x	x	x	x	-
18.4-30	-	x	x	x	x	-
16.9-34	-	x	x	-	x	x
13.6-38	-	x	x	-	x	x
15.5-38	-	x	x	-	x	x

TEST CONDITIONS

Track setting: 1450 mm at front, 1635 mm at rear

Weights

	without driver	with driver
front	990 kg	995 kg
rear	2085 kg	2165 kg
total	3075 kg	3160 kg

Fuels and lubricants used in tests

Fuel: ARAL Diesel-fuel DIN 51601
density at 15°C at p.t.o. tests 0,836 kg/l
at drawbar tests 0,849 kg/l

Engine: FUCHS TITAN-UNIVERSAL SAE 15W/40

Transmission, rear axle and hydraulic system: JOHN DEERE RENOGEAR HYDRO J 20A

Grease: Multi-purpose grease

Number of grease points: 13

Repairs and remarks: None

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COMPULSORY TESTS

(1) MAIN POWER TAKE OFF PERFORMANCE (540 r/min)

Date of tests: 29th July 1987
Location of tests: DLG-Testing Station Groß-Umstadt
Type of dynamometer: SCHENCK hydraulic dynamometer U1-40

Power kW	speed engine r/min	speed p.t.o. r/min	fuel consumption hourly l/h	fuel consumption hourly kg/h	fuel consumption specific g/kWh	specific energy kWh/l
Maximum power						
At 2-hour test						
41,7	2500	567	12,98	10,85	260	3,22
At rated speed						
41,7	2500	567	12,98	10,85	260	3,22
At standard p.t.o. speed						
40,8	2382	540	12,42	10,38	254	3,29
Part loads, the governor hand lever in the position corresponding to maximum power at full load (curve a)						
(i) the torque corresponding to maximum power at rated speed						
41,7	2500	567	12,98	10,85	260	3,22
(ii) 85% of the torque obtained in (i)						
36,1	2544	577	11,71	9,79	271	3,08
(iii) 75% of the torque defined in (ii)						
27,3	2566	582	9,85	8,23	301	2,78
(iv) 50% of the torque defined in (ii)						
18,3	2576	584	8,07	6,75	369	2,26
(v) 25% of the torque defined in (ii)						
9,2	2592	588	6,35	5,31	576	1,45
(vi) unloaded						
-	2616	593	4,66	3,90	-	-

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Power kW	speed engine r/min	speed p.t.o. r/min	fuel consumption hourly l/h	fuel consumption hourly kg/h	fuel consumption specific g/kWh	specific energy kWh/l
Part loads, the governor hand lever in the position corresponding to the standard p.t.o. speed at full load (curve b)						
(i) the torque corresponding to maximum power						
40,8	2382	540	12,42	10,38	254	3,29
(ii) 85% of the torque obtained in (i)						
35,2	2413	547	11,11	9,29	264	3,17
(iii) 75% of the torque defined in (ii)						
26,5	2424	549	9,21	7,70	291	2,87
(iv) 50% of the torque defined in (ii)						
17,9	2447	555	7,55	6,32	354	2,36
(v) 25% of the torque defined in (ii)						
9,0	2461	558	5,83	4,88	543	1,54
(vi) unloaded						
-	2480	562	4,25	3,55	-	-

Standard specific fuel consumption (g/kWh): 271/369/264/354

No load maximum engine speed: 2616 r/min
Equivalent flywheel torque at rated engine speed: 159 Nm
Maximum equivalent flywheel torque: 191 Nm at 1616 r/min of the engine

Mean atmospheric conditions

temperature	28 °C
pressure	996 mbar
rel. humidity	45 %

Maximum temperatures

coolant	85 °C
oil	105 °C
fuel	28 °C
air intake	28 °C

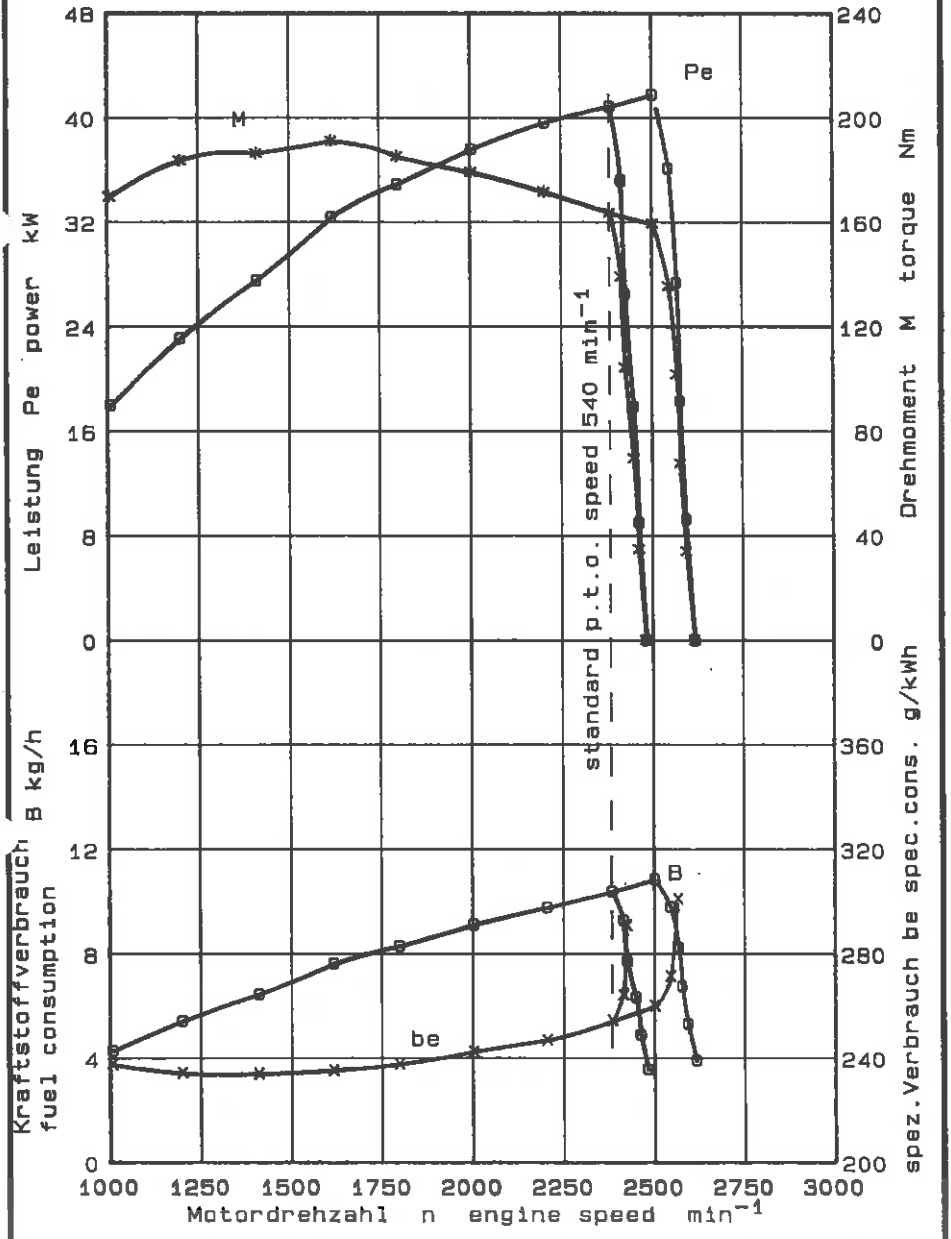
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Zapfwellenmessung

p.t.o. test



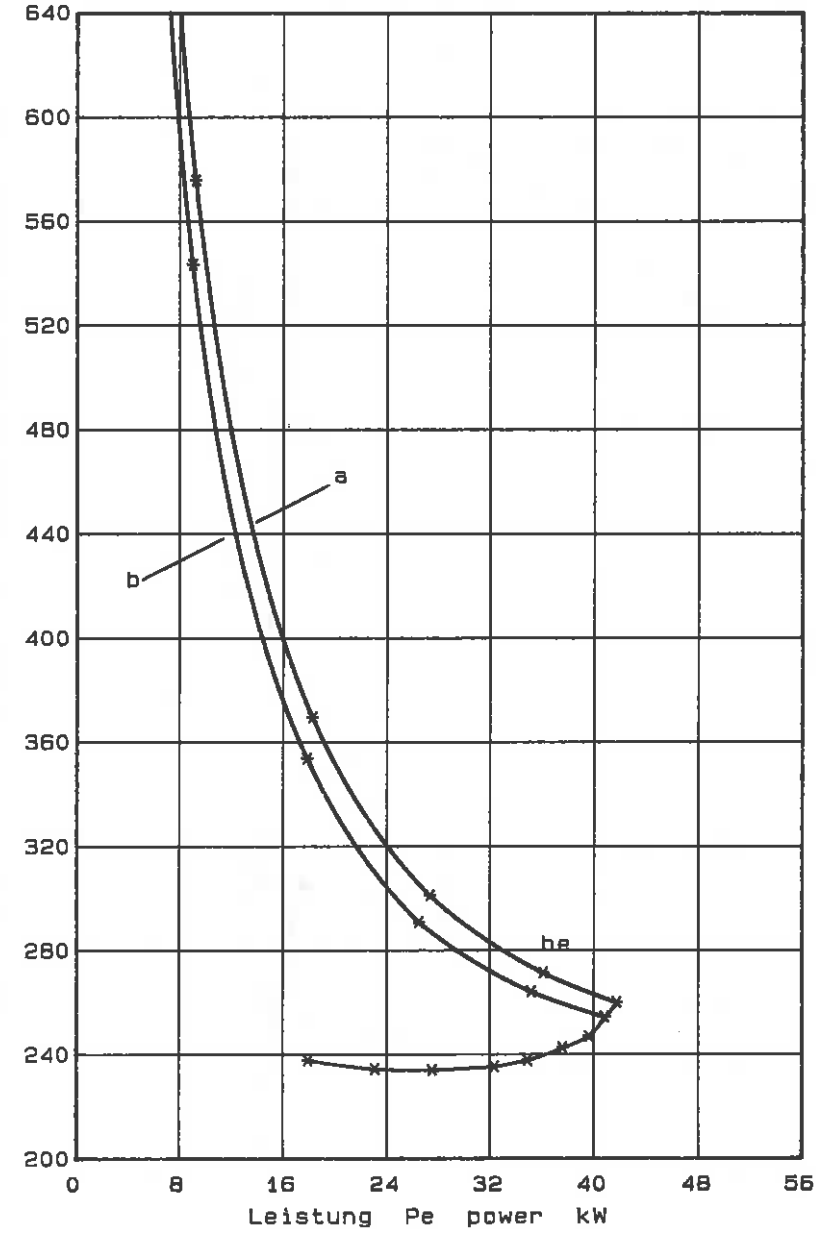
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Zapfwellenmessung

p.t.o. test



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(2) LIFTING FORCES AND HYDRAULIC POWER

Date of tests: 6th August 1987

Lifting Forces (Linkage dimensions: see pages 10 and 11)

	Height of lower hitch points above ground in down pos. mm	Vertical movement mm	Max. force exerted through full range daN	Corresp. pressure of hydraul. fluid bar	Moment about rear axle daNm	Max. tilt angle of mast over range of lift degrees
At hitch points	200	580	1520	132	-	-
On the frame	200	710	1390	132	2200	13

Temperature of hydraulic fluid at start of test 65 °C

Lifting heights relative to horizontal lower links

mm	-350	-300	-295	-200	-100	0	+100	+200	+285	+300	+360
Lifting forces at hitch points											
daN			1520	1755	1935	2045	2130	2185	2205		
Lifting forces at test frame											
daN	1390	1460		1570	1630	1660	1635	1605		1555	1505

Hydraulic Power

Sustained pressure with pump stalled 160 bar
Pump delivery rate at minimum pressure 55,5 l/min

	Hydraulic power kW	Flow rate l/min	Pressure bar	Oil temperature °C
at 90% of the actual relief valve setting	6,9	28,8	144	65
maximum	11,4	51,9	132	65

Tapping point used for test: At rear of tractor
Return: At gear oil filter housing
(supply into pressure line of transmission oil pump)

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(3) DRAWBAR POWER AND FUEL CONSUMPTION (unballasted tractor)

Date of tests: 30th July 1987
Type of track: Concrete
Height of drawbar above ground: 500 mm

Gear	Driving speed km/h	Power kW	Drawbar pull daN	Engine speed r/min	Slip of wheels %
1 MAXIMUM POWER IN TESTED GEARS					
1 I	2,16	16,4	2725	2581	15,0
2 I	3,07	23,5	2755	2568	15,0
3 I	4,50	31,9	2554	2497	13,8
4 I	6,62	33,4	1818	2501	9,2
1 II	8,99	34,2	1368	2499	6,7
2 II	13,14	34,8	953	2501	4,6
2 FUEL CONSUMPTION					
2.1 In selected gear at maximum power					
2 II	13,14	34,8	953	2501	4,6
2.1.1 75% of pull at maximum power					
2 II	13,61	27,2	720	2559	3,4
2.1.2 50% of pull at maximum power					
2 II	13,85	18,5	480	2574	2,3
2.1.3 Next higher gear at reduced engine speed; same pull and					
3 II	13,71	27,2	713	1740	3,4
2.1.4 Next higher gear at reduced engine speed; same pull and					
3 II	13,73	18,3	479	1721	2,2
2.2 In selected gear nearest to 7,5 km/h					
4 I	6,62	33,4	1818	2501	9,2
2.2.1 75% of pull at maximum power					
4 I	6,95	26,5	1374	2559	6,8
2.2.2 50% of pull at maximum power					
4 I	7,19	18,1	907	2581	4,4
2.2.3 Next higher gear at reduced engine speed; same pull and					
1 II	6,93	26,5	1375	1928	6,8
2.2.4 Next higher gear at reduced engine speed; same pull and					
1 II	7,22	18,1	904	1959	4,4

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	Tyre size	Inflation pressure
Front:	7.50-16	1,8 bar
Rear:	16.9-30	1,0 bar

Tread bar height at the beginning of drawbar tests:
rear tyres: 92% of the value when new

Specific fuel consumpt. g/kWh	Specific energy kWh/l	Temperatures Fuel °C	Coolant °C	Engine-oil °C	Atmospheric conditions Tempe-rature °C	Relative humidity %	Pressure mbar
454	1,87	46	78	88	20	93	991
388	2,19	45	78	88	20	91	991
343	2,47	47	81	94	20	88	991
327	2,59	52	81	94	21	86	991
320	2,66	52	80	94	21	84	991
312	2,72	53	81	94	21	88	991
312	2,72	53	81	94	21	88	991
341	2,49	52	80	92	21	86	991
411	2,07	52	80	92	21	86	991
travelling speed as in 2.1.1							
290	2,93	50	80	90	21	83	991
travelling speed as in 2.1.2							
322	2,64	50	80	90	21	83	991
327	2,59	52	81	94	21	86	991
349	2,43	50	78	94	20	94	991
415	2,05	50	78	94	20	94	991
travelling speed as in 2.2.1							
301	2,82	50	78	87	22	80	991
travelling speed as in 2.2.2							
336	2,53	50	78	87	22	80	991

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ADDITIONAL TESTS

(4) NOISE AT THE DRIVER'S EAR

Date of tests: 31st July 1987
Type of track: Concrete
Type of sound level meter: BRÜEL & KJAER model 2209

Tractor fitted with JOHN DEERE protective frame ROLL GARD

Results of tests

Gear	Drawbar pull at which the tractor develops the maximum sound level daN	Travelling speed nominal km/h	Travelling speed effective km/h	Sound level dB(A)
1 I	2663	2,45	2,17	91,0
2 I	2696	3,49	3,05	92,5
3 I	2545	5,18	4,47	93,0
4 I +)	1814	7,25	6,61	93,5
4 I +)	light load	7,25	7,62	90,0
1 II	1354	9,60	9,01	93,5
2 II	947	13,71	13,15	93,0
4 II	light load	28,44	29,73	91,0

+) The 4 I gear corresponds to the nominal speed nearest to 7,5 km/h

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