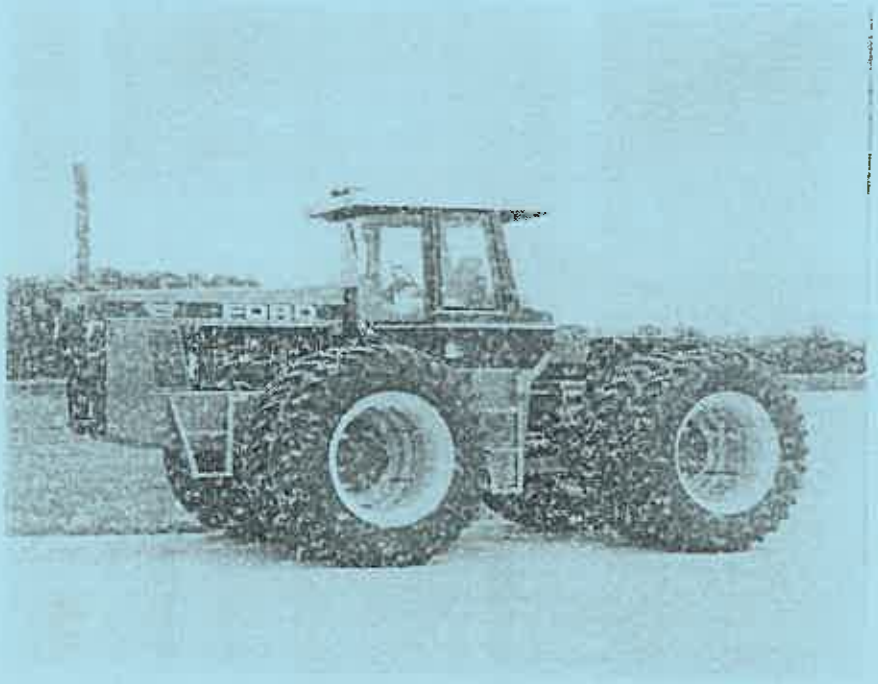
OECD No. 1340 Restricted Code
Date of Approval: December 11, 1991

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



FORD VERSATILE 946 (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, 1991

Printed in Canada

Prairie Agricultural Machinery Institute

Test Station: P.O. Box 1060
Portage la Prairie, Manitoba
CANADA R1N 3C5
Telephone: (204) 239-5445
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Head Office: P.O. Box 1900
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Ford 946

actor manufacturer's me and address:	Versatile Farm Equipment Operations Ford New Holland Canada Ltd. Box 7300 - 1260 Clarence Avenue Winnipeg, MB R3C 4E8 Canada
cation of tractor assembly:	Winnipeg, Manitoba; Canada
bmitted for test by:	Manufacturer
lected for test by:	Manufacturer, with agreement of the test station
ace of running-in:	Versatile Farm Equipment Operations Winnipeg, MB
ration of running-in:	50 h
cation 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)
eliminary remark:	Tractors manufactured with the transmission stated herin are not available with power take-off (PTO). The Engine power test was conducted by attaching the dynamometer directly to the transmission output shaft.

SPECIFICATIONS OF TRACTOR

ACTOR

ke/Model/Type:	Ford Versatile/946/4-wheel drive, articulated
mber of driving wheels:	4
rial No.:	946-91-D476055
t Serial No.:	946-89-D430119

GINE

ke/Model/Type:	Cummins/NTA-855-C/Diesel, turbocharged aftercooled, direct injection
rial No:	30330174

linders

mber/disposition:	6/in-line, vertical
re/stroke:	140 mm /152 mm
pacity:	14016 cm^3
mpression ratio:	14.5:1

Arrangement of valves:	Overhead
Cylinder liners:	Wet (replaceable liners)
Turbocharger	
Make/Model:	Holset/HT3B/Exhaust gas driven turbo
Pressure:	122-149 kPa - rated speed & load
Fuel System	
Fuel feed system:	Engine driven transfer pump
Make/Model/Type of fuel filter(s):	Fleetguard/FS1212/Spin on
Capacity of fuel tank:	1085 dm^3
Make/Model/Type of injection pump:	Cummins/Type G, Model PT
Serial No.:	9449 A 044496
Manufacturer's production setting of injection pump:	
Max. Flow rate (rated engine speed and full load):	54 kg/h at fuel density of 0.842 g/cm^3
Timing:	Controlled by camshaft actuation-20° BTDC
Make/Model/Type of injectors:	Cummins/PTD/Cam Actuated
Injection pressure:	68.95 MPa
Rail Pressure:	765-848 kPa (full load @ rated speed)
Governor	
Make/Model/Type:	Cummins/Centrifugal flyweight, integral to fuel pump
Governed range of engine speed	From 650 to 2460 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/Part #STB 14-0111
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:	Two

Cooling system

Type of coolant:	50/50 water/glycol base anti-freeze
Type of pump:	Belt driven centrifugal pump
Specification of fan or blower:	Belt driven
Number of fan blades:	8
Fan diameter:	813 mm
Coolant capacity:	60.3 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 and on clutch

Electrical system

Voltage:	12 volt, negative ground
Alternator:	
Make/Model/Type:	Delco/1117732/400
Power:	12 volt, 90 amp
Battery (number of accumulators):	Four 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/21338-N/Aspirating
Location:	On front R/H hood, mounted vertically 292 x 209 mm oval body 1016 mm long

TRANSMISSION

Clutch (travel alone)

Make/Type:	Spicer/AS1552/Dry
Number of plates:	2
Diameter of plates:	395 mm
Method of operation:	Mechanical

Gear box

Make/Model/Type:	Versatile/12 Speed/Mechanical
Arrangement:	Gearbox with 3 forward and 1 reverse speed/ 4 ranges, 2 levers
Number of gears:	12 forward, 4 reverse
Available options:	None

Rear axle and final drives

Make/Type:	Versatile/Outboard planetary
Differential lock:	Optional
Type:	Electrical solenoid operated mechanical clutch
Method of engagement:	Floor mounted switch
Method of disengagement:	Same

Front axle and final drives

Make/Type:	Versatile/Outboard planetary
Differential lock:	Optional
Type:	Electrical solenoid operated mechanical clutch
Method of engagement:	Floor mounted switch
Method of disengagement:	Same

'otal Ratios and Travelling Speeds

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	125	5.7
2		69	10.4
3		35	20.5
1	2	107	6.7
2		59	12.2
3		30	24.0
1	3	93	7.7
2		51	14.0
3		26	27.6
1	4	80	9.0
2		44	16.3
3		23	31.2
Reverse	1	96	7.5
	2	83	8.7
	3	72	10.0
	4	62	11.6

*) Calculated with a tyre dynamic radius index of: 905 mm (ETRTO Standards anual - 1991)

lumber of revolutions of front wheels
'or one revolution of rear wheels: 1.0

'OWER TAKE-OFF

lain power take-off: Not Available

'OWER LIFT

lake/Model/Type: Versatile/Hydraulic

'ype of hydraulic system: Closed centre, load sensing

'ype and number of cylinders (single-or double-acting): External, 2 double acting

'ype of linkage lock for transport: Electro-Hydraulic

Relief valve pressure setting (tolerance): 16.89 ± (0.35) MPa (MPa)

Opening pressure of cylinder safety valve: None

.ift pump type: Cessna axial piston, pressure & 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 L
Type, number and location of tapping points:	4 pairs ISO Standard lever type at rear of tractor
Maximum volume of oil available to external cylinders:	29.5 dm^3 level 8.7 dm^3 at 25° tilt

Three-point Linkage

Category 3/4 in conformity with 3 wide/4 narrow of ISO 730/3-1982.

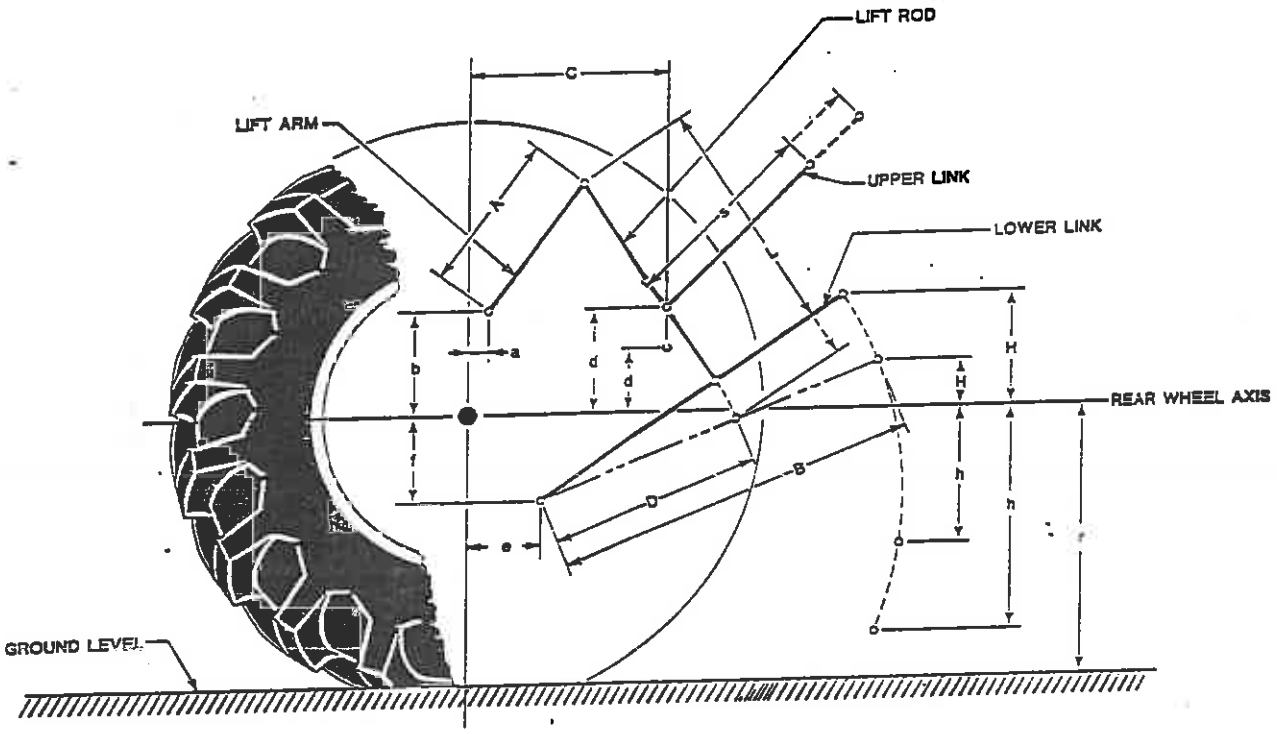
Category adapter:	Reverse lower links; install alternate bushings at hitch points

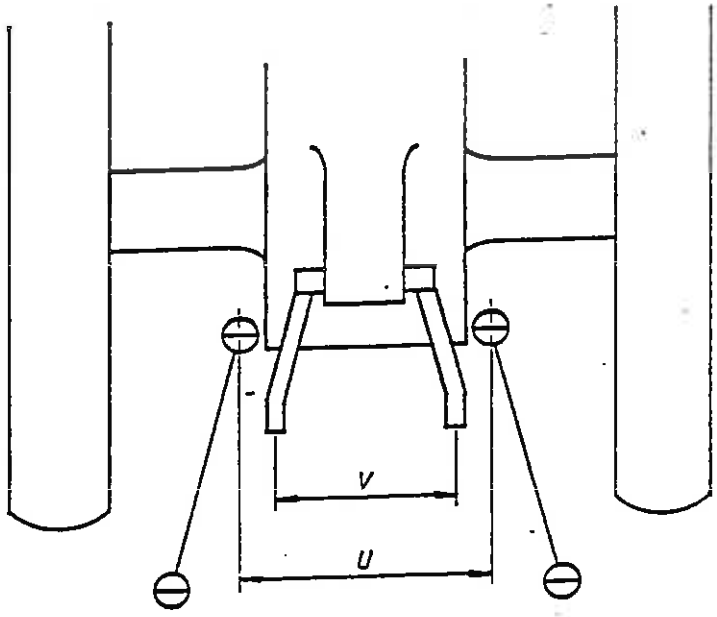
Table 2.1 - Dimensions of linkage geometry
(when connected to the standard frame)

		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 point from rear-wheel axis: horizontally	(a)	182	
Distance of lift arm pivot 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	769
Distance of upper link pivot point from rear wheel axis: horizontally	(c)	642	
Distance of upper link pivot point from rear wheel axis: vertically	(d)	320 or 193	193
Distance of lower link pivot point from rear wheel axis: horizontally	(e)	264	
Distance of lower link pivot point from rear wheel axis: vertically	(f)	263	
Distance of lower link pivot points to lift rod pivot points on lower links	(D)	457 or 635	635
Length of lift rods	(L)	from 737 to 876	850
Height of lower hitch points relative to the rear-wheel axis: - in low position	(h)	from 383 to 617	612
Height of lower hitch points relative to the rear-wheel axis: - in high position	(H)	from 344 to 136	140
Height above ground of lower hitch points when locked in transport position (*)		Any height within lift range	

(*) Assuming r - tyre dynamic radius index of 905 mm (ETRTO - 1991)

mplement Linkage:





SWINGING DRAWBAR

Type:	Versatile
Height above ground:	533 mm to top of drawbar
Type of adjustment:	
Vertical	Fixed
Lateral	Manual slide
Distance of hitch point from rear wheel axis, horizontally:	649 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

STEERING

Make/Model/Type:	Eaton/251-1004-001/Hydrostatic open centre valve
Method of Operation:	Articulated
Pump:	One gear pump
Ram(s):	Two, 89 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):	None

Parking brake

Type:	Calliper
Method of operation:	Mechanical

WHEELS

Number

Front: 2 driving
Rear: 2 driving

Wheelbase: 3302 mm

Track width adjustment

	Inner Wheel Minimum mm	Inner Wheel Maximum mm	Adjustment Method	Dual Wheel Minimum & Maximum mm
Front	1829	2032	Reverse rims	2542
Rear	1829	2032	Reverse rims	2542

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

LIGHTING

	Height above ground of centre mm	Size mm	Distance from outside edge of lights to median plane of tractor mm
Headlights	1253	184 x 127	408
Sidelights	2084	133 Dia	970
Rearlights	2093	133 Dia	1111
Reflectors	2060	triangle with 350mm sides	203

II. TEST CONDITIONS

Overall dimensions

Length mm	Width minimum mm	Width maximum mm	Height at top of protective structure mm	Height at top of exhaust silencer mm
6600	3800	3800	3330	3560

Ground Clearance (unballasted tractor): 486 mm
Clearance-limiting part: Drawbar clamp bolts

Tractor Mass (with cab)

	Unballasted		Ballasted*	
	Without Driver kg	With Driver kg	Without Driver kg	With Driver kg
Front	7344	7390	10501	10547
Rear	4687	4716	5184	5213
Total	12031	12106	15685	15760

* All ballast in the form of liquid added to tires

Ballast (all ballast in the form of liquid added to tyres)

	Weights kg	CaCl Solution kg
Front	--	3157
Rear	--	497
Total	--	3654

	Front	Rear
Tyres:		
. dimensions	20.8 R42 Dual	20.8 R42 Dual
. ply rating	Two Star	Two Star
. type	Radial	Radial
. maximum load (tyre mft.)	40.7 kN	40.7 kN
. maximum load (tractor mft.)	40.7 kN	40.7 kN
. max. inflation pressure (tyre mft.)	165 kPa	165 kPa
. dynamic radius index	905 mm	905 mm
Chosen track width:	2542 mm	2542 mm

Oils and lubrication

Capacity and change interval

	Capacity dm^3	Oil Change h	Filter Change h
Engine	37	200	200
Gear Box	20.3	400	400
Front Axle (*)	38.8	400	-
Rear Axle (*)	38.8	400	-
Final drive (Front)	in axle		
Final drive (rear)	in axle		
Hydraulic system(**)	55	400	200

Note: First change engine oil/ filters at 50 hr
Transmission filter change at first 50 hr; wash suction screen at 400 hr intervals
Hydraulic reservoir suction screen wash every 400 hr

* Final drive reservoir common with axle

** Hydraulic system and steering use common sump

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

	Recommended	Used during test
Engine Oil .Type .Viscosity .Classification:	SAE 15W 40 110 cSt at 40°C API SF/CD	As Recommended
Transmission oils .Type .Viscosity .Classification:	Hygear 23 55 cSt at 40°C SAE 20 SF/CD	As Recommended
Hydraulic Fluid .Type .Viscosity .Classification:	Hygear 23 55 cst at 40°C SAE 20 SF/CD	As Recommended
Steering oil .Type .Viscosity .Classification:	Same as Hydraulic	As Recommended

Grease: SAE Multipurpose grease

-Number of lubrication points: 33

Fuel

Type: No. 2 Diesel in conformity with national standard

Density at 15°C: 0.842 g/cm^3

III. TEST RESULTS

COMPULSORY TEST RESULTS

1. ENGINE POWER*

-Date and location of tests: June 26, 1991 Winnipeg, Manitoba, Canada
-Type of dynamometer: Water Brake

Power	Engine Speed	Fuel Consumption			Specific Energy
		Hourly		Specific	
kW	rev/min	kg/h	l/h	g/kWh	kWh/l
1.1 MAXIMUM POWER - TWO HOUR TEST					
224.9	2002	53.0	63.0	236	3.57
1.2 POWER AT RATED ENGINE SPEED					
219.2	2102	54.0	64.1	246	3.42
1.4 PART LOADS 1.4.1 the torque corresponding to maximum power at rated engine speed					
219.2	2102	54.0	64.1	246	3.42
1.4.2 85% of torque obtained in 1.4.1					
194.3	2190	50.7	60.2	261	3.23
1.4.3 75% of torque defined in 1.4.2					
149.9	2248	42.4	50.3	283	2.98
1.4.4 50% of torque defined in 1.4.2					
101.3	2287	34.0	40.4	335	2.51
1.4.5 25% of torque defined in 1.4.2					
51.5	2324	23.3	27.7	453	1.86
1.4.6 unloaded					
0.3	2350	17.0	20.0	56706	0.01

* This tractor configuration not available with Power Take-off (PTO). Power test conducted by attaching dynamometer to transmission output shaft.

-No load maximum engine speed: 2350 rev/min

-Torque (equivalent crankshaft) at maximum power: 1072.2 Nm

-Torque (equivalent crankshaft) at rated engine speed: 995.9 Nm

-Maximum torque (equivalent crankshaft): 1420 Nm at 1307 rev/min

-Mean atmospheric conditions:

- -Temperature: 25°C
- -Pressure: 100.11 kPa
- -Relative Humidity: 60%

-Maximum temperatures:

- -Coolant: 91°C
- -Engine oil: 104°C
- -Fuel: 38°C
- -Engine air intake: 46°C

HYDRAULIC POWER AND LIFTING FORCE

-Date of tests: June 27, 1991

HYDRAULIC POWER TESTS

-Sustained pressure with relief valve open: 17.7 MPa
(Pump stalled)

-Pump delivery rate at minimum pressure: 89.7 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	85.1	13.8	19.6
Flow rate and hydraulic pressure corresponding to maximum hydraulic power	84.0	15.4	21.6

-Tapping point used for test: Remote circuit coupler

-Temperature of hydraulic fluid: 65 ± 5°C

POWER LIFT TEST

	At the hitch point	On the frame
Height of the lower hitch points above ground in down position	293 mm	309 mm
Vertical movement	783 mm	760 mm
Maximum corrected force exerted through full range	89.7 kN	59.7 kN
Corresponding pressure of hydraulic fluid	17.2 MPa	17.2 MPa
Moment about rear wheel axis	113.8 kNm	110.9 kNm
Maximum tilt angle of mast from vertical	-	16 degrees

-Linkage 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	-357	-349	-300	-200	-100	0	+100	+200	+300	+400	+403	+41
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	101.1	-	100.7	99.1	97.6	96.0	94.4	92.9	91.3	89.8	89.7	-
Corresponding pressure: 17.2 MPa												
at the frame kN	-	91.6	89.5	85.3	81.1	76.9	72.7	68.6	64.4	60.2	-	59.
Corresponding pressure: 17.2 MPa												

3. DRAWBAR POWER AND FUEL CONSUMPTION (UNBALLASTED TRACTOR)

Date of tests: June 24, 1991

Type of track: Concrete

	Tire inflation pressure			
	Front		Rear	
	Inside dual	Outside dual	Inside dual	Outside dual
Height of drawbar above ground 533 mm	110 kPa	97 kPa	110 kPa	97 kPa

range					wheels	consumption				oil		humidity	
	kW	kN	km/h	rev/min	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.1 MAXIMUM POWER IN TESTED GEARS													
1-1	163.9	121.4	4.9	2177	9.7	313	2.69	35	83	99	24	73	101.31
1-2	183.9	121.4	5.5	2101	9.9	290	2.90	36	84	100	24	73	101.31
1-3	190.9	117.4	5.9	1939	9.1	274	3.08	37	84	100	24	73	101.31
1-4	196.5	100.1	7.1	1943	5.5	265	3.18	35	84	99	24	73	101.31
2-1	198.8	84.7	8.5	1957	4.1	262	3.21	35	84	99	24	73	101.31
2-2	198.1	71.7	10.0	1967	3.1	253	3.33	34	84	99	24	73	101.31
3.2 FUEL CONSUMPTION													
3.2.1 in selected gear, at maximum power													
2-1	198.8	84.7	8.5	1957	4.1	262	3.21	35	84	99	24	73	101.31
3.2.1.1 75% of pull at maximum power at rated speed													
2-1	163.3	63.8	9.2	2101	2.5	293	2.88	35	83	99	26	64	101.31
3.2.1.2 50% of pull at maximum power at rated speed													
2-1	110.1	42.6	9.3	2097	1.3	313	2.69	34	80	98	26	64	101.31
3.2.1.3 next higher gear at reduced engine speed;same pull and travelling speed as in 3.2.1.1													
2-2	163.9	64.1	9.2	1807	2.5	255	3.30	34	83	98	26	64	101.31
3.2.1.4 next higher gear at reduced engine speed;same pull and travelling speed as in 3.2.1.2													
2-2	110.0	42.5	9.3	1809	1.4	279	3.02	34	80	96	26	62	101.25
3.2.2 in selected gear nearest to 7.5 km/h													
1-4	196.5	100.1	7.1	1943	5.5	265	3.18	35	84	99	24	73	101.31
3.2.2.1 75% of pull at maximum power at rated speed													
1-4	163.5	75.1	7.8	2104	3.1	283	2.97	35	83	99	26	62	101.25
3.2.2.2 50% of pull at maximum power at rated speed													
1-4	110.5	50.0	8.0	2102	1.7	314	2.68	35	80	98	26	62	101.25
3.2.2.3 next higher gear at reduced engine speed;same pull and travelling speed as in 3.2.2.1													
2-1	164.2	75.1	7.9	1808	3.2	267	3.15	34	83	95	26	62	101.25
3.2.2.4 next higher gear at reduced engine speed;same pull and travelling speed as in 3.2.2.2													
2-1	110.1	50.0	7.9	1792	1.6	280	3.01	35	80	96	26	62	101.25

Note: 15% slip not achieved due to wheel bounce.

	Tire inflation pressure			
	Front		Rear	
	Inside dual	Outside dual	Inside dual	Outside dual
Height of drawbar above ground 572 mm	110 kPa	97 kPa	97 kPa	83 kPa

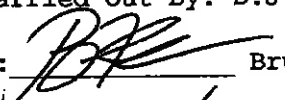
Gear and range	Power	Drawbar pull	Speed	Engine speed	Slip of wheels	Specific fuel consumption	Specific energy	Temperature			Atmospheric conditions		
								Fuel	Coolant	Engine oil	Temp.	Relative humidity	Pressure
	kW	kN	km/h	rev/min	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.1 MAXIMUM POWER IN TESTED GEARS													
1-1	194.8	157.1	4.5	1974	8.6	268	3.14	29	82	98	19	59	102.04
1-2	198.8	137.0	5.2	1925	5.5	263	3.20	30	82	98	19	60	102.05
1-3	200.1	116.2	6.2	1954	4.1	261	3.22	30	83	98	20	59	101.99
1-4	202.1	99.0	7.4	1976	3.2	249	3.38	30	83	98	20	59	101.99
2-1	202.7	84.2	8.7	1978	2.4	260	3.24	29	82	97	20	58	101.99
2-2	205.6	72.1	10.3	2008	1.9	263	3.20	30	83	97	21	58	101.99
2-3	204.7	62.7	11.8	1990	1.4	256	3.29	31	83	98	21	58	101.99

Note: 15% wheel slip not achieved due to wheel bounce.

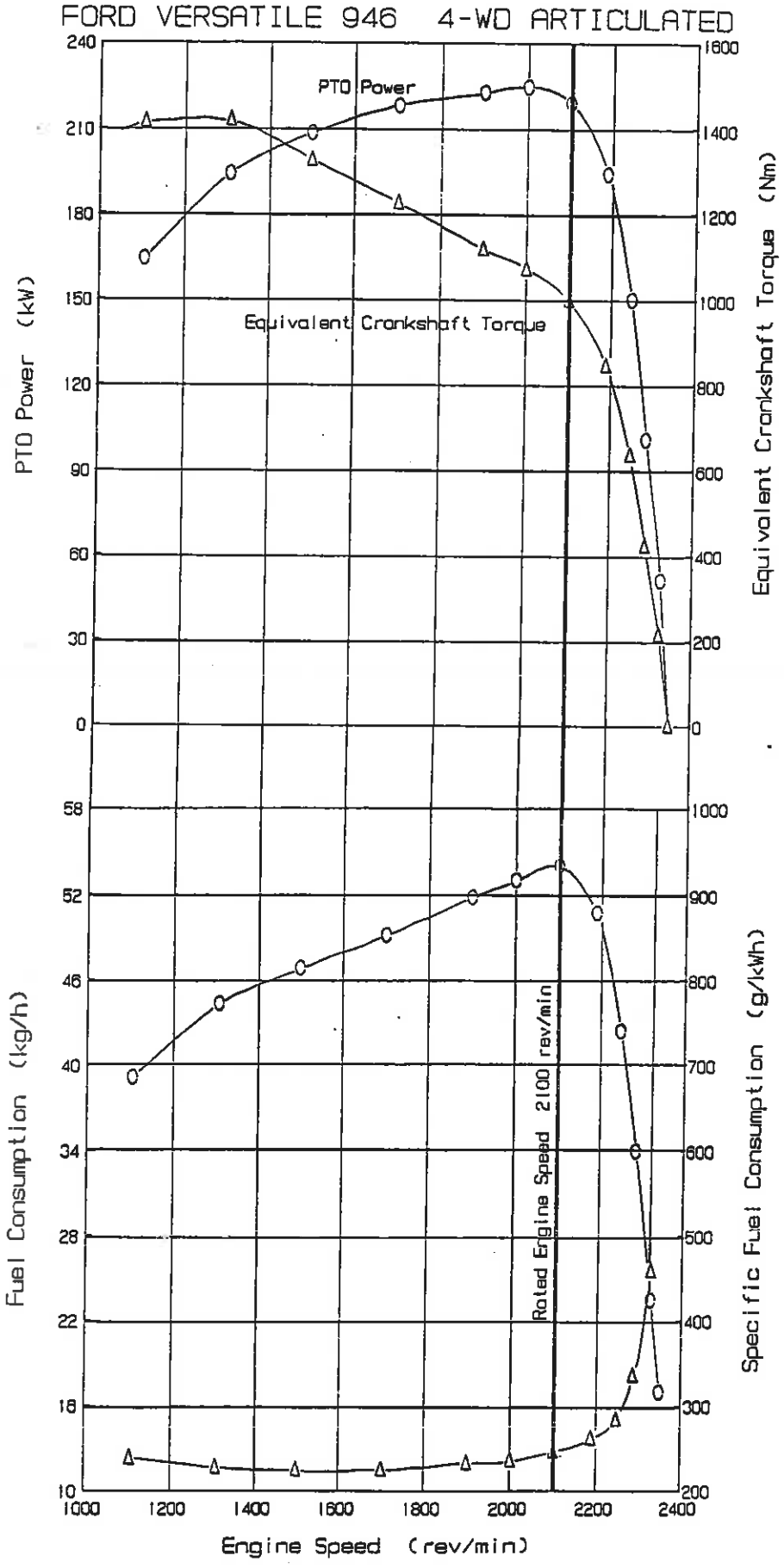
REPAIRS AND ADJUSTMENTS DURING TESTS: None

REMARKS: 15% wheel slip could not be achieved during drawbar tests due to the occurence of wheel hop or bounce. This tractor configuration was not available with Power Take-off (PTO). Power test was conducted by attaching dynamometer directly to transmission output shaft.

Test Carried Out By: D.J. May, P. Eng, Project Engineer; K.A. Carmichael, Project Technologist

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

Date: Dec 20/91


FORD VERSATILE 946 4-WD ARTICULATED
PTO Power
Equivalent Crankshaft Torque
PTO Power (kW)
Equivalent Crankshaft Torque (Nm)
Fuel Consumption (kg/h)
Specific Fuel Consumption (g/kWh)
Rated Engine Speed 2100 rev/min
Engine Speed (rev/min)
240
210
180
150
120
90
60
30
0
58
52
46
40
34
28
22
16
10
1600
1400
1200
1000
800
600
400
200
0
1000
900
800
700
600
500
400
300
200
1000
1200
1400
1600
1800
2000
2200
2400

FORD VERSATILE 946 4-WD ARTICULATED

