297/O.E.C.D.

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

EICHER PUMA II, ES 400, TYPE 3701

Manufactured by:

Gebr. Eicher Traktoren- und Landmaschinenwerke. Forstern/Obb.



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

Date of Approval: 31-12-1959 *Serial No.: 297*

INSTITUUT VOOR LANDBOUWTECHNIEK EN RATIONALISATIE
DR. S. L. MANSHOLTLAAN 12 - WAGENINGEN

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Power take off test
curves of power-off-horse power, torque, fuel consumption, specific fuel consumption/engine speed.

Drawbar test with ballast
curves of drawbar horse power and wheelslip/drawbar pull curves.

Drawbar test without ballast
curves of drawbar horse power and wheelslip/drawbar pull.

Spec. Fuel consumption and travelling speed

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

Part I SPECIMEN TEST REPORT

Tractors manufacturer's name and address: Gebr. Eicher, Traktoren- und Landmaschinenwerke, 8011 Forstern.
Submitted for test by: Manufacturer.
Selected by: Manufacturer, in accordance with testing station.
Place of running-in: by Manufacturer.
Duration of running-in: 16,5 h.

SPECIFICATION OF TRACTOR

Tractor

make: Eicher
model: Puma 2, ES 400
type: 3701
Serial no.: 117413

Motor

make: Eicher
model: four-stroke diesel
type: EDK 3-3
Serial no.: 107320

Cylinders

number: 3
disposition: in line
bore/stroke: 100/125 mm
capacity: 2944 cm^3
compression ratio: 20,4 : 1
arrangement of valves: overhead valves
cylinder liners: replaceable Alfin cylinders with cooling ribs

Fuel and ignition system

type of fuel feed: commercial diesel fuel
make, type and model of fuel filters: Knecht FB 716/1 MM with replaceable fine paper element
capacity of fuel tank: 36 l

make, type and model of injection pump: Kugelfischer PSAFE 13-22.28 A plunjer line pump
Serial no.: 8 P 00757
manufacturer's production setting: 23° (+ 1°) before top dead centre
make, type and model of injectors: Kugelfischer DFO 40 A
manufacturer's production setting: 140 + 5 atm

Governor

make: Eicher
type: centrifugal governor
range of speed: 600 - 2140 rev/min engine speed
rated speeds: 2000 rev/min

Air cleaner

main: oil bath filter
make: Mann and Hummel
type: 310 4075 094
oil capacity: 0.9 l

Pre cleaner

main: centrifugal pre-cleaner
make: Mann and Hummel
type: 480 3667 160

Lubrication system

type: forced feed from gear pump
type and number of filters: full flow, replaceable paper filter
oil capacity: 9.5 l
changing period: 200 h

Cooling system

type: air cooled
details of pump and fan: three separate blowers on one shaft, driven by V-belt
coolant capacity: -
means of temperature control: distance thermometer
pressure details: -

Electrical system

Voltage: 12 V

Generator: DC generator

make: Bosch
type: 0101 209 032

Battery

main: accumulator lead
make: Mittermaier
type: 12D90
capacity: 90 Ah

Starting system

main: electric starting
make: Bosch
type: 0001 359 006
aids for cold starting: means of a hand fuel pump

Transmission

clutch: dry clutch with two functions: 1. transmission
2. p.t.o.
make: Fichtel und Sachs
type and size: DO 250/255 K
method of operation: clutch pedal

Gearbox

make: Zahnradfabrik Friedrichshafen
type: A 210/11
No. of speeds: 8 forward speeds and 4 reverse

Rear axle and final drive

make: Zahnradfabrik Friedrichshafen
type: -
differential look: Zahnradfabrik Friedrichshafen
type: -
method of operating look: by foot pedal
details of transmission if other than above: final reduction gear with planet gear

Oil capacity

gearbox: and differential gear 13.0 type:
rear axle: per planet gear 1,75 type: gear oil SAE 80
final drive(s): -
change period: 1000 h or at least once a year

Gear No.	Number of engine revolutions for one revolution wheel or sprocket	Nominal travelling speed for rated speed of engine, m.p./h.(km/h)	Travelling speed for max. engine speed	Travelling speed for rated engine speed
1 L	354,38	1,14	1,26/2213	1,14
2 L	207,21	1,94	2,15/2209	1,95
3 L	126,27	3,19	3,54/2209	3,20
4 L	77,89	5,17	5,70/2210	5,19
1 H	98,45	4,09	4,56/2210	4,13
2 H	57,57	7,00	7,74/2204	7,03
3 H	35,08	11,49	12,59/2190	11,49
4 H	21,65	18,62	20,10/2162	18,64
Reverse 1	197,15	2,04	The values, given in these two columns are measured by the testing station, the others are given by the manufacturer.	
2	115,14	3,50		
3	70,15	5,74		
4	43,30	9,31		

Power take-off

location: at rear of tractor
dimensions: 29 x 34,9 x 8,7 mm = 1 3/8"
no. of splines: 6
standard B.S.: 1495; ASAE 203.2; DIN 9611/Form A
height above ground: 422 mm
proportional engine speed: 558/1116 rev/min at 2000 rev/min engine speed
engine speed: 1935/1795 rev/min at standard p.t.o. speed 540/1000 rev/min
direction of rotation: clockwise viewed from driving end

Belt pulley

location. at rear of p.t.o. (not fitted on tested tractor, specification as given by manufacturer)
type: -
dimensions: 220 mm
diameter and width of face: 150 mm
speed-liner: 17,7 m/sec and: 1545 rev/min
at rated engine speed: 2000 rev/min, engine speed 1892,7 rev/min at standard linear speed 16,75 m/sec
direction of rotation: clockwise or anti-clockwise, depending on way of fitting

Power lift

make: ZF-Bosch-Eicher
type: hydraulic
oil capacity: 7,5 l motor oil SAE 20, change period 1500 h
category: Cat. I implement linkage, acc. DIN 9674
description of controls: single lever operation

Drawbars

implement linkage: three point linkage
height above ground max.: 860 mm min.: 50 mm
method of changing position by power lift and adjustable stay links
distance from central hole behind rear wheel centre: 807 mm
distance from central hole behind p.t.o.: 548 mm
lateral adjustment: none (swinging drawbar is not fitted)

Hitch

height above ground: 610, 660 or 710 mm
distance from rear axle: 411 mm
position relative to p.t.o.: 151 mm

Steering

make: ZF-Gemmer
type: 7337 900 138
method of operation: mechanical

Brakes

make: own make

type: internal shoe brakes
method of operation: by brake pedals. It is possible to couple the right and the left brake by turning the right brake pedal
type of parking brake: mechanical

Wheeled tractors

Steering wheels

number: 2
arrangement: at front
type of tyre(s): pneumatic tyres acc. DIN 7808
make: Firestone-Phoenix
size: 5.00 - 16
ply rating: 4
maximum permissible weight on each tyre: 350 kg at 2 atm.press.
track widths: normal 805 mm; changeable at 950, 1050, 1150 and 1250 mm
method of changing: by extending front axle

Driving wheels

number: 2
position: at rear
type of tyre(s): pneumatic tyres acc. DIN 7808
make: Vredestein
size: 12.4/11 - 24
ply rating: 6
rim size: W10 x 24
maximum permissible weight on each tyre: 1125 kg at 1,55 atm. pressure
track width: normal 780 mm, adjustable at 850, 910, 980, 1180 and 1250 mm
method of changing: reverseable discs and rims
wheelbase: 1998 mm

Weights

Tractor (without driver but with tanks full)

	Front	Rear	Total
Without ballast	534 kg	1088 kg	1622 kg
With ballast	627 kg	1255 kg	1882 kg

Ballast

	No. of weights	Total weight	Water
Front	1	77,5 kg	-
Rear	-	-	182,5 kg
Additional	-	-	-

Seat

make: Eicher
type of suspension: springs
type of damping: -
range of adjustments: -

Number of grease points (whole tractor): 20

Overall dimensions (mm)

	Length	Width	Height
With ballast	3180	at track width 780 mm 1080	steering wheel: 1220 passenger seat:
Without ballast	3180	at max. track width 1490	1220

special remarks: -

Lighting

Height above ground of centre		Diameter or dimension	Distance from outside edge of tractor to centre
	mm	mm	mm
Head Lights	862	144 x 75	402
Side Lights	1025	45 x 110	235
Rear Lights	1074	45 x 110	235
Reflectors	1074	100	140

Mirror and passenger seat: -

Remarks: -

Part II FUELS AND LUBRICANTS USED IN TESTS

TRACK TESTS/LABORATORY TESTS

Fuel: Shell automotive gas oil

type: Shell diesoline Specific gravity at 15° C: 0,83
octane or cetane number: 53
conforms to: -

Engine-oil

type: Motor oil HD Viscosity: SAE 20

Transmission-oil

type: gear oil Viscosity: SAE 80

Part III COMPULSORY TESTS

Date and location of tests: Aug. 1969, Wageningen
Type of dynamometer: 2 RT water brake

Horsepower (h.p.)	Speed		Fuel consumption		
	Engine rev/min	p.t.o. rev/min	Total l/h	Specific ghp/h	hp.h/l
Maximum power - 2 hours test					
44,7	2084,9	1161,5	10,7	199,5	4,17
Standard p.t.o. speed (540/1000 rev/min)					
41	1795	1000	9,62	194	4,29
The speed recommended by the manufacturer for drawbar work					
43,8	2000	1116	10,46	200	4,16
Part loads					
38,5	2110,9	1176	9,0	194,4	4,28
0	2206	1229	3,6	-	-
19,6	2150,4	1198	5,4	229,5	3,62
44,7	2084,9	1161,5	10,7	199,5	4,17
9,9	2171,9	1210	4,06	341,4	2,44
29,2	2132,5	1138	7,0	198,2	4,19

No loads maximum engine speed: 2206 rev/min
Equivalent crankshaft torque at maximum power: 15,32 kgm
Maximum equivalent crankshaft torque 16,71 kgm at 1437,8 rev/min of the engine

Mean atmospheric conditions: temperature 27 °C
pressure 758 (mm) Hg
relative humidity 73 %

Maximum temperature : coolant - °C
engine oil 87 °C
fuel 25 °C

(2) DRAWBAR PERFORMANCE

Date of tests: aug.-sept. 1969
Type of track: Concrete
Height of drawbar above ground: 530 mm

Gear number	Horse-power (h.p.)	Drawbar pull (kg)	Engine speed rev/min	Slip of wheels %	Fuel consumption	
					Drawbar horse-power h.p.h./l	Specific g h p.h.
MAXIMUM POWER (ballasted)						
1 1 L	5,5	1420	2181	16,6	-	-
2 2 L	9,7	1475	2180	16,8	1,79	457,4
3 3 L	13,8	1270	2157	15,5	2,44	335,6
4 4 L	22,0	1240	2136	13,7	2,92	281,6
5 1 H	17,8	1310	2141	16,8	2,68	305,9
6 2 H	29,8	1270	2105	14,4	3,03	270,3
7 3 H	35,5	850	2096	6,3	3,26	250,4
8 4 H	33,6	476	2093	2,7	3,2	257,2
FIVE HOUR TEST at 75 % of pull at maximum power						
1 H	13,3	880	2160	8,7	2,5	330,8
FIVE HOUR TEST at pull corresponding to 15 % wheelship in test (i)						
2 H	29,8	1270	2105	14,4	3,03	270,3
MAXIMUM POWER (unballasted)						
1 L	5,5	1375	2187	13,0	-	-
2 L	9,5	1400	2152	12,9	-	-
3 L	15,7	1440	2146,5	14,4	-	-
4 L	25,7	1460	2127	13,3	-	-
1 H	20,7	1500	2132	15,0	-	-
2 H	32,9	1410	2098	14,3	-	-
3 H	33,7	990	1702,5	6,4	-	-
4 H	34,5	510	2020	3,2	-	-

Temperature (°C)			Atmospheric conditions		
Fuel	Coolant	Engine oil	Temperature (°C)	Relative humidity %	Pressure in (mm) Hg
MAXIMUM POWER (ballasted)					
18	-	85	18,5	79,3	768
18	-	85	19,2	85,6	767
19	-	86	20,6	57,7	769
20	-	86	22,7	57	768
20	-	86	20,6	57,7	769
21	-	86	22,7	57	768
21	-	87	23,1	40,6	763
22	-	87	23,1	40,6	763
FIVE HOUR TEST at 75 % of pull at maximum power					
16	-	83	17,4	79	763
FIVE HOUR TEST at pull corresponding to 15 % wheelslip in test(1)					
16	-	86	15,8	75	763
MAXIMUM POWER (unballasted)					
16	-	84	16,6	88	761
18	-	84	19,7	68,3	761
18	-	85	19,7	68,3	761
19	-	85	21,5	66,7	759
18	-	84	19,7	68,3	761
19	-	85	21,5	66,7	759
19	-	86	21,5	66,7	759
19	-	85	21,5	66,7	759

(3) TURNING SPACE AND TURNING CIRCLE

Detail of wheel equipment: front: 5.00 - 16,4 PR; rear: 12,4/11 - 24,6 PR unballasted

Track of wheels - front 805 mm rear 780 mm

Results	With brakes		Without brakes	
	right-hand	left-hand	right-hand	left-hand
Radius of turning space mm	3215	3190	3555	3455
Radius of turning circle mm	3125	3100	3465	3365

(4) LOCATION OF CENTRE OF GRAVITY

Height above ground: 670 mm
Distance forward from the vertical plane containing the axis of the rear wheels : 660 mm
Distance from the medium plane: -

(5) BRAKING

date of test: Sept. 1969
type of track: Concrete
weight of ballasted tractor: 1882 kg

Cold brakes

	Ballasted	Without ballast
Travelling speed of the tractor	20 km/h	20 km/h
(I) deceleration m/sec^2	5,4	5,5
(II) stopping distance m	3,30	2,90
(III) force exerted on the brake pedal	70 kg	74 kg

Brake fade characteristics (hot tests)

deceleration hot/deceleration cold. 100 100 %
stopping distance cold/stopping distance/hot. 100 99 %
force on pedal, cold/force on pedal, hot. 100 100 %
efficiency of handbrake or parkinglatch: no rotation of the wheels
pull on handbrake (cold): 23 kg (hot): 23 kg

(6) MEASUREMENT OF AMBIENT NOISE EMITTED BY THE TRACTOR

Date of tests: 1-10-1969
Type of sound level meter: Rohde und Schwarz type EZGA
Type of track: Asphalt
Results of tests:
Gear: 6
Travelling speed: 14,0 km/h before acceleration
Sound level: Left side 88, right side 87 dBA

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

Date of tests: 1-10-1969

Type of sound level meter and octave filter: Rohde und Schwarz type EZGA

Type of track: Asphalt
Type of frequency analyser: Rohde und Schwarz type PBO
Results of tests:

Gear	Travelling speed (km/h)	Loudness sones
2 H	7,0	129

(8) POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date and location of tests: Oktober 1969, Wageningen
Hydraulic fluid: -
make and type: Motoroil
viscosity: SAE 20
viscosity index: -

	Vertical movement in (mm)	Maximum force exerted through full range (kg)	Pressure (kg/cm^2)
Linkage giving maximum mechanical advantage			
At lower hitch points (height above ground in down position 200 mm	570	1320	-
On the frame	745	745	-
Linkage giving minimum mechanical advantage			
At lower hitch points (height above ground in down position 60 mm	630	1185	-
On the frame	780	685	-

Type of linkage lock for transport: hydraulic

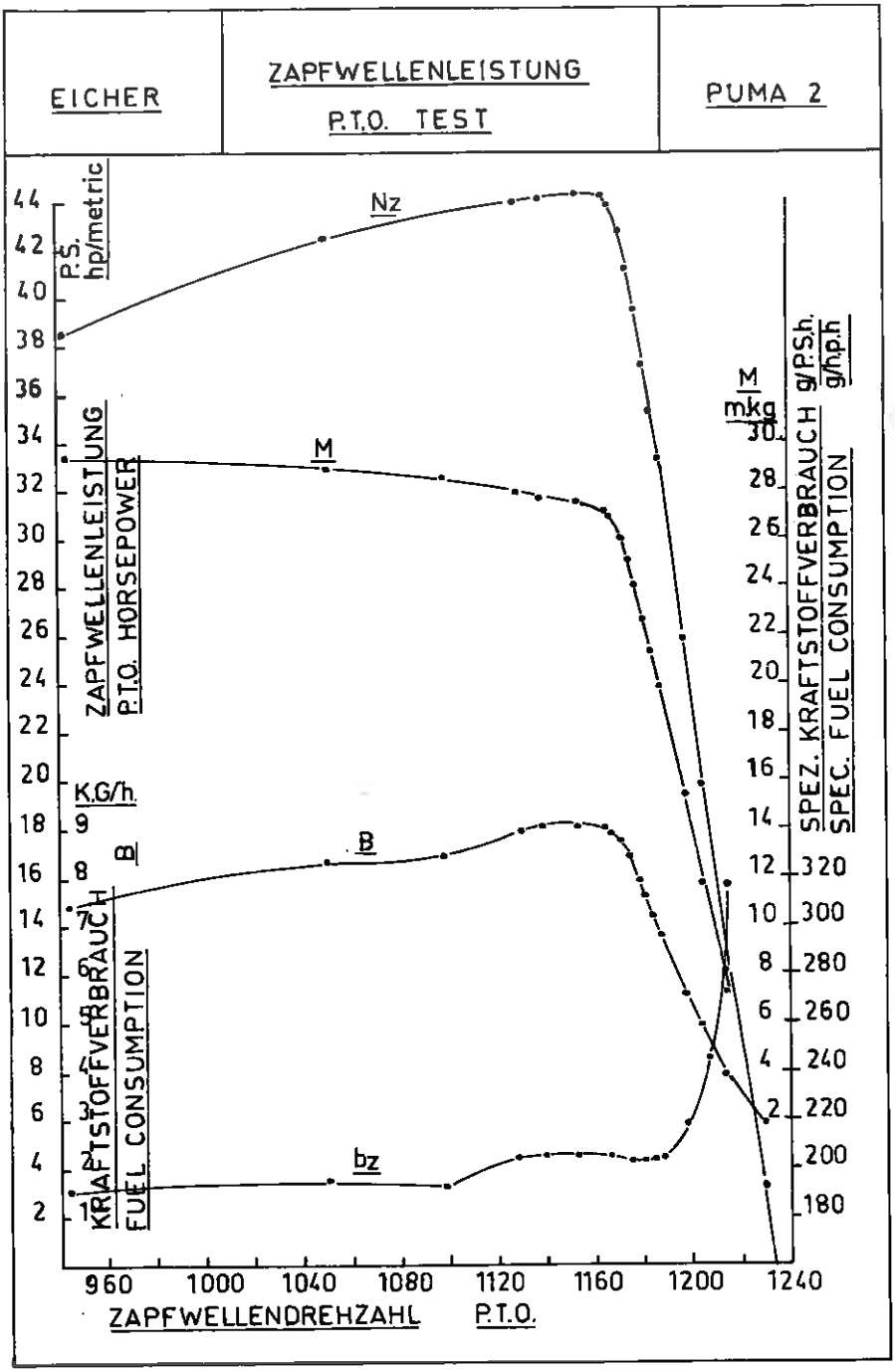
Part IV

1 Repairs and adjustments during tests: none

2 Remarks : none

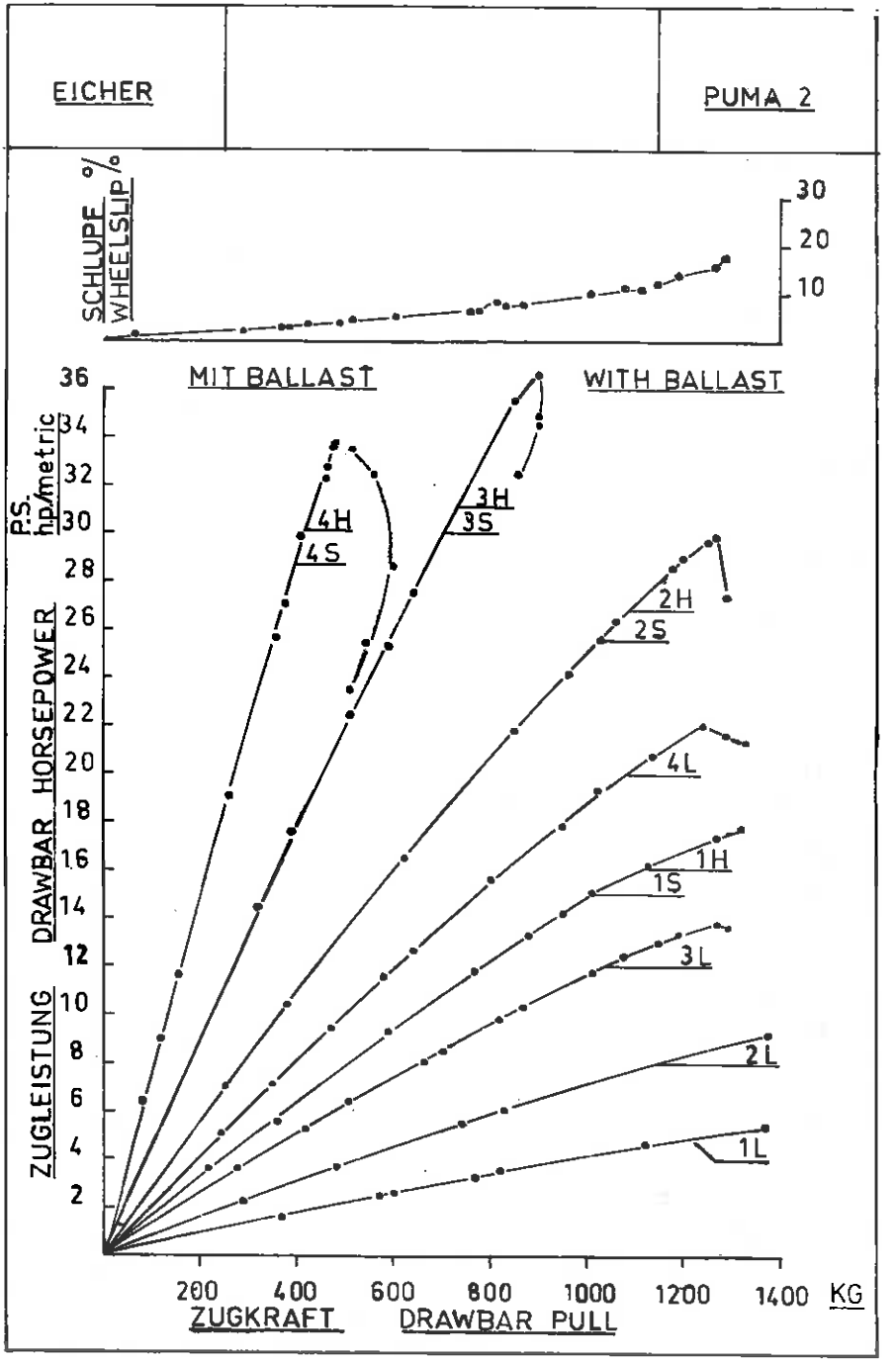
Wageningen, 27 december 1969

Head of Department of Agricultural Engineering Agricultural University	Head of Testing Department Institute of Agricultural Engineering and Rationalization
Prof.Ir. G.J. Quast	Ir. A.R. Kraai


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B
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bz
M mkg
SPEZ. KRAFTSTOFFVERBRAUCH g/P.S.h.
SPEC. FUEL CONSUMPTION g/h.p.h
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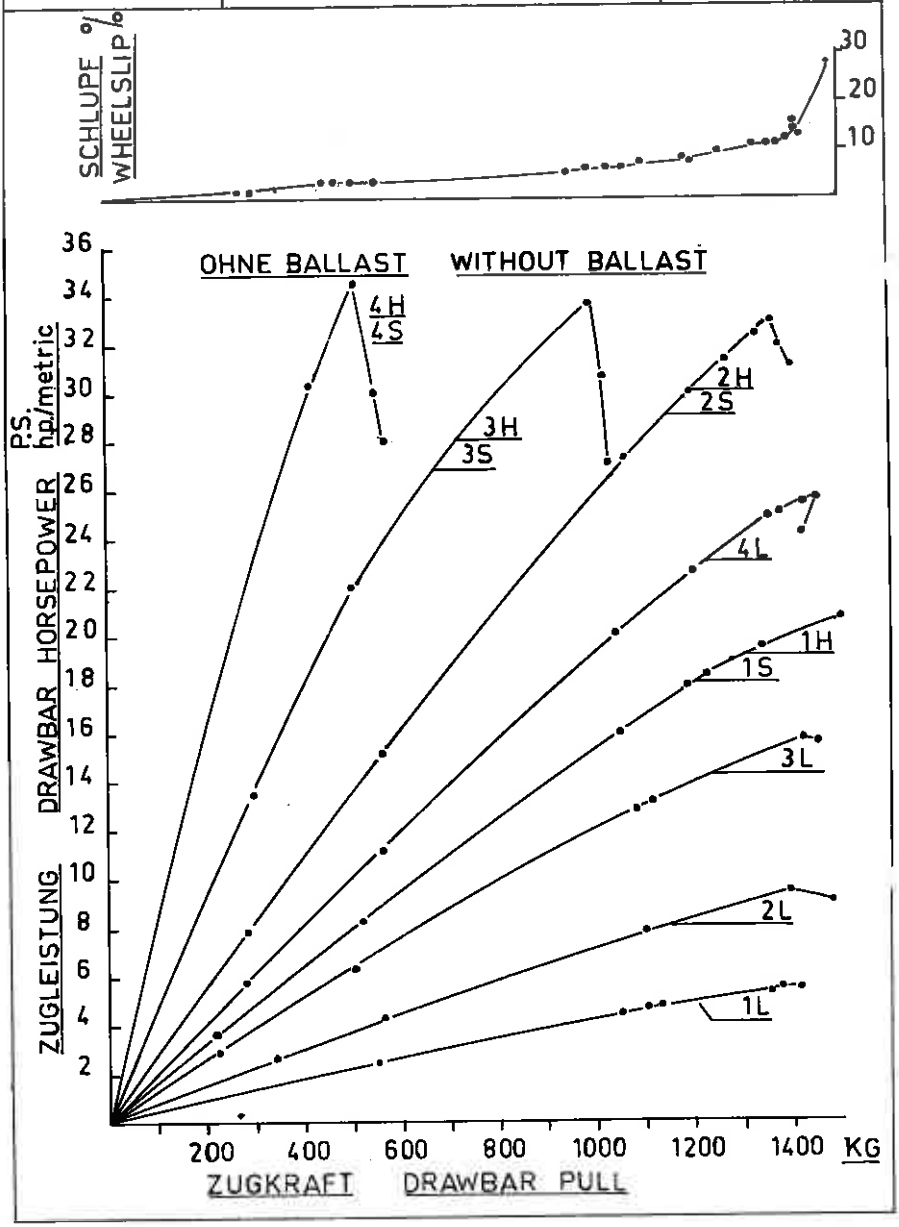
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