



MF3600 SERIES

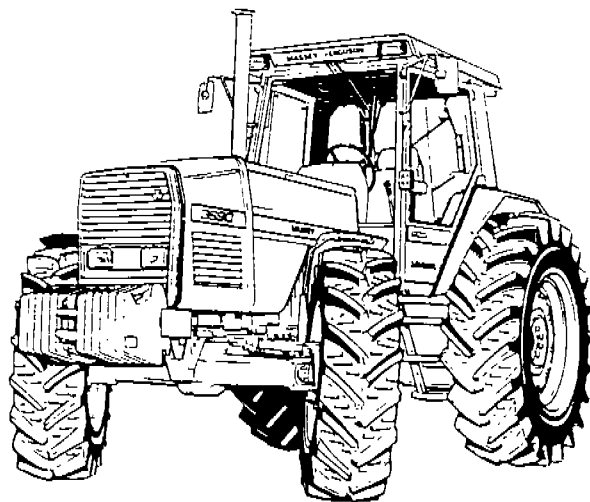
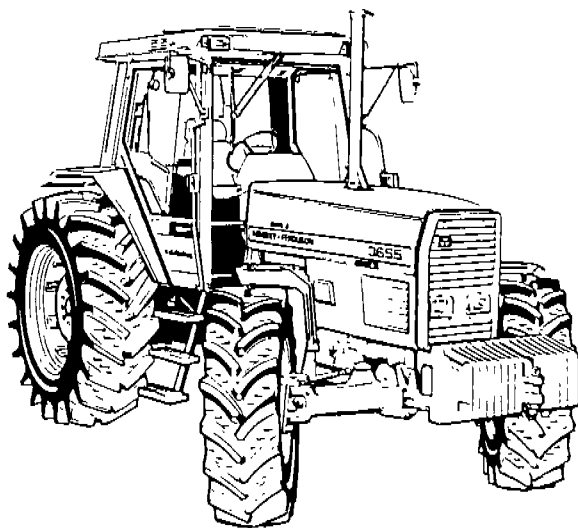


WORKSHOP SERVICE MANUAL

Part 1

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1 . INTRODUCTION

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Introduction

1 A01 Introduction

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Introduction

A. Reading the manual

General

The aim of this manual is to assist Distributors and Dealers in the efficient installation, maintenance and repair of MASSEY FERGUSON machinery. These operations can be carried out within the times specified in the repair times schedule by following the procedures specified and using appropriate specialised tools.

Page numbering

Example: 6 B03.2

This manual is divided into sections and parts. Each page is identified with the following information:

- 6 = Section
- B = Part
- 03 = Sequence number within the part
- 2 = Page number within the part

The issue number and the date are shown at the bottom of the page.

Using the manual

To make information easier to find, there is an index at the beginning of each section listing the various parts in that section.

At the beginning of each part there is a table of contents which should also be used as a guide to locate information.

Items are indicated by means of identifying symbols (circles, squares, triangles).

Meaning of identifying symbols

Circle ○ (...) : identifies component part only.

Square □ [...] : identifies component part and indicates an adjustment.

Triangle ▲ /...\\ : identifies component part and indicates an important point to be noted during assembly and disassembly.

Amendments

Amended pages are issued with the same page numbers as the previous pages: only the issue number and the date are changed.

The old pages must be destroyed.

Service tools

When a special service tool must be used in an operation, the tool number is specified along with the instruction requiring its use.

Repairs and replacements

When parts have to be replaced, it is essential that only genuine MASSEY FERGUSON parts should be used. Special attention should be paid to the following points concerning repairs and the fitting of replacement parts and accessories.

Safety features embodied in the tractor could be impaired if genuine parts are not fitted.

In certain countries, legislation prohibits the fitting of parts that fail to comply with tractor manufacturer's specifications. The torque wrench setting figures specified in the workshop manual must be strictly complied with. Locking devices must be installed where specified. If the efficiency of a locking device is impaired during removal, a new one must be fitted.

The tractor warranty is invalidated if parts other than genuine MASSEY FERGUSON parts are fitted. All MASSEY FERGUSON replacement parts benefit from the full backing of the manufacturer's warranty. MASSEY FERGUSON Distributors and Dealers are required to supply only genuine parts.

Repair time schedule

The sections on repair times are identical to those in the workshop manual. This repair time schedule is available under publication number 1646984M1.



Introduction

B. General specifications

Perkins engines equipped with CAV injection pump

	3610	3630	3635	3645	3650	3655/3660
Type	A6.354.4	AT6.354.4	1006.6T7	1006.6T5	AT6.3544cc	1006.6T4WG
Number of cylinders	6	6	6	6	6	6
Turbocharging	-	Yes	Yes	Yes	Yes, water-cooled	Yes
Bore (mm)	98,47	98,47	100	100	98,47	100
Stroke (mm)	127	127	127	127	127	127
Cubic capacity (cm ³)	5800	5800	6000	6000	5800	6000
Max. engine power DIN (kW)	83	98	97	104,5	110	114,8
Power at PTO (kW)	74	88	86	96,5	100	103
At engine speed of (rpm)	2400	2400	2200	2200	2400	2200
Maximum torque (Nm)	374	441	498	522	510	574
Engine speed at max. torque	1400	1600	1200	1500	1600	1400
Idling speed (rpm)	1000	1000	1000	1000	1000	1000
Torque at max. speed (Nm)	337	396	441	454	450	495
Max. no-load speed (rpm)	2450/2510	2450/2510	2310	2310	2450/2510	2310
Max. transmissible power (kW) 2,200 rpm at front PTO	75	75	75	75	75	75
Max. torque (Nm)	328	328	328	328	328	328
Lubrication	By gear type pump with strainer on suction side and external filters with interchangeable cartridge					
Valves	Overhead, push-rod operated					
Valve clearance (cold)						
- Inlet	0,20	0,20	0,20	0,20	0,20	0,20
- Exhaust	0,45	0,45	0,45	0,45	0,45	0,45
Engine oil cooler	Yes	Yes	Yes	Yes	Yes	Yes

Fuel injection system and air filter

Supply pump	A C DELCO					
Fuel filter	CAV, with dual element and sediment bowls					
Number of elements	2	2	2	2	2	2
Injection pump	CAV - rotary with built-in mechanical governor					
Injection timing	28°	30°	18°	18°	30°	17°
Injectors and injector-holder	CAV	CAV	CAV	CAV	CAV	CAV
Cold starting	Thermostat or ether equipment					
Air filter	Two-stage, dry elements removable for maintenance with clogging indicator (warning light). Built-in centrifugal prefilter, self-cleaning by dust suction by exhaust.					

**Introduction****Perkins engines equipped with Stanadyne injection pump - Valmet engines**

	3635	3645	3655/3660	3670	3680	3690
VALMET				620 DS	612 DS	612 DS
PERKINS	1006.6THR2	1006.6THR3	1006.6THR4			
Number of cylinders	6	6	6	6	6	6
Turbocharging	Yes	Yes	Yes	Yes	Yes	Yes
Bore (mm)	100	100	100	108	108	108
Stroke (mm)	127	127	127	120	134	134
Cubic capacity (cm ³)	6000	6000	6000	6600	7400	7400
Max. engine power DIN (kW)	99,3	106,6	114	125	132	140
Power at PTO (kW)	88,3	97	103	112,6	118	127,3
At engine speed of (rpm)	2200	2200	2200	2200	2200	2200
Max. torque (Nm)	551	588	625	650	670	730
Engine speed at max. torque	1400	1400	1400	1400	1400	1400
Idling speed (rpm)	1000	1000	1000	1000	1000	1000
Torque at max. speed (Nm)	430	462	495	555	560	620
Max. no-load speed (rpm)	2310	2310	2310	2370	2420	2370
Max. transmissible power (kW) 2,200 rpm at front PTO	75	75	75	92,1	67	67
Max. torque (Nm)	328	328	328	400	290	290
Lubrication	By gear type pump with strainer on suction side and external filters with interchangeable cartridge					
Valves	Overhead, push-rod operated					
Valve clearance (cold)						
- Inlet	0,20	0,20	0,20	0,35	0,30	0,30
- Exhaust	0,45	0,45	0,45	0,35	0,30	0,30
Engine oil cooler	Yes	Yes	Yes	Yes	Yes	Yes

Fuel injection system and air filter

Supply pump	A C DELCO			Bosch		
Fuel filter	CAV, with dual element and sediment bowls					
Number of elements	2	2	2	2	2	2
Injection pump	Stanadyne			Bosch in line		
Injection timing				22°	24°	24°
Injectors and injector-holder	Stanadyne				Bosch	
Cold starting	Thermostart or ether equipment			Thermostart		
Air filter	Two-stage, dry elements removable for maintenance with clogging indicator (warning light). Built-in centrifugal prefilter, self-cleaning by dust suction by exhaust.					



Introduction

Electrical system

Voltage:

12 volts, negative earth

Batteries:

2 maintenance-free batteries

Starting safety:

Operated by clutch pedal

Lamp bulbs:

Headlights:

European code 40/45 W

Sidelights:

5 W

Rear/brake lights:

21/5 W

Direction indicators:

21 W

Number-plate light:

10 W

Work lamps:

55 W, iodine type H3

Instrument panel lighting and warning lights:

W 10/9

Roof lights:

2 x 10 W

Cooling

Mode:

Centrifugal pump and pressurised cooler

Thermostat control

Maximum opening temperature: 83°C

Thermometer monitoring

Fan:

Disengageable (viscous clutch) (depending on countries)

belt driven

Centrifugal water pump:

- belt-driven (engines A6 - AT6354 and 612DS - 620)

- gear-driven (series 1000 engines)

Deflection of belts:

With tension controller: 355 N

Without controller: 10 mm (on the longest span)

Transmission

Clutch

3610-3630-3635-3645-3655-3660-3670
(for certain countries)

Single disc, dry, 355 mm (14 inches)

pressure by diaphragm-mechanism

self-adjusting hydraulic control

3670 (for certain countries) -3680-3690

Two-disc with diaphragm, 310 mm dia. (12 inches)

self-adjusting hydraulic control

Gearbox:

Without Dynashift

- 8 or 16 speeds

- with creeper gear unit

(ratio 5 to 1) - 8 normal speeds

- 8 creeper speeds

- synchronised reverse shuttle

With Dynashift

- 32 forward speeds

- 32 reverse speeds

- 4 ratios, selectable without pressing clutch

- synchronised reverse shuttle



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3600 SERIES TRACTORS

**Introduction**

VEHICLE FORWARD AND REVERSE SPEEDS

CHARACTERISTICS			3610 - 3630 - 3650 Reduction ratio 5.57/1		3610 - 3630 - 3650 Reduction ratio 6.21/1		3680 Reduction ratio 6.21/1 - 30 km/h	
Speeds	R A N G E	Speed- shift	8-speed	16-speed	8-speed	16-speed	8-speed	16speed
			kph	kph	kph	kph	kph	kph
1	T O R T O I S E 	Slow	-	2.3	-	2.2	-	3.5
		Fast	3.1	3.1	2.9	2.9	4.4	4.4
2		Slow	-	3.7	-	3.4	-	6.1
		Fast	4.9	4.9	4.6	4.6	7.7	7.7
3		Slow	-	5.0	-	4.7	-	7.5
		Fast	6.7	6.7	6.3	6.3	9.5	9.5
4		Slow	-	6.9	-	6.5	-	10.1
		Fast	9.3	9.3	8.7	8.7	12.7	12.7
1	H A R E 	Slow	-	8.1	-	7.6	-	8.7
		Fast	10.8	10.8	10.1	10.1	11.0	11.0
2		Slow	-	12.7	-	11.9	-	15.0
		Fast	16.9	16.9	15.9	15.9	19.0	19.0
3		Slow	-	17.3	-	16.3	-	18.6
		Fast	23.1	23.1	16.3	21.7	23.5	23.5
4		Slow	-	24.1	-	22.6	-	24.9
		Fast	32.1	32.1	22.6	30.2	31.5	31.5
Engine speed			2,400 rpm		2,400 rpm		2,200 rpm	
Rear tyre dimensions			18.4 - 38		20.8 - 38		20.8 - 42	



Introduction

VEHICLE FORWARD AND REVERSE SPEEDS at 2,200 rpm Rear tyres: 20.8 - 38

Characteristics			3635-3645 Reduction ratio: 5.57/1				3635-3645-3655 Reduction ratio: 6.21/1			
			30 kph		40 kph		30 kph		40 kph	
Speed	RANGE	Speedshift	8-speed	16-speed		16-speed	8-speed	16-speed		16 vitesses
1		Slow	-	2.4		3.0	-	2.3		2.9
		Fast	3.0	3.0		3.8	2.9	2.9		3.7
2		Slow	-	3.7		4.7	-	3.7		4.6
		Fast	4.7	4.7		5.9	4.6	4.6		5.8
3		Slow	-	5.1		6.4	-	5.0		6.3
		Fast	6.4	6.4		8.1	6.3	6.3		8.0
4		Slow	-	7.0		8.9	-	6.9		8.8
		Fast	8.9	8.9		11.2	8.8	8.8		11.1
1		Slow	-	8.2		10.3	-	8.1		10.2
		Fast	10.3	10.3		13.1	10.2	10.2		12.9
2		Slow	-	12.9		16.3	-	12.7		16.0
		Fast	16.3	16.3		20.5	16.0	16.0		20.3
3		Slow	-	17.6		22.2	-	17.3		21.9
		Fast	22.2	22.2		28.0	21.9	21.9		27.6
4		Slow	-	24.4		30.8	-	24.0		30.4
		Fast	30.8	30.8		39.0	30.4	30.4		38.4

VEHICLE FORWARD AND REVERSE SPEEDS at 2,200 rpm

Characteristics			3660 - Rear tyres: 20.8 - 38 Reduction ratio: 6.21/1		3670 with tyres 20.8 - 42 Reduction ratio: 6.21/1		3690 with tyres 20.8 - 42 Reduction ratio: 7.14/1			
			30 km/h		30 km/h		40 km/h	30 km/h		40 km/h
Speed	Range	Speedshift	8-speed	16-speed	8-speed	16-speed	16-speed	8-speed	16-speed	16-speed
1		Slow	-	3.2	-	2.6	3.3	-	2.4	3.1
		Fast	4.1	4.1	3.3	3.3	4.2	3.1	3.1	3.9
2		Slow	-	5.7	-	4.5	5.7	-	4.2	5.3
		Fast	7.1	7.1	5.7	5.7	7.2	5.3	5.3	6.7
3		Slow	-	7	-	5.6	7.1	-	5.2	6.6
		Fast	8.8	8.8	7.1	7.1	8.9	6.6	6.6	8.4
4		Slow	-	9.4	-	7.5	9.5	-	7.3	9.2
		Fast	11.8	11.8	9.5	9.5	11.9	9.2	9.2	11.6
1		Slow	-	8.1	-	8.7	11	-	8.1	10.2
		Fast	10.2	10.2	11	11	13.9	10.2	10.2	13
2		Slow	-	13.9	-	15	19	-	14	17.7
		Fast	17.7	17.7	19	19	24	17.7	17.7	22.4
3		Slow	-	17.3	-	18.6	23.6	-	17.4	22
		Fast	21.8	21.8	23.6	23.6	29.8	22	22	27.8
4		Slow	-	23.1	-	24.9	31.5	-	24.2	30.6
		Fast	29.3	29.3	31.5	31.5	39.8	30.6	30.6	38.6



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3600 SERIES TRACTORS

**Introduction****"DYNASHIFT" VEHICLE SPEEDS at 2,200 rpm****FORWARD**

Ratio		With tyres 20.8 - 38		With tyres 20.8 - 42	
		3635 - 3645	3655	3670	3690
	1 A	2.545	2.509	2.538	2.522
	B	2.979	2.937	2.971	2.952
	C	3.517	3.466	3.507	3.485
	D	4.116	4.057	4.105	4.079
	2 A	3.863	3.808	3.852	3.828
	B	4.521	4.457	4.509	4.480
	C	5.337	5.261	5.322	5.288
	D	6.247	6.157	6.229	6.190
	3 A	5.519	5.440	5.503	5.469
	B	6.459	6.367	6.441	6.400
	C	7.624	7.515	7.603	7.555
	D	8.924	8.796	8.899	8.843
	4 A	7.511	7.404	7.491	7.443
	B	8.791	8.666	8.767	8.712
	C	10.377	10.229	10.348	10.283
	D	12.146	11.972	12.112	12.036
	1 A	8.385	8.265	8.362	8.309
	B	9.814	9.673	9.787	9.725
	C	11.584	11.418	11.552	11.479
	D	13.558	13.364	13.521	13.435
	2 A	12.725	12.543	12.690	12.610
	B	14.894	14.681	14.852	14.759
	C	17.580	17.329	17.532	17.421
	D	20.577	20.282	20.520	20.390
	3 A	18.179	17.919	18.128	18.014
	B	21.277	20.972	21.218	21.084
	C	25.115	24.755	25.045	24.887
	D	29.395	28.975	29.314	29.129
	4 A	24.743	24.389	24.675	24.519
	B	28.960	28.546	28.880	28.697
	C	34.184	33.695	34.089	33.874
	D	40.010	39.438	39.900	39.648

REVERSE

Ratio		With tyres 20.8 - 38		With tyres 20.8 - 42	
		3635 - 3645	3655	3670	3690
	1 A	2.343	2.310	2.487	2.322
	B	2.743	2.703	2.910	2.718
	C	3.237	3.191	3.435	3.208
	D	3.789	3.735	4.021	3.755
	2 A	3.556	3.506	3.774	3.524
	B	4.162	4.103	4.417	4.125
	C	4.913	4.843	5.213	4.869
	D	5.751	5.669	6.102	5.699
	3 A	5.081	5.008	6.391	5.035
	B	5.946	5.861	6.310	5.892
	C	7.019	6.919	7.448	6.955
	D	8.215	8.098	8.717	8.141
	4 A	6.915	6.816	7.338	6.853
	B	8.094	7.978	8.588	8.020
	C	9.554	9.417	10.137	9.467
	D	11.182	11.022	11.865	11.081
	1 A	7.719	7.609	8.191	7.649
	B	9.035	8.906	9.587	8.953
	C	10.664	10.512	11.316	10.568
	D	12.482	12.304	13.245	12.369
	2 A	11.715	11.548	12.431	11.609
	B	13.712	13.516	14.549	13.587
	C	16.185	15.953	17.174	16.038
	D	18.944	18.673	20.101	18.772
	3 A	16.736	16.497	17.758	16.584
	B	19.588	19.308	20.785	19.410
	C	23.121	22.791	24.534	22.912
	D	27.062	26.675	28.715	26.817
	4 A	22.780	22.454	24.171	22.573
	B	26.662	26.280	28.290	26.420
	C	31.471	31.021	33.393	31.185
	D	36.835	36.308	39.085	36.501



Introduction

Final reduction units

Reduction units:

Reduction ratio:

Epicyclic - Located on input to each trumpet section

3610-3630-3635-3640-3645-3655-3660:

Std axle 5.571 to 1

3610-3630-3635-3640-3645-3650-3655-3660:

Reinforced axle 6.214 to 1

Bulkheads (3660-3670-3680)

3655 (option)

3690 Double reduction unit 7.141 to 1

Power take-off

Proportional to engine speed

Hydraulic clutch

PTO speed ratio

Shaft 540 rpm at engine 1,992 rpm

Shaft 1,000 rpm at engine 2,090 rpm

Gear speeds

By changing shafts

- 540 rpm shaft - 35 mm dia. - 6 splines

- 1,000 rpm shaft - 35 mm dia. - 21 splines

- 44.5 mm shaft - 21 splines (option)

- 1,000 rpm at engine speed 2,090 rpm

Single speed for 3680-3690

Front power take-off (accessory equipment)

Control

Hydraulic clutch controlled by a push-button in the cab

Rotation speed

1,000 rpm at engine speed 2,040 rpm

Shaft

35 mm dia. - 21 splines

Front axle (4WD)

Clutch

Spring washers. Hydraulic clutch release electrically controlled by a push-button.

Axle

Simultaneous hydromechanical locking of front and rear axles by electrical control

Hydraulic system

Two-stage gear pump driven directly by engine. It supplies:

1st stage (low flow) 21 litres per mn - 17 bar:

"Hare-tortoise" control

"Speedshift" or creeper gears or Dynashift

differential lock

rear PTO

front PTO

front axle

braking system

clutch system

lubrication of gearbox and PTO

2nd stage (high flow) 54 litres per mn - 185 bar:

hydrostatic steering

trailer braking

auxiliary hydraulic system

hydraulic lift



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3600 SERIES TRACTORS

**Introduction****Filtering**

Auxiliary hydraulic pump, 52 Litres per mn,
185 bar (Depending on country)

An external filter 20 micrometres disposable element
(right-hand side of transmission housing)

independent of main pump

External filter, 20 micrometres, left-hand side of
transmission housing

Lifting

Type

3 point, category 2 or category 3 with hitching swivel
ball or hook type ends

Rams (quantity)

2

Lifting force:

in kg (see charts)

MF 3635-45-55-60-70 - 79 mm or 89 mm dia. rams

MF 3690 - 79 mm or 89 mm dia. rams

Position of lift rod on lower links (mm)	Length of lift rod (mm)	Lower links Position			
		Horizontal		Transport	
		Rams 79 mm	Rams 89 mm	Rams 79 mm	Rams 89 mm
530	675	675	6360	6485	8157
	865	865	6545	5612	7060
581	675	675	-	6953	8747
	865	865	7070	5997	7544

Position of lift rod on lower links (mm)	Length of lift rod (mm)	Lower links Position			
		Horizontal		Transport	
		Rams 79 mm	Rams 89 mm	Rams 79 mm	Rams 89 mm
530	675	-	-	6917	8701
	865	5183	6520	5904	7426
581	675	-	-	7374	90275
		5577	7015	6287	7908

Brakes

Main brakes

Type

an oil-immersed single disc per wheel, 355 mm dia.
(343 mm with double reduction unit)

Operation

Hydraulic, with two master cylinders, automatic power-
assisted play adjustment

Parking brake

acts on input gear shaft

Trailer brake

as per versions, with hydraulic distributor

Rear differential lock

Type

Positive clutch

Control

Hydraulic with electrical control



Introduction

Steering

Type

Hydrostatic

Fixed or tiltable and telescopic steering column, one double-acting central ram

Turning radius (3610-3630-3635-3645-3650-3655-3660)

2 wheel-drive

with tyres 11.0 x 16
axle at min. track setting
(1.62 m)

55°

4.26

4.00

4 wheel-drive

with tyres 16.9 - 28
axle in min. track setting
(1.96 m)

50°

radius with front axle
disengaged 5.15
radius with front axle
disengaged 4.44

- angle

- tyre outside radius, without brake (m)

- radius with brake (m)

Turning radius (3670-3680-3690)

2 wheel-drive

with tyres 11.0 x 16
axle at min. track setting
(1.62 m)

55°

4.45

4.15

4 wheel-drive

with tyres 16.9 - 28
axle at min. track setting
(1.85 m)

50°

radius with front axle
disengaged 5.16
radius with front axle
disengaged 4.81

- angle

- radius without brake (m)

- radius with brake (m)

Wheels

FRONT

2 wheel-drive

4 wheel-drive

Steel

Steel with 6 or 8 bridges or cast
iron with automatic adjustment

REAR

Steel with manual adjustment

Cast iron with automatic adjustment (6 or 8 rails)

Cast iron with manual adjustment

Tyres

Compatibility with wheels, identical make and type on front and rear, 4 wheel-drive tractors

Tyres	Front	Rear	Front	Rear	Front	Rear
	11.2 - 24	16.9 - 34	13.6 - 28	18.4 - 34		26.5 - 34
	12.4 - 24	18.4 - 30		18.4 - 38		18.4 - 42
		13.6 - 38	14.9 - 28	18.4 - 32		20.8 - 42
	13.6 - 24	18.4 - 30		24.5 - 32		18.4 - 38
		15.5 - 38		18.4 - 38		18.4 - 42
	11.2 - 28	18.4 - 30		20.8 - <38		
		15.5 - 38	16.9 - 28	20.8 - 38		18.4 - 30
	12.4 - 28	18.4 - 30		18.4 - 42		15.5 - 38
		23.1 - 30				

Note: This table is not restrictive. Any information on other choices can be obtained from your dealer.

**1A01.12****Introduction**

Water ballasting (75% fill)

Average capacity per tyre, variable according to kind and make

Front tyres	2 WD	Litres	4 WD	Litres
	10.0 - 16	50	13.6 - 28	160
	11.0 - 16	95	14.9 - 28	190
	14L - 16.1	105	16.9 - 28	250
			16.9 - 30	260
Rear tyres	18.4 - 38	370		
	20.8 - 38	460		
	20.8 - 42	510		

Capacities (litres)

	3610-3630-3635-3645 3650-3655-3660	3670	3690
Fuel tank	246	246	246
Additional fuel tank (option)	-	60	60
Cooling system	27	27	29.7
Engine casing	16.5	21	21
Transmission / Rear axle*	85	75	75
Front axle	11	11	11
Front final reduction units (each) (50° axle)	1.8	1.8	1.8
Front final reduction units (each) (40° axle)	3.3		
Rear final reduction units, bulkheads (each)	3.6	3.6	-
Double reduction units (each)	-	-	5

* For work on steep slopes, 10 litres of oil can be added in the transmission.



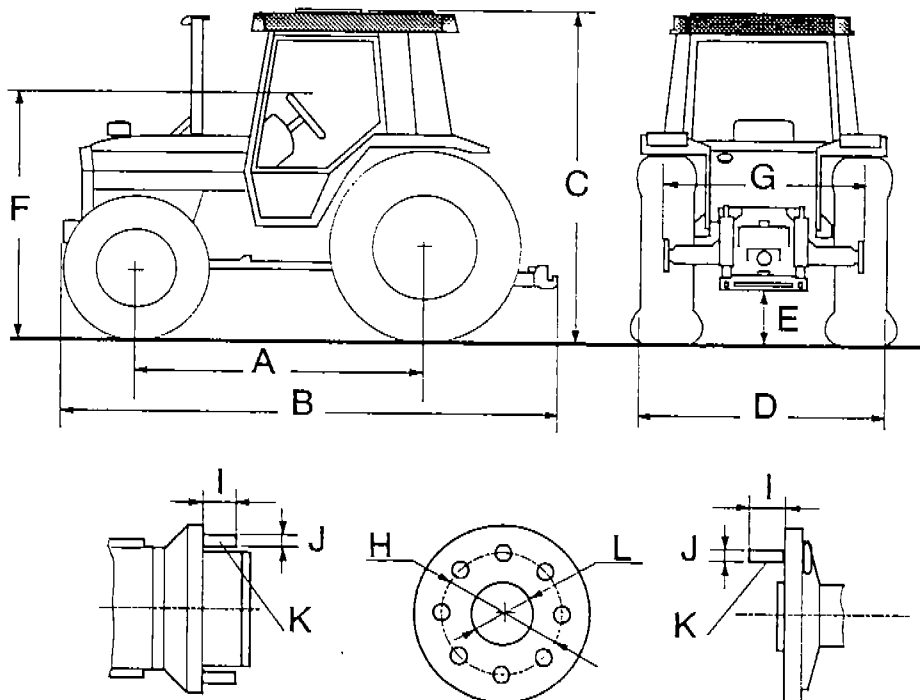
Introduction

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Dimensions and weights (mm - kg)

		3610		3630-3635-3645		3650-3655-3660		3670		3690	
		2WD	4WD	2WD	4WD	2WD	4WD	2WD	4WD	2WD	4WD
Wheels	Front	11.0-16	14.9-28	11.0-16	14.9-28	11.6-16	16.9-28	11.0-16	16.9-28	11.0-16	16.9-28
	Rear	14.4-38	18.4-38	18.4-38*	20.8-38*	18.4-38*	20.8-38*	20.8-38*	20.8-38*	20.8-38*	20.8-38*
* with PAVT wheels											
A. Wheelbase		2777	2765	2777	2765	2777	2765	2940	2920	2940	2920
B. Overall length with drawbars, without front weights		4642	4698	4642	4698	4642	4798	5534	5590	5534	5590
C. Height to roof (cab tractor)		2942	2942	2942	2942	2942	2942	2930	2930	2980	2980
D. Overall width (1)		2771	2832	2771	2832	2771	2832	2852	2852	2832	2832
E. Ground clearance (under swivelling drawbar frame)		385	385	385	385	385	385	550	550	510	510
F. Height to steering wheel (platform tractor)		2204	2204	2204	2204	2204	2204				
. Total weight (with fuel tank full, without weights)											
- Cab tractor		5150	5510	5320	5900	5460	5790	5770	6170	6650	7050
- Platform tractor		4920	5280	5090	5670	5280	5560	-	-	-	-
G. Standard trumpet sections, 82 dia. shaft Reinforced trumpet sections, 82 dia. shafts Reinforced trumpet sections with bulkheads, 95 dia. shaft or double reduction units Reinforced trumpet sections with bulkheads, 82 dia. shafts						Rear axle		Front axle			
						1909					
						1940					
						1940					
						1960		1920			
H. Distance between studs						82 dia. shaft		95 dia. shaft			
L. Centring diameter						203.20		275		325	
						149.35		220.65		284	
I. Length of studs											
- Rim with steel wheel body						41				45	
- Rim with cast iron wheel body						66				45	
J. Diameter of studs						M 18 x 1.5				M 18 x 1.5	
K. Number of studs						8				6	

(1) For tractors set at maximum track.





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3600 SERIES TRACTORS



Introduction

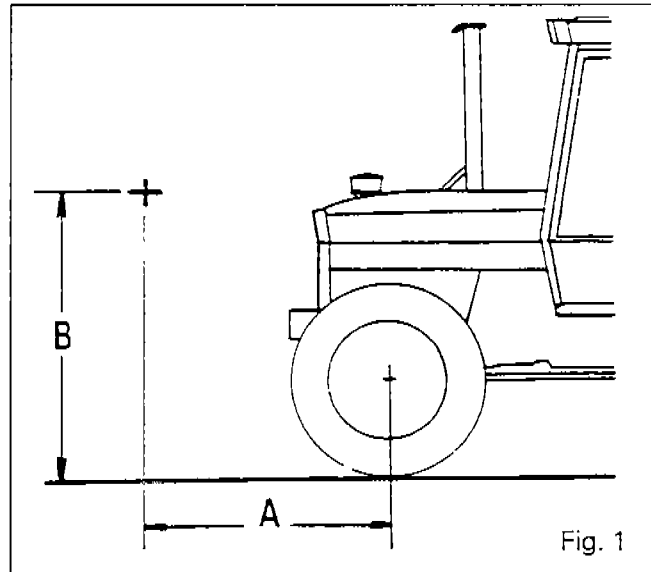
Maximum weight per axle (kg)

	Front		Rear	
	Tyres	Load	Tyres	Load
2-wheel drive	10.00 - 16	2380	18.4 - 38	6420
	11.00 - 16	2640	20.8 - 38	7810
	14L - 16.1	2320		
4-wheel drive	13.6 - 28	3320	20.8 - 42	7400
	14.9 - 28	3850	650/75 R34	8140
	16.9 - 28	4800	710/75 R34	9100
	16.9 - 30	4920		

Permissible load on front (kg) (without lifting equipment)

	A (m) Fig. 1		
	1	2	3
3610/30/35/ 45/50/55/60	945	600	470
3670/80/90	1500	1060	800

B = 2 m max.



**Introduction****C. Chassis mounting points and dimensions****1. Mounting points**

Hole N°	Machining		3610-3630-3635 3640-3645-3650-3655-3660			3670-3680-3690		
			Coordinates			Coordinates		
	Ø	Tapping depth	X	Y	Z	X	Y	Z
1	M20	40	-1633.8	79.3	±190.5	-2067.8	4.3	±220
2	M20	40	-1633.8	-15.97	±190.5	-2067.8	-95.7	±220
3	M20	38	-1392.9	-20	±254	-1929.8	6.35	±254
4	M20	38	-1329.9	-81.6	±254	-1929.8	-95.25	±254
5	M20	38	-922.7	6.35	±254	-1869.48	-50.8	±254
6	M20	38	-922.7	-95.25	±254	-1828.2	-95.25	±254
7	M20	38	-862.38	-50.8	±254	-1828.2	6.35	±254
8	M20	38	-821.1	-95.25	±254	-1594.4	-81.6	±254
9	M20	38	-821.1	6.35	±254	-1594.4	-20	±254
10	M20	38	-	-	-	-1124.2	6.35	±254
11	M20	38	-	-	-	-1124.2	-95.25	±254
12	M20	38	-	-	-	-1063.88	-50.8	±254
13	M20	38	-	-	-	-1022.6	-95.25	±254
14	M20	38	-	-	-	-1022.6	6.35	±254
15	M16	32	121	77	±276	80	77	±276
16	M16	32	121	-24.6	±276	80	-24.6	±276
17	M16	32	222.6	77	±276	181.6	77	±276
18	M16	32	222.6	-24.6	±276	181.6	-24.6	±276
19	3/4-10	through	317.77	-25.4	±215.9	276.77	-25.4	±215.9
20	3/4-10	30	317.77	-203.2	±215.9	276.77	-203.2	±215.9
21	3/4-10	30	524.14	-63.5	±215.9	483.14	-63.5	±215.9
22	3/4-10	30	524.14	-203.2	±215.9	483.14	-203.2	±215.9
23	3/4-10	30	701.9	-203.2	±215.9	660.9	-203.2	±215.9
24	3/4-10	30	701.9	-63.5	±215.9	660.9	-63.5	±215.9
25	20.7	through	1518	-262.8	±632.7	1477	-262.8	±632.7
25	20.7	through	-	-	-	1477	-262.8	±739.6
26	20.7	through	1518	-262.8	±556.5	1477	-262.8	±556.5
26	20.7	through	-	-	-	1477	-262.8	±663.4
27	20.7	through	1759.35	-262.8	±632.7	1718.35	-262.8	±632.7
27	20.7	through	-	-	-	1718.35	-262.8	±739.6
28	20.7	through	1759.35	-262.8	±556.5	1718.35	-262.8	±556.5
28	20.7	through	-	-	-	1718.35	-262.8	±663.4
29	3/4-10	30	2024.98	-151	±149	2024.98	-151	±149
30	3/4-10	30	2024.98	-363	±153	2024.98	-363	±153
31	3/4-10	30	2024.98	-264	±75	2024.98	-264	±75
32	3/4-10	30	2024.98	-363	±57	2024.98	-363	±57
33	5/8-11	24	2024.98	-146	±53.44	2024.98	-146	±53.44

3670/80
3690
3670/80
3690
3670/80
3690
3670/80
3690



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Introduction

2. Chassis dimensions

Dimens.	3610-30-35-40-45-50-55-60	Dim.	3670	3680	3690
34	337.11	34	337.11	337.11	337.11
35	354.6	35	354.6	354.6	354.6
36	862.3	-	-	-	-
37	771.5	37	973	973	973
38	41	-	-	-	-
39	234.10	39	234.10	234.10	234.10
40	823.90	40	823.90	823.90	823.90
41	967	41	967	967	967
42	3699.8	42	4092.8	4092.8	4092.8
43	539.75	43	539.75	539.75	539.75
44	185.41	44	185.41	185.41	185.41
45	139.80	45	139.80	139.80	139.80
46	168.15	46	168.15	168.15	168.15
47	263.65	47	263.65	263.65	263.65
48	76.20	48	76.20	76.20	76.20
49	203.20	49	203.20	203.20	203.20
50	300	50	300	300	300
51	224	51	224	224	224
-	-	52	736.8	736.8	736.8
-	-	53	358	358	358
54	444.62	54	444.62	444.62	444.62
55	1909 (Normal Duty) 82 dia. shaft	-	-	-	-
55	1941 (Heavy Duty) 82 dia. shaft	-	-	-	-
55	1962 (Heavy Duty) sealed reduction unit	55	1962	1962	-
-	double reduction unit	55	-	-	1940
56	double reduction unit	56	2493	2493	2493
56	2355 sealed reduction unit	-	-	-	-
-	double reduction unit	57	2991	2991	2991
57	2997 sealed reduction unit	-	-	-	-
58	233	58	233	233	233
59	47	59	47	47	47
60	204.21	60	204.21	204.21	204.21
61	2098	61	2098	2098	2098
62	1920	62	1920	1920	1920
63	ø 283.8 - 283.6	63	ø 283.8-283.6	ø 283.8-283.6	ø 283.8-283.6
64	ø 325	64	ø 325	ø 325	ø 325
65	ø 149.35 (82 dia. shaft)	-	-	-	-
65	ø 220.65 (95 dia. shaft)	65	ø 220.65	ø 220.65	ø 220.65
66	ø 203.20 (82 dia. shaft)	-	-	-	-
66	ø 275 (95 dia. shaft)	66	ø 275	ø 275	ø 275
67	337.11	67	337.11	337.11	337.11



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3600 SERIES TRACTORS



Introduction

D. Safety precautions

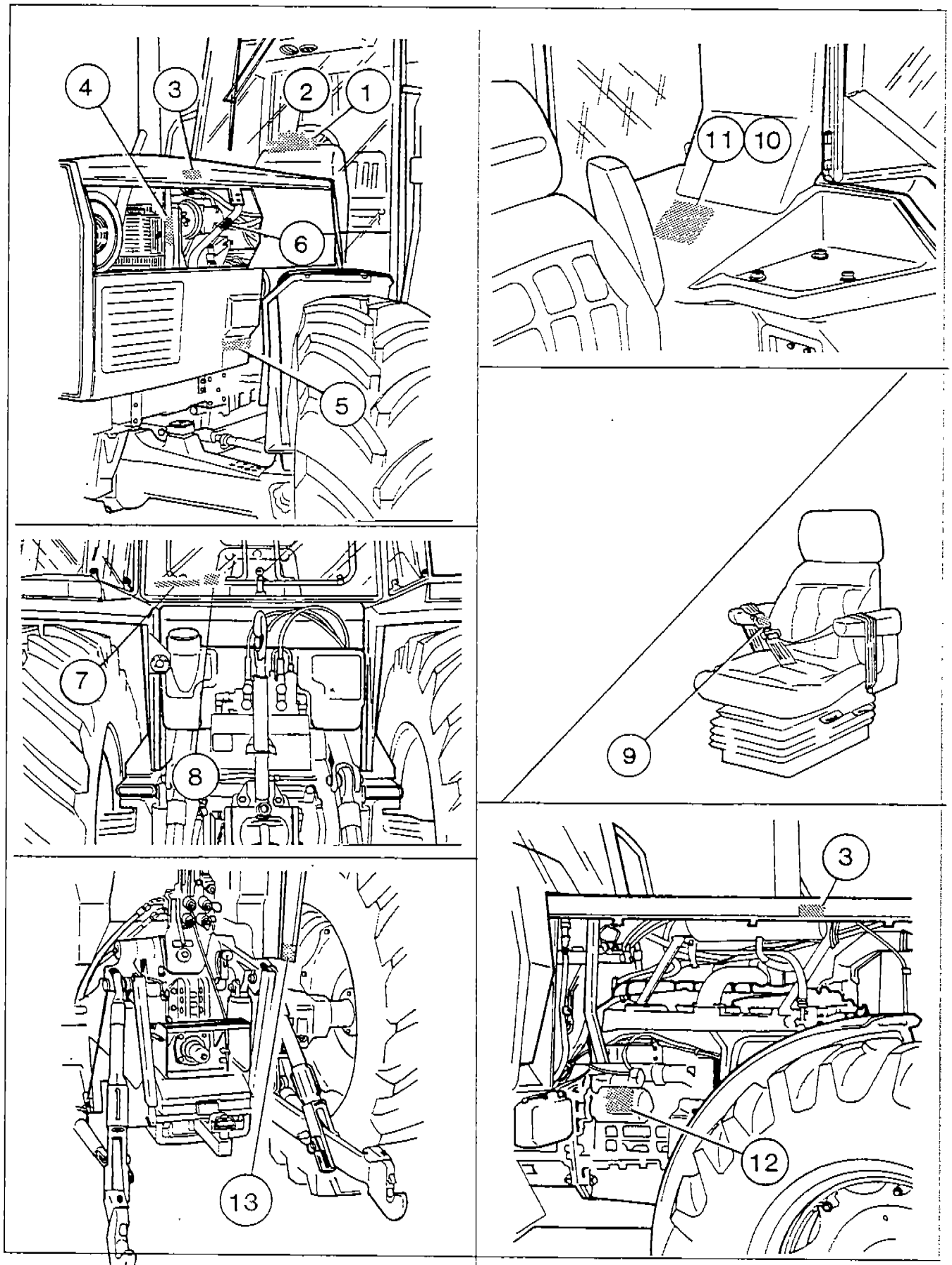
When replacing a tractor part bearing a safety decal (yellow) a new safety sticker MUST be affixed onto the replacement part. A full list of the locations for all safety decals are specified below.

G.B.  CAUTION Before operating, read operator's instruction book thoroughly. Do not start engine until everyone is a safe distance from tractor and equipment. Keep all shields, covers and guards in place while engine is running. Keep hands, feet and clothing away from power driven or moving parts.	Always drive with due care and attention. If differential lock does not disengage automatically, depress clutch pedal. Brake pedals must always be coupled together when independent brakes are not being used. Before leaving tractor, apply parking brake, lower equipment, stop engine and remove key from starter switch.	When attaching equipment check operator's instruction book for front and rear axle load limits. Put the gears lever (1-2-3-4) in neutral position and put the reverse/forward lever in forward position or reverse position in order to use the external lift controls. Ensure that all wheel and rim nuts are tightened as specified in operator's instruction book. On public roads, use SMV emblem and flashing warning lights where required by law.
DO NOT REMOVE OR OBSCURE DECAL 3580321 M3		
 WARNING Gears lever (1-2-3-4) must be in his neutral position and the reverse/forward lever in forward position or reverse position: - In order to use the external lift controls. - When the driver is not in his seat. 2	1	G.B.  WARNING High pressure steam and hot water. Remove filler cap with extreme care. 3 DO NOT REMOVE OR OBSCURE DECAL 3583500 M2
G.B.  WARNING Before working on the tractor, disconnect negative leads to all batteries.	 WARNING Before removing any battery, disconnect all negative leads before positive leads. 4 DO NOT REMOVE OR OBSCURE DECAL 3595679 M1	G.B.   6 DO NOT REMOVE OR OBSCURE DECAL 3596685 M1
G.B.  CAUTION Keep all shields, covers and guards fastened in place while engine is running.	 WARNING Beware hot parts 5 DO NOT REMOVE OR OBSCURE DECAL 3595678 M1	
G.B.  WARNING Always disengage PTO and stop engine before attaching or detaching PTO shafts or working on PTO driven equipment. Always fit PTO cover when PTO is not in use.	 CAUTION Do not stand between tractor and equipment when operating controls. Tow only with MF approved tractor drawbar or hitch 7 DO NOT REMOVE OR OBSCURE DECAL 3591563 M1	G.B.  CAUTION TO AVOID POSSIBLE TRACTOR OVERTURN, PULL ONLY FROM DRAWBAR OR LOWER LINKS OF THREE POINT HITCH 8 2752579 M1
G.B.  WARNING Before working on the tractor or removing this cover, disconnect negative leads to all batteries.	 CAUTION Use seat belt at all times. Keep belt adjusted snugly. 10 DO NOT REMOVE OR OBSCURE DECAL 3580316 M1	 CAUTION Belt for use only on tractors with safety structures. 9 DO NOT REMOVE OR OBSCURE DECAL 523784 M3
 CAUTION Do not short across starter terminals to start engine. Never start engine while standing on the ground. Start engine only with start key from operator's seat, ensuring that gearbox and PTO are in neutral with parking brake applied. 12 DO NOT REMOVE OR OBSCURE DECAL 3596432 M1	G.B.  WARNING If tractor is overturning, hold onto steering wheel. Do not leave seat 11 DO NOT REMOVE OR OBSCURE DECAL 3580315 M1	 3617574 M1 Voir Manuel d'Utilisation. See Operator Instruction Book. Vedere Libretto d'Uso. Siehe Betriebsanleitung Ver Manual del Operador 13



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Introduction

E. Practical advice

Safety

Your safety and that of others must always be the first consideration when working around machines of any type. Safety requires a thorough understanding of the job to be done, the correct use of tools and equipment, and the application of common sense.

Troubleshooting

The following procedure, combined with the information contained in the workshop manual, will be helpful in accurately tracing faults occurring on the machine.

It consists in following a number of logical steps to identify, locate and correct the problem.

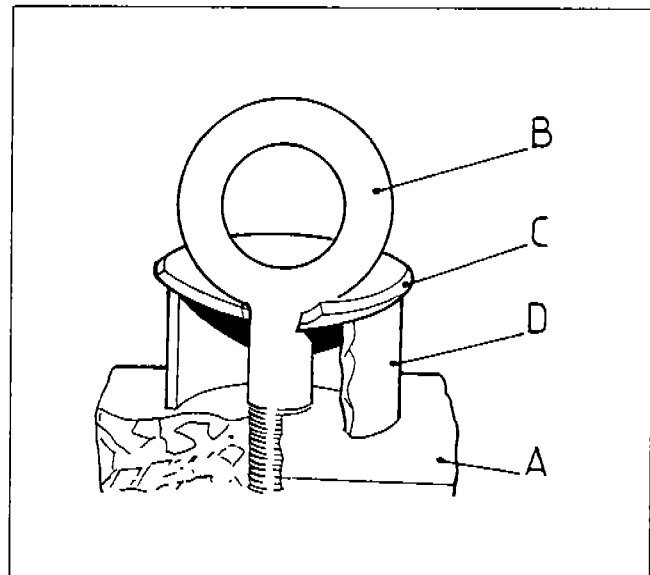
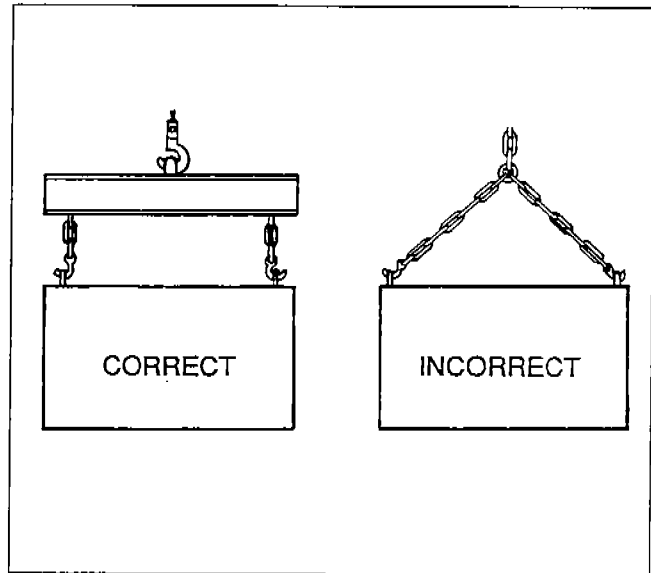
1. Determine the problem.
2. List its possible causes.
3. Differentiate the causes.
4. Conduct checks in a logical order to determine the exact cause.
5. Compare the approximate remaining service life with the cost of parts and labour.
6. Make any repair considered necessary.
7. Check that the parts and functions concerned operate correctly.

Handling heavy components

Unless otherwise specified, all dismantling operations should be performed using adjustable lifting equipment. All supporting slings must be parallel to each other and as near vertical as possible in relation to the object being lifted. However, in cases where the capacity of the slings is far greater than the weight of the load to be lifted, a triangular lifting arrangement may be used (2, 3 or 4 strands from a single ring beneath the hoist hook).

When removing a component at an angle, it should be remembered that the capacity of an eyebolt is reduced when the angle between the supporting members and the object become less than 90° (correct and incorrect methods of lifting).

Eyebolts and brackets must never be bent and must only work under tensile load. A length of pipe and a washer may be used to reduce tension on eyebolts.



Forged eyebolt support

A Load - B Lifting shackle - C Shackle retaining plate (3 mm thick) - D Sleeve (which may or may not be welded to plate).

In some cases, special lifting fixtures are available to obtain the required balance and ensure safe handling. Consult the relevant section of the workshop manual.

Note: If a part proves difficult to remove, check that all the nuts and bolts have been removed and that no obstruction is caused by adjacent parts.



Introduction

Cleanliness

To ensure a machine's long service life, it is important to keep dirt and foreign bodies out of its vital working components. Precautions must be taken to safeguard against this. Enclosed compartments, seals and filters ensure that supplies of air, fuel and lubricant are kept clean. These protective devices must not be removed.

Whenever hydraulic fluid, fuel, lubricating oil or air lines are disconnected, the point of disconnection and the surrounding area must be cleaned. As soon as a line has been disconnected, the line or opening must be blanked with a cap, a plug or adhesive tape to prevent the ingress of foreign bodies.

The same cleaning and covering precautions should be taken when access covers or inspection plates are removed.

Clean and inspect all parts. Make sure that all passages and holes are clear. Cover all parts to keep them clean. Make sure parts are clean when they are reassembled. Leave new parts in their packaging until they are actually needed for reassembly.

Assembly

When reassembling a machine, complete each step in the right order. Never partially assemble one part and then start to assemble another. Make all recommended adjustments. Always check the job on completion to ensure that nothing has been overlooked.

Recheck the various adjustments before putting the machine back into service.

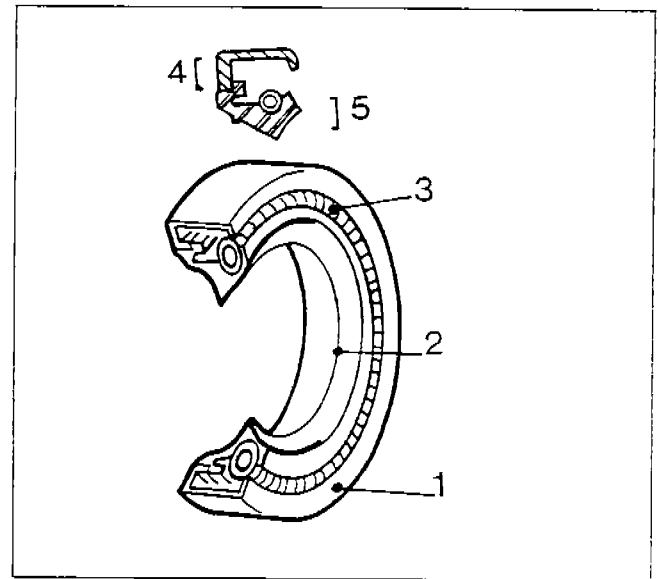
Note: Before fitting new parts, remove the anti-rust compound from all machined surfaces (usually "peel-off" substances).

Lubrication

Where applicable, fill the compartments of repaired or replaced components with the quantity, type and grade of clean lubricant recommended in the routine maintenance section of the operation instruction book.

Shims

When shims are removed, tie them together and identify their locations. Keep shims clean and take care not to bend them before refitting them.



Gaskets

Make sure that the holes in gaskets are lined up with lubricating oilways in the mating parts. If gaskets have to be made, use material of the correct type and thickness. Make sure that holes are punched in the right places. Incorrectly punched gaskets can cause serious damage.

Lip seals ("SPY" type)

Lubricate the lips of "SPY" type lip seals before fitting them. Do not use grease on seals except for grease seals.

The main parts of a "SPY" type lip seal are the case (1), the sealing element (2) and the ring spring (3). The figure above illustrates a simple "SPY" type lip seal. The cross-section shows the "heel" (4) and the "toe" (5), used to identify the sides of a single element seal. Apart from a few exceptions, the toe of a single-lip oil seal is located on the lubricant side. Some seals have a second auxiliary lip with no spring.



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Introduction

Cables and wires

When removing or disconnecting a group of cables or wires, each one should be identified and labelled in order to ensure that they are correctly refitted.

Nut and bolt locking devices

The loosening of nuts and bolts is prevented by using lockwashers, tab washers and cotter pins. In addition to these mechanical means, locking agents of the Loctite type are also used.

Flat retainers must be correctly installed in order to be effective. Bend one end of the retainer against the edge of the part. Bend the other end against one of the flats on the nut or bolt head.

Always fit new retainers in compartments which house moving parts. When fitting lockwashers on aluminium housing, place a flat washer between the lockwasher and the housing.

Note:

- 1) **Never fit a lockwasher (Grower, fan, spring, etc.) under a nut or bolt head to which a specified tightening torque has to be applied (see section H).**
- 2) **Components must always be degreased before applying Loctite type locking agents.**

Lubrication bushes and press fits

Bushes must never be fitted with a hammer alone.

Use a suitable fitting tool and a hammer or, better still, a press if possible.

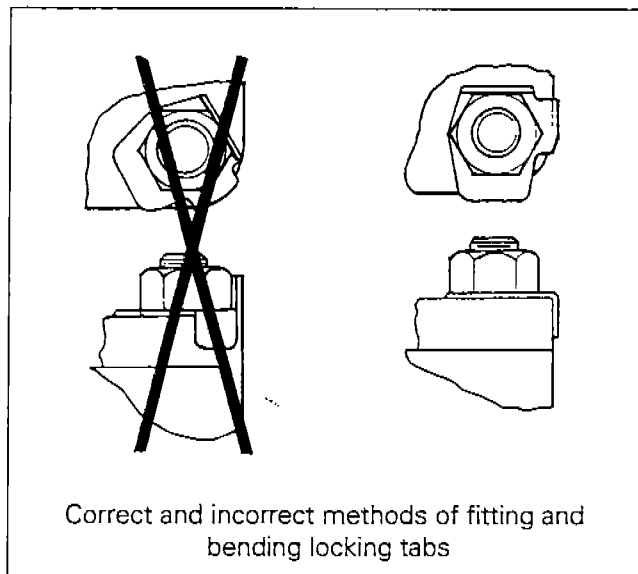
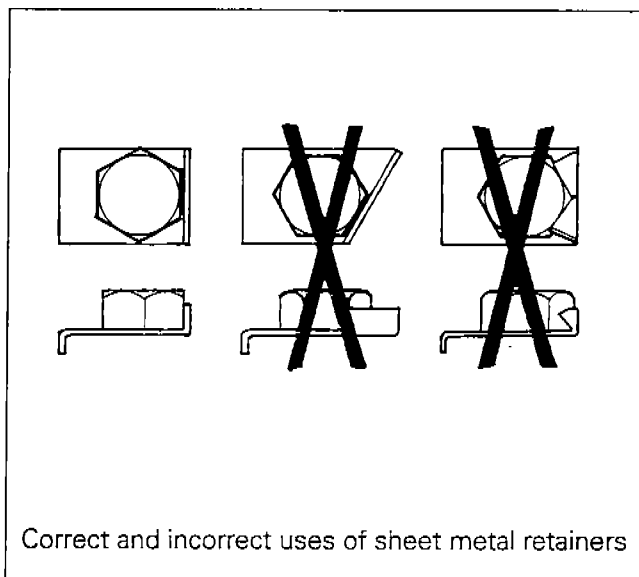
When using a press, ensure that pressure is applied directly in line with the bore. When a lubrication brush has an oil hole, that hole should be aligned with the hole in the mating part.

When press fitting a part into another part, lubricate the mating surfaces. Tapered parts should be assembled dry. Before assembly, check that the tapers are dry, clean and free from burrs.

Fitting bolts in blind holes

Use bolts of the correct length. A bolt which is too long may "bottom" before the head comes into contact with the part it is intended to hold. This will cause damage to the threads.

If a bolt is too short, there may not be enough threads engaged to hold the part securely, and the bolt is therefore ineffective.





Introduction

F. Installation instructions

General

In order to ensure regular servicing of the tractor during the 12 months warranty period, the supplying MF Distributor or Dealer must carry out the 50-hour and 250-hour servicing operations.

The definition of this operation is designed to provide the tractor with maximum efficiency during the whole warranty period, thus ensuring that it gives reliable service after that period.

Pre-delivery check

The performance of the following operations must be ensured by the Distributor before delivery to a Dealer and by the Dealer before delivery to an owner or operator.

1. General installation

- Clean the tops of batteries and smear the terminals with petroleum jelly.
- Charge the batteries, if necessary.
- Check all electrical connections, and cable, ducting and light attachments.
- Check and top up the oil levels in the engine and transmission housings.
- Lubricate all grease points.
- Check and adjust belt tensions, as required (alternator, fan, auxiliary pump and air-conditioning compressor).
- Unless it contains an antifreeze compound, flush the cooling system and refill with soft water.
- If the clutch pedal has been held down to prevent the disc sticking, remove the keeper.
- Check that the fuel tank contains enough fuel of the correct type.
- Check that the cylinder head attaching nuts and bolts are tightened to the required torque. Check that the inlet pipe and exhaust manifold attaching nuts and bolts are correctly tightened.
- Check and adjust the clearance between the valves and rockers and visually check the valve springs.
- Check the injectors, bleed the fuel system and tighten all fuel line connections.
- Check that the engine air filter hoses are secure.
- Check that the engine control linkages are correctly adjusted and operate freely.
- Start the engine.
- Check that the instruments and warning lights operate correctly.
- Check the engine speed on the tachometer with both the hand and foot-operated throttles.

- Hitch up a mounted implement and check that the tractor's hydraulic accessories operate correctly.
- Check and adjust the tyre pressures (road or field work).
- Check the tightness of all nuts, bolts, studs, pipe unions and attachment fittings.
- Check all pipes and hoses for leaks.
- Check that the headlights are correctly adjusted.
- Road test the tractor, checking the correct operation of the brakes and all instruments and accessories.

2. Electronic systems

- Check that the electronic lifting system operates correctly. Carry out the quick check procedure described in section 11D01.
- Check all the Autotronic functions, following the test procedure in section 12B01.
- Check the on-board computer installation in accordance with procedure 13A01.

3. Tightening torques

- Check the tightening torque on the attaching nuts and bolts on the various chassis attachment points:
 - . Front axle/engine,
 - . Engine/gearbox,
 - . Gearbox/rear axle
 - . Trumpet sections/rear axle.
- Check the tightening torque of the attaching nuts and bolts on wheels and wheel bodies.



Introduction

Instructions to driver

Instructions on items listed below must be given to the owner or operator.

1. Safety precautions when starting the engine.
2. Location and significance of tractor and engine serial numbers.
3. Controls and instruments.
4. Running-in.
5. Starting and stopping the engine.
6. Selection of gears and use of gearshift and reverse shuttle levers.
7. Danger of towing down the hill without engine braking and correct use of gearbox.
8. Use and adjustment of brakes and brake pedal latch.
9. Use of the vehicle's clutch.
10. Use of the hydraulic differential lock device.
11. Use of the hydraulic PTO - Clutch and brake.
12. Operation of hydraulic lift system.
13. Hitching and unhitching of towed implements.
14. Grease points.
15. Changing of oil grades.
16. Replacement of engine and transmission filter elements.
17. Operation of fuel system - Bleeding of fuel and injection system - Air filter - Clogging indicator.
18. Cooling system. Frost precautions. Tension of both fan belts.
19. Maintenance of electrical equipment (batteries). System with negative earth.
20. Adjustment of front and rear track.
21. Tyre pressures.
22. Tightness of nuts, bolts and screws.
23. Fuel storage and handling.
24. Use of auxiliary hydraulic equipment.
25. Filling in of tractor and engine serial numbers in the operator instruction book.
26. Reading of the operator instruction book.

G. Conversion tables

Pressure units

1 PSI = 1 lbf/in² = 0.0689 bar

1 bar = 14.512 lbf/in² = 14.512 PSI

Bar	lbf / in ²	Bar	lbf / in ²	Bar	lbf / in ²
0.5	7.256	9.5	137.9	35	508
1	14.51	10	145	40	588
1.5	21.77	11	159.6	45	653
2	29	12	174	50	726
2.5	36.28	13	189	60	871
3	43.54	14	203	70	1029
3.5	50.8	15	218	80	1161
4	58	16	232	90	1306
4.5	65.3	17	247	100	1451
5	72.6	18	261	200	2903
5.5	79.8	19	276	300	4354
6	87.1	20	290	400	5805
6.5	94.3	21	309	500	7257
7	101.6	22	319	600	8708
7.5	108.8	23	334	700	10160
8	116.1	24	348	800	11611
8.5	123.4	25	368	900	13235
9	130.6	30	435	1000	14514

**Introduction**

1A01.25

Torque units

1 Nm = 0.7376 lbf/ft

1 lbf/ft = 1.3558 Nm

Nm		lbf/ft	Nm		lbf/ft	Nm		lbf/ft
1.3558	1	0.7376	46.0972	34	25.0784	90.8396	67	49.4912
2.7116	2	1.4752	47.4530	35	25.8160	92.1944	68	50.1568
4.0674	3	2.2128	48.8088	36	26.5536	93.5502	69	50.8944
5.4232	4	2.9504	50.1646	37	27.2912	94.9060	70	51.6320
6.7790	5	3.6880	51.5204	38	28.0288	96.2618	71	52.3696
8.1348	6	4.4256	52.8762	39	28.7664	97.6176	72	53.1072
9.4906	7	5.1632	54.2320	40	29.5040	98.9734	73	53.8448
10.8464	8	5.9008	55.5878	41	30.2416	100.329	74	54.5824
12.2022	9	6.6384	56.9436	42	30.9792	101.685	75	55.3200
13.5580	10	7.3760	58.2994	43	31.7168	103.041	76	56.0576
14.9138	11	8.1136	59.6552	44	32.4544	104.397	77	56.7952
16.2696	12	8.8512	61.0110	45	33.1920	105.752	78	57.5328
17.6254	13	9.5888	62.3668	46	33.9296	107.108	79	58.2704
18.9812	14	10.3264	63.7226	47	34.6672	108.464	80	59.0080
20.3370	15	11.0640	65.0784	48	35.4048	109.820	81	59.7456
21.6928	16	11.8016	66.4342	49	36.1424	111.176	82	60.4832
23.0486	17	12.5392	67.7900	50	36.8800	112.531	83	61.2208
24.4044	18	13.2768	69.1458	51	37.6176	113.887	84	61.9584
25.7602	19	14.0144	70.5016	52	38.3552	115.243	85	62.6960
27.1160	20	14.7520	71.8574	53	39.0928	116.600	86	63.4336
28.4718	21	15.4896	73.2132	54	39.8304	117.955	87	64.1712
29.8276	22	16.2272	74.5690	55	40.5680	119.310	88	64.9088
31.1834	23	16.9648	75.9248	56	41.3056	120.666	89	65.6464
32.5392	24	17.7024	77.2806	57	42.0432	122.022	90	66.3840
33.8950	25	18.4400	78.6364	58	42.7808	123.378	91	67.1216
35.2508	26	19.1776	79.9992	59	43.5184	124.734	92	67.8592
36.6066	27	19.9152	81.3480	60	44.2560	126.089	93	68.5968
37.9624	28	20.6528	82.7038	61	44.9936	127.445	94	69.3344
39.3182	29	21.3904	84.0596	62	45.7312	128.801	95	70.0720
40.6740	30	22.1280	85.4154	63	46.4688	130.157	96	70.8096
42.0298	31	22.8656	86.7712	64	47.2064	131.513	97	71.5472
43.3856	32	23.6032	88.1270	65	47.9440	132.868	98	72.2848
44.7414	33	24.3408	89.4828	66	48.6816	134.224	99	73.0224



1A01.26

3600 SERIES TRACTORS

**Introduction****Capacity units**

1 litre = 0.2199 imp. gallon

1 imp. gallon = 4.5459 litres

Note:

1 US gallon = 3.79 litres

Imp. gal.		Litres	Imp. gal.		Litres	Imp. gal.		Litres
0.2199	1	4.5459	7.4766	34	154.561	14.733	67	304.575
0.4398	2	9.0918	7.6965	35	159.107	14.9532	68	309.121
0.6597	3	13.6377	7.9164	36	163.652	15.1731	69	313.667
0.8796	4	18.1836	8.1363	37	168.198	15.3930	70	318.213
1.0995	5	22.7295	8.3562	38	172.744	15.6129	71	322.759
1.3194	6	27.2754	8.5761	39	177.290	15.8328	72	327.305
1.5393	7	31.8213	8.7960	40	181.836	16.0527	73	331.851
1.7592	8	36.3672	9.0159	41	186.382	16.2726	74	336.397
1.9791	9	40.9131	9.2358	42	190.929	16.4925	75	340.943
2.1990	10	45.4590	9.4557	43	195.474	16.7124	76	345.488
2.4189	11	50.0049	9.6756	44	200.019	16.9323	77	350.034
2.6388	12	54.5508	9.8955	45	204.566	17.1522	78	354.580
2.8587	13	59.0967	10.1154	46	209.111	17.3721	79	359.126
3.0786	14	63.6426	10.3353	47	213.657	17.5920	80	363.672
3.2985	15	68.1885	10.5552	48	218.203	17.8119	81	368.218
3.5184	16	72.7344	10.7751	49	222.749	18.0318	82	372.764
3.7383	17	77.2803	10.9950	50	227.295	18.2517	83	377.310
3.9582	18	81.8262	11.2149	51	231.841	18.4716	84	381.856
4.1781	19	86.3721	11.4348	52	236.387	18.6915	85	386.402
4.3980	20	90.9180	11.6547	53	240.933	18.9114	86	390.947
4.6179	21	95.4639	11.8746	54	245.479	19.1313	87	395.493
4.8378	22	100.009	12.0945	55	250.025	19.3512	88	400.039
5.0577	23	104.556	12.3144	56	254.570	19.5711	89	404.585
5.2776	24	109.102	12.5343	57	259.116	19.7910	90	409.131
5.4975	25	113.648	12.7542	58	263.662	20.0109	91	413.677
5.7174	26	118.193	12.9741	59	268.209	20.2308	92	418.223
5.9373	27	122.739	13.1940	60	272.754	20.4507	93	422.769
6.1572	28	127.285	13.4139	61	277.299	20.6706	94	427.315
6.3771	29	131.831	13.6338	62	281.846	20.8905	95	431.861
6.5970	30	136.377	13.8537	63	286.392	21.1104	96	436.406
6.8169	31	140.923	14.0736	64	290.938	21.3303	97	440.952
7.0368	32	145.469	14.2935	65	295.483	21.5502	98	445.498
7.2567	33	150.015	14.5134	66	300.029	21.7701	99	450.044

**Introduction**

1A01.27

Capacity units

1 litre = 1.7599 imp. pints

1 imp. pint = 0.5682 litre

Note:

1 litre = 2.113 US pints

Imp. pt.		Litres	Imp. pt.		Litres	Imp. pt.		Litres
1.7599	1	0.5682	59.8366	34	19.3188	117.913	67	38.0694
3.5198	2	1.1364	61.5965	35	19.8870	119.673	68	38.6376
5.2797	3	1.7046	63.3564	36	20.4552	121.433	69	39.2058
7.0396	4	2.2728	65.1163	37	21.0234	123.193	70	39.7740
8.7995	5	2.8400	66.8762	38	21.5916	124.953	71	40.3422
10.5594	6	3.4902	68.6361	39	22.1598	126.713	72	40.9104
12.3193	7	3.9774	70.3960	40	22.7280	128.473	73	41.4786
14.0792	8	4.5456	72.1559	41	23.2962	130.233	74	42.0468
15.8391	9	5.1138	73.9158	42	23.8644	131.993	75	42.6150
17.5990	10	5.6820	75.6757	43	24.4326	133.752	76	43.1832
19.3589	11	6.2502	77.4356	44	25.0008	135.512	77	43.7514
21.1188	12	6.8184	79.1955	45	25.5690	137.272	78	44.3196
22.8787	13	7.3866	80.9554	46	26.1372	139.032	79	44.8878
24.6386	14	7.9548	82.7153	47	26.7054	140.792	80	45.4560
26.3985	15	8.5230	84.4752	48	27.2736	142.552	81	46.0242
28.1854	16	9.0912	86.2351	49	27.8418	144.312	82	46.5924
29.9183	17	9.6594	87.9950	50	28.4100	146.072	83	47.1606
31.6782	18	10.2276	89.7549	51	28.9782	147.832	84	47.7288
33.4381	19	10.7958	91.5148	52	29.5464	149.592	85	48.2970
35.1980	20	11.3640	93.2747	53	30.1146	151.351	86	48.8652
36.9579	21	11.9322	95.0346	54	30.6828	153.111	87	49.4334
38.7178	22	12.5004	96.7945	55	31.2510	154.871	88	50.0016
40.4770	23	13.0686	98.5544	56	31.8192	156.631	89	50.5698
42.2376	24	13.6368	100.314	57	32.3874	158.391	90	51.1380
43.9975	25	14.2050	102.074	58	32.9556	160.151	91	51.7062
45.7574	26	14.7732	103.834	59	33.5238	161.912	92	52.2744
57.5173	27	15.3414	105.594	60	34.0920	163.671	93	52.8426
49.2772	28	15.9096	107.354	61	34.6602	165.431	94	53.4108
51.0371	29	16.4778	109.114	62	35.2284	167.191	95	53.9790
52.7970	30	17.0460	110.874	63	35.7966	168.950	96	54.5472
54.5569	31	17.6142	112.634	64	36.3648	170.710	97	55.1154
56.3168	32	18.1824	114.394	65	36.9330	172.470	98	55.6836
58.0767	33	18.7506	116.153	66	37.5012	174.230	99	56.2518



1A01.28

3600 SERIES TRACTORS

**Introduction**

Length units

1 m = 3.2808 ft

1 ft = 0.3048 m

m		ft	m		ft	m		ft
0.3048	1	3.2808	10.3632	34	111.549	20.4216	67	219.816
0.6096	2	6.5617	10.6680	35	114.829	20.7264	68	223.097
0.9144	3	9.8425	10.9728	36	118.110	21.0312	69	226.378
1.2192	4	13.1234	11.2776	37	121.391	21.3360	70	229.659
1.5240	5	16.4042	11.5824	38	124.672	21.6408	71	232.940
1.8288	6	19.6850	11.8872	39	127.953	21.9456	72	236.220
2.1336	7	22.9659	12.1920	40	131.234	22.2504	73	239.501
2.4384	8	26.2467	12.4968	41	134.514	22.5552	74	242.782
2.7432	9	29.5276	12.8016	42	137.795	22.8600	75	246.063
3.0480	10	32.8084	13.1064	43	141.076	23.1648	76	249.344
3.3528	11	36.0892	13.4112	44	144.357	23.4696	77	252.625
3.6576	12	39.3701	13.7160	45	147.638	23.7744	78	255.906
3.9624	13	42.6509	14.0208	46	150.919	24.0792	79	259.186
4.2672	14	45.9318	14.3256	47	154.199	24.3840	80	262.467
4.5720	15	49.2126	14.6304	48	157.480	24.6888	81	265.748
4.8768	16	52.4934	14.9352	49	160.761	24.9936	82	269.029
5.1816	17	55.7743	15.2400	50	164.042	25.2984	83	272.310
5.4864	18	59.0551	15.5448	51	167.323	25.6032	84	275.591
5.7912	19	62.3360	15.8496	52	170.604	25.9080	85	278.871
6.0960	20	65.6168	16.1544	53	173.885	26.2128	86	282.152
6.4008	21	68.8976	16.4592	54	177.165	26.5176	87	285.433
6.7056	22	72.1785	16.7640	55	180.446	26.8224	88	288.714
7.0104	23	75.4593	17.0688	56	183.727	27.1272	89	291.995
7.3152	24	78.7402	17.3736	57	187.008	27.4320	90	295.276
7.6200	25	82.0210	17.6784	58	190.289	27.7368	91	298.556
7.9248	26	85.3018	17.9832	59	193.570	28.0416	92	301.837
8.2296	27	88.5827	18.2880	60	196.850	28.3464	93	305.118
8.5344	28	91.8635	18.5928	61	200.131	28.6512	94	308.399
8.8392	29	95.1444	18.8976	61	203.412	28.9560	95	311.680
9.1440	30	98.4252	19.2024	63	206.693	29.2608	96	314.961
9.4488	31	101.7060	19.5072	64	209.974	29.5656	97	318.241
9.7536	32	104.9870	19.8120	65	213.255	29.8704	98	321.522
10.0584	33	108.2680	20.1168	66	216.535	30.1752	99	324.803



Introduction

1A01.29

Weight units

1 kg = 2.2046 lb

1 lb = 0.4536 kg

kg		lb	kg		lb	kg		lb
0.4536	1	2.2046	15.4224	34	74.9564	30.3912	67	147.708
0.9072	2	4.4092	15.8760	35	77.1610	30.8448	68	149.913
1.3608	3	6.6138	16.3296	36	79.3656	31.2984	69	152.117
1.8144	4	8.8184	16.7832	37	81.5702	31.7520	70	154.322
2.2680	5	11.0230	17.2368	38	83.7748	32.2056	71	156.527
2.7216	6	13.2276	17.6904	39	85.9794	32.6592	72	158.731
3.1752	7	15.4322	18.1440	40	88.1840	33.1128	73	160.936
3.6288	8	17.6368	18.5976	41	90.3886	33.5664	74	163.140
4.0824	9	19.8414	19.0512	42	92.5932	34.0200	75	165.345
4.5360	10	22.0460	19.5048	43	94.7978	34.4736	76	167.549
4.9896	11	24.2506	19.9584	44	97.0024	34.9272	77	169.754
5.4432	12	26.4552	20.4120	45	99.207	35.3808	78	171.958
5.8968	13	28.6598	20.8656	46	101.412	35.8344	79	174.163
6.3504	14	30.8644	21.3192	47	103.616	36.2880	80	176.368
6.8040	15	33.0690	21.7728	48	105.821	36.7416	81	178.573
7.2576	16	35.2736	22.2264	49	108.025	37.1952	82	180.777
7.7112	17	37.4782	22.6800	50	110.230	37.6488	83	182.982
8.1648	18	39.6828	23.1336	51	112.435	38.1024	84	185.186
8.6184	19	41.8874	23.5872	52	114.639	38.5560	85	187.391
9.0720	20	44.0920	24.0408	53	116.844	39.0096	86	189.596
9.5256	21	46.2966	24.4944	54	119.048	39.4632	87	191.800
9.9792	22	48.5012	24.9489	55	121.253	39.9168	88	194.005
10.4328	23	50.7058	25.4016	56	123.458	40.3704	89	196.209
10.8864	24	52.9104	25.8552	57	125.662	40.8240	90	198.414
11.3400	25	55.1150	26.3088	58	127.867	41.2776	91	200.619
11.7936	26	57.3196	26.7624	59	130.071	41.7312	92	202.823
12.2472	27	59.5242	27.2160	60	132.276	42.1848	93	205.028
12.7008	28	61.7288	27.6696	61	134.481	42.6384	94	207.232
13.1544	29	63.9334	28.1232	62	136.685	43.0920	95	209.437
13.6080	30	66.1380	28.5768	63	138.889	43.5456	96	211.642
14.0616	31	68.3426	29.0304	64	141.094	43.9992	97	213.846
14.5152	32	70.5472	29.4840	65	143.299	44.4528	98	216.051
16.9688	33	72.7518	29.9376	66	145.504	44.9064	99	218.255



1A01.30

Introduction**Conversion table**

Fractions of inches	LENGTHS 1 inch = 25.4 mm						TEMPERATURE			
	Decimals	mm	Inches to mm		mm to inches		Fahrenheit to Celsius			
			Inches	mm	mm	Inches	° F	° C	° C	° F
1/64	.015625	0.3969					- 20	- 28.9	- 30	- 22
1/32	.031250	0.7937					- 15	- 26.1	- 28	- 18.4
3/64	.468750	1.1906					- 10	- 23.3	- 26	- 14.8
1/16	.062500	1.5875	0.0001	0.00254	0.004	0.00015	- 5	- 20.6	- 24	- 11.2
5/64	.078125	1.9844	.0002	.00508	0.005	.00019	0	- 17.8	- 22	- 7.6
3/32	.093750	2.3812	.0003	.00762	0.006	.00023	1	- 17.2	- 20	- 4
7/64	.109375	2.7781	.0004	.01016	0.007	.00027	2	- 16.7	- 18	- 0.4
1/8	.125000	3.1750	.0005	.01270	0.008	.00031	3	- 16.1	- 16	3.2
9/64	.140625	3.5719	.0006	.01524	0.009	.00035	4	- 15.6	- 14	6.8
5/32	.156250	3.9687	.0007	.01778	0.01	.00039	5	- 15.0	- 12	10.4
11/64	.171875	4.3656	.0008	.02032	0.02	.00079	10	- 12.2	- 10	14
3/16	.187500	4.7625	.0009	.02286	0.03	.00118	15	- 9.4	- 8	17.6
13/64	.203125	5.1594	.001	.0254	0.04	.00157	20	- 6.7	- 6	21.2
7/32	.218750	5.5562	.002	.0508	0.05	.00197	25	- 3.9	- 4	24.8
15/64	.234375	5.9531	.003	.0762	0.06	.00236	30	- 1.1	- 2	28.4
1/4	.250000	6.3500	.004	.1016	0.07	.00276	35	1.7	0	32
17/64	.265625	6.7469	.005	.1270	0.08	.00315	40	4.4	2	35.6
9/32	.281250	7.1437	.006	.1524	0.09	.00354	45	7.2	4	39.2
19/64	.296875	7.5406	.007	.1778	0.10	.00394	50	10.0	6	42.8
5/16	.312500	7.9375	.008	.2032	0.20	.0078	55	12.8	8	46.4
21/64	.328125	8.3344	.009	.2286	0.30	.01181	60	15.6	10	50
11/32	.343750	8.7312	.01	.254	0.40	.01575	65	18.3	12	53.6
23/64	.359375	9.1281	.02	.508	0.50	.01969	70	21.1	14	57.2
3/8	.375000	9.5250	.03	.762	0.60	.02362	75	23.9	16	60.8
25/64	.390625	9.9219	.04	1.016	0.70	.02756	80	26.7	18	64.4
13/32	.406250	10.3187	.05	1.270	0.80	.03149	85	29.4	20	68
27/64	.421875	10.7156	.06	1.524	0.90	.03543	90	32.2	22	71.6
7/16	.437500	11.1125	.07	1.778	1	.03937	95	35.0	24	75.2
29/64	.453125	11.5094	.08	2.032	2	.07874	100	37.8	26	78.8
15/32	.468750	11.9062	.09	2.286	3	.11811	105	40.6	28	82.4
31/64	.484375	12.3031	.10	2.540	4	.15748	110	43.3	30	86
1/2	.500000	12.7000	.20	5.080	5	.19685	115	46.1	32	89.6
33/64	.515625	13.0969	.30	7.620	6	.23622	120	48.9	34	93.2
17/32	.53125	13.4937	.40	10.160	7	.27559	125	51.7	36	96.8

**Introduction**

1A01.31

LENGTHS 1 inch = 25.4 mm							TEMPERATURE			
Fractions of inches	Decimals	mm	Inches to mm		mm to inches		Fahrenheit to Celsius			
			Inches	mm	mm	Inches	° F	° C	° C	° F
35/64	.546875	13.8906	0.5	12.70	8	0.31496	130	54.4	38	100.4
9/16	.562500	14.2875	.6	15.24	9	.35433	135	57.2	40	104
37/64	.578125	14.6844	.7	17.78	10	.39370	140	60.0	42	107.6
19/32	.593750	15.0812	.8	20.32	11	.43307	145	62.8	44	112.2
39/64	.609375	15.4781	.9	22.86	12	.47244	150	65.6	46	114.8
5/8	.6250	15.8750	1	25.4	13	.51181	155	68.3	48	118.4
41/64	.640625	16.2719	2	50.8	14	.55118	160	71.1	50	122
21/32	.656250	16.6687	3	76.2	15	.59055	165	73.9	52	125.6
43/64	.671875	17.0656	4	101.6	16	.62992	170	76.7	54	129.2
11/16	.687500	17.4625	5	127	17	.66929	175	79.4	56	132.8
45/64	.703125	17.8594	6	152.4	18	.70866	180	82.2	58	136.4
23/32	.718750	18.2562	7	177.8	19	.74803	185	85.0	60	140
47/64	.734375	18.6531	8	203.2	20	.78740	190	87.8	62	143.6
3/4	.7500	19.05	9	228.6	21	.82677	195	90.6	64	147.2
49/64	.765625	19.4469	10	254	22	.86614	200	93.3	66	150.8
25/32	.781250	19.8437	11	279.4	23	.90551	205	96.1	68	154.4
51/64	.796875	20.2406	12	304.8	24	.94480	210	98.9	70	158
13/16	.812500	20.6375	13	330.2	25	.98425	212	100.0	75	167
53/64	.828125	21.0344	14	355.6	26	1.02362	215	101.7	80	176
27/32	.843750	21.4312	15	381	27	1.06299	220	104.4	85	185
55/64	.859375	21.8281	16	406.4	28	1.10236	225	107.2	90	194
7/8	.875000	22.2250	17	431.8	29	1.14173	230	110.0	95	203
57/64	.890625	22.6219	18	457.2	30	1.18110	235	112.8	100	212
29/32	.906250	23.0187	19	482.6	31	1.22047	240	115.6	105	221
59/64	.921875	23.4156	20	508	32	1.25984	245	118.3	110	230
15/16	.937500	23.8125	21	533.4	33	1.29921	250	121.1	115	239
61/64	.953125	24.2094	22	558.8	34	1.33858				
31/32	.968750	24.6062	23	584.2	34	1.37795				
63/64	.984375	25.0031	24	609.6	36	1.41732				
1	1.00	25.40	25	635	37	1.45669				
			26	660.4	38	1.49606				
					39	1.53543				
					40	1.57480				



Introduction

H. Locking compounds and sealants

The Loctite compounds mentioned in this manual are referred to by their industrial names.

For the purposes of repairs, use their commercial names or the corresponding MF references as per the following chart.

Loctite industrial name	Commercial name	MF reference
242 - 241 - 542	Lock and Seal	1 633 266 M1
270	Stud lock	1 633 267 M1
510 - 221	Instant Gasket Retainer	1 633 270 M2
638 - 648	Superflex sealant.	1 633 268 M1
Silicomet	R.T.V. silicone sealant (clear)	3 405 423 M1

Note: Use the product "Form A gasket 2" when sealing between plastic material and iron (or steel).

Examples: PTO sensor, vehicle speed sensor, etc..

These products can be ordered from the following address:

FRAMET
10 Avenue Eugène Gazeau
Zone Industrielle
60304 - SENLIS
FRANCE

Application method for Loctite products

1. Remove all traces of previous sealants and corrosion
 - by mechanical process: wire brush or emery cloth,
 - by chemical action: "DECAPLOC 88".
 Leave the product to take effect and then wipe clean.
2. Degrease the components with dry solvent
 - preferably, use "LOCTITE 706 Dry Super Solvent".
3. Allow the solvents to evaporate.
4. Apply the recommended type of LOCTITE sealant on the parts:
 - For blind tapped holes: apply a quantity of product on the last threads at the bottom of the hole.
 - For cylindrical fitting components, apply compound on both mating surfaces with a clean brush.
 - For gasket faces, apply a bead on one of the two faces, passing around the holes, and then tighten as quickly as possible.

Note:

- a) Do not use too much of the compound in order to avoid locking adjacent parts.
- b) Do not attempt to retighten after 5 minutes of curing in order to avoid breaking the film of compound.
- c) If the ambient temperature is less than +10°C, and to ensure quicker setting of Loctite compounds (except for SILICOMET), use LOCTITE T 747 activator on at least one of the two parts.

Excess sealant outside the joint will not harden (anaerobic curing of compound - i.e. curing occurs only in absence of oxygen).

Grease

When grease is used in components which are in contact with transmission oil, use a grease which is miscible with oil to avoid clogging the hydraulic filters. Use "Amber Technical" grease supplied by WITCO company, 76320 Saint-Pierre des Elfes, France.

I. Tightening torques

When tightening nuts and bolts, use the recommended tightening torques as per the charts:

- 1 and 2: for metric threads,
- 3 and 4: for inch threads.

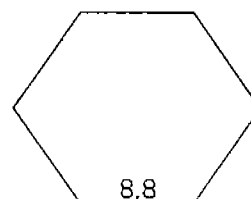
When a specific torque is required, it is mentioned in the text.

Charts 1 and 3 specify the standard tightening torque values applicable to zinc-plated threaded elements with standard nuts with coarse or fine thread, with or without flat washers or lockwashers, and weld nuts deeper than 0.8 d.

Charts 2 and 4 specify the reduced tightening torque values applicable to threaded fasteners in assemblies with self-locking zinc-plated nuts, phosphated nuts or bolts, shallow nuts and weld nuts shallower than 0.8 d. These values are applicable to dry assemblies. If the threads are oiled, reduce the tightening torques.

Note: Read the strength classification on the bolt head and determine the required torque loading.

Example:





Introduction

1A01.33

Chart 1

Tightening torque values: zinc-plated metric threads

Nominal dimension d.	Strength classification		Strength classification	
	ISO 8.8 (SAE 5, BS S)		ISO 10.9 (SAE 8, BS V)	
	Torque Nm		Torque Nm	
	Max.	Min.	Max.	Min.
M3	1.7	1.3	2.4	1
M4	4.1	3.1	5.7	4
M5	8	6	11.5	8
M6	14	10	20	14
M8	35	25	46	36
M10	70	50	96	72
M12	120	90	160	120
M16	260	200	400	300
M20	560	420	800	600
M24	960	720	1300	1000
M30	1800	1400	2800	2100
M36	3300	2500	4800	3600

Chart 2

Reduced tightening torque values: metric threads

Nominal dimension d.	Strength classification		Strength classification	
	ISO 8.8 (SAE 5, BS S)		ISO 10.9 (SAE 8, BS V)	
	Torque Nm		Torque Nm	
	Max.	Min.	Max.	Min.
M3	1.4	1	1.9	1
M4	3.3	2.5	4.6	3
M5	6.4	4.8	9.2	6
M6	11	8	16	12
M8	28	20	37	29
M10	56	40	77	57
M12	96	72	130	100
M16	210	160	320	240
M20	450	340	640	480
M24	770	570	1040	800
M30	1400	1100	2200	1700
M36	2600	2000	3800	2900



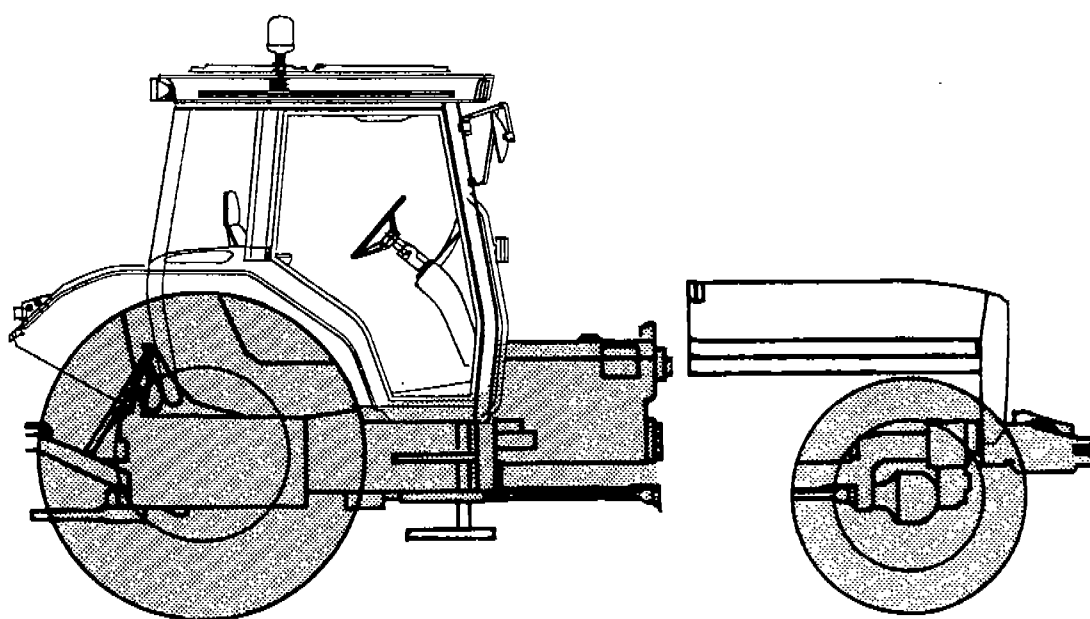
1A01.34

Introduction**Chart 3****Tightening torque values: zinc-plated threads in inches**

Nominal dimension d.	Strength classification		Strength classification	
	SAE 5 (ISO 8.8 BS S)		SAE 8 (ISO 10.9 BS V)	
	Torque Nm		Torque Nm	
	Max.	Min.	Max.	Min.
#6	2.4	1.8	3.3	2
#8	4.4	3.4	6.3	4
#10	6.3	4.7	8.9	6
1/4	15	11	22	16
5/16	30	22	43	31
3/8	53	39	75	55
7/16	86	64	120	90
1/2	130	100	180	140
5/8	260	200	370	280
3/4	460	350	660	490
7/8	760	560	1060	800
1	1120	840	1600	1200
1 1/8	1390	1050	2200	1700
1 1/4	2000	1500	3200	2400
1 1/2	3400	2600	5400	4100

Chart 4**Reduced tightening torque values: zinc-plated threads in inches**

Nominal dimension d.	Strength classification		Strength classification	
	SAE 5 (ISO 8.8 BS S)		SAE 8 (ISO 10.9 BS V)	
	Couple Nm		Couple Nm	
	Max.	Min.	Max.	Min.
#6	1.9	1.5	2.6	2
#8	3.5	2.7	5	3
#10	5	3.8	7.1	5
1/4	12	8.8	18	13
5/16	24	18	34	25
3/8	42	31	60	44
7/16	69	51	96	72
1/2	104	80	140	110
5/8	210	160	300	220
3/4	370	280	530	390
7/8	610	450	850	640
1	900	670	1280	960
1 1/8	1100	840	1760	1360
1 1/4	1600	1200	2560	1920
1 1/2	2700	2100	4320	3280





2 . CAB AND EQUIPMENT

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2 B01 RECHARGING THE SYSTEM WITH REFRIGERANT

2 C01 AIR CONDITIONING SYSTEM FAULTS - COMPRESSOR

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2 A01 Air conditioning

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2A01.2

Cab - Air conditioning

A. General

Suitable control of the internal environment of the cab of an agricultural implement requires:

- that the temperature and humidity in the cab should be within a range that is compatible with human comfort,
- the supply of fresh filtered air to keep the cab under pressure and to prevent the ingress of impurities,
- the de-icing of windows to ensure visibility in all directions.

Moreover, the distribution of air should be such that no difference in temperature can be detected within the cab, especially over the body surface of the driver.

In addition, the air conditioning system must be designed to withstand mechanical stresses caused by the numerous impacts and vibrating stresses associated with applications in the context of agricultural work.

Finally, it is of critical importance that the system should operate satisfactorily in the muddy and dusty conditions associated with agricultural work. The equipment must also be capable of operating in positions corresponding to an angle of tilt that may reach 16° from the horizontal.

The cooling principle

There is no known method of producing cold: only the absorption of heat is possible. Air conditioning is a process by which heat is taken out of the air. Temperature is measured by the quantity of heat in a given substance. Like water, which always runs from a high point to a low point, heat always «runs» from a hot body to a cold body. Consequently, in order to condition the air or absorb heat from the air in a cab, the warm air must be placed in contact with a cold surface.

It is a physical property of liquids that they boil or evaporate at a specific temperature when at a given pressure.

In the vaporising process which takes place at a constant temperature, the liquid absorbs a considerable amount of heat. One example is that, at normal atmospheric pressure, water boils or vaporises at 100°C (212°F). A considerable quantity of heat can be absorbed by the water but its temperature will not rise. The same principle applies if heat is removed: steam returns to the liquid state or liquids become solid. When pressure is controlled in a closed circuit, a liquid can be maintained at low pressure and with a low boiling point. During vaporisation, the liquid absorbs heat from its environment.

The cooling cycle

Air conditioning in the cab is provided by means of a ventilation system. During cold weather, the cab is supplied with filtered air that has been heated by pipes containing hot water from the engine. When the ambient temperature is too high and makes it uncomfortable to drive the tractor (in the summer), a compressor-based cooling system allows the temperature in the cab to be reduced by several degrees. In an air conditioning unit, a refrigerant circulates in a closed circuit under pressure. This refrigerant is freon R12. At specific points in the circuit, the gas is subjected to pressure and temperature modifications.

A compressor, which is belt-driven by the engine, sucks in vapour to maintain a low pressure on the upstream side in the evaporator and compresses the resulting gaseous freon by directing it to a cooling unit known as the condenser. The passage of air across the condenser located in front of the engine water radiator cools and condenses the gaseous freon. The refrigerant which has become liquid is filtered. Humidity and impurities are removed by a filter which also has the function of acting as a temporary reservoir. This filter is known as the dehydrator reservoir.

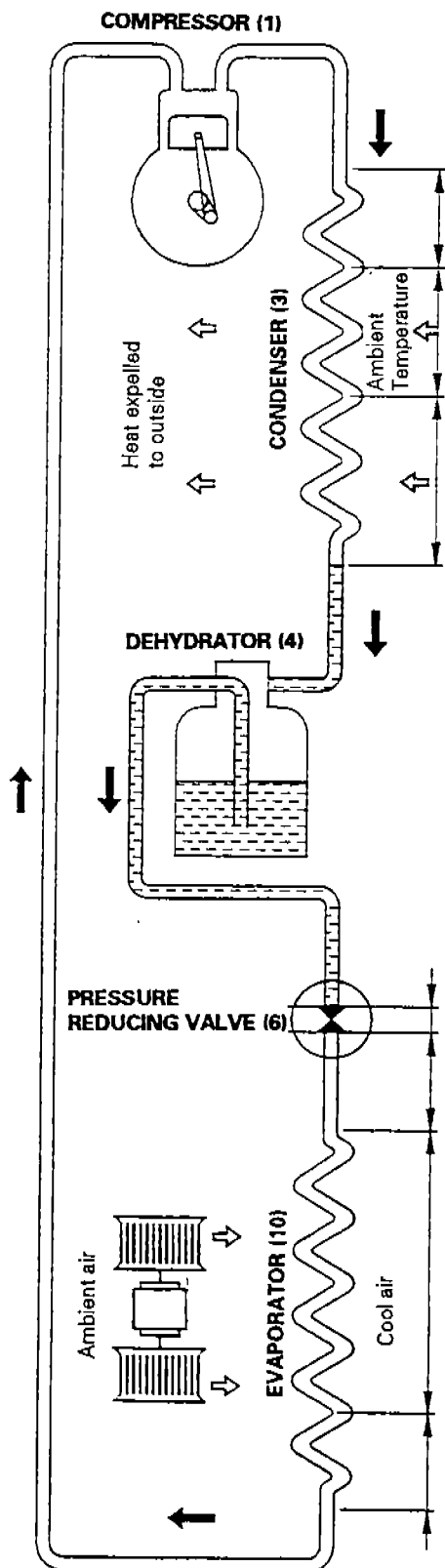
The liquid freon R12 under high pressure is directed to the expansion valve which governs the liquid's flowrate. The pressure is relieved, bringing about a considerable drop in temperature and pressure. The liquid under low pressure starts boiling and evaporating in a heat exchanger or evaporator. The warm, humid air in the cab is pulsed through the evaporator by turbine fans, cools on contact and is driven into the cab. The humidity in the air condenses in the evaporator and is discharged outside the cab through pipes. The cycle is completed when the gas is returned to the compressor.

According to the desired temperature in the cab, a thermostat with an «off» position causes the compressor to be automatically engaged and disengaged by means of an electromagnetic clutch.



Cab - Air conditioning

B. Schematic diagram



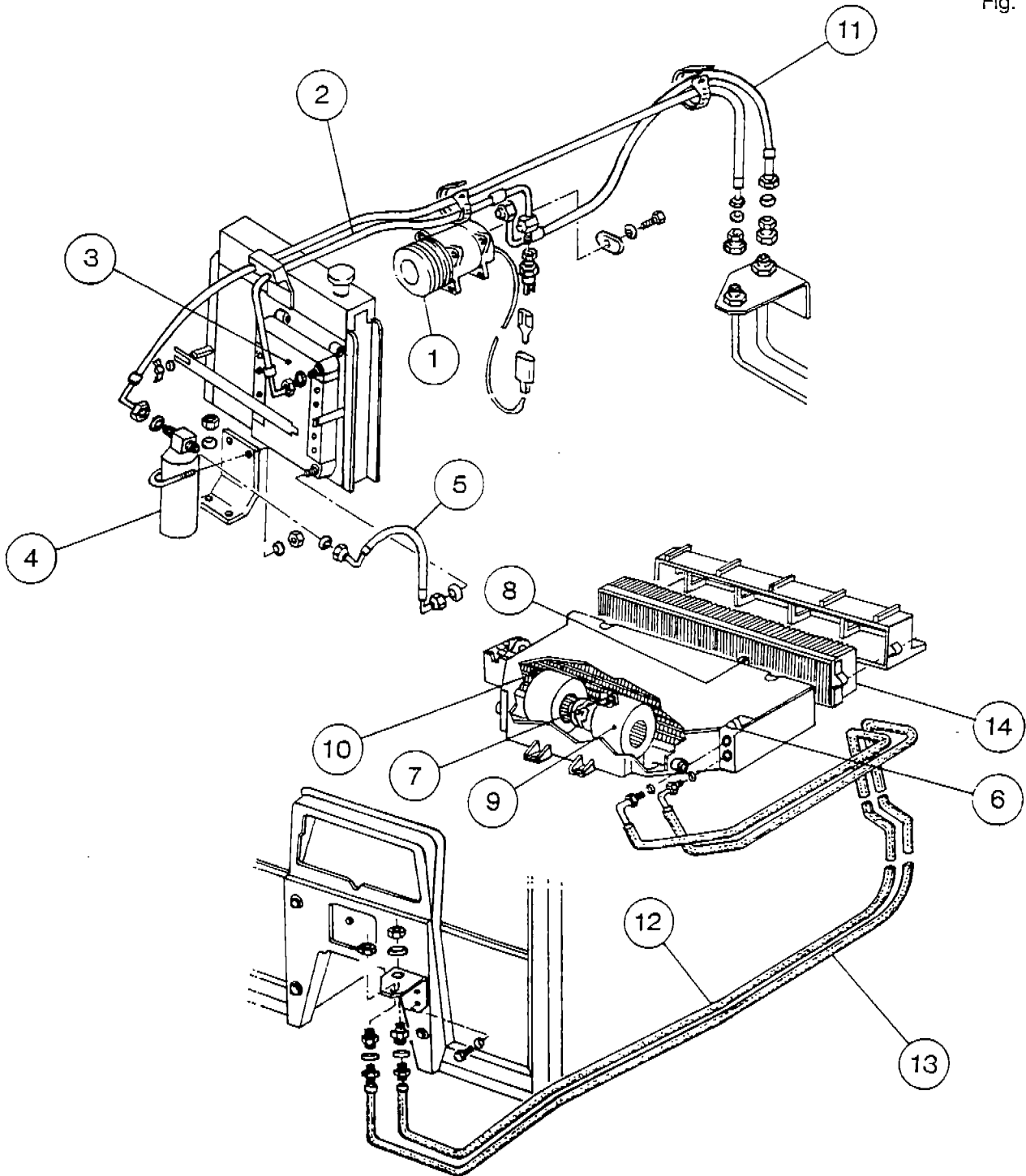
Points on circuit	State of fluid	Pressure	Temperature	Remarks
Compressor	Vapour	Switches from low to high	Switches from low to high	This produces vapour at high pressure and high temperature.
Compressor outlet at condenser inlet	Vapour	High	High	-
Condenser	Vapour + liquid	High	Switches from high to medium	Under the action of outside air, the vapour is liquefied and heat is expelled to the outside. This exchange is assisted by motor-driven fans.
Condenser outlet Dehydrator Pressure reducing valve inlet	Liquid	High	Medium	Allows the removal of humidity from the circuit and the evaluation of circuit filling level.
Pressure reducing valve	Liquid + vapour ($\geq 20\%$)	Switches from high to low	Switches from medium to low	Reduction of the fluid's pressure causes a drop in pressure and temperature, resulting in vaporisation of some of the liquid ($\geq 20\%$).
Pressure reducing valve outlet Evaporator inlet	Liquid + vapour	Low	Low	-
Evaporator	Liquid + vapour	Low	Low	The liquid changes to the vapour state by absorption of the heat contained in the cab air. This has a cooling effect which is assisted by the blower system.
Evaporator outlet Compressor inlet	Vapour	Low	Low	



2A01.4

Cab - Air conditioning

Fig. 1



Key to diagram

- | | |
|--|--|
| (1) Compressor with electromagnetic clutch | (8) Thermostat |
| (2) High-pressure piping, 10 to 18 bar | (9) Fan |
| (3) Condenser | (10) Evaporator (integrated in heating system) |
| (4) Dehydrator | (11) Low-pressure piping (compressor suction) |
| (5) High-pressure piping, 10 to 18 bar | (12) Low-pressure piping (evaporator outlet) |
| (6) Expansion valve (pressure-reducing) | (13) High-pressure piping (quick-connect coupling for connection to pressure-reducing valve) |
| (7) Additional resistor for fan (2 speeds) | (14) Cab filter |



Cab - Air conditioning

C. Characteristics of components

Motor fan assembly

A permanent magnet type motor drives two turbine fans each of which is protected by an air nozzle unit. The assembly is fitted on an insulated support bracket. A resistor system connected to the main switch allows the motor to run at two speeds. Flowrate at turbine fans: 680 m³/h.

Evaporator

The purpose of the evaporator, located behind the turbine fans, is to cool and dehumidify the ambient air.

In the evaporator, the liquid refrigerant which is at low pressure and low temperature after passing through the expansion valve, boils and starts evaporating immediately. This process absorbs the heat from the air sucked in from the cab.

Expansion or pressure-reducing valve

This valve, located on the evaporator inlet, controls the quantity of refrigerant entering the evaporator and reduces the pressure of the refrigerant. It automatically governs the flow of refrigerant to the evaporator according to the amount of heat.

It reacts according to the temperature of its sensitive element and to the pressure of the liquid.

In order to avoid any excessive pressure drop in the evaporator, the valve is equipped with a compensating system with a bulb which takes into account the temperature of the gas on outlet from the evaporator.

This bulb is also connected to the valve diaphragm.

If the valve is replaced:

- Always lightly lubricate the couplings with oil for refrigerant.
- Check that the needle operates correctly before fitting by spraying liquid freon onto the bulb and checking the movement of the needle.
- Check that the valve is correctly connected.
- Handle the capillary tubes with care.
- According to the model, when fixing the heat-sensitive element (the bulb) onto the pipe, clean the pipe to ensure good contact. Secure the bulb onto the pipe with the clip provided and insulate with insulating fabric.

Precautions before fitting and checking during servicing

Spray liquid freon onto the casing of the pressure-reducing valve and make sure that the needle moves inside the pressure-reducing valve.

Temperature control switch (thermostat)

This switch controls the operation of the compressor by means of its electromagnetic clutch.

This is a capillary type thermostat which controls an electrical switch.

It has an adjustable range so that a preset temperature in the cab to be selected.

The capillary tube measures the temperature in the evaporator and controls the operation of the switch by the expansion of its gas.

If the thermostat has to be replaced:

- Handle the capillary tube with care.
- The capillary tube must be in contact with the evaporator pipe and the pressure-reducing valve side.

Condenser

The condenser receives the gaseous refrigerant under high pressure and at high temperature from the compressor and transforms it into pre-cooled liquid in the high-pressure state. It is designed to withstand variations in the temperature of the hot, gaseous refrigerant and cold outside air. When the refrigerant is cooled, the gas becomes liquid. This cooling is obtained by passing a stream of cool air (according to the vehicle's speed and the capacity of the motor fan). The temperatures of the refrigerant in the condenser vary between 49°C and 77°C for pressures of between 10.5 kg/cm² and 21 kg/cm².

If the condenser has to be replaced:

- Avoid damaging the cooling fins in order to ensure the appliance's maximum efficiency.

Dehydrator

The dehydrator is an important component of the air conditioning system. It is supplied with liquid refrigerant from the condenser and removes any humidity and foreign bodies which may have entered the system.

The receptacle is used for temporary storage of the refrigerant, according to the requirements of the expansion valve.

The circulation of freon in the circuit can be checked on the warning light located above this reservoir.

This part also acts as a filter (similar to an engine oil filter) and **must be replaced at least every 1,000 hours or every three years, or after any servicing action causing contamination of the circuit.**

When installing or replacing the dehydrator:

- Check the correct connection on pipes on the IN side to the condenser.
- Remove the rubber protective covers from the couplings at the last moment in order to avoid the entry of any dampness.
- All the seals must be replaced after disassembly and the new seals must be lubricated when fitted. These are special seals.



2A01.6

Cab - Air conditioning**Compressor and electromagnetic clutch
(Fig. 2)****Compressor**

The compressor, its clutch and the pulley constitute a removable assembly.

This assembly compresses the low-pressure gaseous refrigerant to high pressure and ensures circulation of the refrigerant through the system.

Electromagnetic clutch

This allows the compressor to be engaged and disengaged according to the evaporator temperature. The coupling consists of two main components: the stationary induction coil (permanent induction field) and the rotor. The induction coil is fitted directly on the compressor. The grooved pulley is fitted on the tapered end of the crankshaft.

The current transmitted by the temperature control switch generates a magnetic field and the rotor disk is magnetically attracted against the pulley. The compressor runs. When the current is switched off, the rotor is demagnetized and the mechanical coupling is thus disengaged.

If parts are replaced: If the evaporator condenser, dehydrator reservoir, compressor or expansion valve is replaced, the circuit must be drained, taking the precautions specified in the next section and performing the operations in the correct order.

Key to diagram

- (1) Body
- (2) Driving disk
- (3) Rotor
- (4) Piston
- (5) Guiding gear
- (6) Filler cap
- (7) Cylinder head and plate
- (8) Cylinder head gasket
- (9) Suction/delivery valve
- (10) Rear cover
- (11) Square seal
- (12) Bearing
- (13) Suction/delivery couplings
- (14) Safety valve
- (15) Electromagnetic clutch

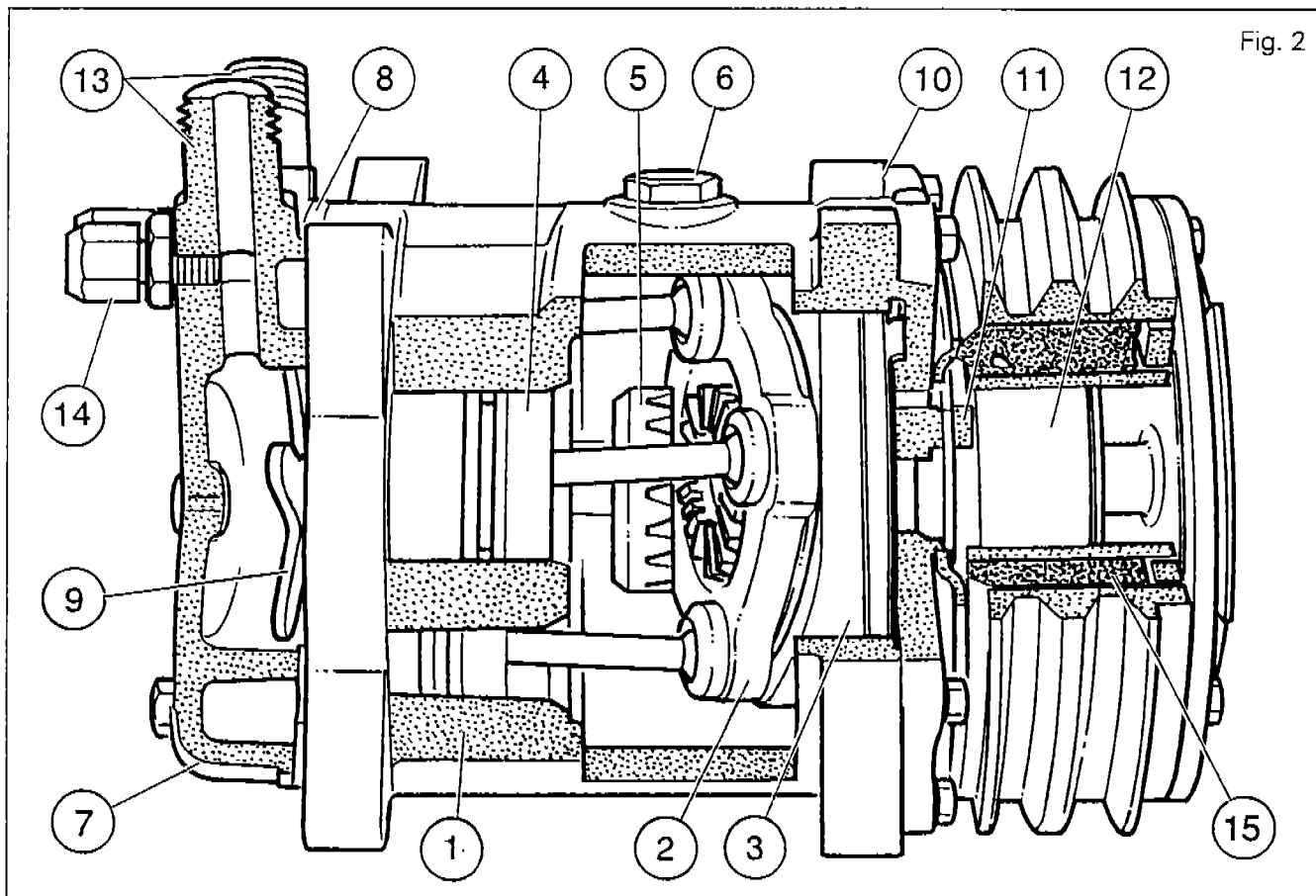


Fig. 2



Cab - Air conditioning

D. Safety instructions

It is very important to work in a clean environment in order to prevent the ingress of any dirt into the system. Carefully clean couplings and, then, lightly lubricate them with compressor oil before making the connections.

Do not blow compressed air into the pipes to remove any particles which might be there: use only refrigerant for that purpose.

Do not remove piping protective coverings until the last moment. Cut flexible hoses using a knife: never use a saw.

Carefully plug pipes when they are stored.

The oil contained in the air conditioning circuit is a refrigerating oil. It is miscible with freon.

Precautions to be taken

An air conditioning unit can be a dangerous piece of equipment which may be compared to a high-pressure steam boiler. The pressure of the refrigerant is always greater than at its normal boiling point. If a rupture occurs on a pipe, the refrigerant will evaporate or boil extremely quickly.

The forces generated by expansion can be very dangerous. A refrigeration technician must always work with care to prevent any uncontrolled escape of refrigerant. R12 refrigerant is non-flammable, non-toxic (except when in contact with a naked flame) and non-corrosive (except in contact with water).

Great care must be taken when handling R12 refrigerant. It can freeze the skin or the eyes on direct contact.

In contact with a flame or at high temperature, it decomposes to produce phosgene gas.

Never handle freon without wearing safety goggles and gloves.

Never attempt to drain a system by loosening a coupling. Slow draining without any danger can only be carried out using the manifold kit.

Never drain the system in a room where there is a flame. **The decomposition of R12 refrigerant produces phosgene gas which is deadly poisonous.**

The same precautions must be taken when checking for leaks.

When it is necessary to retighten a coupling, use two wrenches so as to avoid deformations which may cause leaks.

Never weld or clean with steam near a filled system as this may result in excess pressure and result in leaks.

Do not store R12 refrigerant in direct sunlight or near a source of heat. Always reinstall the bottle safety devices when not in use. Avoid subjecting the bottle to impacts. Do not carry the bottle in the passenger compartment of a vehicle.

In case of accident with R12

If R12 refrigerant comes into contact with the eyes, wash them immediately with a few drops of mineral oil. Continue washing carefully with a solution of boric acid and water (one teaspoonful of boric acid diluted in a quarter of a cup of water). Call a doctor immediately.

Note: Frostbite caused by the liquid refrigerant can be treated by gradually warming the injured area with cold water and then applying a cream for dry skin. Call a doctor immediately.

E. General maintenance

Very important: Before switching on the air conditioning system, check that windows and doors are properly closed. The interior of the cab must be kept as clean as possible. If, for any reason, the cab cannot be fully closed, the air recycling system must be switched off. If these recommendations are not complied with, the evaporator may be clogged and this will stop the air conditioning system and may damage the compressor.

To ensure that the system operates correctly, the filter located at the back of the cab, the condenser, the fans and the evaporator must be periodically checked. Any clogging results in increased high and low pressure and reduces the cooling efficiency. The tension of the driving belt and its alignment must be checked.

Check the condition of the pipes carrying condensation water from the evaporator. Any accumulation of water in the tray may cause the evaporator to ice up and stop the freon circulating, so reducing the system's efficiency.

To keep the system in good condition, it is advisable to run the system for a few minutes every month in order to lubricate all the components, as the oil in the compressor is miscible with freon.



2A01.8

Cab - Air conditioning

Electrical system

For the purposes of electrical checks, it must be ensured that the fuse or pressure switch located at the rear of the compressor are in good condition. A failed fuse will have been overheated and will be deformed so that it will not allow power supply to the compressor. To check that the electromagnetic clutch is actuated, set the fan switch to the low or high speed position and then position the air conditioning switch on the maximum cold position: a click should be heard. After a few minutes in operation, you should notice the successive switching on and off of the electromagnetic clutch.

The connecting wires must be in good condition.

Caution:

When restarting the compressor, especially if it has not been operated for some time, proceed in the following manner to ensure correct lubrication as soon as the compressor starts running:

- a) switch on the electromagnetic clutch.
- b) crank over the tractor engine for a few seconds with the fuel supply cut off.
- c) disconnect the electric stop button and allow the engine to idle for a few minutes.

Visually check the quantity of refrigerant (without bubbles) and its colour through the sight glass in the dehydrator reservoir, while operating the engine at maximum revs (with the fan and the thermostat set to the maximum cold position).

Note: On starting and stopping, the presence of bubbles is normal. If a brown or bluish colouring can be seen through the sight glass: drain the system, change the lubricating oil in the compressor and the dehydrator filter, and if necessary change the expansion valve, in that order.

F. Checking and preventive maintenance

1. Carry out the checks and maintenance operations described in preceding paragraphs.
2. Visually check the evaporator, pipes, condenser, dehydrator, compressor, couplings and belt, and the flow of condensation water on the evaporator.
3. Carry out an «internal» check with low-pressure gauge (blue), high-pressure gauge (red), engine at 1,500 rpm, thermostat on maximum cold position and fan on high speed.
4. Check temperature of components.
The output from the expansion valve (on the evaporator side), the evaporator, the low-pressure pipes and the «inlet valve» on the compressor must be cold to the touch.
The condenser, the dehydrator, the inlet to the expansion valve, the compressor and «delivery valve», and the high-pressure pipes must be hot to the touch.
5. **The dehydrator filter and oil should be changed at least once every three years or 1,000 hours, as well as whenever there is a major leak.**
6. If the circuit is overfilled (more than 2 kg of freon R12), there is a danger of blockage at the dehydrator filter and expansion valve.
7. If the high and low pressure are equal when the air conditioning unit is operating, this means the compressor is faulty.
8. If there is water in the circuit, the expansion valve (needle valve) will be blocked by a drop of water which will freeze to form ice, so decreasing the low and high pressure values.



Cab - Air conditioning

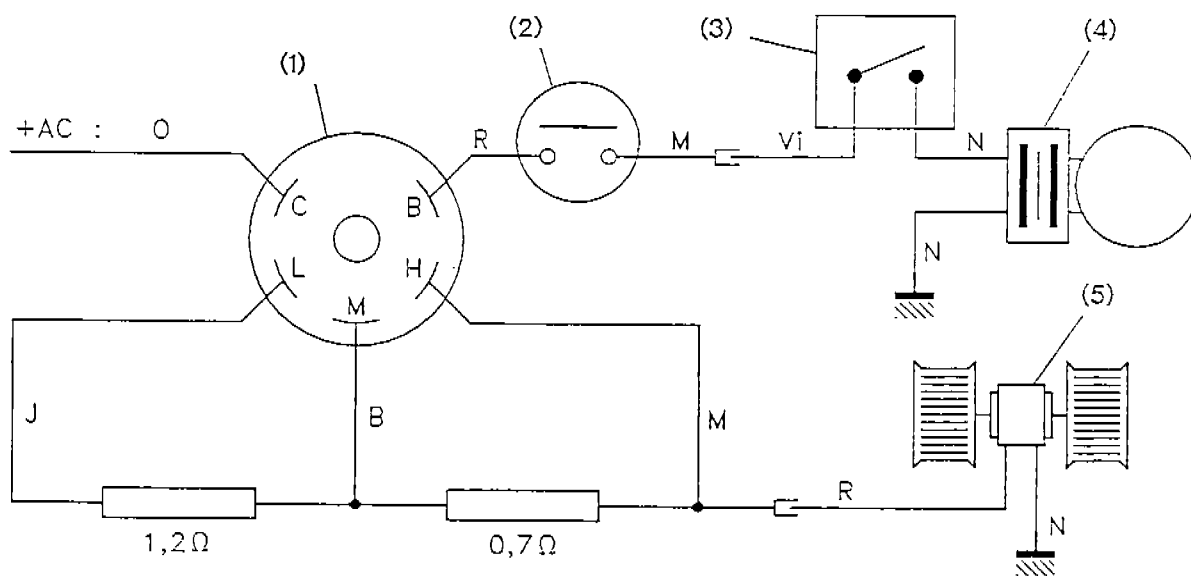
G. Wiring diagram

Key to diagram

- (1) 4-way fan switch
- (2) Air conditioning thermostat
- (3) Pressure switch on HP circuit protecting the system by shutting off power supply to the clutch when high pressure is too low.
- (4) Electromagnetic clutch
- (5) Motor fan

Colour of wires

- B : Blue
- J : Yellow
- M : Brown
- N : Black
- O : Orange
- R : Red
- Vi : Violet





Cab - Recharging the system

2B01.1

2 B01 Recharging the system

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A.	Discharging the system and checking for leaks _____	2
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D.	Checking the pressures _____	5



A. Discharging the system and checking for leaks

Discharging the system

This operation must be carried out in well-ventilated premises.

Avoid any naked flame. Smoking must be prohibited. Prepare the system for discharging by running the engine for a few minutes at 1,000 rpm with the air conditioning unit set to the maximum cooling position. Stop the engine and switch off the air conditioning unit. Remove the pressure switch from the high pressure line and connect up the two wires (violet and black).

Connect the kit to the compressor (Fig. 1):

- red hose with small diameter in place of the pressure switch,
- blue hose with large diameter on low pressure.

Slowly open the manifold **low pressure** valve.

Warning: If the system is discharged too quickly, compressor oil will be carried out with the refrigerant.

After a few minutes, when the pressure has dropped by 1.5 to 2 bar (22 to 29 PSI), **slowly** open the manifold high pressure valve to allow all the refrigerant to escape.

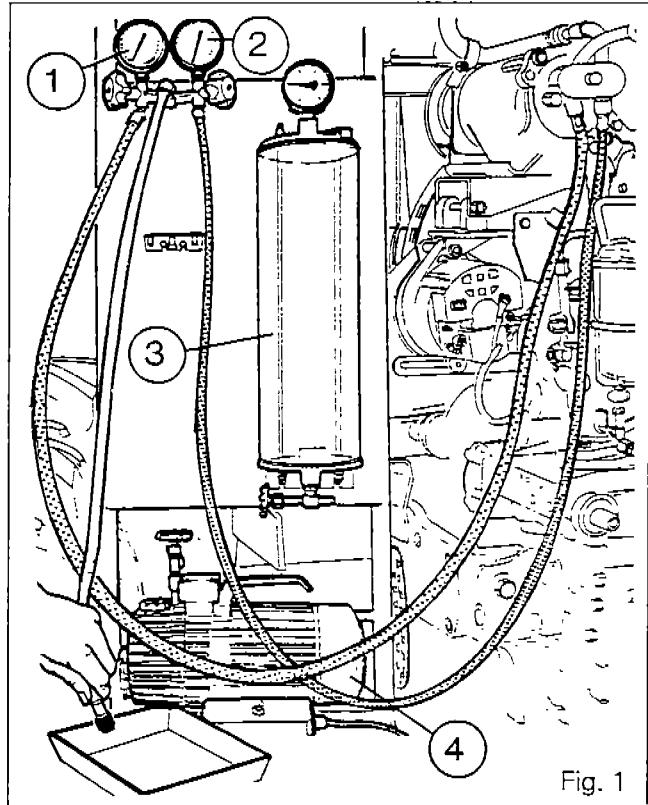


Fig. 1

Checking for leaks

When the system is empty, replace any faulty parts and then flush the system with Freon R12 by sealing with gas under a pressure of 2 to 3 bar (29 to 44 PSI). To do this, connect the middle hose between the pressure gauges to the upper connector on the Freon cylinder (Fig. 4). Slightly loosen the middle by-pass hose connector to bleed the air from the hose and then retighten it.

Open the taps on the high and low pressure gauges and allow the Freon R12 gas to build up a pressure of between 2.5 and 3 bar (36 to 44 PSI) in the system. Shut off the taps and leave the system charged at this pressure for between 15 to 20 minutes before checking for leaks.

Note: Make sure that all the taps are closed before handling the hoses in order to avoid accidents.

Use an electronic leak detector (Fig. 2), and run the end of its hose over:

- a) the compressor valve connectors,
- b) all the compressor seals: shaft rotary seal, oil reservoir plug seal.

Repeat discharging of system

Discharge the system again by allowing the gas to escape through the high and low pressure taps, leaving a residual pressure of between 0.2 and 0.3 bar (3 to 4.4 PSI).

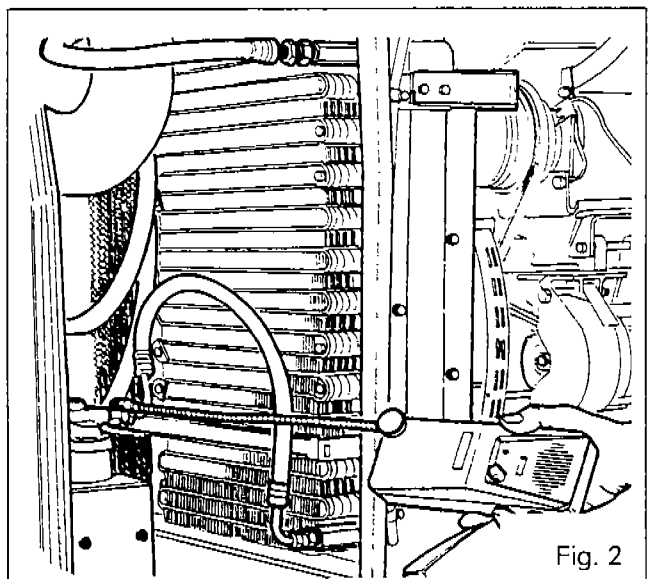


Fig. 2



Cab - Recharging the system

2B01.3

B. Evacuating and flushing the system

Evacuating the system (Fig. 3)

When the system is no longer under pressure, connect the middle hose to the vacuum pump. Open the high pressure tap (with the low pressure tap already open). Open the tap on the vacuum pump and start up the pump.

Note: At ambient temperatures above 20°C (68°F), a sufficient vacuum is generally obtained in 30 minutes, in two 15-minute periods. If the ambient temperature is lower than 20°C (68°F), it will take at least 60 minutes, especially if the relative humidity is high. At the end of the evacuating period, the low pressure gauge should indicate a partial vacuum of 635 to 711 mm (25 to 28 inches) of mercury.

Close the high and low pressure taps and the vacuum pump tap, and switch off the pump.

Flushing the system (Fig. 4)

Disconnect the middle by-pass hose from the vacuum pump and connect it to the top of the measuring cylinder. Open the top tap on the measuring cylinder, slightly loosen the middle by-pass hose in order to bleed any air from the hose and retighten the connector when R12 refrigerant starts to escape from the hose.

Open the high and low pressure by-pass taps to obtain an R12 gas pressure of between 2.5 and 3 bar (36 to 44 PSI).

Close the taps and leave the charged system for 20 minutes.

Using the leak detector, check the system for leaks again (Fig. 2).

Discharging and evacuating the system (Fig. 3)

Purge the system by slightly opening the low pressure by-pass tap and allowing R12 refrigerant to escape.

Close the tap when a residual pressure of between 0.1 and 0.2 bar (1.4 to 3 PSI) is obtained on both pressure sides.

Connect the middle hose to the vacuum pump.

Open the high and low pressure taps and let the vacuum pump run for 20 minutes.

Close the high and low pressure taps after ensuring that the low pressure gauge indicates a partial vacuum of between 634 and 711 mm (25 to 28 inches) of mercury. When all these operations have been carried out, the system is ready for recharging with Freon R12.

Note: The air must be bled from the hoses each time they are connected to the pressure gauges and charging cylinder.

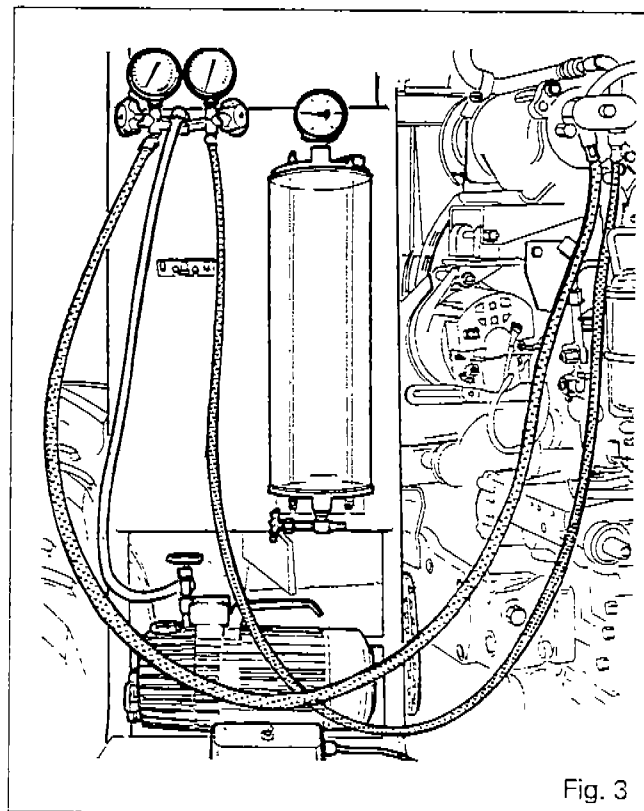


Fig. 3

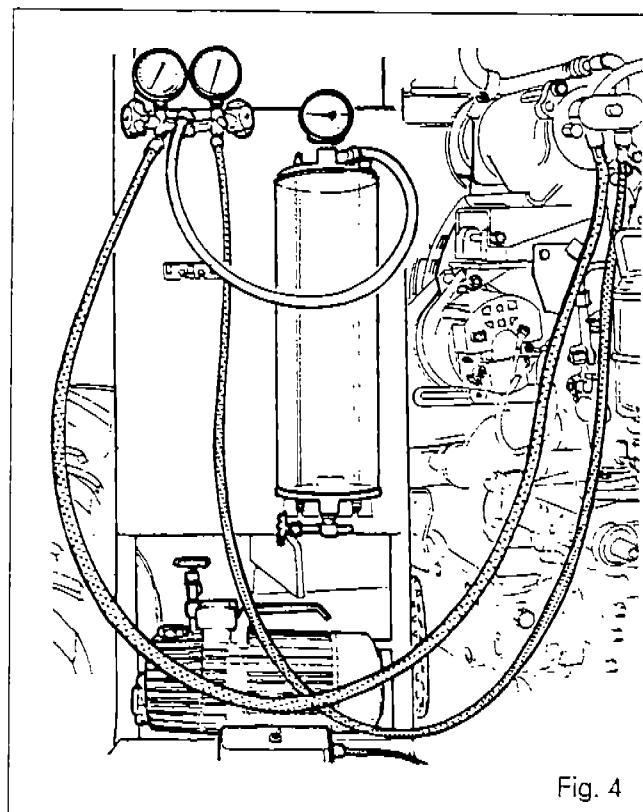


Fig. 4



C. Recharging the system (engine stopped)

The quantity of Freon required to charge the system correctly is between 1.7 and 1.9 kg (3.7 to 4.2 lbs).

1. Instructions for filling the charging cylinder from the Freon gas bottle (Fig. 5)

Connect the Freon bottle to the bottom of the charging cylinder and tip the bottle upside down. Open the taps. When the pressures are equal in the bottle and in the charging cylinder, bleed gas from the charging cylinder through the top tap until the quantity of Freon required for the system is obtained.

2. Connecting the charging system (Fig. 6)

Connect the bottom of the charging cylinder to the middle connector between the pressure gauges.

- Bleed air from the hoses.
- Mark the level of Freon on the charging cylinder.
- Slowly open the low and high pressure taps on the pressure gauges in order to charge the system.

Note: To ensure complete charging with liquid, the pressure in the charging cylinder must be between 6 and 7 bar (87 and 101 PSI).

When a system is correctly charged and when the pressures are equal, the pressure on both the low and high pressure sides should be between 4 and 5 bar (58 to 73 PSI).

When the charging cylinder is not equipped with a heating element, the system must be partially charged with liquid and then topped up with gas.

Partial recharging with liquid and topping up with gas (engine stopped, then running)

When the pressures in the charging cylinder and the system are equal, close the high and low pressure taps as well as the tap on the bottom of the charging cylinder. To top up with gas, connect the middle hose between the pressure gauges to the top of the charging cylinder, and then purge the hose (by unscrewing the hose slightly and allowing gas to escape for a few seconds). (Fig. 7). For this operation, open **only the low pressure tap**. Run the engine at between about 1,000 and 1,200 rpm with the air conditioning set to maximum cooling and the fan on maximum speed.

The system is correctly charged when the required level is obtained on the charging cylinder.

At that moment, close the taps on the charging cylinder and on the low pressure gauge.

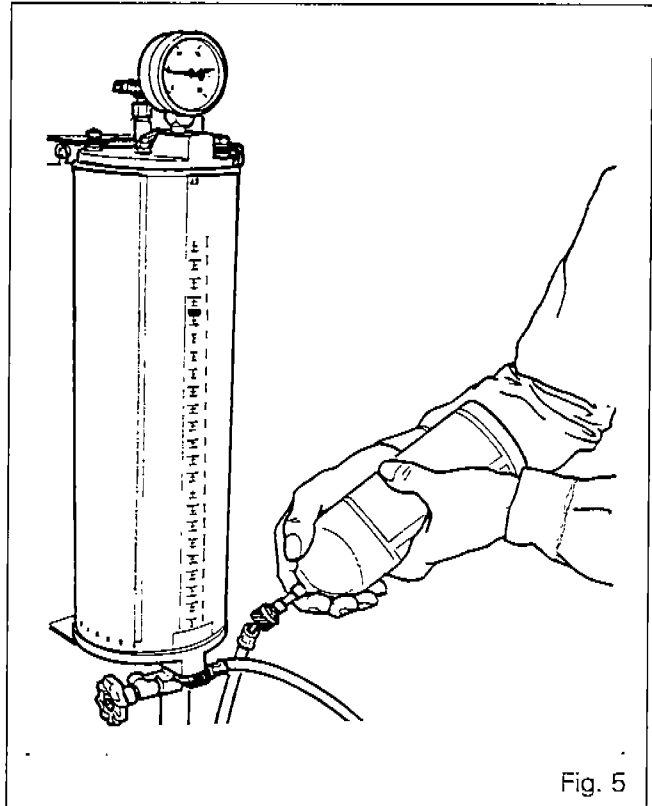


Fig. 5

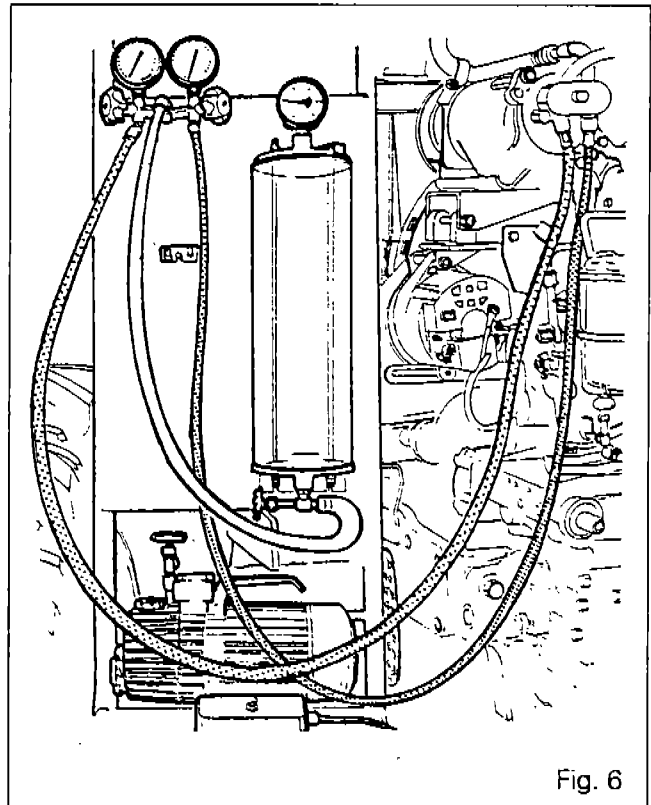


Fig. 6



Cab - Recharging the system

2B01.5

D. Checking the pressures

Once charging has been completed, the air conditioning system should be checked for correct operation.

With the pressure gauges connected to the compressor (Fig. 8), run the engine and set the thermostat control to maximum cooling and the fan to maximum speed.

After a few moments' operation, **the high pressure hose should feel hot and the low pressure hose should feel cold.**

No bubbles should be visible in the dehydrator sight glass.

Check the compressor cycles. The compressor operating time should be approximately equal to its shutdown time once the temperature in the cab has stabilized, according to the thermostat setting.

When the air conditioning is switched off, the pressures on the low and high pressure sides should be equal and between 4 and 5 bar (58 and 73 PSI) if the system is correctly charged. **These values vary, however, according to the outside temperature.**

When the air conditioning system is running, the low pressure should be between 0.2 and 1 bar (3 and 15 PSI) and the high pressure between 8 and 15 bar (116 and 218 PSI).

All these values depend on the outside temperature. The system should cycle on and off in all cases.

Note:

- Fan on maximum speed and thermostat on coldest setting.
- Engine running at 1,800 to 2,000 rpm.

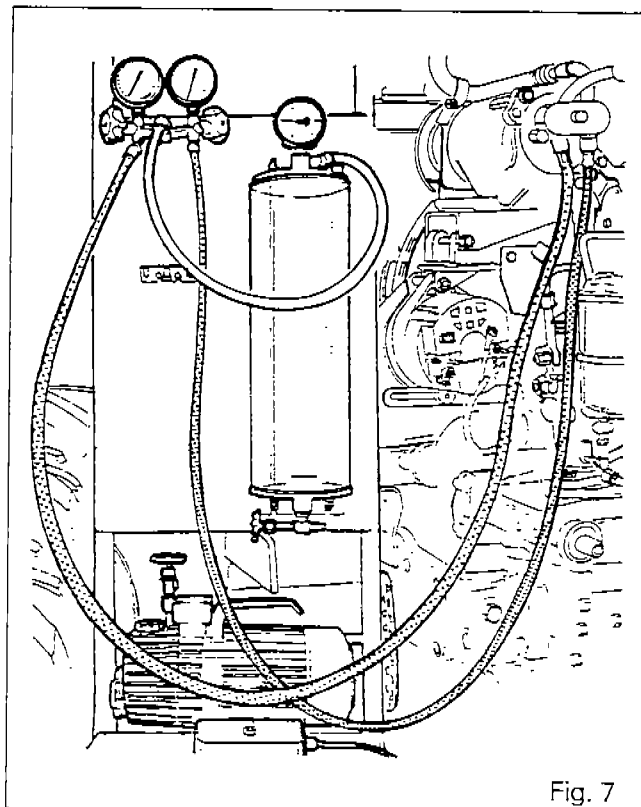


Fig. 7

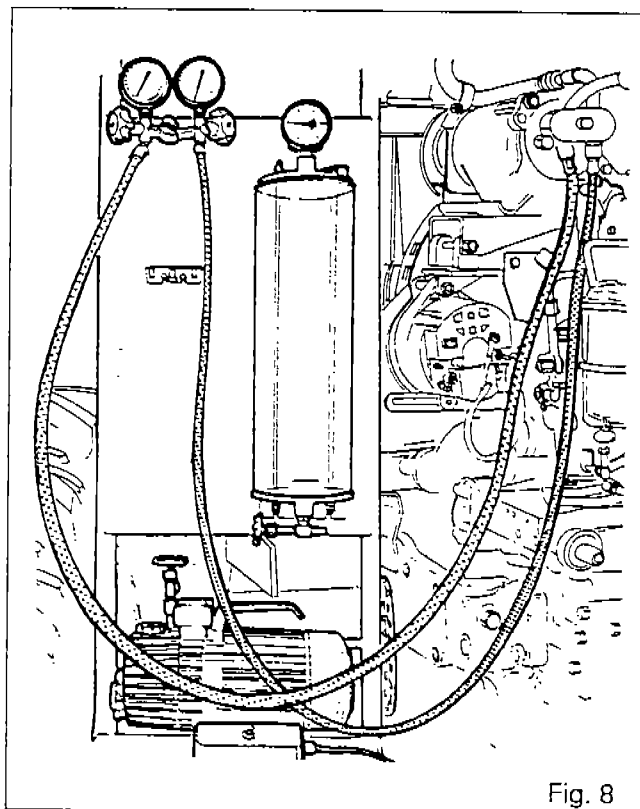


Fig. 8



Cab - Failures - Compressor

2 C01 Air conditioning system failures - Compressor

CONTENTS

A.	Diagnosis and failure analysis _____	2
B.	Failure of air conditioning unit _____	2
C.	Compressor _____	4



A . Diagnosis and failure analysis

Diagnosis

In general, pressure readings are directly related to atmospheric conditions (pressure and temperature). At temperatures between 21°C and 30°C (68°F and 86°F), low pressure readings will vary between 0.1 and 1 bar (1.5 and 15 PSI) and high pressure readings will vary between 10 and 18 bar (145 and 261 PSI). To locate failures, the pressure gauge kit must be connected to the compressor.

Failure analysis

Leaks in the system will lead to inadequate cooling, and low and high pressures will be too low.

If the system is under-charged, bubbles will always be visible in the dehydrator sight glass, in addition to the symptoms already mentioned.

If the evaporator is dirty or an expansion valve is clogged or frozen up, there will be a partial vacuum on the low pressure side and insufficient pressure on the high pressure side.

If the system is over-charged, an expansion valve is stuck in the open position or the condenser is fouled, the pressure will be too high on the low pressure side. If the condenser is fouled, over-charging will cause excessive pressure on the high pressure side.

Over-charging problems

In a correctly charged system, the R12 refrigerant discharged from the compressor in the form of gas loses its excess heat resulting from compression in the first coil of the condenser and condenses into a liquid in the subsequent coils. The resulting liquid is held in the last condenser coil before flowing to the reservoir. If the system is over-charged, the liquid level rises in the condenser, leaving fewer coils available to condense gas. Both the temperature and pressure then build up causing hoses to burst in some cases.

Causes of failure with engine running

Over-charging

Worn hoses

Chafed hoses

Hoses cut by sharp edges on sheet metal

Bends too tight

Hoses too close to battery (acid)

Causes of failure with engine stopped

These are the same as when the engine is running, plus the following:

- shutdown of engine compartment ventilation,
- «temperature surge» caused by the engine immediately after it has been stopped.

The temperature increase when the engine is stopped causes both the temperature and pressure in the air conditioning system hoses to rise.

If a hose is only just holding, it is more liable to burst due to this effect.

This is particularly prevalent in systems that are over-charged with R12 refrigerant and when hoses are worn or badly positioned (in hot spots).

B . Failure of air conditioning unit

The «by-pass» kit must be connected to the compressor valves.

High pressure reading too high

1. Refrigerant over-charge.
Purge the system.
Avoid leaving the system under-charged.
2. Air in system, in spite of correct low pressure reading.
Purge the system.
After purging, recharge the system.
3. Space between condenser fins clogged with insects.
Clean the condenser.
4. Refrigerant remains in liquid state in suction pipe at evaporator outlet. This causes the formation of moisture or frost on the hose or on the compressor inlet valve.
Check that the expansion valve sensing bulb is properly secured in contact with the suction pipe.
5. Plug left in a pipe during assembly. This is indicated by a difference in temperature upstream and downstream of the point where the plug is located.
6. If high pressure reading is higher than the reading obtained during normal operation with correct low pressure reading and charge but presence of bubbles in the dehydrator, then the dehydrator hose connections have been reversed and fluid is flowing in the wrong direction.
7. If high pressure reading is very high and low pressure reading is normal, with bubbles in the dehydrator and frosting of the dehydrating reservoir, there is a restriction at the dehydrator inlet, causing the dehydrator to act as an expansion valve.



Cab - Failures - Compressor

2C01.3

High pressure reading too low

1. Incorrect charge. A lack of refrigerant is shown by bubbles which appear in the sight glass.
2. Compressor gasket cracked or compressor valves leaking.

Low pressure reading too low, together with insufficient cooling

1. Restriction in a hose or in dehydrator. This problem can be detected by a difference in temperature upstream and downstream of the restriction or by cooling of the dehydrator reservoir when the system is running.
2. Insufficient charge in the expansion valve sensing bulb.
Warm up the end of the temperature-sensing bulb in the hand. The intake pressure should quickly rise to at least 1.45 bar (21 PSI) with the engine idling. If it does not, the expansion valve must be replaced.
3. Expansion valve capillary tube broken or leaking.
The expansion valve stays closed causing the system to operate at very low pressure.
4. Formation of frost in expansion valve or jet.
The expansion valve or jet may be frosted even though the pipes are hardly frosted at all.
5. Expansion valve stuck. Rust residue in system.
Heating the end of the bulb has no effect on the low pressure reading.
The expansion valve may open after a period at rest and then stick again after some time in operation.
6. Check that the evaporator air inlet is not obstructed.

Low pressure reading too high

1. Compressor belt too slack.
2. Expansion valve sensing bulb incorrectly installed.
3. Expansion valve needle stuck in the open position.
Refrigerant flows too freely through the coils and cools or freezes the inlet pipe.
4. Compressor inlet valve filter blocked.
5. Low refrigerant charge.
Check whether bubbles can be seen in the sight glass when the system is operating with the fans switched on.
6. Leakage from compressor inlet and outlet valves.
7. If the high pressure reading is low, the low pressure reading is high and the charge is correct, there is leakage from the compressor gasket or valves are faulty.

Noisy expansion valve (persistent whistling)

1. Low refrigerant charge, indicated by the presence of bubbles in the sight glass.

Insufficient cooling

1. Incorrect operation of compressor.
2. Incorrect operation of expansion valve.
3. High and low pressure readings are low, tending to cause partial vacuum with correct charge. Temperature too low at evaporator outlet, causing expansion valve to close and poor synchronization between thermostat cycling and opening of expansion valve.

Formation of frost on evaporator fins

1. Check thermostat electrical contacts.
2. Check that the sensing bulb is in contact with the evaporator fins.

Intermittent operation of compressor (irregular cycling)

Check belt tension.
Check clutch drive plate clearance.
Check clutch coil voltage and current.
Check compressor.

Abnormal compressor noise

In engaged position:

Check installation of compressor.
Check clutch and that there is no slipping.
Check Freon R12 refrigerant charge.
Check clutch and compressor bearings.
Check quantity of refrigerant oil (175 cm³ + 15 cm³)
Check compressor inlet and outlet valves.

In disengaged position:

Check clutch drive plate clearance.



C. Compressor

Setting the clutch drive plate clearance

Check the clearance with feeler gauges. The clearance should be 0.4 to 0.8 mm (Fig. 1).

If the clearance is not the same all the way round, lift slightly and tap gently where the difference is greatest.

Note: The correct clearance is obtained using shims.

When reinstalling the clutch or fitting a new one, try fitting the original shims first.

When fitting a new clutch on a compressor, use the following shim sizes: 1.02 mm (0.04016 in) - 0.05 mm (0.00197 in) - 0.12 mm (0.00472 in). Tighten the nut to a torque of 40 Nm (30 lbf/ft).

Precautions to be taken when removing and refitting the compressor:

Note: 1) Run the air conditioning system for 5 to 10 minutes before removing the compressor in order to return all the refrigerant to the compressor.

2) The head connectors must be facing upwards or in line with the oil filler hole (Fig. 2).

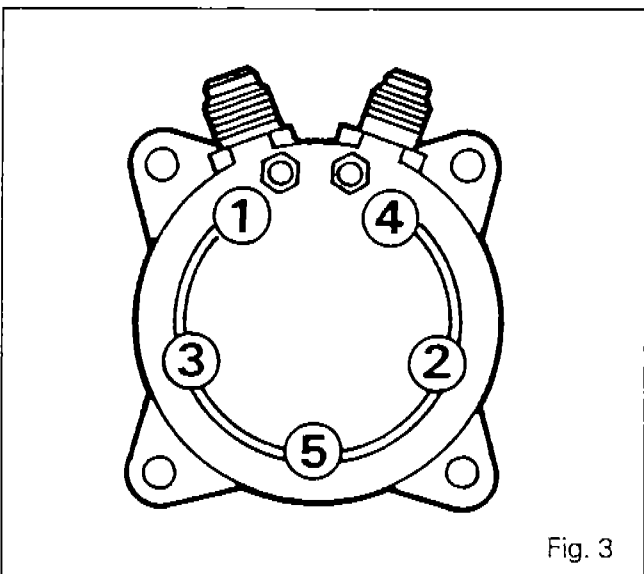
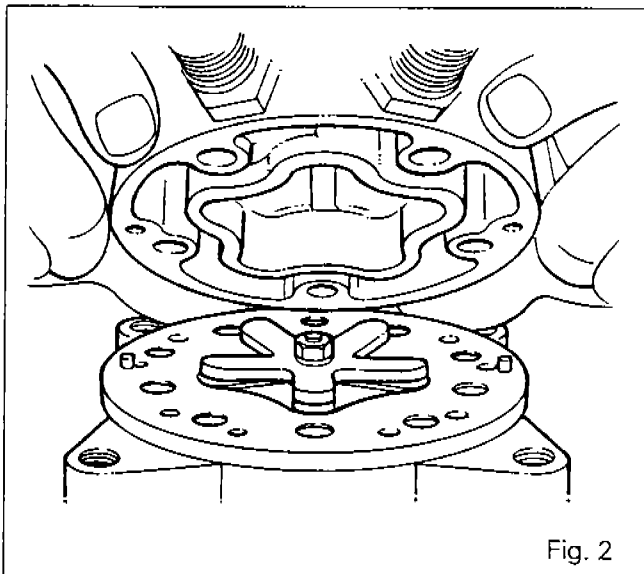
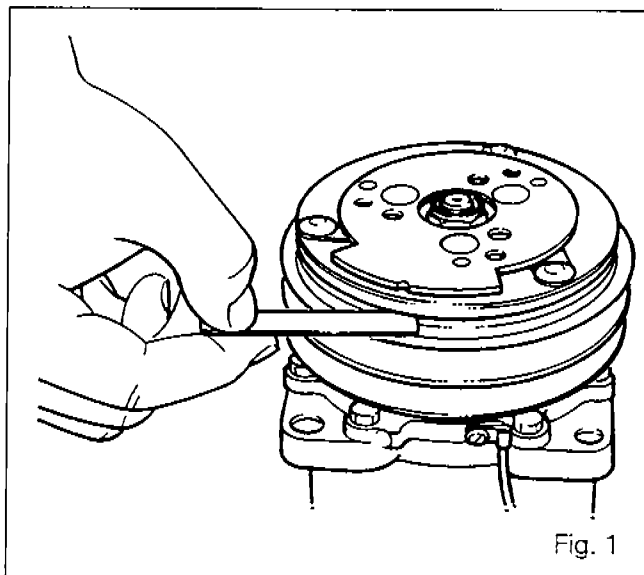
Locate the valve cover plate dowels in the correct holes in the block and then align the plate. Tighten to a torque of 30 to 34 Nm (22 to 25 lbf/ft) in the order shown in Fig. 3.

Filling with oil

Discharge the R12 refrigerant (see part A, section 2 B01).

It is advisable to drain the oil from the compressor and refill with the recommended quantity of clean oil whenever work is carried out on the system and whenever a component has to be replaced (pipes, dehydrator, condenser).

Note: When the system is topped up with oil, gas must be discharged from the installation.



**Cab - Failures - Compressor**

2C01.5

1. Remove the filler plug.

Note: Use only refrigerant oil (see the table of the various brands). Close the container after use.

2. Refit the filler plug.

Check the condition of the O-ring.

Check that the O-ring and its seat are clean.

3. Tighten the plug to a torque of between 8 and 12 Nm (6 to 9 lbf/ft). If there is any leak, do not tighten the plug any further but remove it and fit a new O-ring).

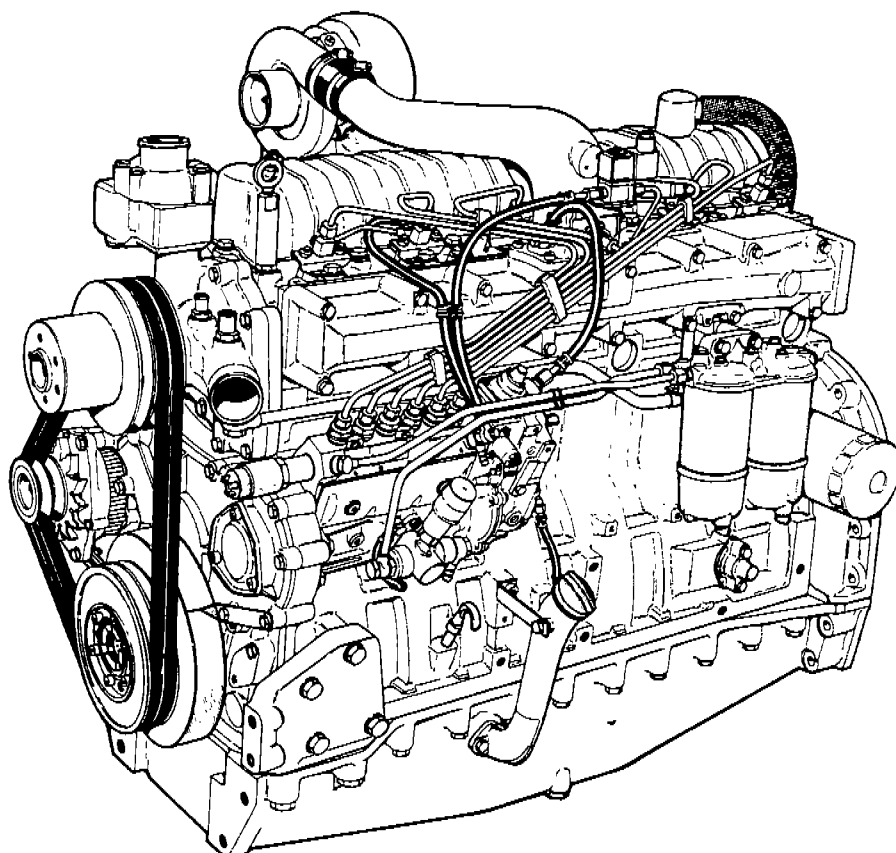
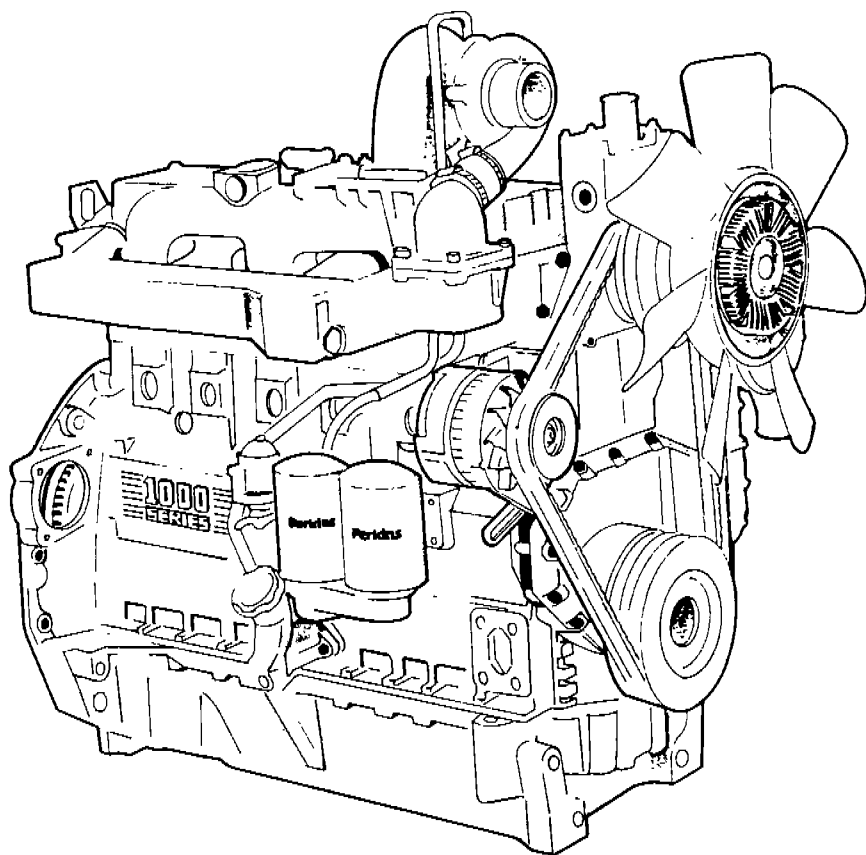
Note: Regular checking of the oil level is unnecessary, except when servicing is required.

4. Recharge the installation (see part C, section 2 B01).

Table of recommended oils for filling of compressor SD.510.HD

Capacity 175 cm³ (+ 100 cm³ for system)

Make	Name	Grade	Viscosity "E at 50°C
Sun Oil Co.	Suniso	4 GS	-
		5 GS	-
	Sunbis	31/41/51	-
Caltex	Capella	WF100	-
		WF68	-
BP	Enagole	LPT 100/150/185	-
Shell	Talpa Oil	20/30	-
	Bitoria Oil	33/41	-
Mobil	Gargoyle Artil	300	-
Castrol	Ice Matic	299/99	-
Texaco	Capella E	-	7.2
Shell	Clavus Oil 41	-	7.5
Esso	Zerice S 58	-	8
Fina	Purfrigor 37	-	5.6





3 . SPLITTING THE TRACTOR

Contents

- 3 A01 SPLITTING THE TRACTOR BETWEEN THE FRONT FRAME AND THE ENGINE**
- 3 B01 SPLITTING THE TRACTOR BETWEEN THE ENGINE AND THE GEARBOX**
- 3 C01 SPLITTING THE TRACTOR BETWEEN THE GEARBOX AND THE REAR AXLE**



Splitting the tractor

3A01.1

3 A01 Splitting the tractor between the front frame and the engine

CONTENTS

A.	Uncoupling _____	2
B.	Recoupling _____	3



3A01.2

3600 SERIES TRACTORS



Splitting the tractor

A . Uncoupling

1. Disconnect the two 4WD front axle control hoses. Plug the pipe connections.
2. Remove the guard and the 4WD transmission shaft.
3. Remove the sheet metal panels. Disconnect the earth cables only from the batteries.
4. **Disconnect and mark the positions of hoses and flexible connections, as follows:**
 - the two Orbitrol steering hoses,
 - the hose from the cooler on the hydraulic bar above the engine,
 - the hose from the left-hand side cover towards the cooler,
 - the harness connecting the vacuum tester, the 7.5 A and 10 A fuses and the red wire to the positive terminals of the batteries,
 - the positive cable on the starter,
 - the inlet sleeve between the turbocharger and the air filter,
 - the suction pipe between the air filter and the exhaust pipe.
5. Drain the cooling system. Disconnect the lower and upper hoses from the radiator.
6. Remove the upper attachment on the radiator.
7. Remove the air conditioning compressor and bracket assembly and tilt it forwards with its two hoses (according to option fitted).
8. Remove the front earth connections.
9. Immobilise the tractor. Carry out procedure 6, section 3 B01.
10. Loosen the bolts attaching the engine to the front frame.
11. Support the tractor under the frame using a trolley jack and separate the engine from the frame (Fig. 1).

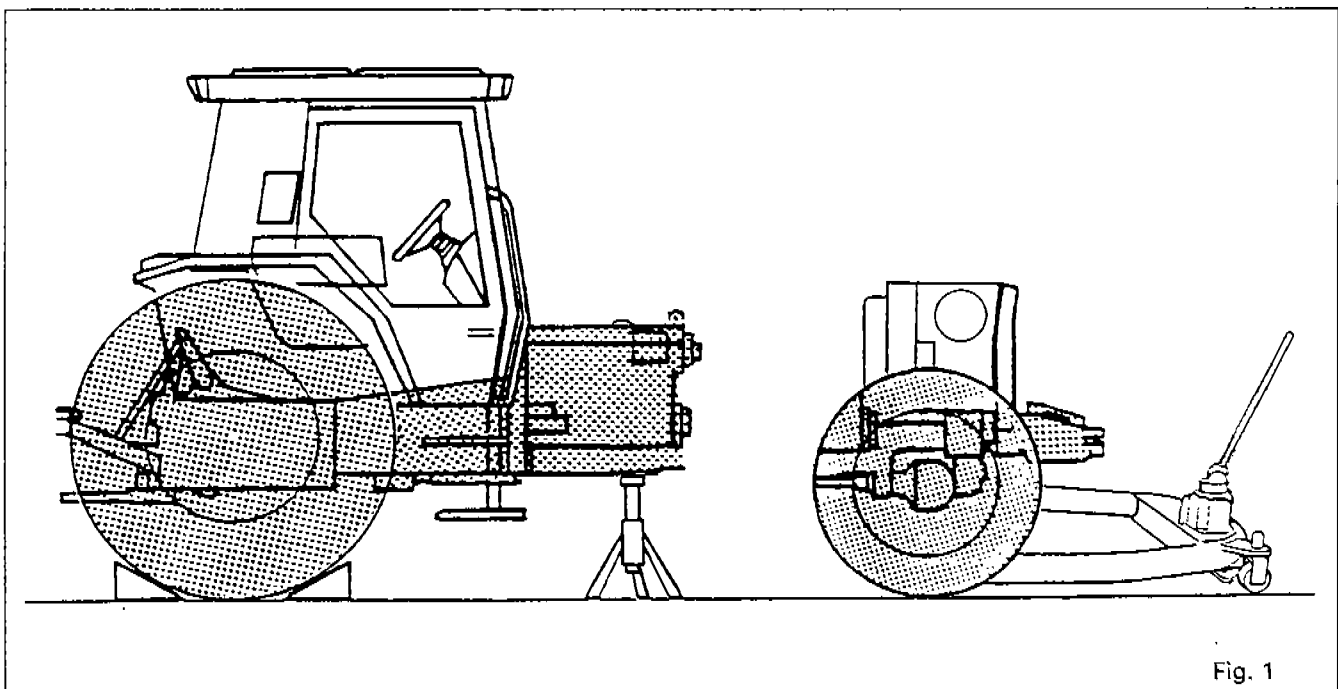


Fig. 1



Splitting the tractor

B . Recoupling

12. Screw two dowel pins (locally made) into diametrically opposite positions on the front frame.
13. Fit the frame to the engine.
14. Install the bolts and tighten to the torque specified in Fig. 2.
15. Remove the wedges between the frame and the front axle.
16. Carry out procedures 4 to 8 in reverse order.
17. Reconnect the batteries. Carry out procedures 1 and 2 in reverse order.
18. Start the engine.
19. Bleed the brake and clutch systems (sections 5 B01 and 8 H01).
20. Check :
 - the hydraulic systems for leaks,
 - the correct operation of electrical circuits.
21. Reinstall the sheet metal panels.
22. Carry out road test.

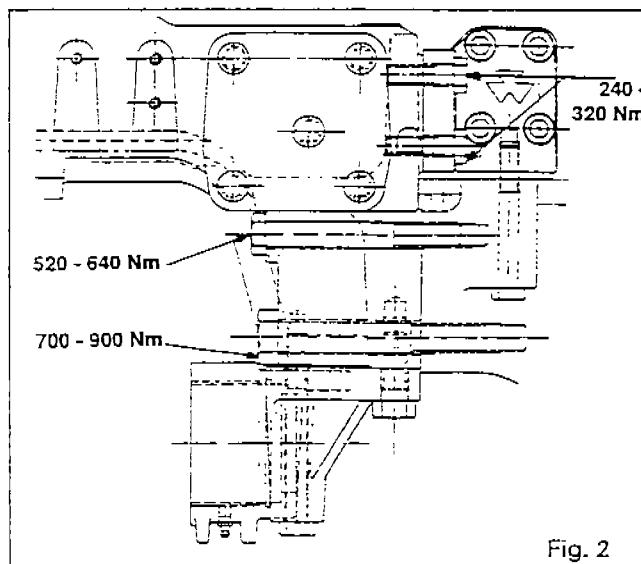


Fig. 2



Splitting the tractor

3 B01 Splitting the tractor between the engine and the gearbox

CONTENTS

A.	Uncoupling _____	2
B.	Recoupling _____	2
C.	Service tool _____	3



3B01.2

3600 SERIES TRACTORS



Splitting the tractor

A . Uncoupling

1. Disconnect the front differential lock (4WD) control hoses. Plug the pipe connections.
2. Remove the guard and the 4WD transmission shaft.
3. Remove the sheet metal panels. Disconnect the earth cables only from the batteries.
4. Remove the hood rear bracket (Perkins series 1000 engine).
5. Disconnect and plug :
 - the two Orbitrol steering ram hoses (and mark their position),
 - the two air conditioning connections and bracket (according to option fitted),
 - the cooler hose on the hydraulic bar above the engine,
 - the hose to the cooler on the left-hand cover,
 - the accelerator control on the injection pump,
 - the flowmeter harness (if fitted),
 - the main wiring harness connections above the engines (Perkins series 1000 engine) or on the right-hand side (Valmet engine),
 - the heating hoses (plug the openings to avoid draining the cooling system completely.)
 - the 7.5 A and 10 A fuse harness (to release this harness, slightly slacken the loosen the bar above the radiator),
 - the diesel fuel supply and return hoses.
6. Immobilise the tractor :
 - apply the handbrake,
 - fit wedges between the frame and the front axle (Fig.1).
7. Support the tractor under the gearbox using a stand.
8. Support the tractor under the sump using a trolley jack.
9. Loosen the bolts attaching the engine to the gearbox.
10. Separate the gearbox from the engine.
Note : As a safety measure, remove the front weights.

B . Recoupling

Note: If it proves necessary to replace the bearing sealing bush or the O-ring in the PTO drive hub, see the section dealing with the engine clutch.

11. Clean the mating faces of the gearbox spacer and the engine adaptor plate.
12. Coat the spacer mating face with Loctite 510 sealing compound or equivalent.
13. Screw two dowel pins into the spacer.
14. Lightly grease the PTO and gearbox input shaft splines (with grease of type GN + Molykote).
15. Check that the two dowel pins (4) are fitted on the engine (See section 4 B01).
16. Fit the engine to the gearbox spacer by turning the flywheel ring gear manually.
17. Install the attaching bolts after coating them with Loctite 270.
Tightening torque : see section 4 B01.
Note: reinstall the front weights.
18. Carry out procedures 4 to 8 in reverse order.
19. Top up the radiator.
20. Reconnect the batteries. Start the engine.
21. Check the accelerator control setting.
22. Carry out procedures 1 and 2 in reverse order.
23. Bleed the brake and clutch systems (sections 5 B01 and 8 H01).
24. Check :
 - the hydraulic systems for leaks,
 - the correct operation of electrical circuits.
25. Reinstall the sheet metal panels.
26. Carry out road test.

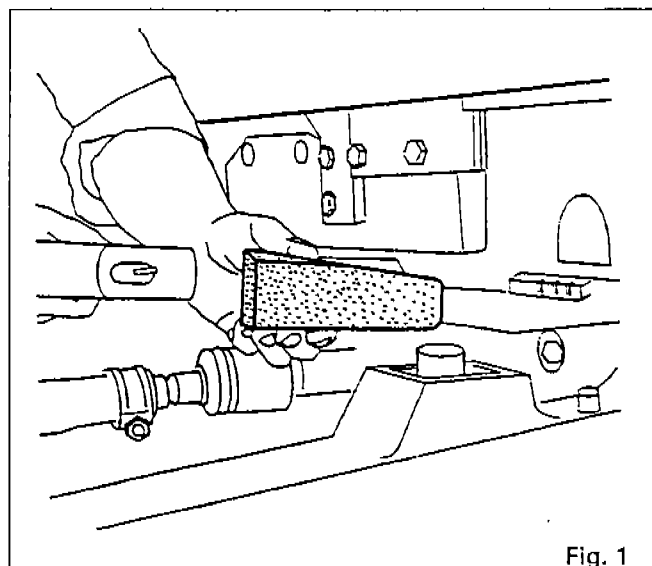


Fig. 1

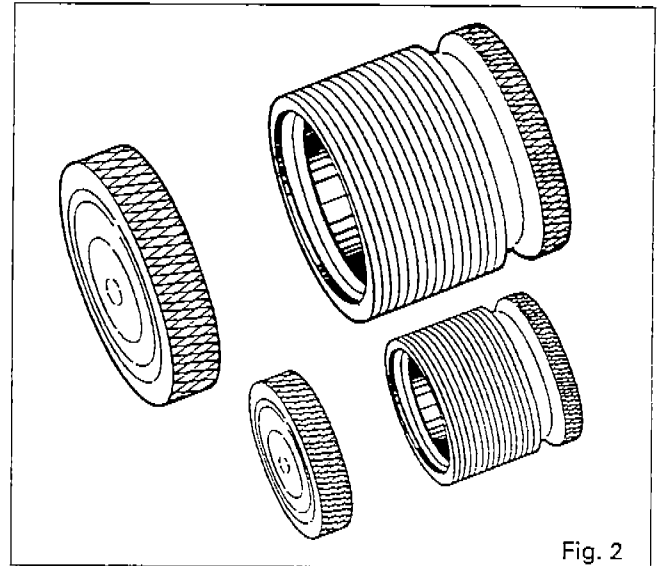


Splitting the tractor

3B01.3

C . Service tool

3376935 M91 Plugs kit for air conditioning





Splitting the tractor

3 C01 Splitting the tractor between the gearbox and the rear axle

CONTENTS

-	General	2
A.	Preliminary operations	2
B.	Uncoupling	2
C.	Recoupling	3
D.	Final operations	4



Splitting the tractor

General

Depending on the type of servicing operation, the cab can remain integral either with the rear axle assembly or with the gearbox.

1. Cab integral with the rear axle

This allows the replacement of the gearbox and operations carried out to the rear of the gearbox, such as replacing the handbrake unit, the mechanism, the cover plate or the output shaft.

2. Cab integral with the gearbox

This allows servicing action on the differential driving gear or on the rear axle housing.

The uncoupling procedure is similar for both versions but the operations marked with an asterisk (*) should not be performed in case 2. In this case, the cab and the gearbox will be supported differently. It is necessary to remove the sheet metal panels and disconnect the brake pipes, the distributors and the probe wiring harnesses.

The cab rear end attaching nuts (1) and locknuts (2) (see Fig. 1) must be tightened to the following torques :

- nut 27 - 35 Nm,
- locknut 13 - 20 Nm (Loctite 270).

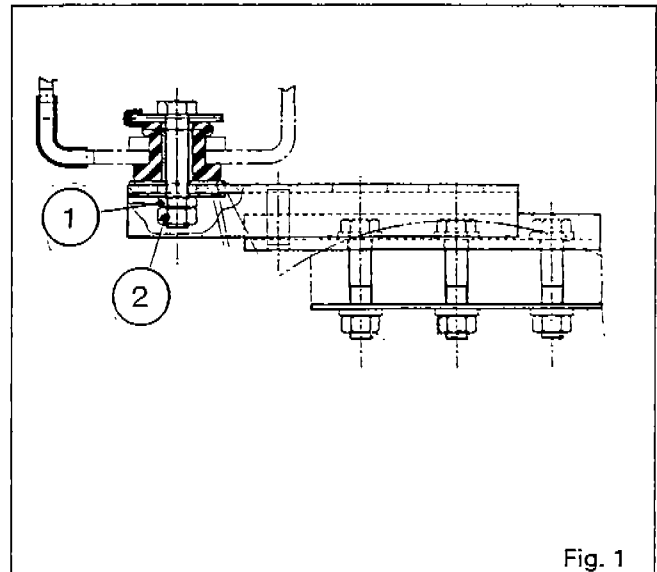


Fig. 1

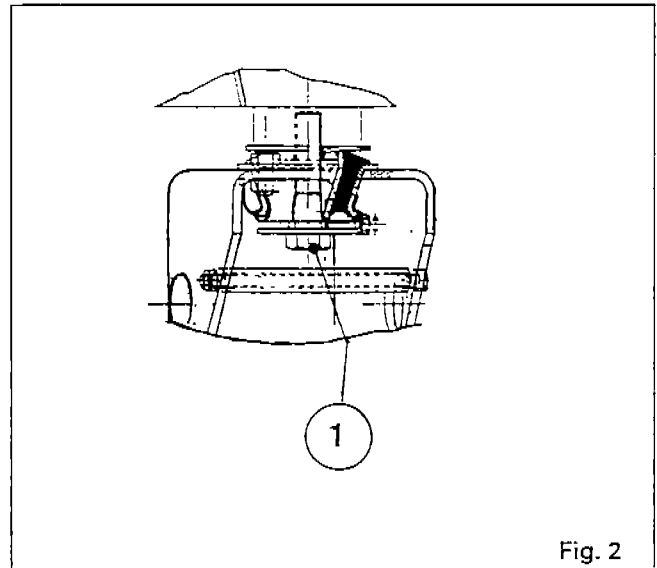


Fig. 2

A. Preliminary operations

1. Remove the transportation shock absorbing system (ATC) and the auxiliary tank (if fitted).

B. Uncoupling

2. Disconnect the two front differential lock (4WD) control hoses and protect the pipe connections.
3. Remove the guard and the transmission shaft.
4. Drain the oil from the gearbox and the rear axle.
5. Remove the 4WD clutch unit (see section 7 A01) or the cover plate (2WD).
- *6. Carry out procedures 3 to 6 in section 3 B01.
7. **Disconnect and plug the following tubes or hoses:**
 - 17-bar supply for the Speedshift or Dynashift distribution unit,
 - control to the Orbitrol distributor,
 - 17-bar supply for power braking (if fitted),
 - control for the trailer brake,
 - *- the Hare / Tortoise range,
 - *- gearbox assembly lubrication,
 - *- clutch control from the master cylinder.

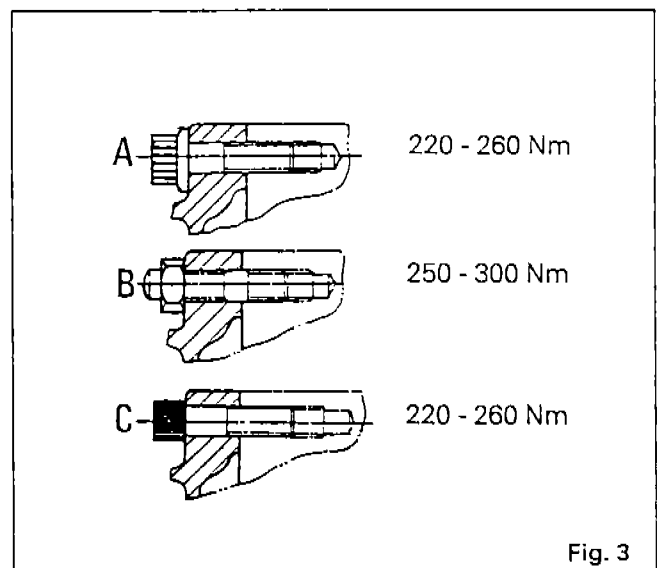


Fig. 3



Splitting the tractor

- *8. Disconnect the following harnesses:
 - the temperature probe (Dynashift),
 - the hare / Tortoise solenoid valve switch,
 - the earth wire,
 - the solenoid valves on the Dynashift distribution unit,
 - the radar harness (Datatronic).
- *9. Remove the two bolts (1) from the front shock absorbers on the right-hand and left-hand cab supports (Fig. 2). Raise the cab and fit wedges.
10. Disconnect the power take-off clutch lubricating tube above the rear axle housing.
11. Detach the control cable from the handbrake. Remove lever **F** and unscrew the control pin (25) (see section 5 K01).
12. Hold the pin with a pin wrench.
- *13. Position a trolley jack under the gearbox.
- *14. Place a stand at the front end of the rear axle housing.
15. If the cab is integral with the gearbox, position a stand under the gearbox and a trolley jack under the hitch hook.

Note: Do not remove the draw-bars, in order to ensure the stability of the rear axle housing.
16. Loosen the bolts attaching the gearbox to the rear axle.
17. Separate the gearbox from the rear axle.

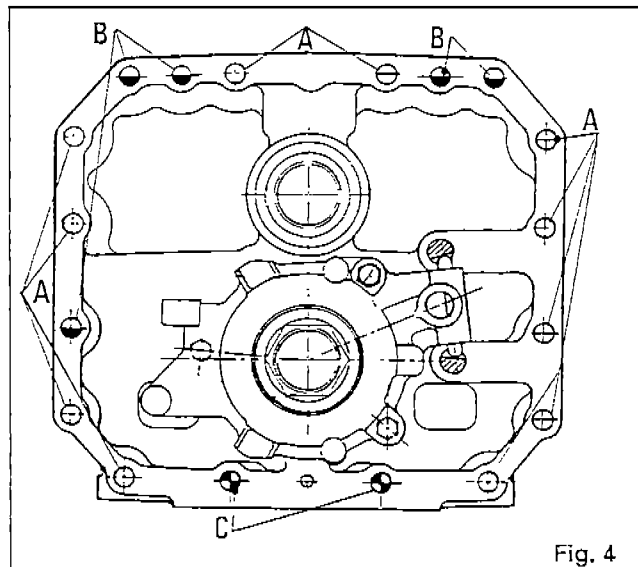


Fig. 4

C . Recoupling

18. Clean the mating faces on the gearbox and the rear axle housing.
19. Check that the dowel pins are tightened and that the locating pin is fitted on the housing.
20. Apply Loctite 510 sealing compound or equivalent on the mating face of the rear axle housing.
21. Recouple the tractor between the gearbox and the rear axle.
22. Tighten the bolts and nuts to the torque values specified in Fig. 3 and 4.
23. Screw in and lock the pin (25). Position lever **F** and reconnect the control cable (see section 5 K01).
24. Reconnect the PTO clutch lubricating tube.
- *25. Lower the cab, ensuring that the balls of the gear lever and reversing lever are correctly positioned. Install the bolts (1) in the shock absorbers (Fig. 2) and tighten to a torque of 200 - 270 Nm.



3C01.4

Splitting the tractor

26. If necessary, adjust the balls of the gear lever (2) and reversing lever (3) in the neutral position as per Fig. 5. Tighten the nuts (1) to a torque of 44 - 55 Nm (Fig. 5).
27. Remove the stands.
- *28. Carry out procedures 4 to 6, section 3 B01, in reverse order.
- *29. Top up the radiator.
30. Carry out procedures 2 to 5 in reverse order.
31. Reconnect the batteries. Start the engine.
- *32. Check the accelerator control setting.
33. Bleed the brake and clutch systems (see sections 5 B01 and 8 H01).
34. Check :
 - for leaks on the mating face between the gearbox and rear axle and on hydraulic unions,
 - the correct operation of electrical circuits.
35. Reinstall the sheet metal panels.
36. Carry out road test.

D . Final operations

37. Reinstall the transportation shock absorbing system (ATC) and the auxiliary tank (if fitted).

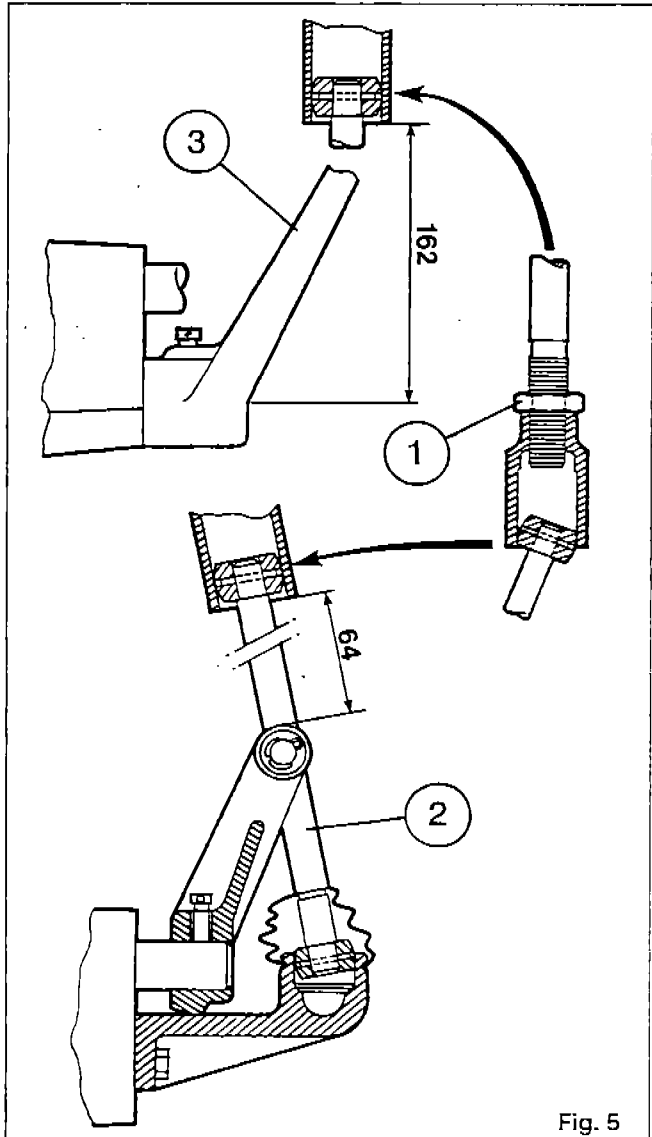
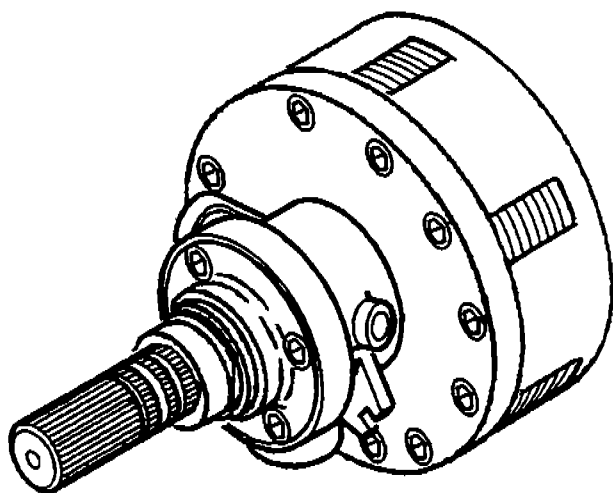


Fig. 5





4 . ENGINE

Contents

4 A01 GENERAL

4 B01 SPACER



Engine

4 A01 General

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4A01.2

Engine

A. Introduction

This section is intended only to provide some general information on the engines used in the 3600 range.

If further information is required on technical data, adjustments, and disassembly and assembly procedures, the following publications should be referred to:

1. Perkins engines

- Workshop manual covering all types of Perkins engines manufactured for MF tractors, published by Massey Ferguson under the reference 1856562M1.

- Workshop manual specific to engines in the 1000 series, published by Massey Ferguson under the reference 1646906M1.

2. Valmet engines

Workshop manual covering engines of type 612DS and 620DS, published by Massey Ferguson under the reference 1646994M1.

B. Main specifications

Tractors equipped with engines of type A6.354.4

	MF 3610	MF 3630	MF 3650
Engine type	A6.354.4	AT6.354.4	AT6.354.4CC
Perkins list No.	TW31151	TU31143	TU31145
Nbr of cylinders	6	6	6
Bore (mm)	98.47	98.47	98.47
Stroke (mm)	127	127	127
Cubic capacity (litres)	5.8	5.8	5.8
Compression ratio	15.5/1	15.5/1	15.5/1
Power at 2,400 rpm (kW) (DIN 70020)	83	98	110
Max. torque (Nm)	374	441	510
at engine speed of (rpm)	1,400	1,600	1,600
Idling speed (rpm)	1,000	1,000	1,000
Rated engine speed (rpm)	2,400	2,400	2,400
Max. no-load speed (rpm)	2,510	2,510	2,510
Injection pump:			
Trademark and type	CAV DPA	CAV DPA	CAV DPA
CAV ref.	3269 F981	3362 F021	3363 F000
Code	37775 MX	37759 LX	2643 D145 JY
Direction of rotation	Clockwise	Clockwise	Clockwise
Cylinder No. 1 output	X	X	X
Spring attachment code	8	8	9
Static timing angle (degrees)	28	30	30
Engine checking angle (degrees)	160	159	159
Pump checking angle (degrees)	146	146	146
Piston displacement (mm)	9.45	10.82	10.82
Injectors			
Trademark	CAV	CAV	CAV
Code	HS	GG	HE
Injector-holder	2646466	2646466	2645A302
Nozzle	2646844	2646845	JB 6801019
Calibration, new or overhauled (bar)	215	215	240
Intake system	Natural	Turbocharger	Turbo/Intercooler
Boost pressure (bar)	-	0.76-0.93	0.76-0.93
Rocker adjustment (mm) In/Ex	0.20/0.45	0.20/0.45	0.20/0.45
Engine oil cooler	Yes	Yes	Yes



Engine

Tractors fitted with 1006 engines and CAV injection pumps

	MF 3635	MF 3645	MF 3655
Engine type	1006-6T7	1006-6T5	1006-6T4
Perkins list No.	YB31245	YB31246	YB31247
Nbr of cylinders	6	6	6
Bore (mm)	100	100	100
Stroke (mm)	127	127	127
Cubic capacity (litres)	6	6	6
Compression ratio	16/1	16/1	16/1
Power at 2,200 rpm (kW) (DIN 70020)	97	104.5	114
Max. torque (Nm)	498	522	574
at engine speed of (rpm)	1,200	1,500	1,400
Idling speed (rpm)	1,000	1,000	1,000
Rated engine speed (rpm)	2,200	2,200	2,200
Max. no-load speed (rpm)	2,350	2,310	2,310
Injection pump:			
Trademark and type	CAV DPA	CAV DPS	CAV DPS
CAV ref.	3363 F850	8521 A620A	8521 A810A
Code	2643 D615/KK	2643 M016/PK	2643 M022RK
Direction of rotation	Clockwise	Clockwise	Clockwise
Cylinder No. 1 output	Y	Y	Y
Spring attachment code	7	2	3
Static timing angle (degrees)	18	16	17
Engine checking angle (degrees)	325	326	327.5
Pump checking angle (degrees)	334	334	336
Piston displacement (mm)	3.99	3.15	3.55
Injectors			
Trademark	CAV	CAV	CAV
Code	JT	JF	JL
Injector-holder	LRB 6703206	LRB6703201	LRB6703203
Nozzle	JB 6801 104	JB 6801 052	JB 6801 093
Calibration, new or overhauled (bar)	250	250	250
Intake system	Turbo Schwitzer S2B	Turbo Garret T04B	Turbo Garret TBP4WG
Supercharging pressure (bar)	0.60 minimum at 2,200 rpm, full load	0.76 to 0.90 at 2,200 rpm, full load	1.05 to 1.19 at 2,200 rpm, full load
Valve spring	Single	Double	Double
Valve seat inserts	No	Yes	Yes
Rocker adjustment (mm) Inlet/Exhaust	0.20/0.45	0.20/0.45	0.20/0.45
Engine oil cooler	Yes	Yes	Yes

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Thank you very much!

Have questions.

Please write to me.

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