TRACTORS 6110
6120
6130
6140
6150
6160
6170
6180
6190

North American market only

CALIFORNIA

PROPOSITION 65 WARNING

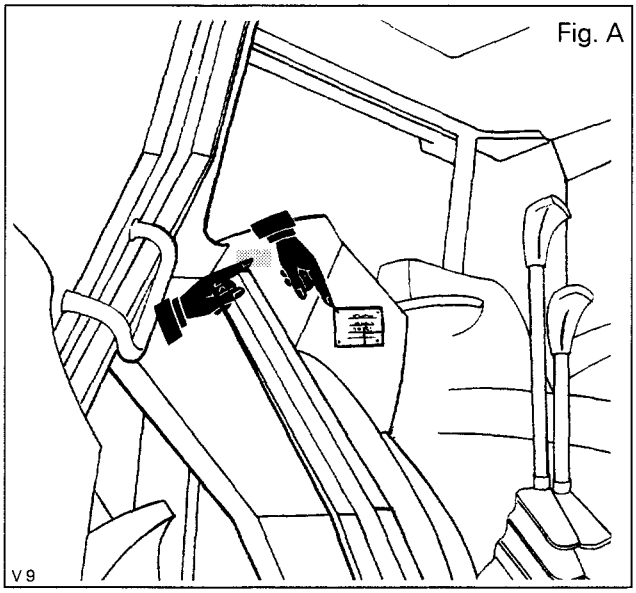
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

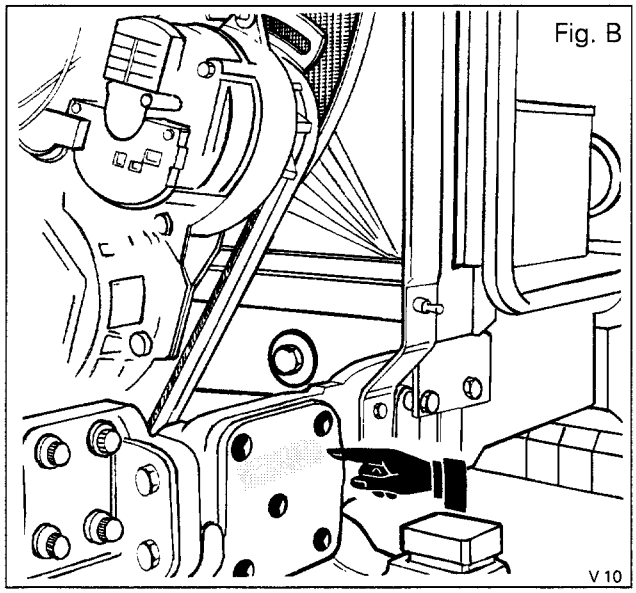
CONTENTS SECTION

SERIAL NUMBER

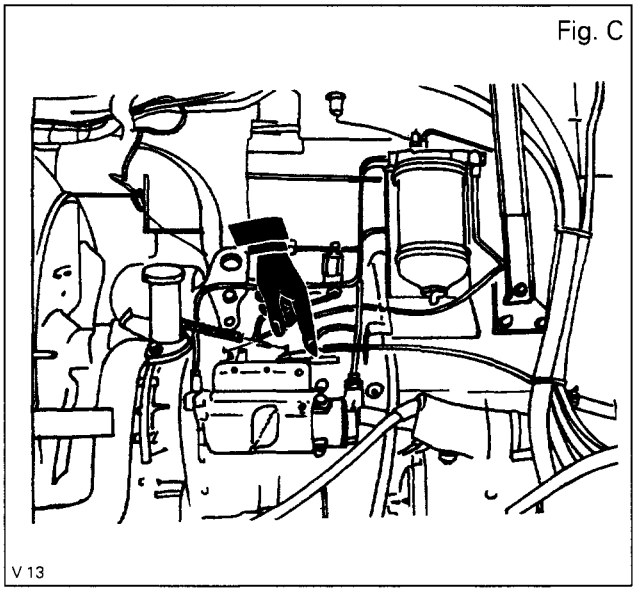
Important :
NOTE THE SERIAL NUMBER OF YOUR TRACTOR. ALWAYS QUOTE THE SERIAL NUMBER IN ANY COMMUNICATION TO YOUR MASSEY FERGUSON DEALER.

Tractor serial number

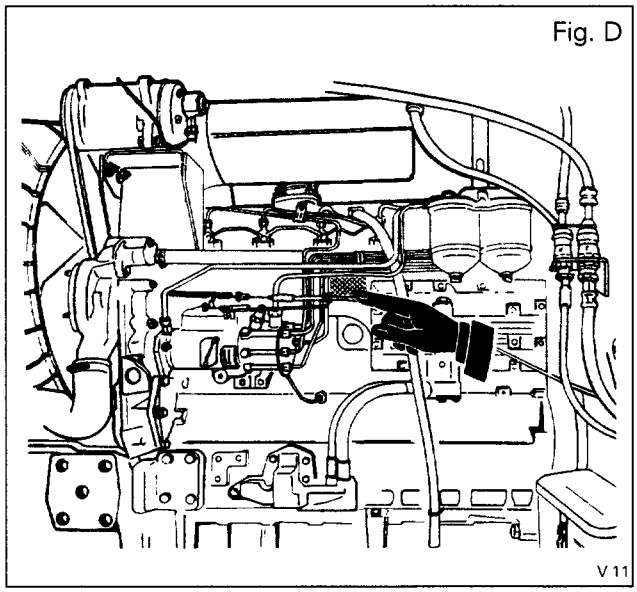




Engine serial number



4 cyl. Engine



6 cyl. Engine

SAFETY - ALERT SYMBOL AND TERMS

This Safety After Symbol means ATTENTION ! BECOME ALERT ! YOUR SAFETY IS INVOLVED !

The safety alert symbol identifies important safety messages on machines, safety signs, in manuals, or elsewhere. When you see this symbol, be alert to the possibility of personal injury or death. Follow the instructions in the safety message.

Why is SAFETY important to you ?

★ ACCIDENTS DISABLE AND KILL

★ ACCIDENTS ARE COSTLY

★ ACCIDENTS CAN BE AVOIDED

SAFETY - TRACTOR AND IMPLEMENT

The tractor is a source of power - Mechanical
- Hydraulic

- On its own, the tractor is of little practical value. Only when used in conjunction with an implement or other attachment does it become a working unit.
- This instruction book is compiled to cover those safe working practices that are associated with the base tractor operation.
- It does not cover all operation and safety instructions relevant to all known implements and attachments that may be fitted at the time of tractor delivery or at some future date.
- It is essential that operators use and understand the relevant instruction manual of such implements and attachments.

SAFETY - INTRODUCTION

This safety section of your Operator Instruction Book is intended to point out some of the basic safety situations which may be encountered during the normal operation and maintenance of your tractor, and to suggest possible ways of dealing with these situations. This section is NOT a replacement for other safety practices featured in other sections of this book.

Additional precautions may be necessary, depending on attachments used and conditions at the work site or in the service area. Massey Ferguson has no direct control over tractor application, operation, inspection, lubrication, or maintenance. Therefore it is YOUR responsibility to use good safety practices in these areas.

SAFETY - A WORD TO THE OPERATOR

It is YOUR responsibility to read and understand the safety section in this manual before operating your tractor. You must follow these safety instructions that take you step by step through your working day.

In reading this section, you will note that illustrations have been used to highlight certain situations. Each illustration is numbered and the same number appears in the text in parenthesis. This number is placed at the end of the written text that refers to the illustration.

Remember that YOU are the key to safety. Good safety practices not only protect you, but also the people around you. Study the features in this manual and make them a working part of your safety program.

Watch out for others

- Be aware of what is going on.
- Never allow an untrained or unqualified person to operate your tractor. They could injure themselves or someone else.

WARNING : Your tractor is a one-person machine. Do not permit others to ride on the tractor or the implement except on certain implements, such as planting or harvesting equipment specifically designed for riders, and only during field operation.

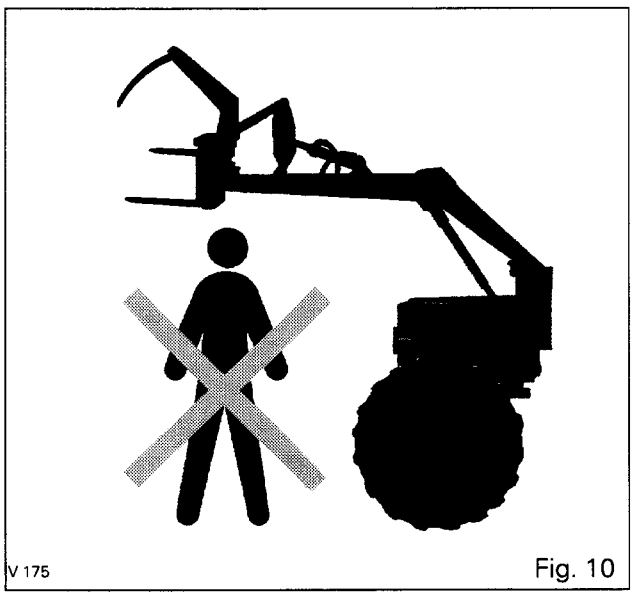
WARNING : Never allow children on the tractor.

WARNING : Be certain you can control both speed and direction before moving. *Move slowly until you are sure that everything is operating properly. After starting, recheck the steering, right and left. Be certain you have full steering and brake control. If differential is locked, do NOT operate at high speed or turn the tractor until the differential lock is disengaged.*

WARNING : Never lift a load over anyone.

- Keep others away from your operation. Never allow anyone to stand or pass under a raised implement (Fig. 10).
- DO NOT lift objects that can not be contained safely in the bucket, get the appropriate attachment.
- When using a loader, avoid sudden stops, starts, turns, or change of direction. Keep loads close to the ground when transporting.
- Never drive a tractor up to someone standing in front of a fixed object.
- Never stand (or allow anyone else to stand) in front of, under, or behind loaded or loading equipment.
- Never allow anyone to stand on the ROPS or fenders.
- Keep others away from articulation joints, hitches, drawbar, lift arms, PTO drives, cylinders, belts, pulleys, and other moving parts. Keep all shields and guards in place.

V 176 Fig. 9



V 175 Fig. 10

WARNING : Never stand, or allow anyone else to stand, between the tractor and implement unless the engine is turned off and the parking brake is engaged, the transmission is in neutral, and all attachments or implements are lowered to the ground.

SEAT

Description (Fig.10).

1. Height and weight adjustment.
2. Height and weight adjustment indicator window.
3. Front/rear position adjustment: (according to model)

Standard: Position adjustment (sliderails).
Pneumatic: 3 adjustments position:

- Up: Horizontal adjustment.
- Middle: Horizontal suspension.
- Down: Locked.

4. Seat rotation.
5. Lumbar support adjustment, 5 positions.
6. Backrest angle adjustment.
7. Armrest angle adjustment (according to model).
8. Thigh support adjustment, 3 positions (pneumatic only)
9. Seat back extension.

Adjustment.

DANGER: Do not adjust seat when tractor is in operation.

The seat can be adjusted as follows:

1 - Sit on the seat

2 - Use lever or turn handle 1 to adjust seat height and weight: (according to model)

Standard. Turn clockwise to raise seat
Turn anti - clockwise to lower seat.

Pneumatic. Pull Up to raise seat
Pull Down to lower seat.

3 - Check ride indicator 2 show green *(if red, readjust seat height).*

NOTE: Within the green band of the ride indicator there is 75mm (2.95 in) of height adjustment for any driver.
for maintenance consult your dealer or distributor.

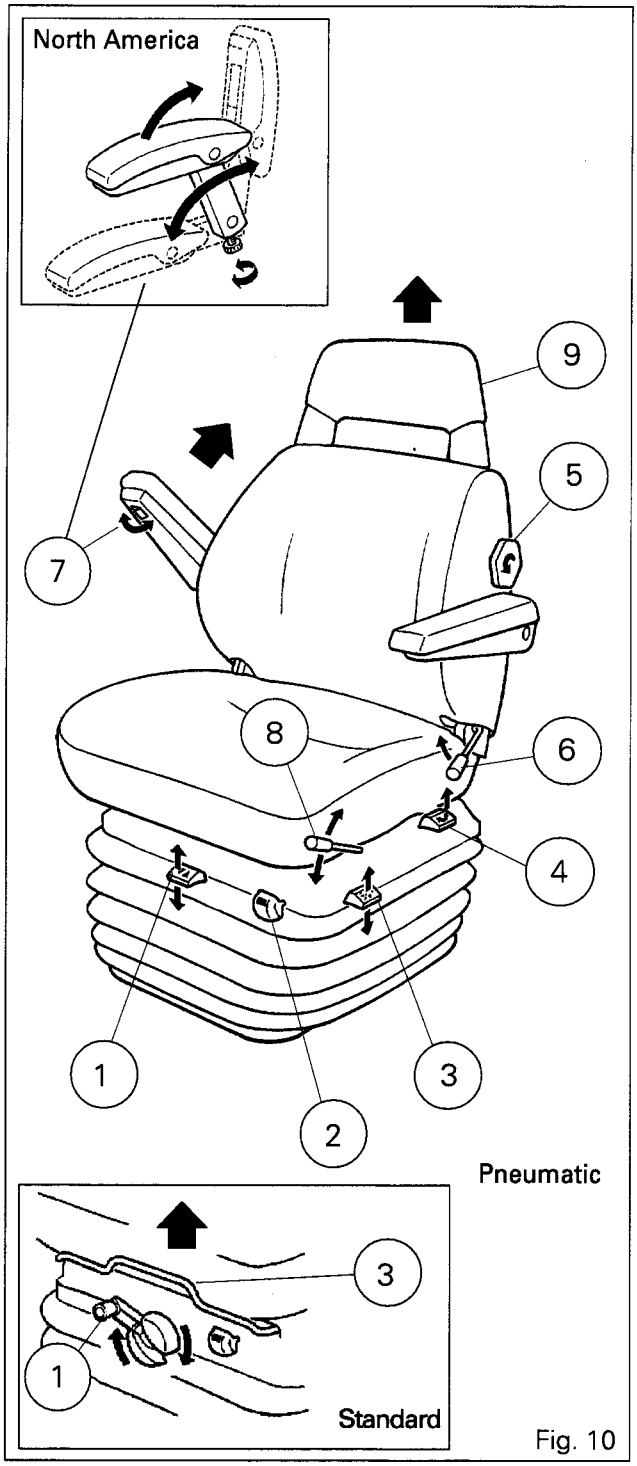
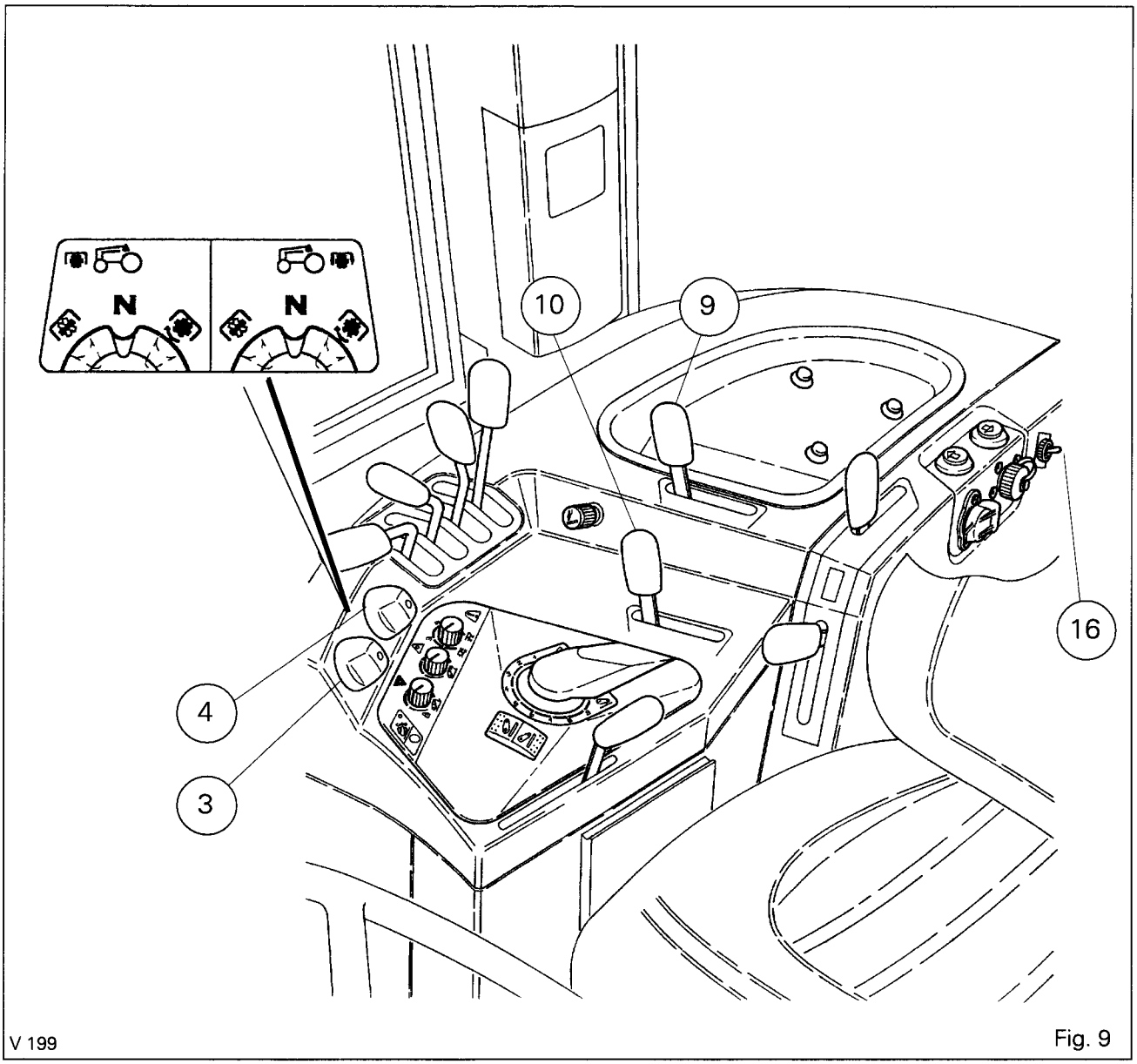


Fig. 10



V 199

Fig. 9

POWER TAKE OFF (P.T.O)

The P.T.O can be engaged and disengaged independently of the transmission. By selecting the required ratio either 540 rev/min or 1000 rev/min can be achieved.

Engage the P.T.O at low engine speed in order to protect the clutch and driveline.

To engage the P.T.O, press knob 4 while turning it clockwise (Fig. 9)

Press or strike the knob to return it to the neutral position.

To completely immobilise the P.T.O, turn the knob to the "power take-off brake" position.

WARNING : Always disengage the P.T.O and stop the engine before attaching or detaching an implement or making adjustments to it.

Observe all safety precautions in any operation involving implements driven by the P.T.O

When P.T.O is not used, place the knob in neutral.

AUXILIARY HYDRAULICS (FIG. 23)

The tractors are designed to take up to four spool valves. The two are standard and the rest are available as dealer installed accessories

Types of spool valves or features:

The spools are normally spring loaded to return to neutral when the lever is released, but they can be adjusted to hold the selected position and will "kick-out" to neutral at the end of the hydraulic ram stroke.

- Flow Control Valve

The flow of oil to the spool valve can be adjusted to suit implements where maximum flow is not required e.g. where precise operation is required, or to regulate the speed of hydraulic motors (in conjunction with the special motor spool). Is is also useful for keeping available a flow of oil for the simultaneous use of the lift linkage and of the auxiliary hydraulics. To regulate the flow of oil, turn the knob 1.

- "Zero leakage"

All spool valves have a small internal leakage, which may result in small changes in the implement settings. This spool valve avoids this problem.

- "Float" position" (double acting only)

When the spool valve has this feature, the float position is achieved by pushing the lever forward beyond the "kick-out" position. The oil can then circulate freely and the implement follows the ground contours.

The spool valves can be adjusted for single - or double-acting operation.

To adjust for single or double acting operation, move the screw 2 (Fig. 23) in for double acting and out for single acting.

Connect two hoses on the same spool valve (vertical line).

Note : After disconnecting, put protective covers on all the female couplers to prevent dirt getting in. Before connecting the hoses be sure ends are free from dirt.

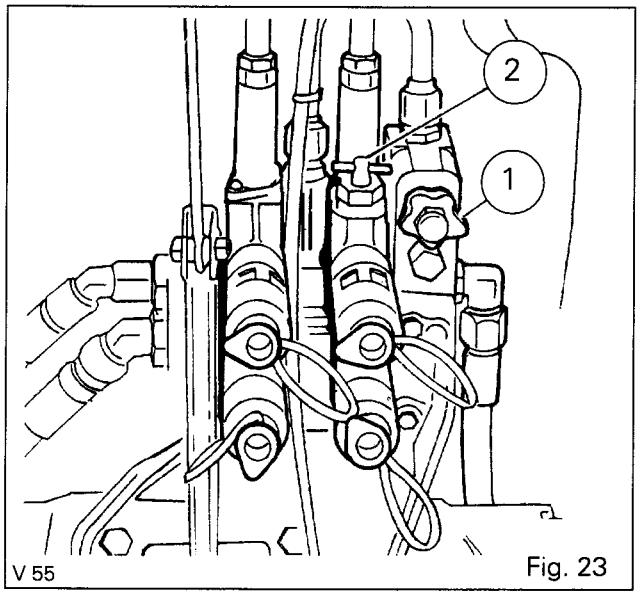


Fig. 23

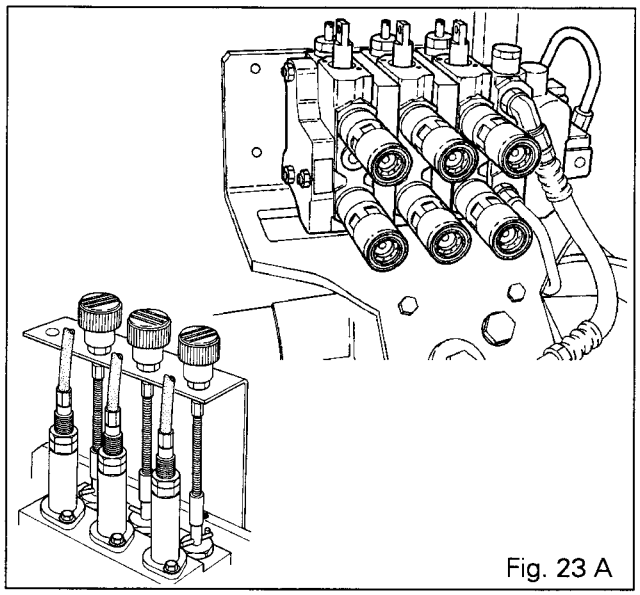


Fig. 23 A

Closed center load sensing (optional).

- Bosch SB23 spool valves mechanical command (Fig. 23A)

Set the flowrate on each spool valve using the controls accessible from the cab.

Hose coupling

A color on the cap indicates the auxiliary valve correspondance.

***Note:** the two hoses of one ram must be connected on the same auxiliary.*

Option

Two distributors

3P. zero leakage

4P. kick out position

Two distributors

3P. zero leakage

4P. kick out position

4P. kick out position and zero leakage

Two distributors

4P. kick out position and zero leakage

Flow control valve

The flow of oil can be adjusted on each of the spool valve.

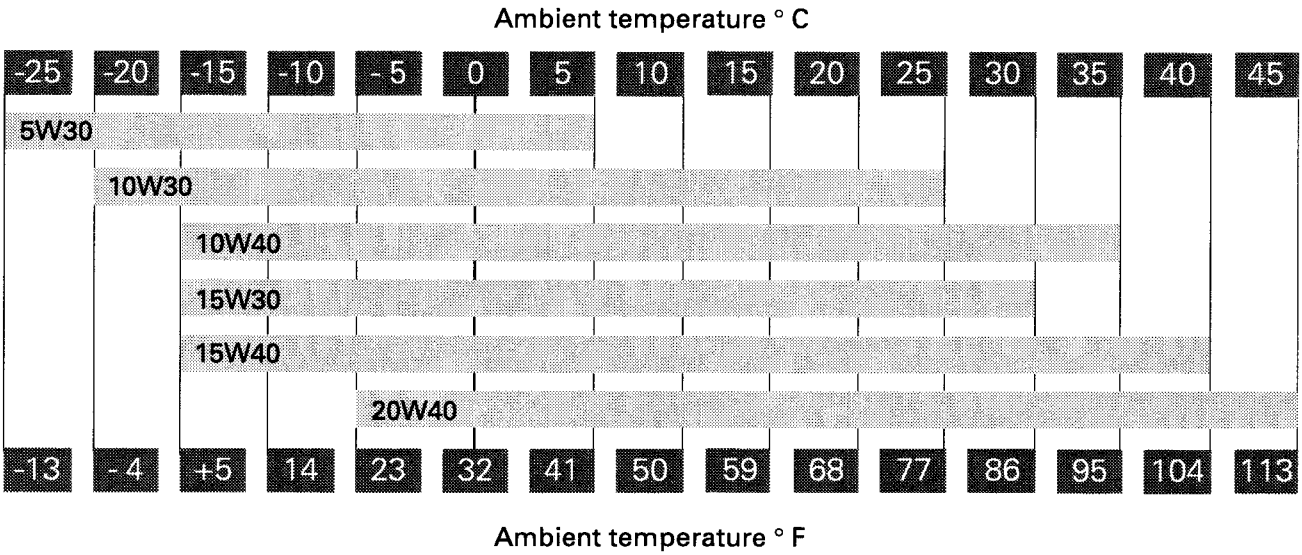
For adjustment, turn the knob found on top of the spool valve :

In the clockwise to increase the flow oil and anti-clockwise for the decrease.

APPROVED LUBRICANTS

Engine oil : Use Massey Ferguson Multiguard®, or equivalent engine oil meeting : API CD, CE or MF. CMS M1144.

Recommended SAE viscosity grades (SAE J300d)



Engine coolant : Antifreeze : Permanent type ethylene/glycol

Transmission : oil approved by Massey Ferguson, following the standard MF CMS M1143 or CMS M1144.

Front axle (4-WD only) : API GL5 - 80W90

Lubrication fittings : Use Massey Ferguson Spec. M-1105 or equivalent multi-purpose lithium base grease with the following N.L.G.I. index numbers :

- Ambient temperatures consistently below 45° F (7° C)	N.L.G.I. No. 1
- Ambient temperatures consistently between 45° and 80° (7° and 27° C)	N.L.G.I. No. 2
- Ambient temperatures consistently above 80° F (27° C)	N.L.G.I. No. 3

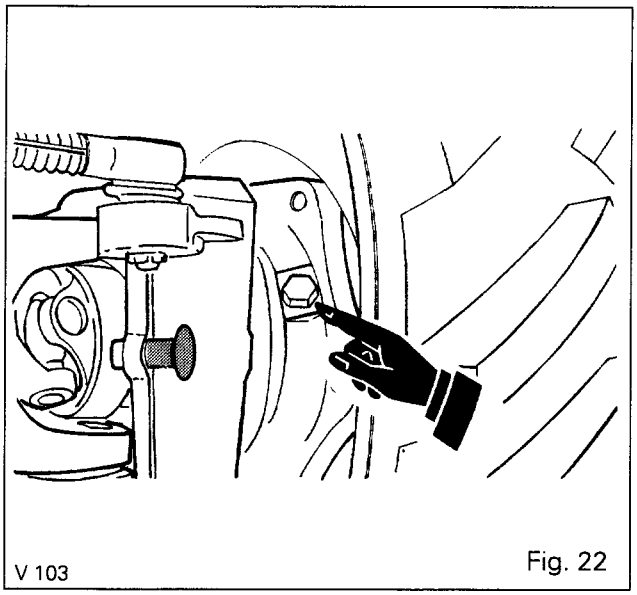
Note for all territories
The warranty is valid on the condition that the lubricants used meet the requirements of the following classification excluding any other product :
Engine : API CD or CE / CCMC D4 or D5
Transmission : MF CMS M1143 or CMS M1144
4WD Front axle : API GL5

INSTRUCTIONS FOR PRESSURE WASHING

When pressure washing, protect and do not direct the jet on the following components:
- alternator,
- starter motor,
- cooler,
- four-wheel-drive axle stub pivot pins
- inspector cover
- radar,
- safety decal,
- electrical harnesses,
- electrical connections.

FRONT AXLE - 2-WHEEL DRIVE

Check front axle screws and nuts tightness from time to time.



V 103 Fig. 22

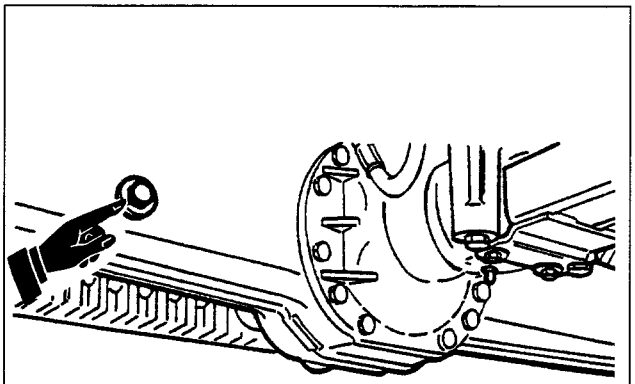
FRONT AXLE - 4-WHEEL DRIVE

Final reduction units

Check the oil level in the front axle final reduction units every 250 hours (Fig. 22).
The oil should be level with the filler plug when the plug is in the horizontal position.
Drain the oil from the final reduction units every 1000 hours or every 500 hours when working in muddy wet or humid conditions.
Turn the wheel of the tractor to bring the drain filler plug to its lowest point.

Front axle

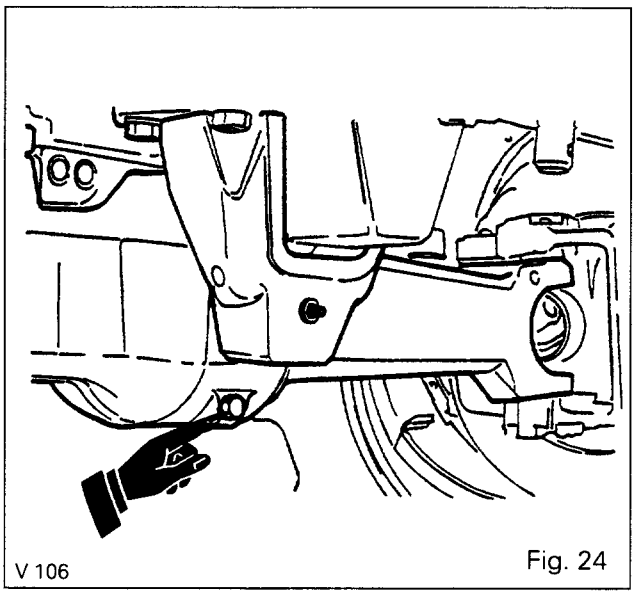
Check the front axle oil level every 250 hours. The oil should be to the level plug (Fig. 23).
Drain the oil from the front axle every 1000 hours-drain plug (Fig. 24).



V 105 Fig. 23

CLUTCH AND BRAKES

The clutch and brakes are operated hydraulically and require no adjustment. If a fault is apparent, consult your Distributor or Dealer.
Bleed the circuit every 1000 hours and after every repair operation.



V 106 Fig. 24

TRACK ADJUSTMENTS mm (in)

FRONT TRACK

• 2-wheel drive

The front track is adjustable in increments of 100 mm (4 in)

Wheels	Tyre Dimension	hub	Inner wheel disc	outer wheel disc
6 Bolts	750 x 18	Normal Duty	Inner 1380 (54.3)	1575 (62)
			outer 1785 (70.3)	1980 (77.9)
		Heavy Duty	Inner 1482 (58.3)	1676 (66)
			outer 2200 (86.6)	2390 (94)
	10 x 16	Normal Duty	Inner 1456 (57.3)	1492 (58.7)
			outer 1860 (73.2)	1900 (74.8)
	11 x 16	Heavy Duty	Inner 1555 (61.2)	1591 (62.6)
			outer 2270 (89,4)	2300 (90.5)
8 Bolts	11 x 16	Heavy Duty	Inner 1538 (60.5)	1617 (63.6)
			outer 2250 (88.5)	2330 (91.6)

To adjust, proceed as follows :

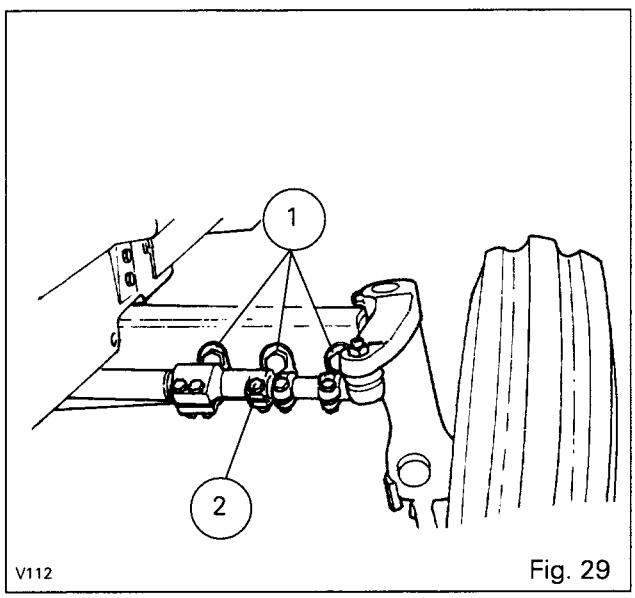
1) Raise the front of the tractor using a jack capable of lifting 5000 kg (5 ton).

2) Take out the three bolts (1, Fig. 29) and remove the bolt locking the telescopic ram (2, Fig. 29).

3) Extend the axle outer arms to achieve the desired track setting then refit the bolts and tighten to a torque of 400 to 600 Nm (293 to 440 lbf ft).

4) Adjust the steering rams to correspond with the selected track width. Refit the screws and nuts and torque them to 75 to 80 Nm (51 to 59 lbf ft)

NOTE : The two widest track settings must only be used under light load conditions.



V112 Fig. 29

• 4-Wheel drive

The track widths available are dependent on the type of axle and tyre dimensions.

ELECTRICAL EQUIPMENT

The 12 volts circuit is a negative earth system.

Batterie(s) :

Wipe the battery top and smear the terminals with petroleum jelly every 250 hours.

Alternator :

Check the fan and alternator belt tension every 100 hours.

Alternator belt adjustment

The correct belt deflection is 19 mm (3/4 in) (4 cyl. engines) or 10 mm (3/8 in) (6 cyl. engines) with the belt depressed by hand midway between the fan pulley and the crankshaft pulley.

A new belt will bed in and require adjustment after half an hour to an hour of service. To adjust the belt, slacken the alternator securing bolts and reposition the alternator as required. Retighten the bolts securely.

Get your Distributor or Dealer to check the alternator every 1000 hoursl or once a year.

IMPORTANT : The alternator wiring must be disconnected before any arc welding is carried out on the tractor or on an implement which is attached to it. Never run the engine with the alternator disconnected.

Do not attempt to connect any additional electrical equipment, as this may damage components of the existing electrical system.

Trailer socket (not available for North America)

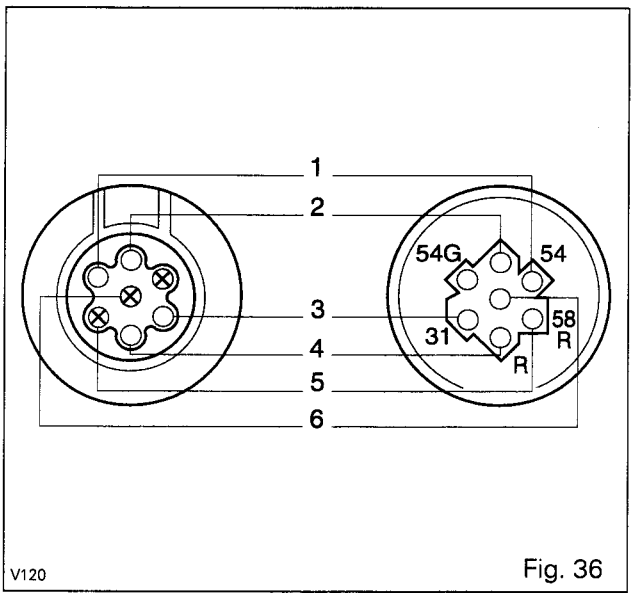
Connection (Fig. 36).

1 - Brake light (white wire)
2 - L.H. turn signal (pink wire.)
3 - Ground (black wire)
4 - R.H.turn signal (brown wire)
5 - R.H. side light (red wire - red terminal)
6 - R.H. side light (red wire)

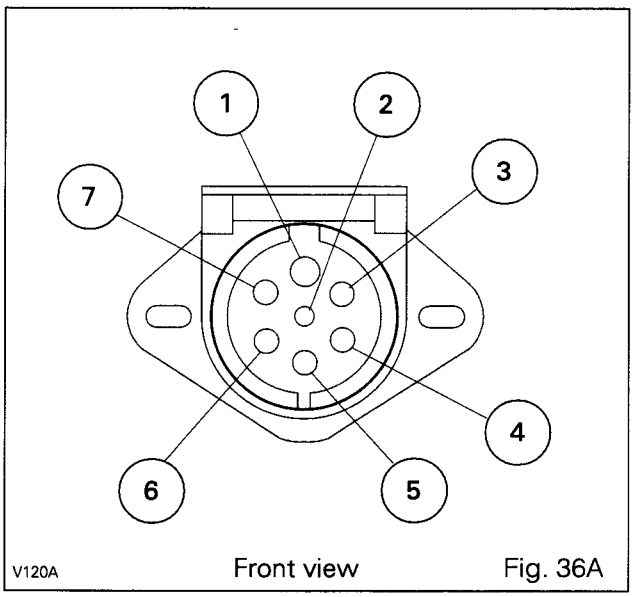
Trailer socket (for North America only)

Connection (Fig. 40A)

1 . Ground return to towing vehicle (white)
2 . Auxiliary (blue)
3 . Clearance, side marker, and identification lamps (black)
4 . Left turn signal and hazard lamps (yellow)
5 . Stop lamps and antilock devices (red)
6 . Right turn signal and hazard lamps (green)
7 . Tail and license plate lamps (brown)



V120 Fig. 36



V120A Front view Fig. 36A

Road speeds at 2200 rev/min - 4 x 2 Gearbox
6110/6120/6130/6140 - 16.9 - 34 tyres

Speed	Range	Speed-shift	16 SPEED 30 KPH				16 SPEED 40 KPH			
			FORWARD		REVERSE		FORWARD		REVERSE	
			KPH	MPH	KPH	MPH	KPH	MPH	KPH	MPH
1	LOW	Slow	1.91	1.19	1.86	1.16	2.45	1.52	2.38	1.48
		Fast	2.45	1.52	2.38	1.48	3.10	1.92	3.01	1.87
2		Slow	2.93	1.82	2.85	1.77	3.70	2.30	3.59	2.23
		Fast	3.70	2.30	3.59	2.23	4.68	2.91	4.55	2.83
3		Slow	4.05	2.52	3.94	2.45	5.12	3.18	4.97	3.09
		Fast	5.12	3.18	4.97	3.09	6.48	4.03	6.30	3.91
4		Slow	5.87	3.65	5.70	3.54	7.42	4.61	7.21	4.48
		Fast	7.42	4.61	7.21	4.48	9.38	5.83	9.12	5.67
5	HIGH	Slow	7.78	4.83	7.56	4.70	9.83	6.11	9.55	5.94
		Fast	9.83	6.11	9.55	5.94	12.43	7.72	12.08	7.51
6		Slow	11.75	7.30	11.42	7.10	14.86	9.28	14.48	8.97
		Fast	14.85	9.23	14.43	8.97	18.77	11.67	18.25	11.34
7		Slow	16.26	10.10	15.80	9.82	20.56	12.79	19.98	12.42
		Fast	20.56	12.79	19.98	12.42	25.98	16.15	25.26	15.70
8		Slow	23.55	14.64	22.89	14.23	29.76	18.50	28.92	17.97
		Fast	29.76	18.50	28.92	17.97	37.62	23.38	36.57	22.72

6150/6160/6170 -16.9 - 38 tyres

Speed	Range	Speed-shift	16 SPEED 30 KPH				16 SPEED 40 KPH			
			FORWARD		REVERSE		FORWARD		REVERSE	
			KPH	MPH	KPH	MPH	KPH	MPH	KPH	MPH
1	LOW	Slow	1.92	1.19	1.86	1.16	2.43	1.51	2.36	1.46
		Fast	2.43	1.51	2.36	1.46	3.07	1.91	2.98	1.85
2		Slow	2.90	1.81	2.81	1.74	3.67	2.28	3.57	2.21
		Fast	3.67	2.28	3.57	2.21	4.64	2.88	4.51	2.80
3		Slow	4.01	2.50	3.90	2.42	5.08	3.16	4.94	3.07
		Fast	5.08	3.16	4.94	3.07	6.42	3.99	6.24	3.88
4		Slow	5.81	3.62	5.64	3.50	7.35	4.57	7.15	4.44
		Fast	7.35	4.57	7.15	4.44	9.29	5.78	9.03	5.61
5	HIGH	Slow	7.71	4.80	7.49	4.66	9.74	6.06	9.47	5.90
		Fast	9.74	6.06	9.47	5.90	12.31	7.66	11.96	7.43
6		Slow	11.64	7.24	11.31	7.03	14.72	9.15	14.31	8.89
		Fast	14.72	9.15	14.31	8.89	18.60	11.56	18.08	11.23
7		Slow	16.11	10.02	15.66	9.73	20.37	12.66	19.80	12.30
		Fast	20.37	12.66	19.80	12.30	25.74	16.00	25.02	15.55
8		Slow	23.33	14.50	22.67	14.09	29.49	18.33	28.66	17.81
		Fast	29.49	18.33	28.66	17.81	37.27	23.17	36.22	22.51

"Economy" independant power take-off (optional extra)	The normal 540 and 1000 rev/min p.t.o. speeds can be obtained at the above stated engine speeds or at 1550 engine rev/min by selecting the "economy" ratio.
Control	Lever in the cab.
Ground speed P.T.O. (optional extra)	An addition to the independent P.T.O.
Control	Lever in the cab.
Speed : MF 6110/6120/6130/6140	- 540 rev/min - 7.87 revolutions of the p.t.o. shaft for 1 turn of the wheel axle. - 1000 rev/min - 14.83 revolutions of the p.t.o. shaft for 1 turn of the wheel axle.
Speed : MF 6150/6160/6170	- 540 rev/mn - 8.48 revolutions of the p.t.o. shaft for 1 turn of the wheel axle. - 1000 rev/mn - 15.54 revolutions of the p.t.o. shaft for 1 turn of the wheel axle.
Speed : MF 6180/6190	- 540 rev/mn - 8.23 revolutions of the p.t.o. shaft for 1 revolution of the whee axle.l. - 1000 rev/mn - 15.08 revolutions of the p.t.o. shaft for 1 revolution of the wheel axle.
Front power take-off (optional extra)	
Control	Hydraulic clutch mechanism controlled by a knob in the cab.
Ratio	1000 rev/min at 2040 engine rev/min.

Four-wheel drive front axle

Clutch mechanism	Hydraulic, electrically actuated by push button in the cab
Differential Lock	Front and rear differential lock-hydraulic with electrical control.
Reduction ratios	AG85 (18,975), AG105 (20,7), AG125 (20,77), AG155-6190 (20,872)

Hydraulics (according to model)

1) Open centre hydraulic system: two stage gear pump, driven directly by the engine, supplies :

1st Stage (Flow. 32.7 l/min (5 Imp. gal/min) (5.9 US gal/min) at maximum engine speed,pressure: 17 bar (246.5 lbf/in²) ensures:

- hydrostatic steering
- differential lock
- high/Low range gear,
- I.P.T.O. clutch
- P.T.O. brake
- front P.T.O. (if fitted)
- four-wheel drive (if fitted)
- hydraulic brakes
- clutch
- lubrication of gearbox,P.T.O. and rear axle

2nd Stage (Flow. 57 l/min (12.5 Imp. gal/min) (15 US gal/min) at maximum engine speed, pressure:185 bar (2684 lbf/in²) 6190 : 200 bar (2902 lbf/in²) ensures:

- auxiliary hydraulic system, trailer brake supply, hydraulic lift.

Filtration	External 150-micron throwaway, canister type suction strainer. External 15 micron High pressure filter.

2) Closed centre hydraulic system with flow and pressure control (optional):

Primary booster system: (Max. flow 164.5 l/mn at 2.200 rpm (36.19 imp.gal - 43.42 US gal) ensures:

- constant boost pressure of 5 bar from variable displacement pump, lubrication of the gearbox, cooling system, boost pressure of master cylinders.

High-pressure system : (Max. flow > 105 l/mn (23 imp.gal - 27.7 US gal) at 2.200 rpm maxi pressure 200 bar) ensures: steering, trailer brake, 17-bar valve, auxiliary hydraulic distribution, hydraulic lift system.

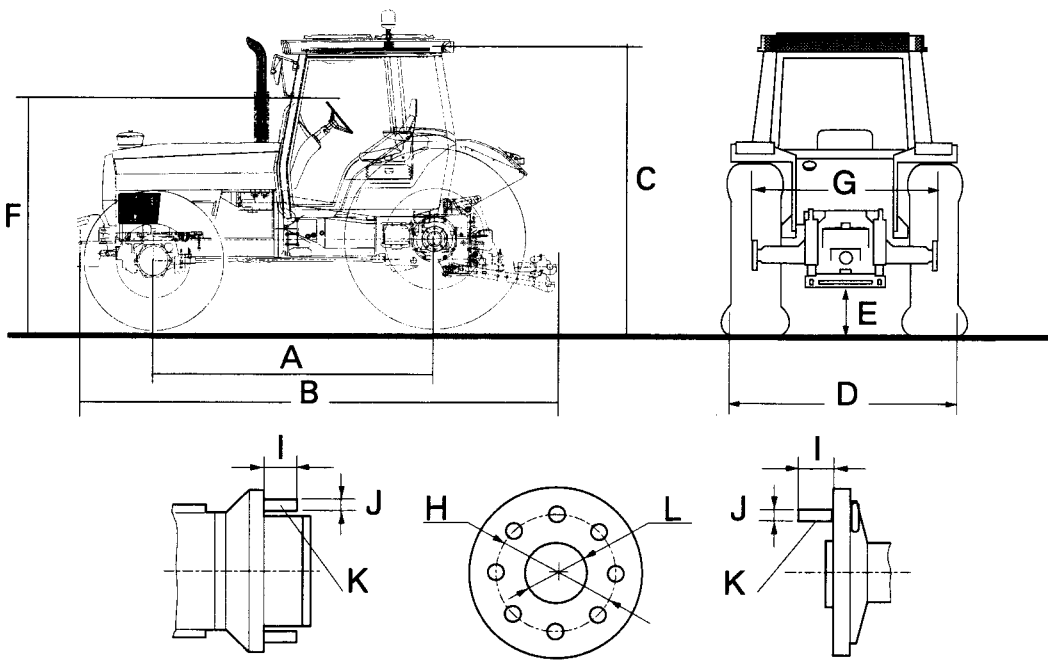
Filtration :	1 strainer, 150 micron, on suction, located to the left of the transmission housing. External main high-pressure filter, 15 micron, to the right of the housing.

Dimensions and weights

CHARACTERISTICS mm (in) - Kg (lb)	6110/6120		6130/40		6150		6160/70		6180		6190
	2WD	4WD	2WD	4WD	2WD	4WD	2WD	4WD	2WD	4WD	4RM
A Wheelbase	2371 (93.34)	2375 (93.35)	2371 (93.34)	2375 (93.35)	2549 (100.35)	2553 (100.51)	2696 (106.10)	2699 (106.25)	2696 (106.10)	2699 (106.25)	2679 (105.5)
B Overall length with drawbar	3995 (117.9)	4069 (160.2)	3995 (117.9)	4069 (160.2)	4137 (162.87)	4137 (162.87)	4320 (170)	4472 (176)	4402 (173.3)	4402 (173.3)	4952 (195))
C Height to roof (cab tractor)	2627 (103.4)	2627 (103.4)	2627 (103.4)	2627 (103.4)	2724 (107.2)	2724 (107.2)	2755 (108.5)	2755 (108.5)	2768 (109)	2768 (109)	2867 (112.9)
D Overall width (1)	2570 (101.2)	2570 (101.2)	2570 (101.2)	2570 (101.2)	2570 (101.2)	2570 (101.2)	2570 (101.2)	2570 (101.2)	2733 (107,6)	2733 (107,6)	2760 (108.7)
E Ground clearance (under drawbar Frame)	385 (15.2)	385 (15.2)	385 (15.2)	385 (15.2)	385 (15.2)	385 (15.2)	445 (17.5)	445 (17.5)	442 (17.4)	442 (17.4)	480 (18.9)
F Height to steering wheel	1971 (77.6)	1971 (77.6)	1971 (77.6)	1971 (77.6)	2023 (79.6)	2023 (79.6)	2068 (81.4)	2068 (81.4)	2110 (83)	2110 (83)	2148 (84.6)
Mini. weight (with full tank, without extra weight steel wheels)	3565 (7859)	3840 (8465)	3565 (7859)	3840 (8465)	4120 (9080)	4400 (9698)	4440 (9800)	4730 (10439)	4190 (9249)	4920 (10858)	5420 (11956)
Front tyres	11.2-28				13.6-28		14.9-28				
Rear tyres	16.9-34				16.9-38		18.4-38				

	Rear axle	Front axle			
		AG85	AG105	AG125	AG155
G Distance between flanges	1774 (69.84)	1669 (65.7)	1800 (70.86)	1800 (70.86)	1920 (75.6)
* Normal duty axle housing shaft Ø 82	1835 (72.34)				
* Shaft straight shaft Ø 82	2230 (87.79)				
	Ø 82 shafts (3.23)				
H Stud distance	203,20 (8.00)	275 (10.8)		335 (13.20)	325 (12.8)
L Centring diameter	149,35 (5.88)	220.8 (8.7)		280,8 (11.04)	
I Stud length					
Wheel with steel hub	41 (1.61)	43 (1.70)	43 (1.70)	55 (2.16)	
Wheel with cast iron hub	66 (2.60)				
J Stud diameter	M 18 x 1,5	M 18 x 1,5		M 22 x 1,5	
K Number of studs	8	8		10	

(1) These dimensions are for maxi track = 2304 m (90.7 in)
* 6180/6190 only



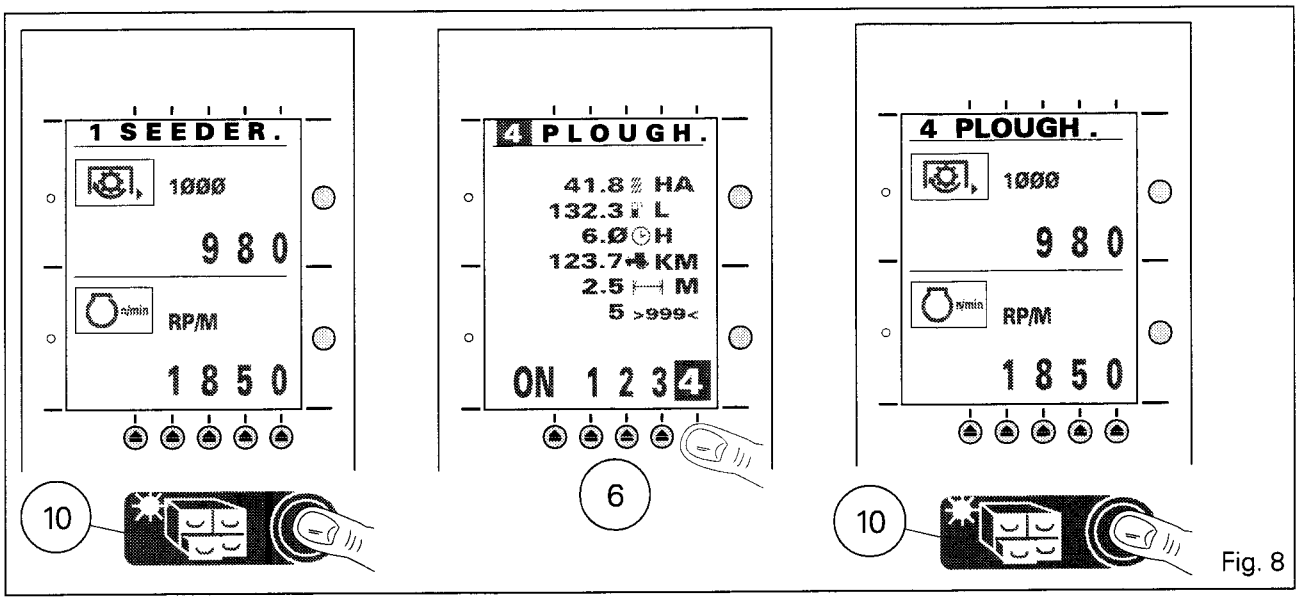


Fig. 8

Use when working

Before starting your work, select the memory that you want (1 to 4); refer to the "MEMORY MODE" section, page 5.

Press the memory key 10 (fig. 8), then press the key 6 corresponding to the memory that you want to use for your work; *the selection appears in grey.*

Press key 10 again: the pre-recorded data (name, implement, etc.) is displayed at the top of the screen. The half-screens display the last selections stored when quitting, before selecting "MEMORY MODE".

Working position

This operating mode takes three parameters into account:

1. The PTO speed in ON/OFF position,
2. The elevation (low position) ON/OFF,
3. The coupled implement (through the auxiliary socket located in the cab).

Application:

Select the working width of the implement used by pressing key 7 (fig. 9); modify the figures by pressing the corresponding keys 6, then turn knob 14 to display new values. Press key 7 again to return to the previous screen.

***Note**: The display of the work function has priority whenever the key is pressed.*

Select the work function 11. The display appears, the work can start.

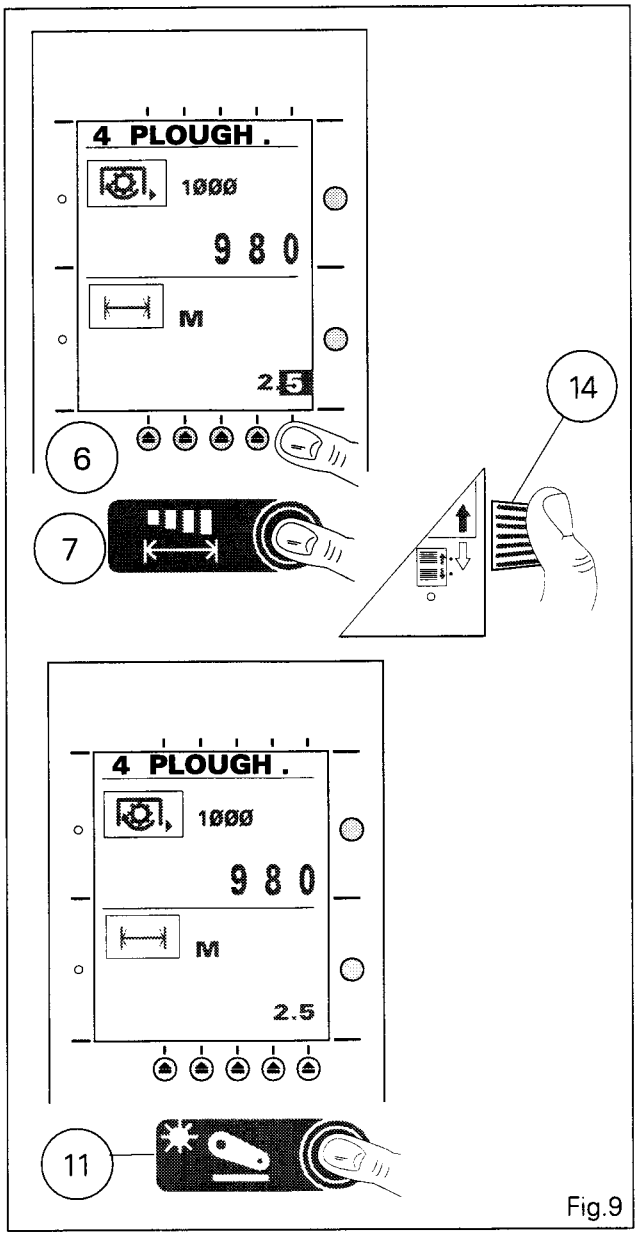


Fig.9