MACHINERY INSTITUTE

OECD No. 817

REPORT OF TEST IN ACCORDANCE WITH OECD STANDARD CODE



AGRICULTURAL TRACTOR FIAT 44-28

Manufactured by: VERSATILE FARM EQUIPMENT COMPANY
1260 Clarence Avenue
Winnipeg, Manitoba
R3T 1T3 Canada

Date of test: May 1981

Prairie Agricultural Machinery Institute

Head Office: P.O. Box 1900
Humboldt, Saskatchewan
CANADA SOK 2A0
Telephone: (306) 682-2555
Telex: 074-2468

MACHINERY INSTITUTE

EXPLANATORY NOTES

This report is based on engineering tests conducted according to the OECD STANDARD CODE for the Official Testing of Agricultural Tractor Performance. It is not an evaluation of tractor performance under practical working conditions.

Date of tests: April-May, 1981

Test Station: Prairie Agricultural Machinery Institute
P. O. Box 1060
Portage la Prairie, Manitoba
R1N 3C5 Canada

This report has been approved by the OECD Coordinating Centre (C.E.M.A.G.R.E.F., Antony, France)

- Date of approval: 15 March 1982
- Approval number: 817

This report may not be reproduced in whole or in part without prior approval of the Prairie Agricultural Machinery Institute.

This report has been prepared using SI units of measurement. The following conversion table gives some common Imperial equivalents.

1 metre (m)	= 3.3 feet (ft)
1 millimetre (mm)	= 0.04 inches (in)
1 kilogram (kg)	= 2.2 pounds mass (lb)
1 newton (N)	= 0.2 pounds force (lb)
1 kilowatt (kW)	= 1.3 horsepower (hp)
1 litre (L)	= 0.035 feet^3 (ft^3)
1 kilopascal (kPa)	= 0.15 pounds/inch^2 (psi)
1 kilometre/hour (km/h)	= 0.6 miles/hour (mph)

Test No. DOP-2

TABLE OF CONTENTS

	Page
Tractor Speicifications	1 to 5
Test Conditions	6
COMPULSORY TESTS	
(1) Power take-off performance	7
(2) Drawbar performance	9
(3) Turning space and turning circle	10
(4) Location of centre of gravity	10
(5) Braking performance	10
(6) Ambient noise level	12
(7) Noise level at operator's ear	12
(8) Power lift and hydraulic pump performance	12 to 14

Manufacturer	Versatile Farm Equipment Company 1260 Clarence Avenue Winnipeg, Manitoba, R3T 1T3 Canada
Submitted by:	Manufacturer
Selected by:	Manufacturer and test station
Place of running-in:	Winnipeg and Portage la Prairie
Duration of running in:	1 h at 50% load; 2 h at 75% load; 4 h at 100% load (all at 2 100 engine rev/min)

TRACTOR SPECIFICATIONS

Tractor	
Make:	Fiat
Model:	44-28
Type:	Wheeled tractor, four wheel drive, articulating frame
Serial No:	87581055665
Engine	
Make:	Cummins
Model:	NT-855-C280
Type:	4-stroke diesel, direct injection, liquid cooled
Serial No:	10961132
Cylinders:	6, vertical in-line; 1 39.7 mm bore, 1 52.4 mm stroke, 14.011 L displacement; 14.1 compression ratio; replaceable wet cylinder liners
Valves:	Overhead, operated by pushrods and rockerarms
Fuel system:	Cummins PT Type G-VS/TMD in-line piston injection pump; 2 filters in series; fuel tank capacity 700 L; manufacturer's seting 49 kg/h at 2 100 rev/min engine speed full load with fuel of 0.838 specific gravity at 15°C; Cummins PTD P/N3018566 injector nozzles, injection pressure 840-930 kpa, pump delivery starts 23° before TDC

Governor:	Cummins, mechanical, incorporated in fuel injection pump; governed range of engine speed 900 to 2 330 rev/min; rated engine speed 2 100 rev/min
Air cleaner:	Donaldson strata system, type STB 14-0034 with centrifugal precleaner; two - stage dry, replaceable paper element; on left side
Exhaust muffler:	Nelson, 295x210 mm oval body 1 040 mm long; on right front, outlet directed upward 3 550 mm above ground plane
Lubrication system:	Forced feed from gear pump with sump strainer; full flow replaceable element filter with bypass, oil conditioner filter and oil cooler; oil capacity 33.1 L, recommended oil: SAE 10W30 SE/CD grade motor oil at temp. above 4°C, SAE 10W20 grade motor oil at temp. -7°C to 16°C; recommended oil life, 200 h; filter change period: after first 50 h, then every 200 h.
Cooling system:	Liquid cooled, pressurized at 48 kPa; impeller assisted, centrifugal pump; flow 9.08 L/s at 2 100 rev/min; 6 blade 710 mm dia belt driven fan behind radiator; thermostat temperature control; coolant capacity 44.5L
Starting system:	Delco Remy, Bendix drive type engaging, 12 V electric starter motor; remote operated ether cold start aid

Electrical System

Voltage:	12 V, negative ground
Alternator:	Delco, 12 V, 90 A
Battery:	2 - CBMA BC1 Group 8D 193 A·h rating at 20 h

Transmission

Clutch:	Dana Spicer, 2 plate dry, 256 mm dia, pedal operated
Gear box:	Mechanical gear box with 3 forward gears and one reverse gear, 4 ranges per gear. Total: 12 forward and 4 reverse speeds

Rear axle/final drive: Eaton Series 23120, single reduction differential, outboard planetary final drive, optional hydraulic actuated engaging differential lock in front and rear axle.

Oil capacity: Transmission 20.3 L, change at 200 h; recommended oil SAE 20 SE/CD above 4°C, SAE 5W20 SE/CD below 4°C; axles 38.8L, change after first 30 h then every 400 h, recommended oil SAE 85W140 GL5 above 32°C, SAE 80W90 GL5 below 32°C.

Gear Ratios and Speeds

Gear	Range	Speed ratio: $\frac{\text{Engine}}{\text{Drive wheel}}$	Nominal ground speed at rated engine speed (km/h)*
1	1	150.8	4.2
	2	131.9	4.8
	3	124.2	5.1
	4	96.0	6.6
2	1	83.3	7.6
	2	71.2	8.9
	3	62.7	10.1
	4	54.1	11.7
3	1	42.8	14.8
	2	36.8	17.2
	3	32.0	19.8
	4	27.5	23.0
R	1	115.1	5.5
	2	102.1	6.2
	3	88.0	7.2
	4	75.4	8.4

* Calculated with 24.5 x 32 tires, 800 mm loaded rolling radius

Power take-off At rear, in median plane of tractor; 45 mm dia, 20 spline to SAE Standard J1170 and ISO Standard; 750 mm height above ground; 593 mm behind rear axle; plate clutch independent of main clutch, engaged by hand lever; clockwise rotation viewed from rear. Engine speed of 2 083 rev/min at standard 1 000 rev/min power take-off speed; power take-off speed of 1008 rev/min at rated engine speed of 2 100 rev/min

Power Lift

Hydraulic system:	Hydraulic floating position; single gear pump 28.4 mL/rev. displacement; gear driven by engine; drive ratio 1.50:1, 89.4 L/min at 2 100 rev/min; 2 single acting cylinders, 101.6 mm bore, 38 mm rod dia, 320 mm stroke; maximum oil pressure 16 000 kPa; oil capacity 82 L; recomended oil: SAE 20 SE/CD above 4°C, SAE 5W20 SE/CD below 4°C; change period 400 h; filter element change period 200 h
Implement linkage:	Three point linkage; to SAE Standard J715, category IV, convertable to category III, ISO Standard; lift rods adjustable from 735-870 mm. Lifting range above ground plane adjustable from 140 to 1 180 mm
Controls:	4 spool valves, flow control adjustable from 15 to 89.4 L/min 10%; Number 1 spool includes float position and priority over other spools; relief valve setting 15 860 kPa; 4 pairs of remote hydraulic outlets
Drawbar	Swinging, range 30°; pivot position forward of rear wheel centre 1 270 mm; vertical height to centre of clevis 510 mm; hitch hole to rear axle distance 830 mm; distance to power take-off: 305 mm above, 250 mm ahead; permissible vertical load 32 300 N; drawpin diameter 38 mm
Steering	Hydrostatic; steering wheel operated, 4.5 rev. lock-to-lock; valve displacement 738 mL/rev; pump output 99 L/min at 2 100 rev/min; steering controlled by two double acting cylinders located on articulating frame; oil supplied from hydraulic system

Brakes

Service brake:	Hydraulic, single pedal operated, self-adjusting caliper acting both on driveline and at two rear wheels; 432 mm dia driveline disc, 508 mm wheel discs; calipers twin piston, non-floating

Parking brake	Mechanically acting caliper; 432 mm dia disc located on driveline, activated by hand lever with adjustable over-centre lock
Trailer brake	Optional hydraulic brake line, hand operated valve

Wheels

Steering wheels:	Both front and rear, about articulated frame
Driving wheels:	4 pneumatic tires 24.5 x 32, 10 ply; Goodyear R1 bias ply front and rear; maximum weight supported by each tire 37 570 N at 124 kPa inflation pressure track width 1 830 mm front and rear, not adjustable; tire rim size 21 x 32 mm
Wheel base:	3 340 mm

Lighting equipment

Headlights: Bosch 0-301-203-001 quartz halogen with high and low beam, conform to Canadian regulation

Light type	Light size (mm)	Height above ground (mm)	Distance from outside edge of tractor (mm)
Head lights	120 x 140	870	420
Side lights	65 x 55	895	270
Rear lights	165 x 80	1 125	375
Reflectors	55 x 100	690, 1 870	930, 275

Number of Grease Points 44

Overall Dimensions

Total length:	6 500 mm (with three-point hitch)
Total width:	2 530 mm
Total height:	3 550 mm (to top of exhaust stack)
Ground clearance:	420 mm (to bottom of drawbar)

Seat

Make:	Grammer
Damping:	Sealed air cylinder
Suspension:	Spring
Range of adjustments:	
- up and down	200 mm
- fore and aft	190 mm
Minimum height above floor	340 mm

TEST CONDITIONS

Mass

Tractor without operator; all tanks full

Operating Mode	Front (kg)	Rear (kg)	Total (kg)
Unballasted	6 400	4 020	10 420
Ballasted*	7 770	5 630	13 400

*All liquid ballast; 1 370 kg front, 1610 kg rear

Track setting during test

Front: 1 830 mm
Rear: 1 830 mm

Fuels and lubricants used in tests

Fuel: Shell No. 2 (summer) diesel fuel
Specific gravity 0.843 kg/L at 15°C
Viscosity 1.90 mm^2/s at 50°C
Cetane No. 41

Lubricants:

Engine: Shell Rotella 10W30
Viscosity 179 mm^2/s at 20°C

Hydraulic: Shell Donax TG
Viscosity 87.9 mm^2/s at 20°C

Transmission: Shell Donax TD
Viscosity 140 mm^2/s at 20°C

Differential: Shell Spirax HD 80/90
Viscosity 498 mm^2/s at 20°C

COMPULSORY TESTS

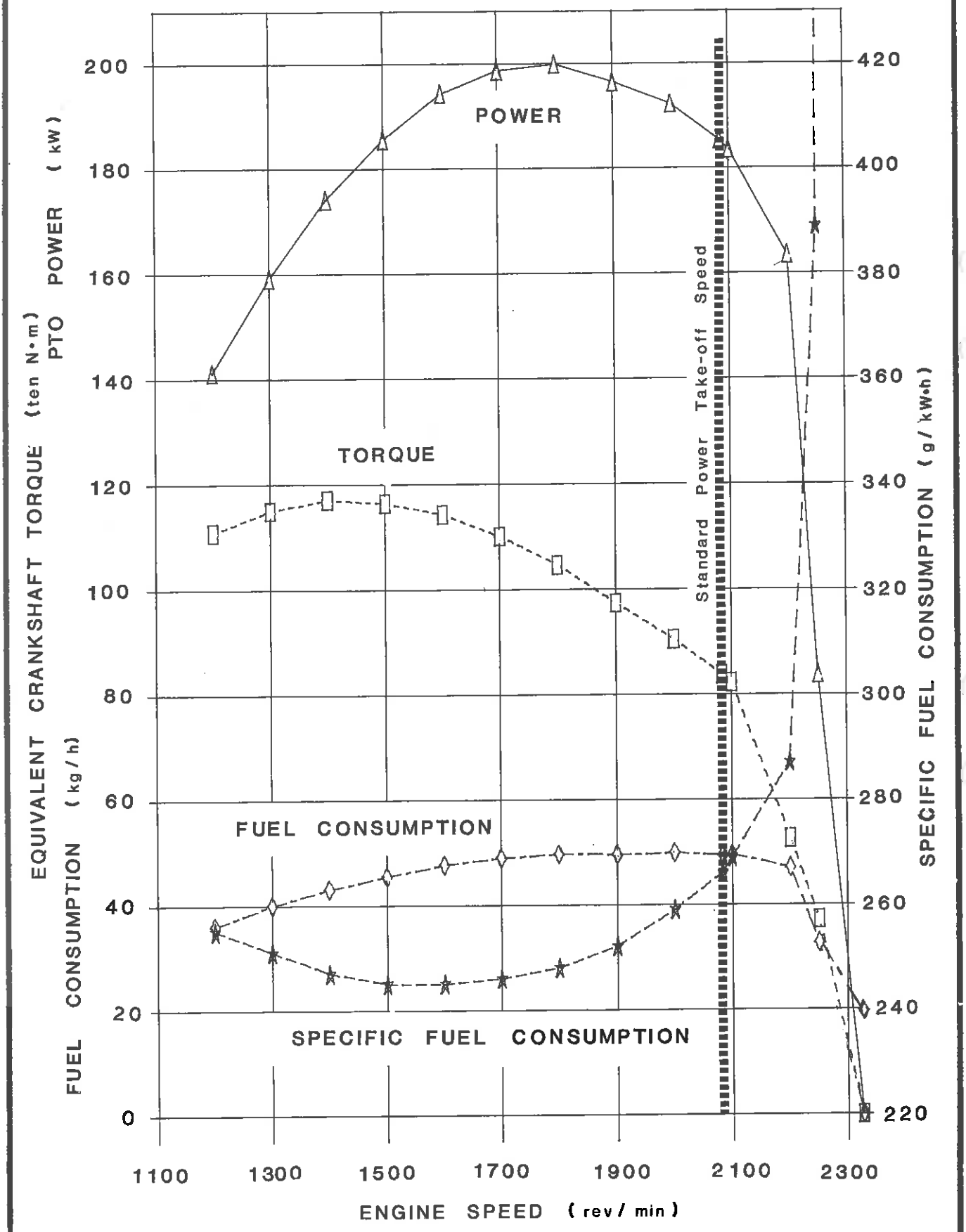
1. POWER TAKE-OFF PERFORMANCE

Date of Tests: 8 April 1981
Dynamometer Type: Water brake

Power, kW	Speed, rev/min		Fuel Consumption			Specific Energy kW•h/L
	Engine	Power Take-off	Hourly L/h	Hourly kg/h	Specific g/kW•h	
Maximum Power - 2 hour test						
183.5	2100	1008	57.5	48.5	264	3.18
Standard Power Take-off Speed						
185.3	2083	1000	59.7	50.3	271	3.10
Speed Recommended for Drawbar Work						
183.5	2100	1008	57.5	48.5	264	3.18
Part Loads at Rated Engine Speed						
(i) 85% of torque at maximum power						
163.5	2200	1056	54.5	45.9	283	3.00
(ii) No Load						
-	2327	1117	21.1	17.8	-	-
(iii) 50% of Load in (i)						
83.7	2250	1080	38.6	32.5	389	2.17
(iv) Maximum Power						
183.5	2106	1011	58.4	49.2	268	3.14
(v) 25% of Load in (i)						
42.3	2270	1090	29.5	24.9	589	1.43
(vi) 75% of Load in (i)						
124.2	2230	1070	58.0	48.9	393	2.14
Part Loads at standard power take-off speed						
(i) 85% of torque at maximum power						
165.6	2192	1052	56.8	47.9	289	2.91
ii) No Load						
-	2327	1117	21.2	17.8	-	-
(iii) 50% of Load in (i)						
85.1	2250	1080	39.1	32.9	387	2.18
(iv) Maximum Power						
185.3	2083	1000	59.1	49.8	269	3.13
(v) 25% of Load in (i)						
42.9	2277	1093	30.5	25.7	598	1.41
(vi) 75% of Load in (i)						
126.2	2229	1070	47.4	40.0	317	2.66

Standard specific fuel consumption, g/kW•h: 283/389/289/387
No load, maximum engine speed: 2327 rev/min
Equivalent crankshaft torque at maximum power (2 h): 834 N•m
Maximum equivalent crankshaft torque (1 430 rev/min): 1 170 N•m
Mean atmospheric conditions:
Temperature 17°C
Pressure 101 kPa
Relative Humidity, Rated engine speed test 32%
Standard power take-off test 50%
Maximum temperatures: Coolant 81°C
Engine oil 99°C
Fuel 36°C
Engine air intake 30°C

POWER TAKE-OFF PERFORMANCE



DATE OF TESTS: APRIL 1981

TYPE OF TRACK: CONCRETE

TIRES: SEE SPECIFICATIONS

TIRE INFLATION PRESSURE: 124 kPa

WHEEL SLIP CALIBRATED BETWEEN TESTS

Gear	Speed km/h	Power kW	Drawbar Pull kN	Engine Speed rev/min	Wheel Slip %	SFC g/kW·h	Specific Energy kW·h/L	Temperatures (°C)			Atmospheric Conditions		
								Fuel	Coolant	Engine Oil	Temperature °C	Relative Humidity %	Pressure kPa
(i) MAXIMUM POWER WITH BALLAST, HEIGHT OF DRAWBAR ABOVE GROUND 510 mm *													
1.3	4.92	143.9	105.30	2097	14.5	356	2.37	25	80	99	14	37	101.9
1.4	6.07	149.7	88.76	2101	11.2	327	2.58	23	81	99	14	32	102.2
2.1	7.38	155.9	76.06	2101	7.0	316	2.67	41	82	101	24	29	102.2
2.2	8.73	159.3	65.66	2102	5.1	313	2.69	36	81	100	20	33	103.6
2.3	10.03	160.1	56.47	2102	4.2	307	2.75	27	78	98	16	39	104.6
2.4	11.98	160.4	48.20	2102	2.3	312	2.70	18	79	98	14	29	102.3
(ii) FIVE HOUR TEST AT 75% OF PULL AT MAXIMUM POWER IN 2nd AND 3rd GEAR													
2.3	10.90	127.7	42.13	2216	2.2	334	2.52	25	79	96	7.6	81	98.3
(iii) FIVE HOUR TEST AT PULL CORRESPONDING TO GEAR HAVING MAXIMUM WHEEL SLIP BELOW 15% IN TEST (i) (NO ADDITIONAL BALLAST)													
1.4	6.12	151.8	88.69	2098	9.5	331	2.54	33	80	98	9.6	63	98.8
(iv) MAXIMUM POWER WITHOUT BALLAST, HEIGHT OF DRAWBAR ABOVE GROUND 510 mm													
2.1	7.16	151.7	76.55	2098	11.3	-	-	42	81	99	16	40	101.9
2.2	8.53	155.4	65.71	2100	8.4	-	-	39	80	99	14	40	101.9
2.3	9.98	157.3	56.83	2099	6.5	-	-	26	80	98	10	43	102.2
2.4	11.80	157.2	48.11	2100	4.9	-	-	32	80	98	11	44	102.1
3.1	14.90	157.9	38.20	2097	3.7	-	-	37	80	98	12	38	102.0

Average oil consumption rate during ten hour duration of test (ii) and (iii): 26 g/h

* Manufacturer does not recommend drawbar operation in slow gears.

(3) TURNING SPACE AND TURNING CIRCLE*

Wheel equipment: as specified, without ballast
Track width: 1 830 mm, front and rear

	Left Turn	Right Turn
Turning space radius, m	6.05	6.23
Turning circle radius, m	5.95	5.91

* Steering brake not provided

(4) LOCATION OF CENTRE OF GRAVITY

Height above ground plane, mm		1 340
Distance forward from the vertical plane containing the axis of the rear wheels, mm		2 050
Distance from the tractor median plane, mm		12, left
Distance from vertical plane containing the centre of the front and rear axles at maximum articulation	left, mm	60, right
	right, mm	80, left

(5) BRAKING PERFORMANCE

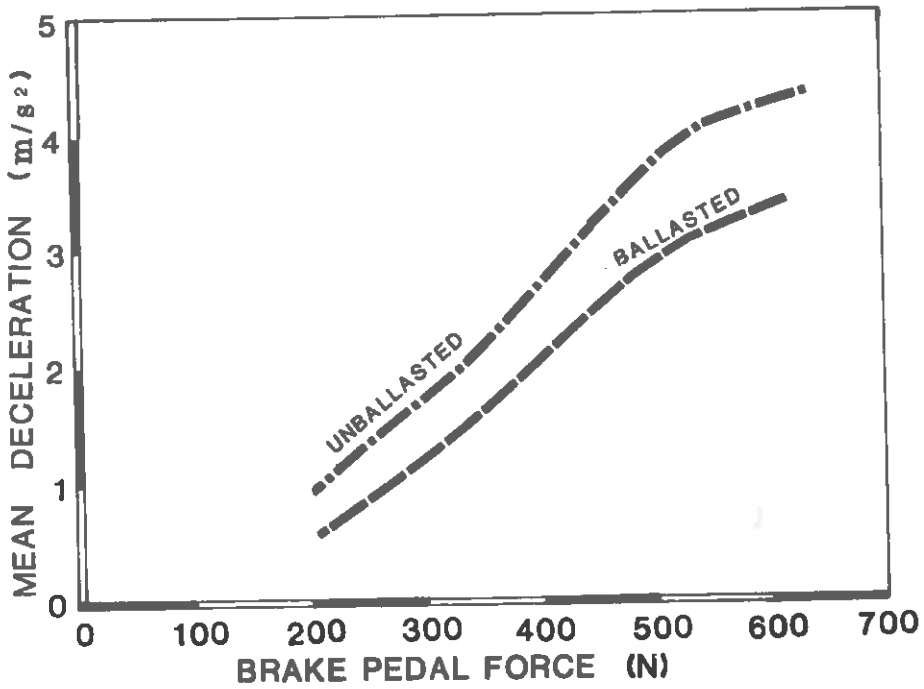
A) Service Brake

Date of tests: April 1981
Type of track: concrete
Mass of tractor, unballasted: 13 400 kg
ballasted : 10 420 kg

Cold Brakes

	With Ballast	Without Ballast
Speed, km/h	23.0	22.4
Deceleration, m/s^2	3.0	4.2
Stopping Distance, m	8.0	5.7
Force on Pedal, N	600	600
Pedal Force at 2.5 m/s^2 decentration, N	430	390

Service brake performance



Service brake fade characteristics, (brakes hot*), ballasted

Maximum deceleration	hot/cold	149%
Stopping distance	cold/hot	147%
Force on pedal	cold/hot	111%

*Tractor towed 1 km at 80% maximum design speed

B) Parking Brake

Brake force to prevent tractor rolling

Slope Direction	Ballasted tractor on 18% slope	Unballasted tractor and unbraked 3 t trailer on 12% slope
Facing upward	84 N	78 N
Facing downward	91 N	84 N

(6) AMBIENT NOISE LEVEL

Date of tests: May 1981
Type of track: concrete
Type of sound level meter: Bruel & Kjaer Type 2607, 2307

Results of test

Gear: 3-4
Speed before acceleration: 19.1 km/h
Sound level: 91 dBA

(7) NOISE LEVEL AT THE OPERATOR'S EAR

Sound level meter: Bruel & Kjaer Type 2607, 2307
Type of track: concrete

Tests conducted on tractor as supplied with Versatile safety cab model TRA-55825 with all doors and windows closed. Gear 2.1 is the nominal speed nearest 7.5 km/h.

Gear	Drawbar load at maximum sound level (kN)	Speed (km/h)	Operator Sound Level (dBA)
2.1	71.6	8.0	87
2.1	2.8	8.8	81
2.2	59.2	9.0	87
2.3	49.8	10.6	87
top gear	3.7	25.8	83

(8) POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date of tests: May 1981
Hydraulic oil: see specifications

A) **Hydraulic Pump** (oil temperature 64°C)

(1) Opening pressure of relief valve in remote circuit — 14 800 kPa

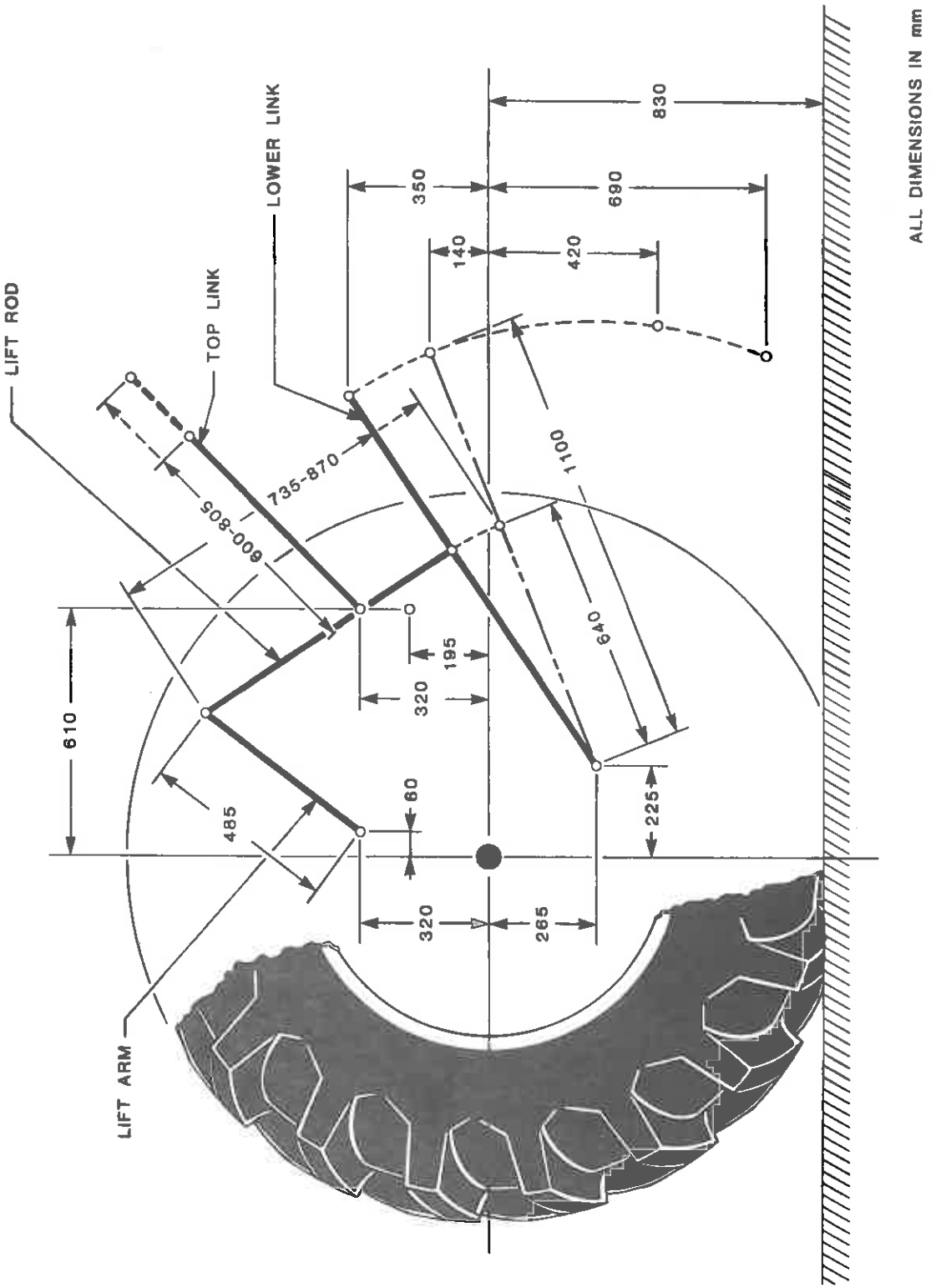
Pressure sustained with relief valve open (Pump rotating) — 14 800 kPa

(2) Pump delivery rate at minimum pressure and rated engine speed — 92.0 L/min

(3) Hydraulic power at 90% of relief valve setting — 13.1 kW
Corresponding delivery rate — 59.0 L/min
Pressure — 13 320 kPa

B) Power Lift

(1) Dimensions of linkage geometry



(2) **Power Lift Forces***

Hitch point height relative to a horizontal line through the lower link pivot (mm)						
-190	-165	150	250	355	455	560
Lift force at hitch point (kN)						
	86.1	83.7	82.9	80.5	76.9	73.3
Lift force at the point of application on test frame (kN)						
86.1	84.7	68.6	63.4	58.3	53.1	48.0

*Lift forces are determined at 90% of minimum recommended relief setting of 15 500 kPa (13 950 kPa) Linkage geometry set in mid position.

	Lower hitch point height in down position (mm)	Vertical movement (mm)	Power Lift Capacity through full range (kN)	Corresponding hydraulic oil pressure (kPa)	Moment about rear axle (kN m)	Maximum frame tilt over lift range (degrees)
At hitch points	370	750	73.3	12 555	116	21
On the frame	390	970	48.0	12 555	168	21

Temperature of hydraulic fluid at start of test 64°

Chief Engineer: E. O. Nyborg

Senior Engineer: J. C. Thauberger

Project Engineer: R. R. Hochstein

The Prairie Agricultural Machinery Institute is a co-operative undertaking of the Canadian provinces of Manitoba, Saskatchewan, and Alberta. To meet its objectives of evaluating existing agricultural machinery and developing new and improved machinery, the Institute operates three facilities located at Portage la Prairie, Manitoba; Humboldt, Saskatchewan; and Lethbridge, Alberta. Programs of evaluation, research and development are conducted relevant to machinery used by prairie farmers.

This report is published under the authority of the ministers of Agriculture of Manitoba, Saskatchewan and Alberta and may not be reproduced in whole or in part without the prior approval of the Prairie Agricultural Machinery Institute.

For further information on other reports which are available and on the work of the Machinery Institute contact the

PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

Head Office: P.O. Box 1900
Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-2555
Telex: 074-2468

Test Stations: c/o LCC Campus
Lethbridge, Alberta, Canada T1K 1L6
Telephone: (403) 329-1212

P.O. Box 1060
Portage la Prairie, Manitoba, Canada R1N 3C5
Telephone: (204) 857-9701

P.O. Box 1150
Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-5033