PAMI

OECD No. 1298 Restricted Code
Date of Approval: February 14,1991

REPORT OF TEST IN ACCORDANCE WITH OECD RESTRICTED CODE (CODE II)
FOR THE OFFICIAL TESTING OF AGRICULTURAL TRACTORS



FORD VERSATILE 846 (4WD) ARTICULATED AGRICULTURAL TRACTOR

Manufactured by: Ford New Holland Canada Limited
Versatile Farm Equipment Operations
Box 7300-1260 Clarence Avenue
Winnipeg, Manitoba
R3C 4E8 Canada

Date of test: June, 1990

Printed in Canada

Prairie Agricultural Machinery Institute

Test Station: P.O. Box 1060
Portage la Prairie, Manitoba
CANADA R1N 3C5
Telephone: (204) 239-5445
Fax: (204) 239-7124

Head Office: P.O. Box 1900
Humboldt, Saskatchewan
CANADA S0K 2A0
Telephone: (306) 682-2555
Fax: (306) 682-5080

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Ford 846

Tractor manufacturer's name and address:	Versatile Farm Equipment Operations Ford New Holland Canada Ltd. Box 7300 - 1260 Clarence Avenue Winnipeg, MB R3C 4E8 Canada
Location of tractor assembly:	Winnipeg, Manitoba; Canada
Submitted for test by:	Manufacturer
Selected for test by:	Manufacturer, with agreement of the test station
Place of running-in:	Versatile Farm Equipment Operations Winnipeg, MB
Duration of running-in:	50 hours prior to test
Location of test:	Tests carried out at the manufacturer's premises VERSATILE, Winnipeg, MB and witnessed by D.J. May, Project Engineer (PAMI - Portage la Prairie, MB)

I. SPECIFICATIONS OF TRACTOR

TRACTOR

Make/Model/Type:	Ford Versatile/846/4-wheel drive, articulated
Number of driving wheels:	4
Serial No.:	846-90-451858
1st Serial No.:	846-89-430993

ENGINE

Make/Model/Type:	Cummins/L10/Diesel, turbo charged
Serial No:	34626766

Cylinders

Number/disposition:	6/in-line, vertical
Bore/stroke:	125 mm/136 mm
Capacity:	10014 cm^3
Compression ratio:	16:1
Arrangement of valves:	Overhead
Cylinder liners:	Wet (replaceable liners)

Turbocharger (exhaust gas driven)	
Make/Model:	Holset/H2C
Pressure:	108 kPa at rated engine speed
Fuel System	
Fuel feed system:	Engine driven transfer pump
Make/Model/Type of fuel filter(s):	Fleetguard/FS1212/Spin on
Capacity of fuel tank:	887 dm^3
Make/Model/Type of injection pump:	Cummins/PTG-US/Pressure/Time regulated
Serial No.:	1283479 Code X678B CPL776
Manufacturer's production setting of injection pump:	
Flow rate (rated engine speed and full load):	39.0 kg/h
Timing:	Controlled by camshaft actuation
Make/Model/Type of injectors:	Cummins/TOP STOP PT (Type D)/Cam actuated
Injection pressure:	827 kPa rail pressure at maximum power
Maximum injection pressure:	98.6 MPa
Governor	
Make/Model/Type:	Cummins/VS/Variable speed
Governed range of engine speed	From 1000 to 2457 rev/min
Rated engine speed:	2100 rev/min
Air Cleaner	
Pre-cleaner:	Stratatube exhaust aspirated
Make:	Donaldson
Location of air intake:	Integral with air cleaner
Main cleaner:	
Make/Model/Type:	Donaldson/STB14/Dry paper dual element
Location of air intake:	Mounted on R/H fender and fuel tank
Maintenance indicator:	Restriction indicator mounted on air cleaner
Lubrication system	
Type of feed pump:	Full pressure, positive displacement
Type of filter:	Spin on

Number:	One
Cooling system	
Type of coolant:	50/50 water/glycol base anti-freeze
Type of pump:	Mechanical driven centrifugal pump
Specification of fan or blower:	Belt driven
Number of fan blades:	8
Fan diameter:	710 mm
Coolant capacity:	52.1 dm^3
Type of temperature control:	Thermostat
Superpressure system:	48 kPa
Starting system	
Make/Model/Type:	Delco/42 MT 400/electric motor
Starter motor power rating:	7.46 kW
Cold starting aid:	Optional engine coolant heater and ether spray to intake manifold
Safety Device:	Electrical lockout on transmission gear shift
Electrical system	
Voltage:	12 volt, negative ground
Alternator:	
Make/Model/Type:	Delco/1117732/400
Power:	12 volt, 90 amp
Battery (number of accumulators):	Three group 31 (maintenance free)
Rating:	625 amps at -18°C - cold cranking capacity 119 Ah each at 20 hours rating
Exhaust system	
Make/Model:	Nelson/21337-N
Location:	On front R/H hood, mounted vertically
TRANSMISSION TO WHEELS	
Clutch (travel alone)	
Make/Type:	Rockford/Hydraulic, multi plate
Number of plates:	10
Diameter of plates:	197 mm

Method of operation: Mechanical/hydraulic

Gear box

Make/Model/Type: Versatile/3 x 5/Mechanical

Arrangement: Gear box with 5 synchronized gears, 3 forward ranges and 1 reverse

Number of gears: 15 forward, 5 reverse

Available options: PTO

Rear axle and final drives

Make/Type: Versatile/Outboard planetary

Differential lock: None

Front axle and final drives

Make/Type: Versatile/Outboard planetary

Differential lock: None

Total ratios and travelling speeds: Axle reduction 27.45:1

Gear No.	Group or Range	Number of engine revolutions for one revolution of the driving wheels	Nominal travelling speed(*) at rated engine speed of 2100 rev/min km/h
Forward			
1	1	222	2.7
2		194	3.2
3		163	3.6
4		143	4.3
5		121	5.2
1	2	107	5.8
2		93	6.7
3		79	7.9
4		69	9.0
5		58	10.7
1	3	46	13.5
2		40	15.5
3		34	18.4
4		30	21.0
5		25	24.9
Reverse			
1	1	163	3.6
2		140	4.4
3		115	5.4
4		99	6.4
5		82	7.6

(*) Calculated with a tyre dynamic radius index of: 820 mm (ISO 4251/1-1984).

Number of revolutions of front wheels for one revolution of rear wheels (for 4WD tractor only):	1.0

POWER TAKE-OFF

Main power take-off

Type:	Independent, wet, mutiple plate
Method of engagement:	Manually controlled valve to hydraulic clutch
Number of shafts:	One at rear of tractor in vertical median plane
Method of changing power take-off shaft ends and speeds:	1000 rpm only at 2100 rpm

1000 rev/min

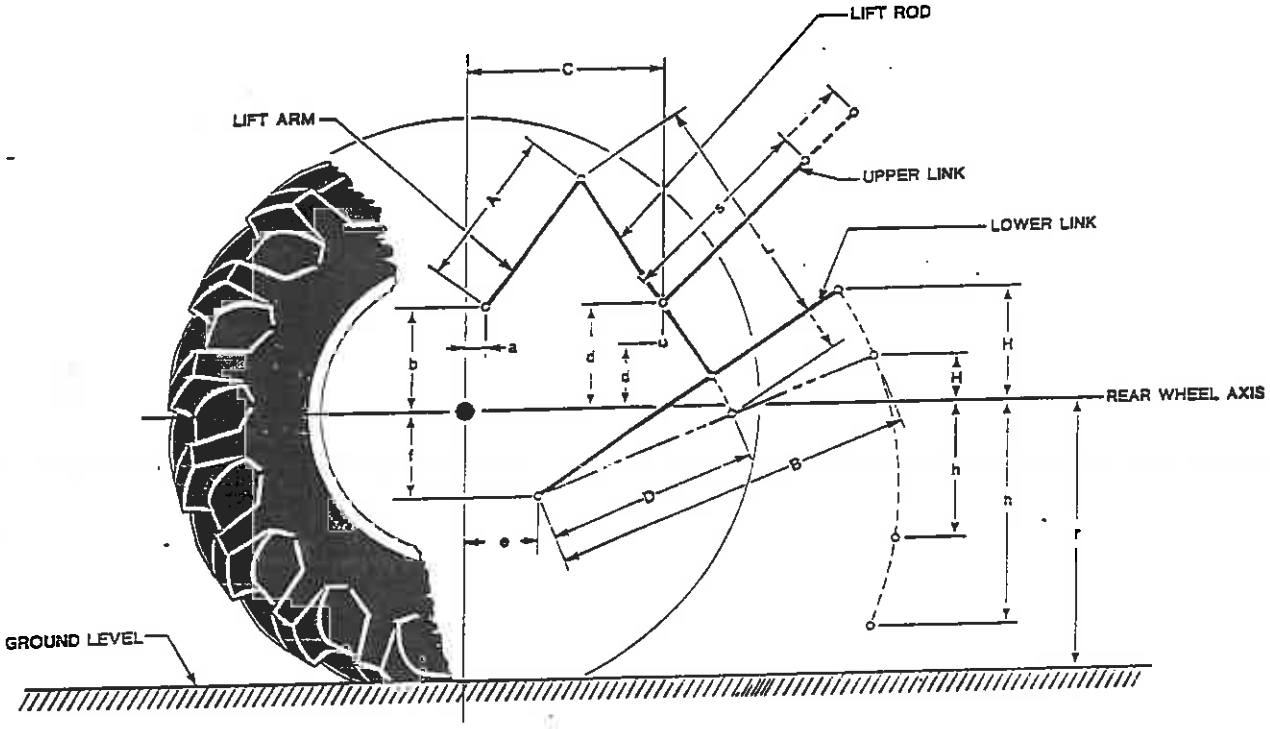
Location:	Rear of tractor in vertical median plane
Diameter of power take-off shaft end:	44.4 mm
Number of splines:	20 in conformity with ISO 500/1979
Height above ground:	777 mm
Distance from the median plane of the tractor:	0 mm
Distance behind rear-wheel axis:	649 mm
PTO speed at rated engine (2100 rev/min):	1009 rev/min
Engine speed at standard power take-off speed:	2080 rev/min
Ratio of rotation speeds (engine speed/ PTO speed)	2.08:1
Direction of rotation (viewed from behind tractor):	Clockwise

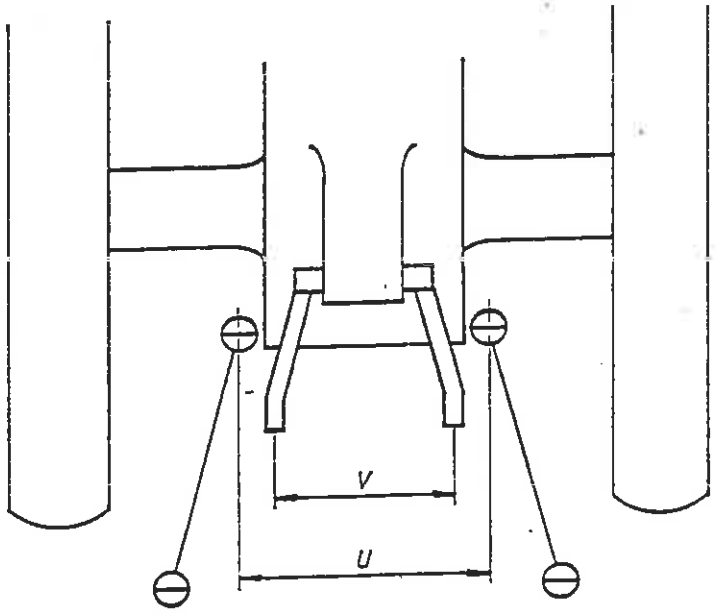
POWER LIFT

Make/Type:	Versatile/Hydraulic
Type of hydraulic system:	Closed centre, load sensing
Type and number of cylinders:	External, two double acting
Type of linkage lock for transport:	None
Relief valve pressure setting (tolerance):	16.87 (± 0.37) MPa (MPa)
Opening pressure of cylinder safety valve (if fitted):	N/A

Lift pump type:	Cessna axial piston, pressure and flow compensated
Transmission between pump and engine:	Direct drive at engine accessory drive
Type and number of filters:	Two, Canister type, replaceable element, cleanable suction screen inside reservoir
Site of oil reservoir:	Beneath engine, 58 dm^3 capacity
Type number and location of tapping points:	4 pairs ISO Standard lever type couplers at rear of tractor
Maximum volume of oil available to external cylinders:	23.5 dm^3
Three-point linkage	
Category:	3 or 4 in conformity with categories 3 wide or 4 narrow of ISO 730/3-1982
Category adapter:	Reverse lower links, install alternate bushings at hitch points

mplement Linkage:





		Dimension or range mm	Settings used in test mm
Length of lift arms	(A)	472	
Length of lower links	(B)	1092	
Distance of lift arm pivot: horizontally	(a)	182	
point from rear-wheel axis: vertically	(b)	483	
Horizontal distance between the 2 lower link points	(u)	760	
Horizontal distance between the 2 lift arm end points	(v)	730	
Length of upper link	(s)	from 660 to 838	721
Distance of upper link pivot point from rear : horizontally	(c)	642	
wheel axis : vertically	(d)	320,193	320
Distance of lower link pivot point from rear : horizontally	(e)	264	
wheel axis : vertically	(f)	263	
Distance of lower link pivot points to lift rod pivot points on lower links	(D)	635	
Length of lift rods	(L)	from 737 to 876	858
Height of lower hitch points relative to the rear-wheel axis:			
- in low position	(h)	from 383 to 617	610
- in high position	(H)	from 344 to 136	163
Height above ground of lower hitch points when locked in transport position (*)		Any height within range	

Table 2.1 - Dimensions of linkage geometry
(when connected to the standard frame)

(*) Assuming r - tyre dynamic radius index of 820 mm, ISO 4251/1-1984.

SWINGING DRAWBAR

Type:	Versatile
Height above ground:	
Minimum:	440 mm
Type of adjustment:	
Vertical	Fixed
Lateral	Manual slide
Distance of hitch point from rear-wheel axis, horizontally:	649 mm
Distance of hitch point from power take-off shaft end:	
Vertically:	285 mm

Lateral adjustment (centre of clevis):	
Right-hand:	305 mm
Left-hand:	305 mm
Distance of pivot point from rear-wheel axis, horizontally:	1694 mm
Diameter drawbar pin hole:	50.8 mm
Maximum vertical permissible load:	33.36 kN at 406 mm 26.69 kN at 508 mm

STEERING

Make/Model/Type:	Eaton/251-1003-001/Hydrostatic open centre valve
Method of operation:	Articulated
Pump:	Gear pump/Cessna/pressure and flow compensated
Ram(s):	Two, 75 mm double acting, 419 mm stroke
Working pressure:	15.9 MPa

BRAKES

Service brake

Make/Model/Type:	Kelsey Hayes/Calliper/Dry disc
Method of operation:	Hydraulic
Trailer braking take-off (hydraulic or air brake):	N/A

Parking brake

Type:	Calliper
Method of operation:	Mechanical

WHEELS

Number

Front:	2 driving
Rear:	2 driving
Wheelbase:	3300 mm

Track width adjustment

	Inner Wheel Minimum mm	Inner Wheel Maximum mm	Adjustment Method	Dual Wheel Minimum & Maximum mm
Front	1830	2030	Reverse wheels/ changes offset	3150
Rear	1830	2030	Reverse wheels/ changes offset	3150

STRUCTURE

Make/Model/Type: Versatile/Enclosed ROPS/4 post

Manufacturer's name and address: Versatile Farm Equipment Operations
Ford New Holland Canada Ltd.
Box 7300 - 1260 Clarence Avenue
Winnipeg, MB
R3C 4E8 Canada

Device:

Cab: Not tiltable

OECD approval number: None

DRIVER'S SEAT

Make/Model/Type: Grammer/LS95H/LA/Electric compressor air support with swivel

Type of suspension: Air ride weight adjustment

Type of damping: Shock absorber/hydraulic

Range of adjustment:

Longitudinal: 150 mm

Vertical: ±57 mm

HTING

	Height above ground of centre mm	Size mm	Distance from outside edge of lights to median plane of tractor mm
Headlights	1175	184 X 127	357
Sidelights	1950	133 dia	1089
Rearlights	1950	133 dia	1070
Reflectors	1930	triangle with 350 mm sides	175

TEST CONDITIONS

Overall Dimensions

Length mm	Width		Height at top of	
	minimum mm	maximum mm	protective structure mm	exhaust silencer mm
6600	3670	3670	3195	3530

Ground clearance (unballasted tractor): 410 mm

-Clearance limiting part: Drawbar cage

Tractor mass

(with cab)

	Unballasted		Ballasted*	
	Without driver kg	With driver kg	Without driver kg	With driver kg
Front	6441	6488	7988	8035
Rear	4495	4523	4694	4722
Total	10936	11011	12682	12757

*All ballast in the form of liquid added to tires

Tires and track width specifications

	Front	Rear
Tires:		
-dimensions	18.4 X 38 dual	18.4 X 38 dual
-ply rating	one star	one star
-type	radial	radial
-maximum load (tire manufacturer's)	28.468 kN	28.468 kN
-maximum load (tractor manufacturer's)	22 kN	22 kN
-inflation pressure (tire manufacturer's)	152 kPa	152 kPa
-dynamic radius index	820 mm	820 mm
Chosen track width:	3150 mm	3150 mm

Oils and lubrication

-Capacity and change interval

	Capacity dm^3	Oil Change h	Filter change h
Engine	26.0	200	200
Gear Box	23.6	400	400
Front Axle	38.8	400	-
Rear Axle	38.8	400	-
Final Drive (front)+	-	-	-
Final Drive (rear)+	-	-	-
Hydraulic system*	58.0	400	200
Other (steering...)	-	-	-

+Final drive (front and rear) fluids are common with axles
*Hydraulic system and steering use common sump

-Specifications (SAE, API, Mil.L, ISO)

	Recommended	Used during test
Engine oil		
-Type:	SAE 15W40	
-Viscosity:	110 cSt @ 40°C	As Recommended
-Classification:	API SF/CD	
Transmission oil		
-Type:	HyGear 23	
-Viscosity:	55 cSt @ 40°C	As Recommended
-Classification:	SAE 20 SF/CD	
Hydraulic fluid		
-Type:	HyGear 23	
-Viscosity:	55 cSt @ 40°C	As Recommended
-Classification:	SAE 20 SF/CD	
Steering oil		
-Type:		
-Viscosity:	same as hydraulic	
-Classification:		

-Grease: SAE multi-purpose grease
-Number of lubrication points:38

L

-Type: No. 2 Diesel, in conformity with national standard

-Density at 15°C: 0.838 g/cm^3

III. TEST RESULTS

COMPULSORY TEST RESULTS

1. MAIN POWER TAKE-OFF

-Date and location of tests: June 13, 1990 Winnipeg, Manitoba, Canada
-Type of dynamometer: Eddy Current

Power	Speed		Fuel Consumption			Specific Energy
	Engine	PTO	Hourly		Specific	
kW	rev/min		kg/h	l/h	g/kWh	kWh/l
1.1 MAXIMUM POWER - TWO HOUR TEST						
162.9	1912	919	37.4	45.8	230	3.65
1.2 POWER AT RATED ENGINE SPEED						
157.7	2097	1008	38.1	46.6	242	3.46
1.3 STANDARD POWER TAKE-OFF SPEED (1000 ± 25 OR 540 ± 10 rev/min)						
157.7	2097	1008	38.1	46.6	242	3.46
1.4 PART LOADS 1.4.1 the torque corresponding to maximum power at rated engine speed						
157.7	2097	1008	38.1	46.6	242	3.46
1.4.2 85% of torque obtained in 1.4.1						
139.8	2184	1050	35.6	43.7	255	3.29
1.4.3 75% of torque defined in 1.4.2						
107.4	2248	1080	30.3	37.1	282	2.97
1.4.4 50% of torque defined in 1.4.2						
72.3	2272	1092	25.0	30.6	345	2.43
1.4.5 25% of torque defined in 1.4.2						
36.8	2294	1102	18.1	22.1	490	1.71
1.4.6 unloaded						
5.5	2337	1123	12.6	15.4	2300	0.37

Power	Speed		Fuel Consumption			Specific Energy
	Engine	PTO	Hourly		Specific	
kW	rev/min		kg/h	l/h	g/kWh	kWh/l
1.5 PART LOADS AT STANDARD POWER TAKE-OFF SPEED (1000/540 rev/min) 1.5.1 the torque corresponding to maximum power						
157.7	2097	1008	38.1	46.6	242	3.46
1.5.2 85% of torque obtained in 1.5.1						
139.8	2184	1050	35.6	43.7	255	3.29
1.5.3 75% of torque defined in 1.5.2						
107.4	2248	1080	30.3	37.1	282	2.97
1.5.4 50% of torque defined in 1.5.2						
72.3	2272	1092	25.0	30.6	345	2.43
1.5.5 25% of torque obtained in 1.5.2						
36.8	2294	1102	18.1	22.1	490	1.71
1.5.6 unloaded						
5.5	2337	1123	12.6	15.4	2300	0.37

-No load maximum engine speed: 2337 rev/min

-Torque (equivalent crankshaft) at maximum power: 805.6 Nm

-Torque (equivalent crankshaft) at rated engine speed: 711.2 Nm

-Maximum torque (equivalent crankshaft): 1083.8 Nm at 1200 rev/min

-Mean atmospheric conditions:

-Temperature: 29°C
-Pressure: 100.4 kPa
-Relative Humidity: 50%

-Maximum temperatures:

-Coolant: 95°C
-Engine oil: 113°C
-Fuel: 44°C
-Engine air intake: 44°C

2. HYDRAULIC POWER AND LIFTING FORCE

-Date of tests: July, 1990

2.1 HYDRAULIC POWER TESTS

-Sustained pressure with relief valve open: 16.6 MPa
(Pump stalled)

-Pump delivery rate at minimum pressure: 94.6 l/min

	Flow Rate l\min	Pressure MPa	Power kW
Flow rate corresponding to a hydraulic pressure equivalent to 90 per cent of the actual relief valve pressure setting and corresponding hydraulic power	84.8	14.9	21.1
Flow rate and hydraulic pressure corresponding to maximum hydraulic power	88.6	16.4	24.2

-Tapping point used for test: Remote circuit coupler

-Temperature of hydraulic fluid: 65 ± 5°C

2.2 POWER LIFT TEST

	At the hitch point	On the frame
Height of the lower hitch points above ground in down position	210 mm	179 mm
Vertical movement	773 mm	760 mm
Maximum corrected force exerted through full range	86.7 kN	59.6 kN
Corresponding pressure of hydraulic fluid	16.9 MPa	16.9 MPa
Moment about rear wheel axis	110.1 kNm	112.0 kNm
Maximum tilt angle of mast from vertical	-	14 degrees

nkage settings for test- see Table 2.1 and Figures 2.1 and 2.2

Lifting heights relative to the horizontal, plane including the lower link pivot points												
mm	-347	-346	-300	-200	-100	0	+100	+200	+300	+400	+414	+426
Lifting forces (the values measured are corrected to correspond to a hydraulic pressure equivalent to 90% of the actual relief valve pressure setting or to a maximum power delivered by the hydraulic system, whichever is lower)												
atthe hitch points kN	99.7	-	98.7	96.9	95.2	93.5	91.8	90.1	88.4	-	-	86.7
Corresponding pressure: 16.9 MPa												
at the frame kN	-	99.7	97.3	92.1	86.9	81.8	76.7	71.6	66.6	61.5	59.6	-
Corresponding pressure: 16.9 MPa												

DRAWBAR POWER AND FUEL CONSUMPTION (UNBALLASTED TRACTOR)

Date of tests: June 16 & 17, 1990

Type of track: Concrete

	Tire inflation pressure			
	Front		Rear	
	Inside dual	Outside dual	Inside dual	Outside dual
Height of drawbar above ground 454 mm	96.5 kPa	82.7 kPa	96.5 kPa	82.7 kPa

Gear and range	Power	Drawbar pull	Speed	Engine speed	Slip of wheels	Specific fuel consumption	Specific energy	Temperature			Atmospheric conditions		
								Fuel	Coolant	Engine oil	Temp.	Relative humidity	Pressure
	kW	kN	km/h	rev/min	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.1 MAXIMUM POWER IN TESTED GEARS													
1-3	99.3	102.4	3.5	2197	14.7	358	2.35	38	83	108	23	56	101.3
1-4	116.0	102.9	4.1	2143	12.1	337	2.50	38	83	107	23	57	101.3
1-5	128.6	101.6	4.6	1963	15.0	282	2.98	37	84	108	23	58	101.2
2-1	135.7	94.0	5.2	1922	4.7	278	3.03	39	84	109	23	59	101.2
2-2	138.5	79.3	6.3	1976	6.1	239	3.52	38	84	109	24	57	101.2
2-3	139.8	65.9	7.6	1989	7.1	250	3.37	38	83	107	24	55	101.1
2-4	140.9	58.9	8.6	1954	7.6	228	3.68	39	84	109	24	54	101.1
2-5	141.4	49.3	10.3	1960	8.3	231	3.65	38	84	109	24	53	101.0
3-1	138.0	37.9	13.1	1963	3.7	238	3.53	38	84	109	24	53	101.0
3.2 FUEL CONSUMPTION													
3.2.1 in selected gear, at maximum power													
2-5	141.4	49.3	10.3	1960	8.3	231	3.65	38	84	109	24	53	101.0
3.2.1.1 75% of pull at maximum power at rated speed													
2-5	116.6	37.2	11.3	2105	1.4	252	3.33	37	83	106	23	70	100.6
3.2.1.2 50% of pull at maximum power at rated speed													
2-5	77.4	24.7	11.3	2103	1.2	275	3.07	37	81	104	24	68	100.6
3.2.1.3 next higher gear at reduced engine speed;same pull and travelling speed as in 3.2.1.1													
3-1	116.1	37.3	11.2	1671	1.6	196	4.28	36	83	105	24	68	100.6
3.2.1.4 next higher gear at reduced engine speed;same pull and travelling speed as in 3.2.1.2													
3-1	76.2	24.3	11.3	1674	1.0	245	3.42	36	82	103	24	68	100.6
3.2.2 in selected gear nearest to 7.5 km/h													
2-3	139.8	65.9	7.6	1989	7.1	250	3.37	38	83	107	24	55	101.1
3.2.2.1 75% of pull at maximum power at rated speed													
2-3	113.0	49.9	8.2	2092	3.2	265	3.18	37	83	107	25	61	100.5
3.2.2.2 50% of pull at maximum power at rated speed													
2-3	75.9	33.1	8.3	2099	2.2	289	2.91	38	81	104	25	61	100.5
3.2.2.3 next higher gear at reduced engine speed;same pull and travelling speed as in 3.2.2.1													
2-4	111.2	49.6	8.1	1815	2.3	249	3.38	38	83	105	25	61	100.5
3.2.2.4 next higher gear at reduced engine speed;same pull and travelling speed as in 3.2.2.2													
2-4	76.5	33.2	8.3	1844	1.3	291	2.89	38	82	104	26	57	100.4

Gear and range	Power	Drawbar pull	Speed	Engine speed	Slip of wheels	Specific fuel consumption	Specific energy	Temperature			Atmospheric conditions		
								Fuel	Coolant	Engine oil	Temp.	Relative humidity	Pressure
	kW	kN	km/h	rev/min	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.1 MAXIMUM POWER IN TESTED GEARS Tire inflation Pressure- 110 kPa Height of drawbar above ground- 445 mm													
1-1	96.2	125.5	2.8	2215	11.8	357	2.36	33	82	112	23	66	100.67
1-2	106.5	121.6	3.2	2191	11.3	327	2.57	34	82	112	23	66	100.67
1-3	123.7	123.2	3.6	2112	11.0	316	2.66	35	83	112	23	62	100.77
1-4	130.9	123.2	3.8	1954	10.7	288	2.92	35	84	111	23	62	100.77
1-5	138.6	102.3	4.9	1976	4.9	274	3.06	35	84	111	23	62	100.84
2-1	141.2	92.4	5.5	1957	3.8	266	3.16	34	83	110	23	62	100.84
2-2	142.2	80.8	6.3	1948	2.6	266	3.16	34	84	109	23	55	100.92
2-3	141.7	66.4	7.7	1970	1.7	265	3.17	36	84	109	23	55	100.92

REPAIRS AND ADJUSTMENTS DURING TESTS:

Tractor was manufactured with insufficient hydraulic relief valve sustained pressure (16.5 MPa). Manufacturer adjusted relief valve prior to Power Lift and Hydraulic Pump Performance Test. Relief valve was adjusted to manufacturer's recommendation of 17.2 MPa.

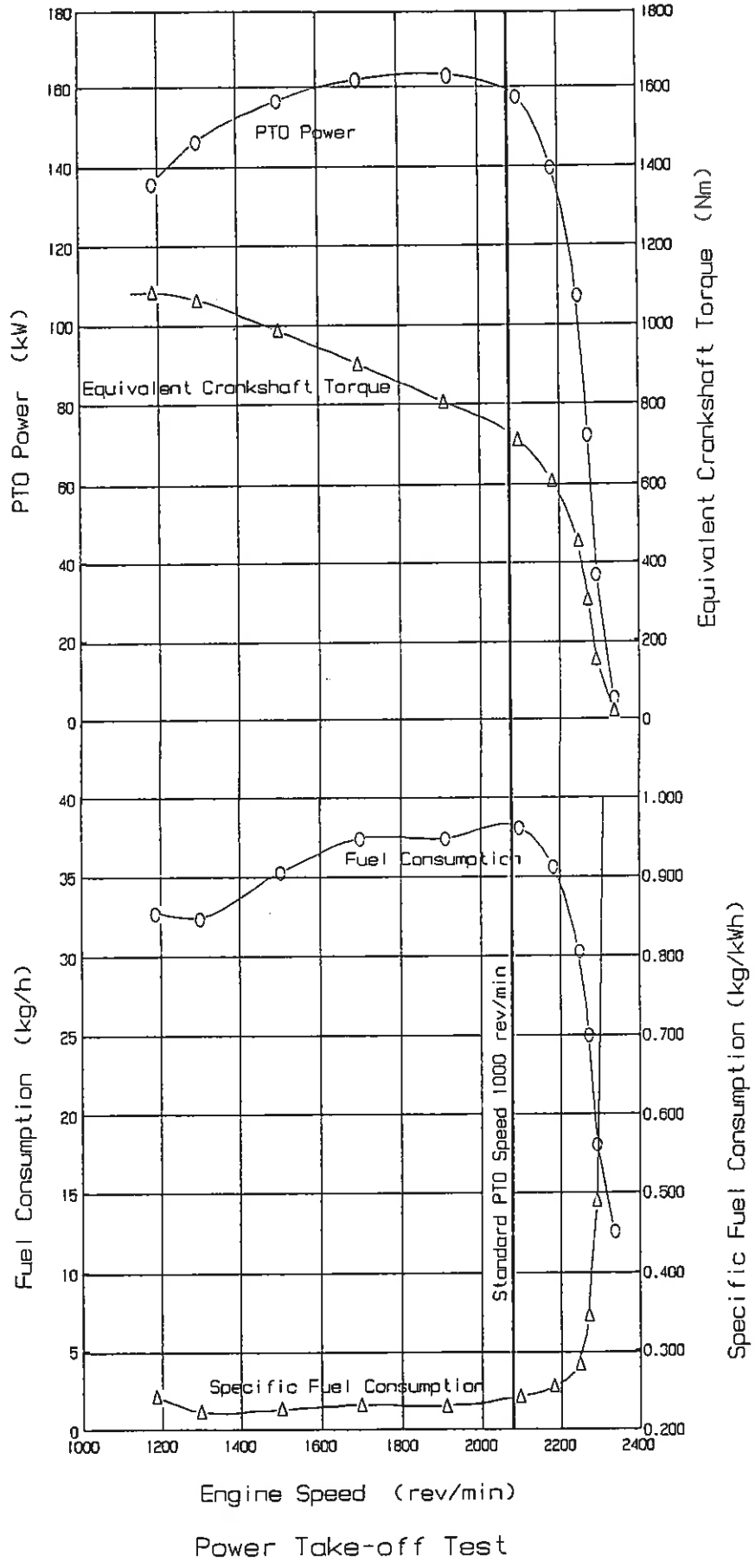
REMARKS: None

Test Carried Out By: D.J. May, P. Eng, Project Engineer

Signed:  Bruce Allen, Head of Test Station, for the Director

Date: FEB 27/91

FORD VERSATILE 846 4-WD ARTICULATED



Power Take-off Test

FORD VERSATILE 846 4-WD ARTICULATED

