09 - Hydraulics

CONTENTS

Hydraulics

9A20 - Description of Load Sensing system

CONTENTS

A . General

The hydraulic system is closed centre with controlled pressure and flow rate.

It consists of two separate systems (high and low pressure), supplied by a variable displacement pump with a maximum flow rate of 45 cm^3 per revolution. The variable displacement pump is supplied by a charge pump.

The two pumps are driven by:

- a gear which is driven by the engine flywheel (GPA30);
- the PTO clutch external teeth (GPA20 and GPA40).

Charge pump

The charge pump is fitted to the left-hand cover plate. It sucks oil through a strainer from the common tank formed by the centre housing and gearbox. The charge flow rate is then directed towards the right-hand cover plate and passes through the main filter before flowing towards the variable displacement pump and the oil manifold of the centre housing (GPA20 and GPA40) or the intermediate housing (GPA30) to lubricate the following components;

- trumpet housings,
- the rear PTO clutch (GPA20 and GPA40);
- the hydraulic pump drive gear/bearing (GPA30);
- mechanical parts of the rear PTO;
- the 4WD unit (GPA30 and GPA40);
- rear bearing of the pinion (GPA20);
- the pinion bearings and the hand brake mechanism (GPA40).

The safety valve set to 5 bar, located on the internal face of the right-hand cover plate, maintains the charge pressure.

Variable displacement pump

The variable displacement pump supplies either one or two priority blocks fitted on the right-hand cover plate:

- one unit for tractors without hydraulic trailer braking;
- two units for tractors with hydraulic trailer braking;
- two units for tractors fitted with high-pressure brakes with or without hydraulic trailer braking.

The first unit supplies:

- first priority, the steering system;
- second priority, the 17 bar or 21 bar slave device system.

If a second unit is fitted, it shares the priority between the steering system and the trailer braking system.

Once the priorities have been met, the remaining oil flow becomes available to the auxiliary spool valves and the linkage spool valve.

All the control signals from the various high-pressure valves are directed to the priority block(s) to then be transmitted to the variable displacement pump regulator.

The regulator takes into account the control signal corresponding to the function requiring the highest pressure.

Principle of the Load Sensing system

The purpose of the closed centre Load Sensing hydraulic system is to limit the power absorbed by the engine. If no hydraulic slave device is actuated, no flow is discharged by the variable displacement pump.

When a function is activated, the pump only supplies the output required for that function.

IMPORTANT: *If the housing is drained, or if the main filter is replaced or any servicing operation results in air entering the system, it is essential to prime the hydraulic system.*

Description of Load Sensing system

Hydraulic component specifications (Fig. 1)

Suspension strainer (13)

- Type: cartridge
- Filtering threshold: 150 µ

Charge pump (12)

- Brand: Rexroth - Sigma
- Displacement: 60 cm^3 per revolution
- Flow rate: 165 l/min at 2200 rpm

Main filter (37)

- Filtering threshold: 15 µ
- With differential pressure bypass: 3.5 bar
- With differential pressure switch: 2.4 bar

Safety valve (46)

- Setting: 22 bar or 24 bar
- Fitted on the low-pressure system

Safety valve (50)

- Setting: 5 bar
- Unused slave devices: re-supply charge pump
- Switch: 5 bar (blockage indicator placed on main filter)
  - opening: 3 bar
  - closing: 2 bar
  - fitted in parallel to filter
  - linked to indicator light on instrument panel

Variable displacement pump (49)

- Brand: Brueninghauss
- Type: Axial pistons
- Variable displacement between 0 and 45 cm^3 per revolution
- Flow rate: 0 to 105 l/min at 2200 rpm
- Minimum pressure: 22 bar
- Maximum pressure: 200 bar
- Internal lubrication with return to housing

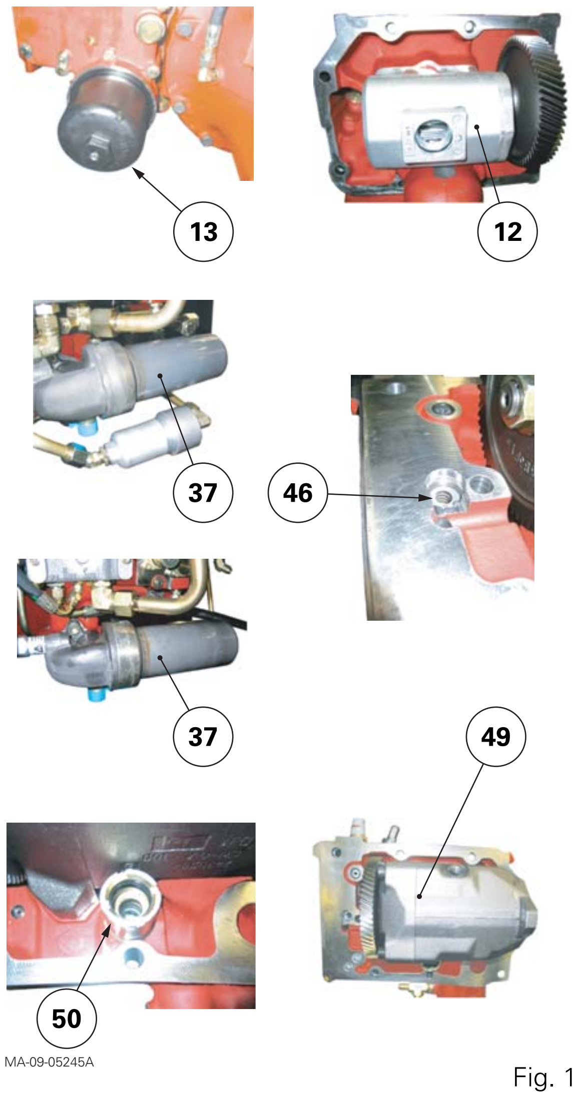

Fig. 1

B . Power Shuttle suction system for gearbox types GBA10 and GBA20

Power Shuttle suction system for gearbox type GBA10 (GPA30 rear axle)

Legend (Fig. 2)

A Gearbox
B Intermediate housing
D Strainer
G Suction pipes

Suction

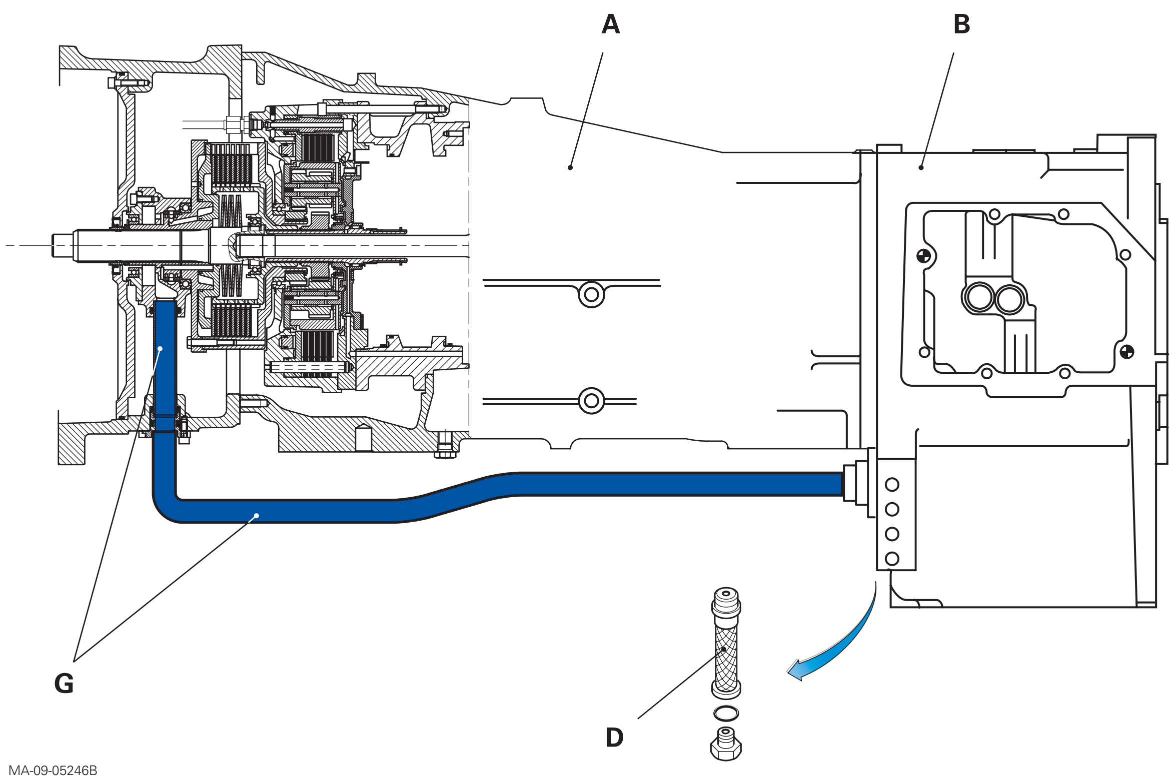

Fig. 2

Description of Load Sensing system

Power Shuttle suction system for gearbox type GBA10 (GPA40 rear axle)

Legend (Fig. 3)

A Gearbox
B Centre housing
D Strainer
G Suction pipes

Suction

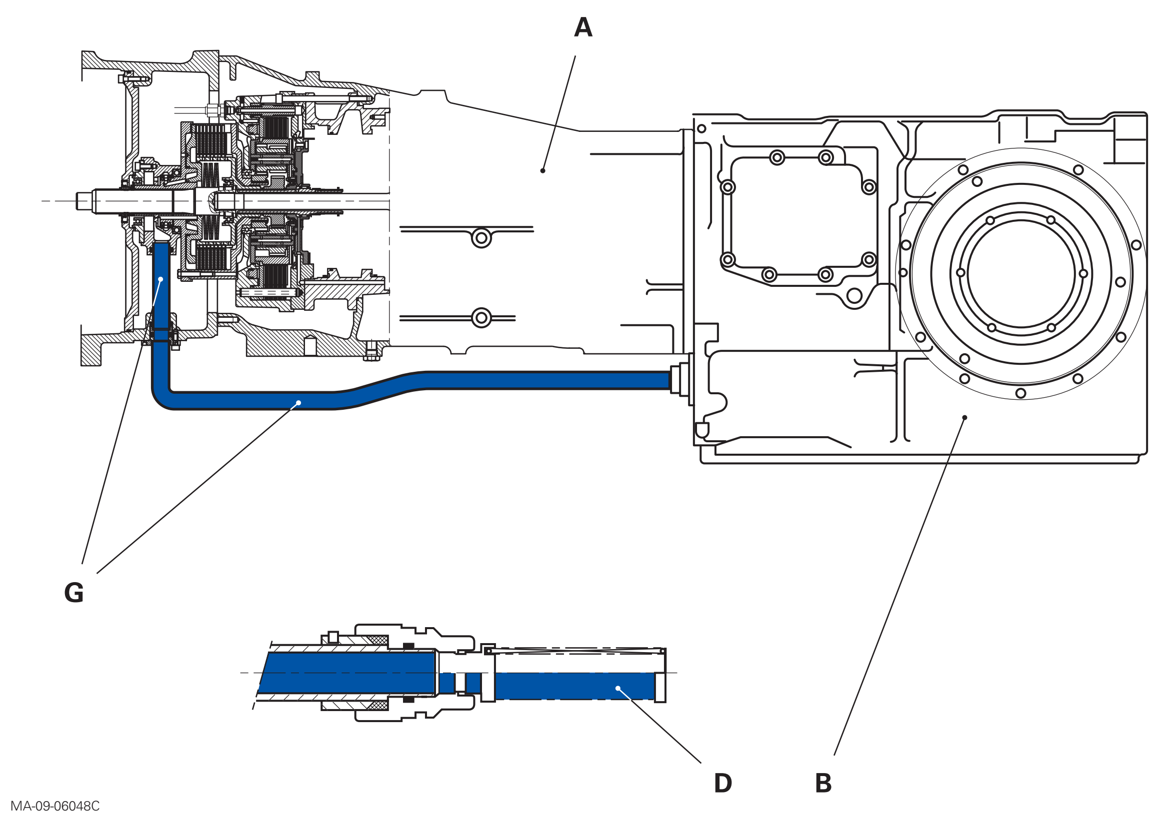

Fig. 3

Power Shuttle suction system for gearbox type GBA20 (GPA20 rear axle)

Legend (Fig. 4, Fig. 5)

A Gearbox
D Strainer
G Suction pipes
H 4WD unit cover plate

Suction

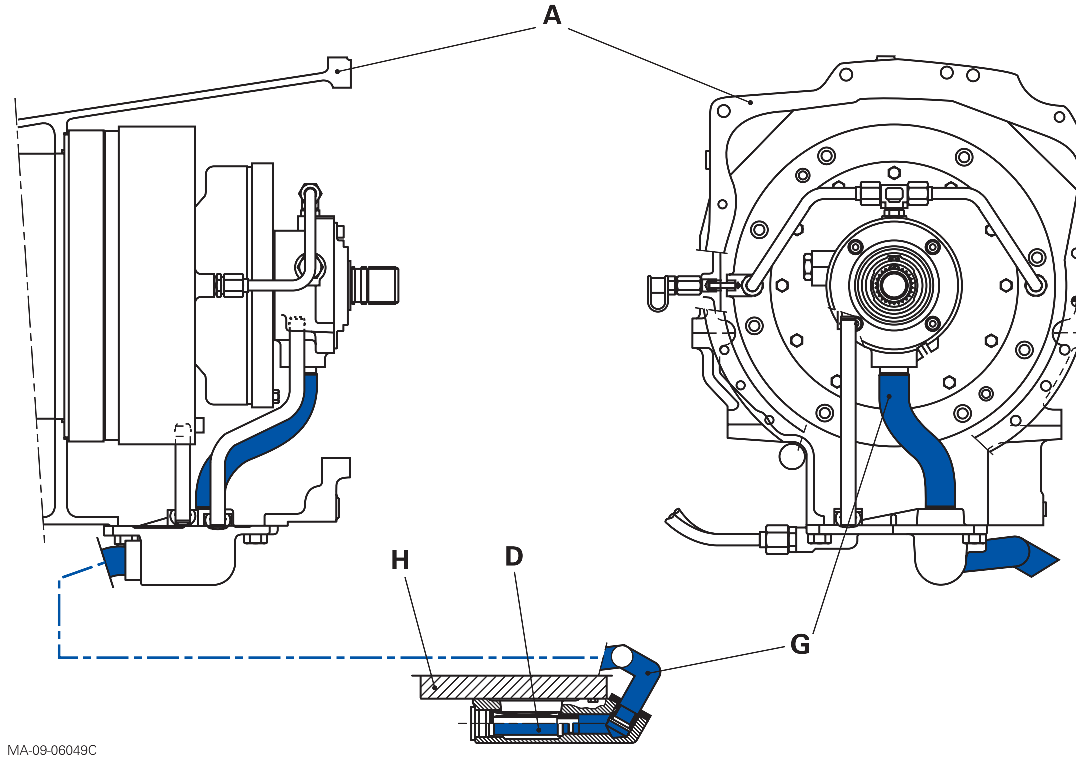

Fig. 4

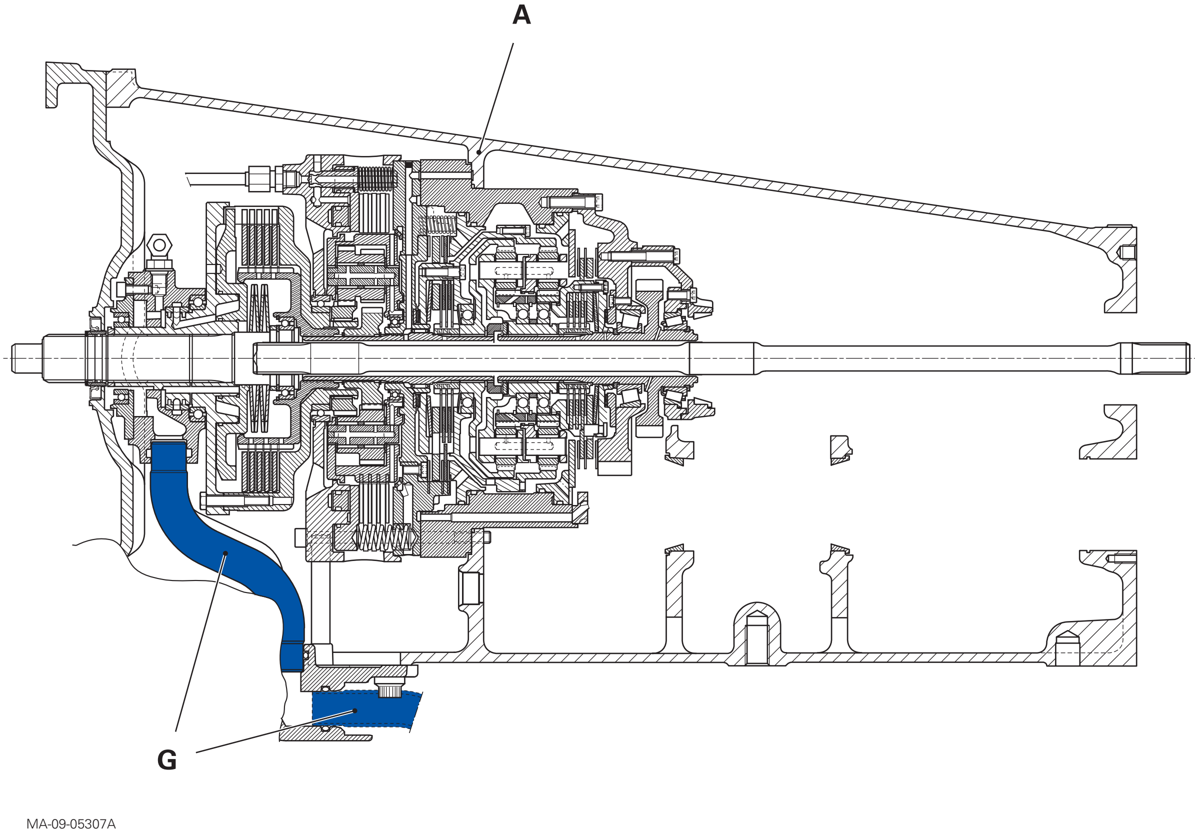

Fig. 5

C . Lubrication system for Power Shuttle and Dynashift for gearbox types GBA10 and GBA20

Lubrication system for Power Shuttle and Dynashift for gearbox type GBA10 (GPA30 and GPA40 rear axles)

Legend (Fig. 6)

A Gearbox
C Lubrication pipes
F Details

Lubrication

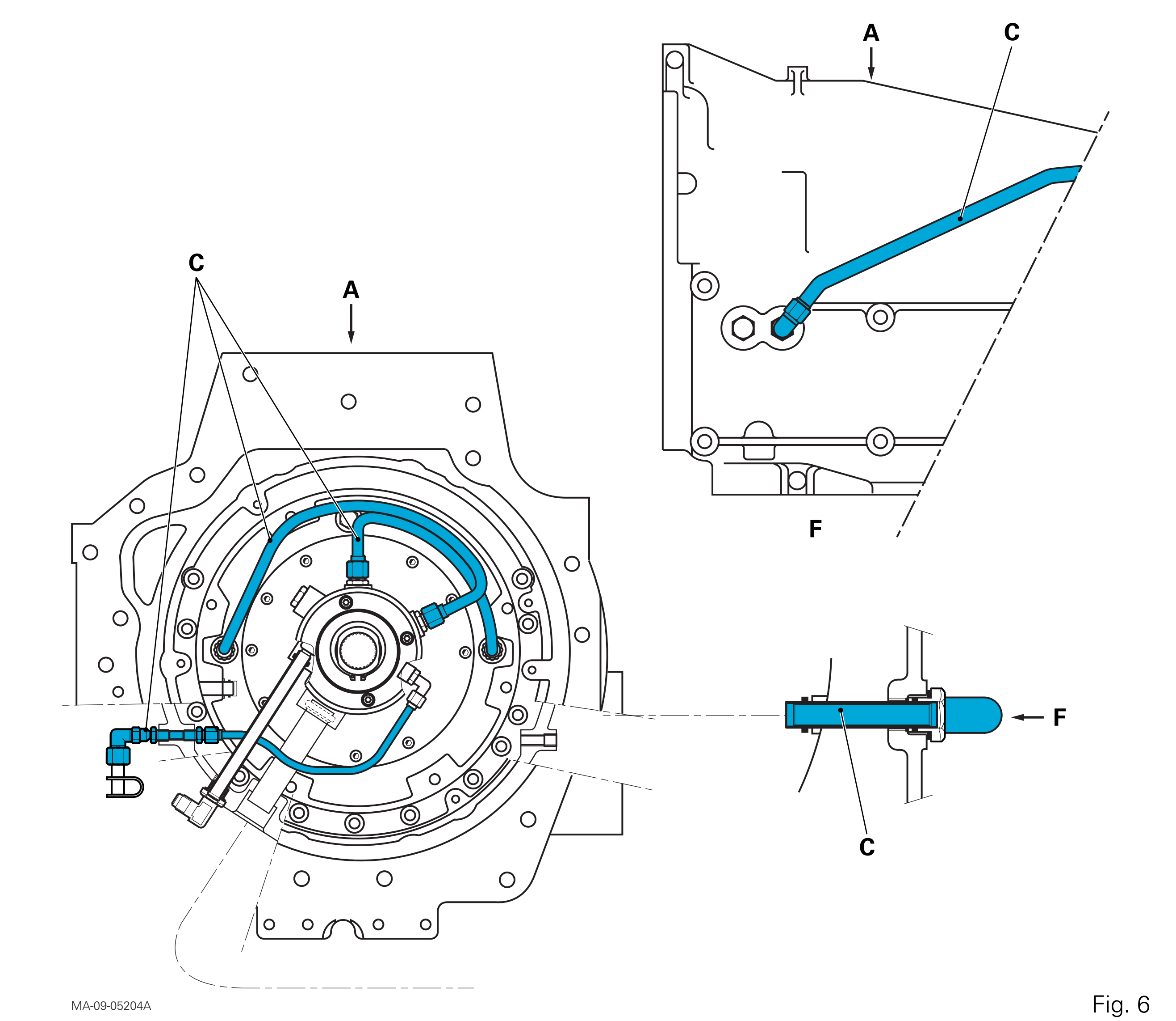

Fig. 6

Lubrication system for Power Shuttle and Dynashift for gearbox type GBA20 (GPA20 rear axle)

Legend (Fig. 7, Fig. 8)

A	Gearbox
C	Lubrication hoses
C1	Lubrication pipes
F	Details
V	Thermo valve (if fitted)

Lubrication

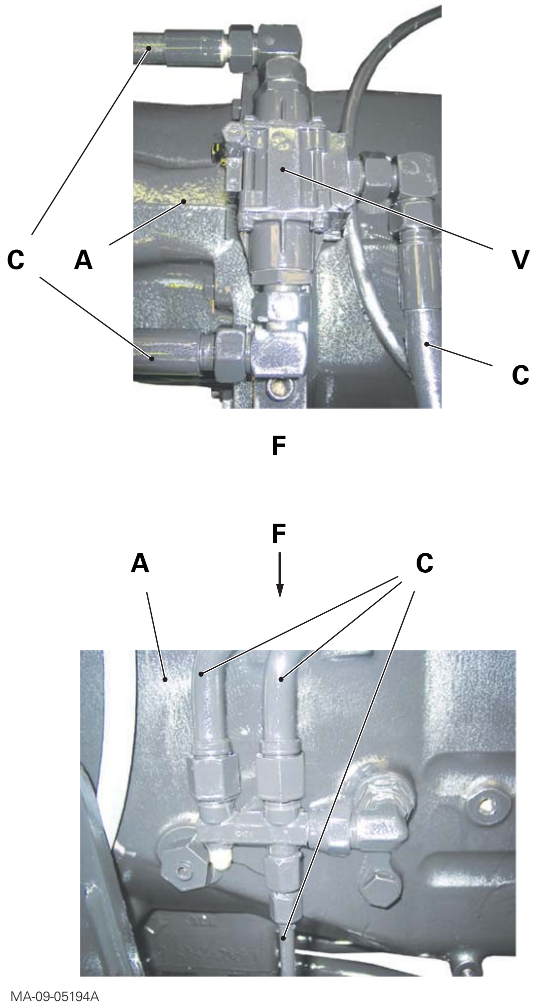

Fig. 7

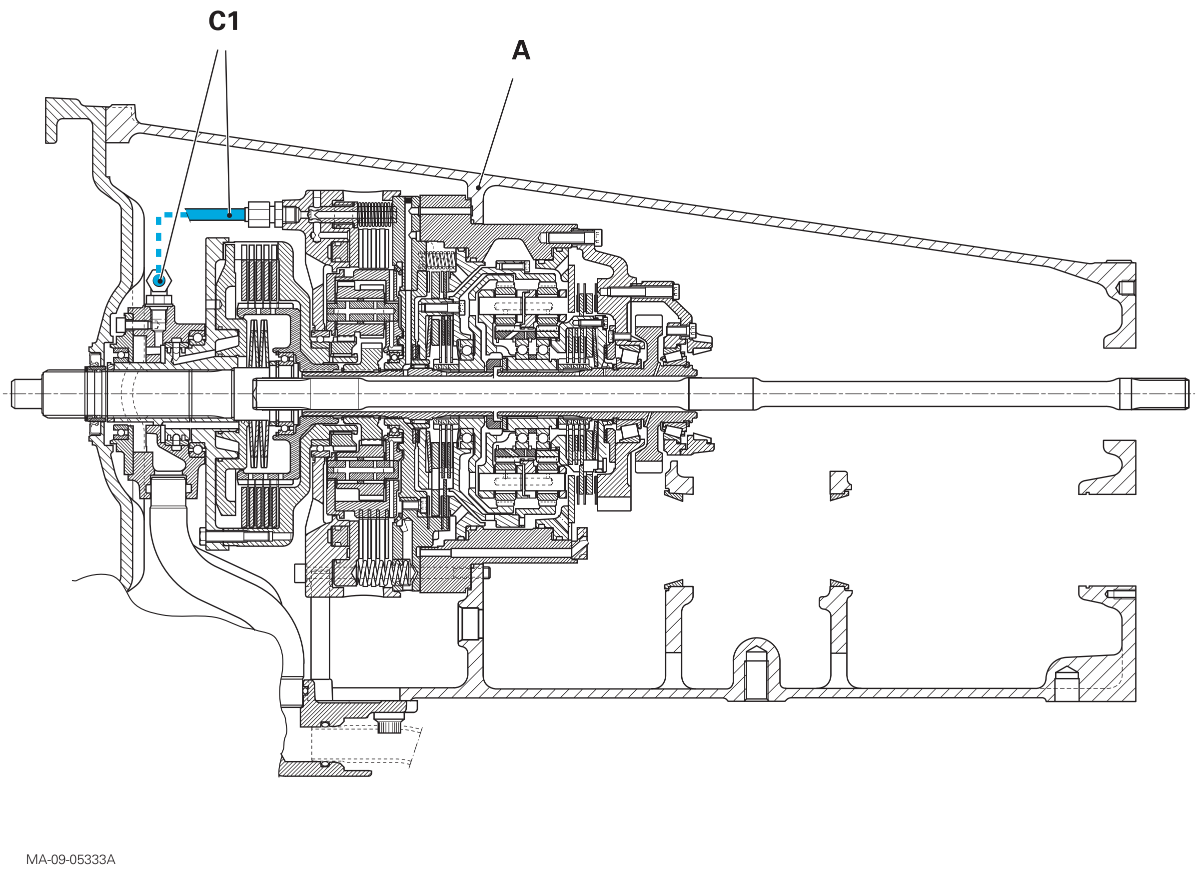

Fig. 8

D . Lubrication system for Power Shuttle and Powershift module for gearbox types GBA15 and GBA25

Lubrication system for Power Shuttle and Powershift module for gearbox type GBA15

Legend (Fig. 9, Fig. 10)

- E Spacer/housing
- O Lubricating port to Powershift module
- P Lubrication pressure coming from the right-hand hydraulic cover plate

Lubrication

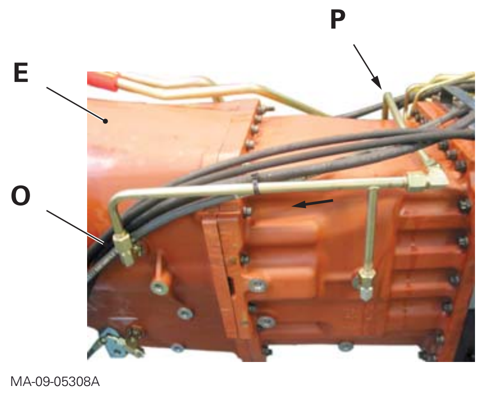

Fig. 9

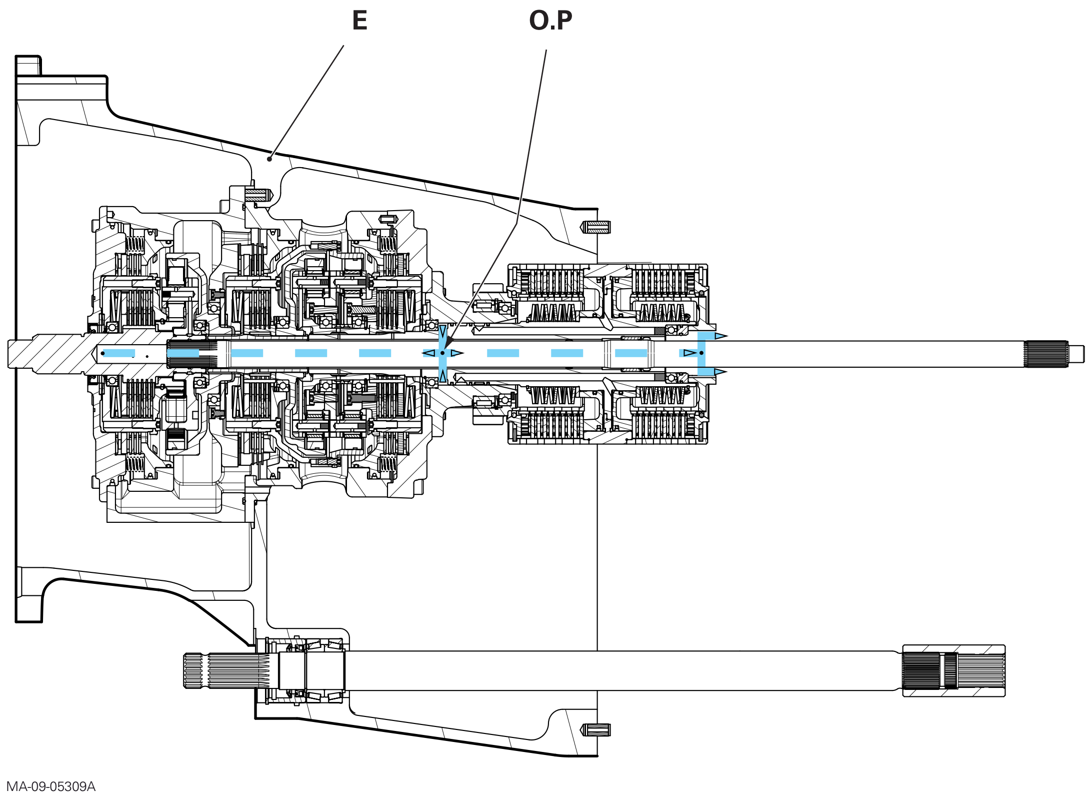

Fig. 10

Lubrication system for Power Shuttle and Powershift module for gearbox type GBA25

Legend (Fig. 11, Fig. 12)

E Spacer/housing
O Lubricating port to Powershift module
P Lubrication pressure coming from the right-hand hydraulic cover plate

Lubrication

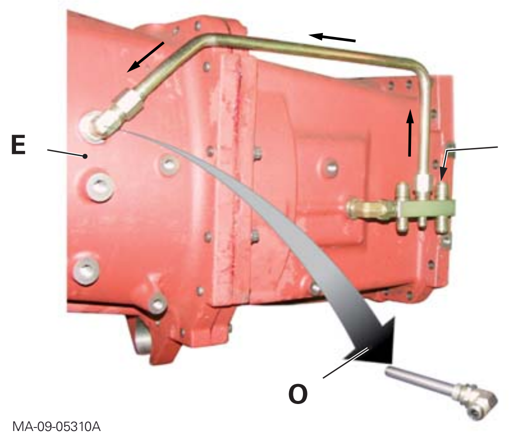

Fig. 11

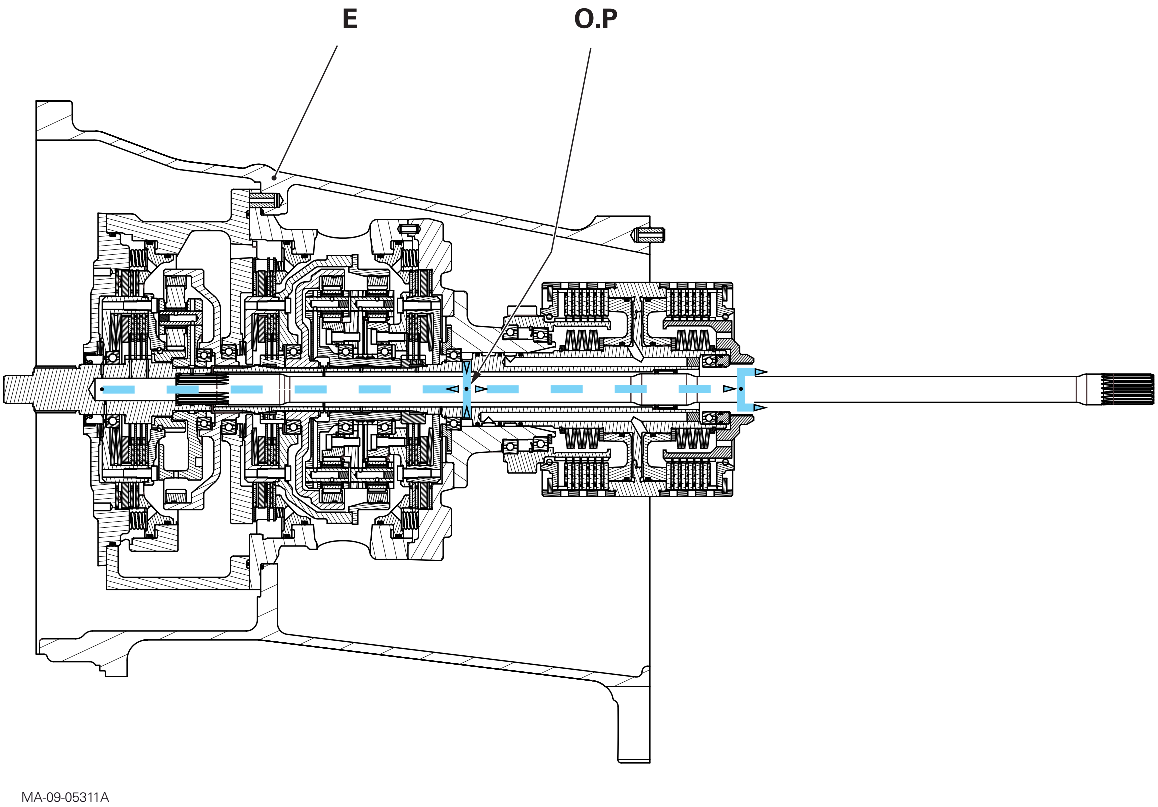

Fig. 12

E . Lubrication system for gearbox types GBA10, GBA15, GBA20 and GBA25

Lubrication system for gearbox type GBA10

Legend (Fig. 13, Fig. 14)

A Gearbox

O Lubricating port to the gearbox

P Lubrication pressure coming from the right-hand hydraulic cover plate

Lubrication

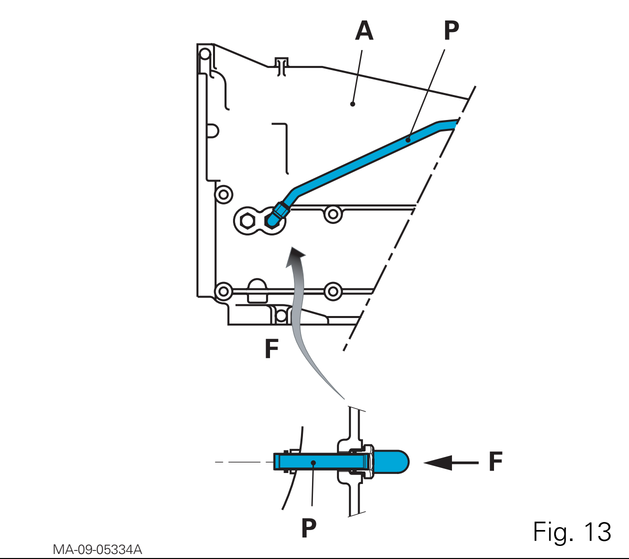

Fig. 13

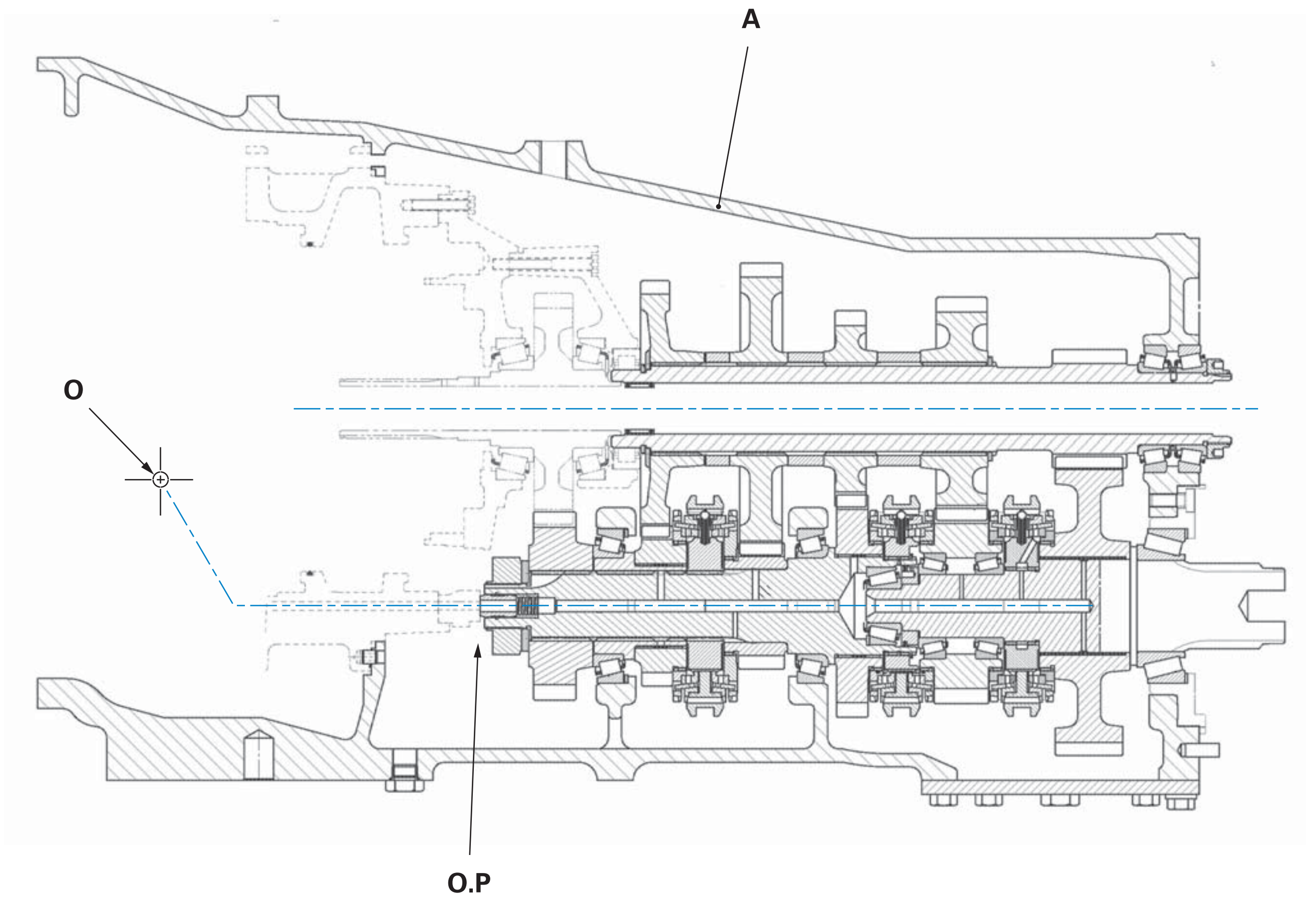

Fig. 14

Lubrication system for gearbox type GBA15

Legend (Fig. 15, Fig. 16)

A Gearbox
O Lubricating port to the gearbox
P Lubrication pressure coming from the right-hand hydraulic cover plate

Lubrication

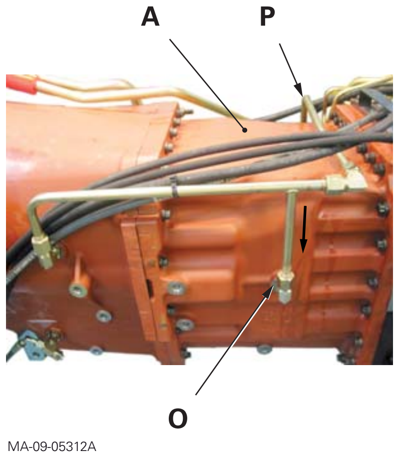

Fig. 15

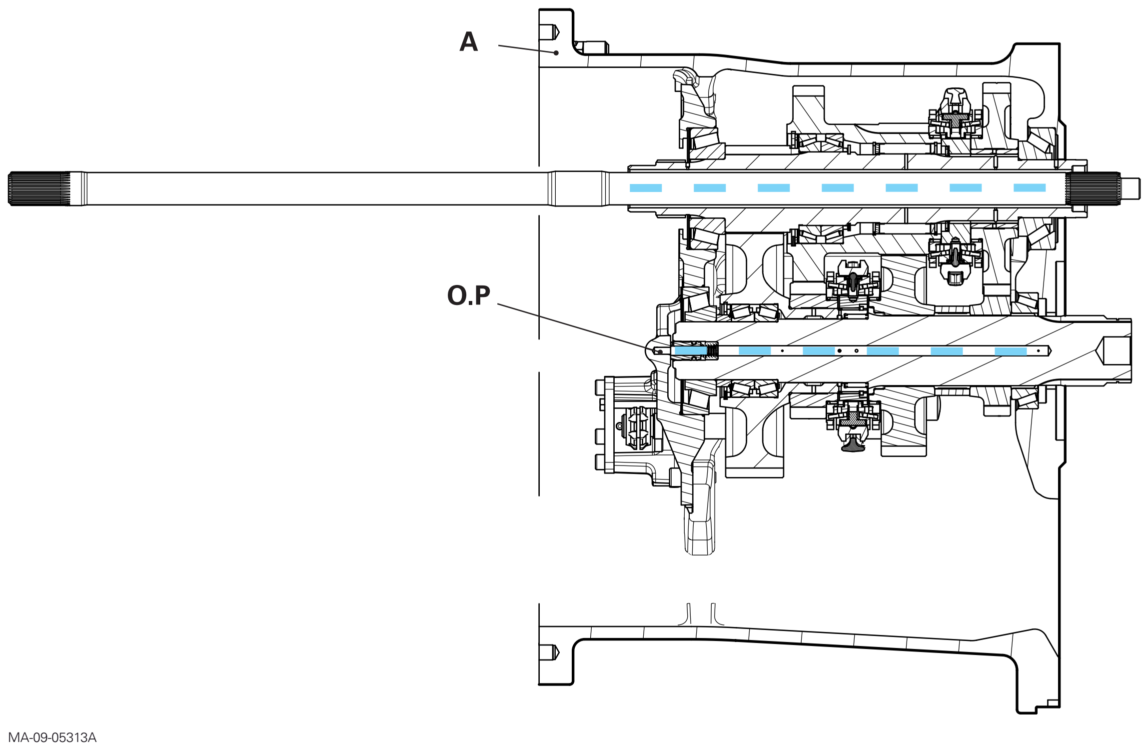

Fig. 16

Lubrication system for gearbox type GBA20

Legend (Fig. 17)

A Gearbox
C Lubrication hoses
F Details
V Thermo valve (if fitted)

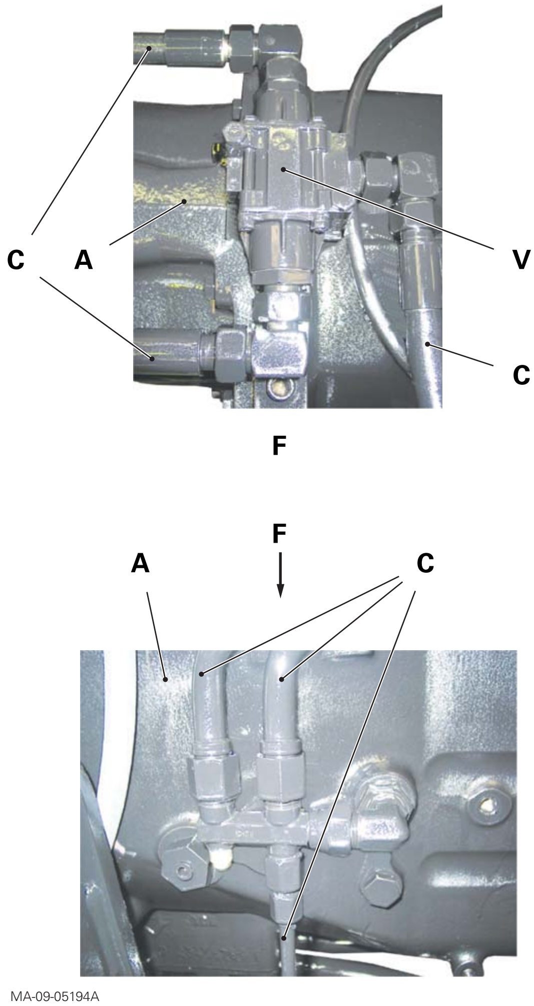

Fig. 17

Lubrication system for gearbox type GBA25

Legend (Fig. 18, Fig. 19)

A Gearbox
O Lubricating port to the gearbox
P Lubrication pressure coming from the right-hand hydraulic cover plate

Lubrication

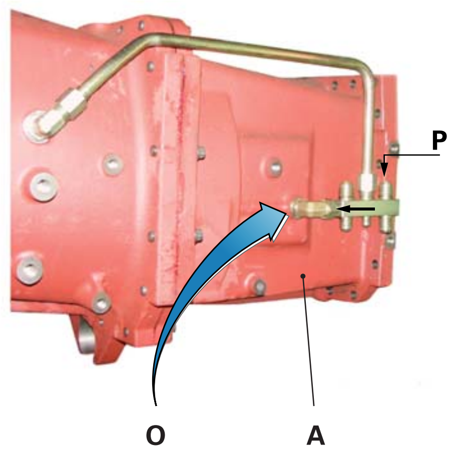

Fig. 18

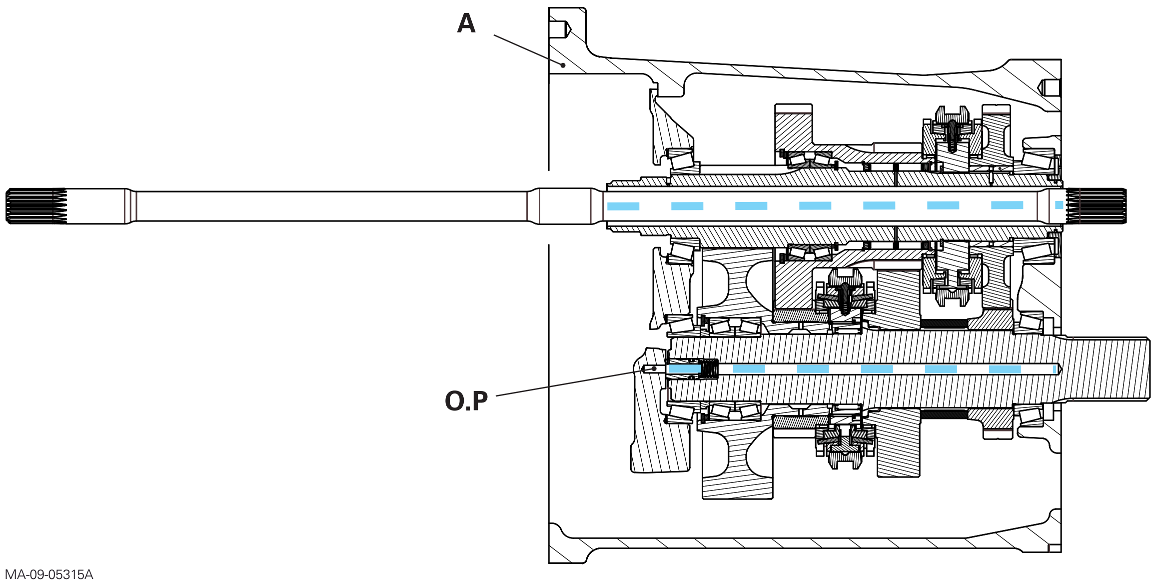

Fig. 19

F . Low pressure system for gearbox types GBA10, GBA15, GBA20 and GBA25

Low pressure system for gearbox type GBA10

Legend (Fig. 20)

A Gearbox
B Low pressure main supply (17 bar)
C Low pressure supply (17 bar) for Power Shuttle forward or reverse clutches
D Hare/Tortoise solenoid valve
E Unit housing the control for the Power Shuttle and for the Dynashift
F Main accumulator
G Accumulator connected to the brake master cylinder hydraulic line
K Filter

Low pressure (17 bar)
Nitrogen

Specifications of accumulators F and G

Accumulator F assists the low-pressure hydraulic line.

Accumulator G maintains the brake master cylinder hydraulic line under pneumatic pressure as soon as the tractor stops (ignition switched off).

These two accumulators have the same specifications:

- Brand: HYDAC
- Type: 1/20
- Capacity: 1 l
- Gas: Nitrogen
- Inflation pressure: 8 to 10 bar

  ***IMPORTANT:** The pressure should be checked every six months, with the engine stopped.*

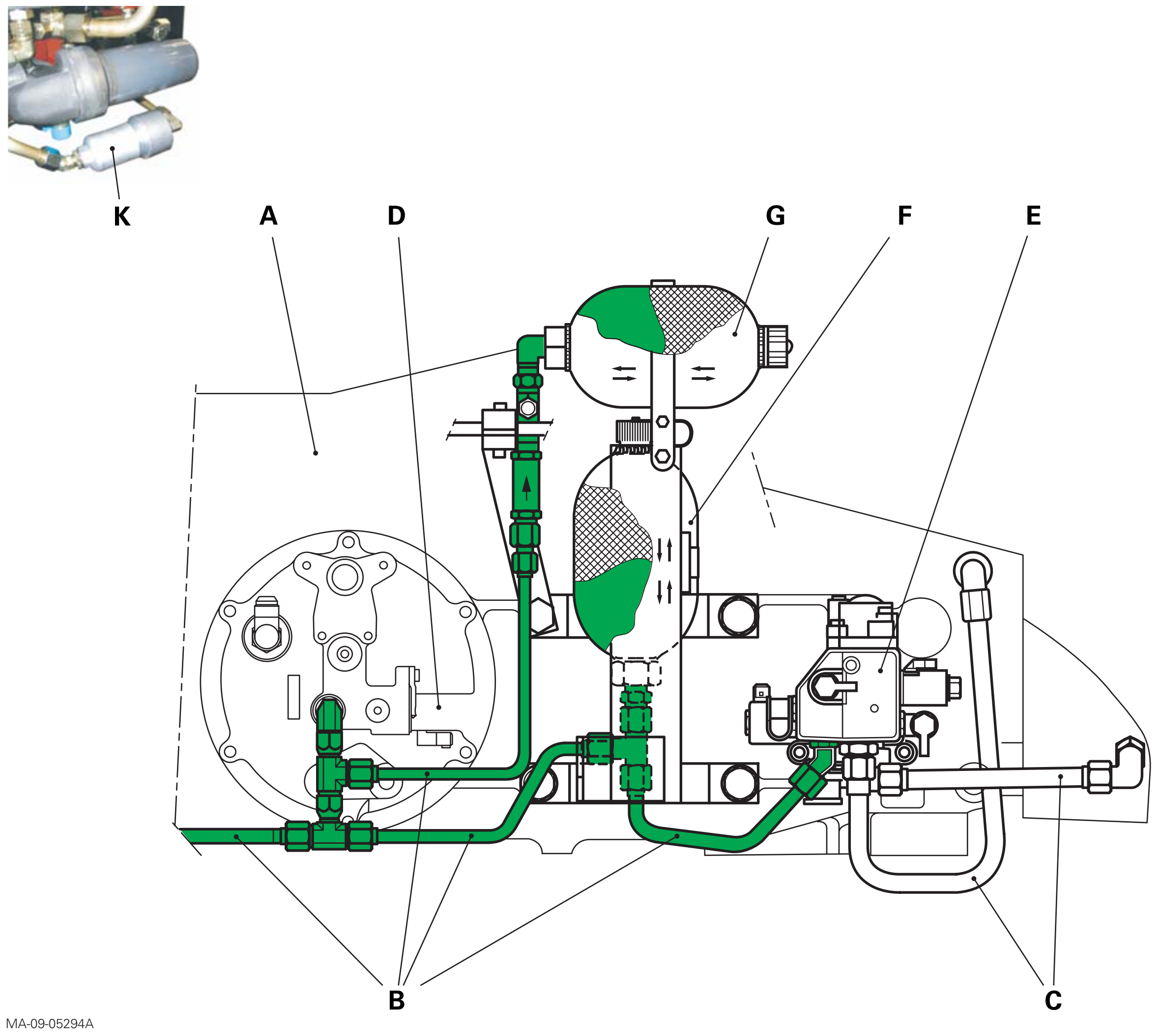

Fig. 20

Low pressure system for gearbox type GBA15 (40 kph version)

Legend (Fig. 21)

A Gearbox/Powershift module assembly
B Centre housing
C Low pressure main supply (21 bar)
E Unit housing the control:
- for the Power Shuttle
- for the Dynashift module
- for the multiplier module

F Main accumulator
G Accumulator connected to the brake master cylinder hydraulic line
J Non-return valve
K Filter
L Low pressure supply (21 bar) for the Powershift module and the Power Shuttle
N Range 1 and 2 solenoid valves
O Range 3 and 4 solenoid valves

Specifications of accumulators F and G

Accumulator F assists the low-pressure hydraulic line.

Accumulator G maintains the brake master cylinder hydraulic line under pneumatic pressure as soon as the tractor stops (ignition switched off).

These two accumulators have the same specifications:
- Brand: HYDAC
- Type: 1/20
- Capacity: 1 l
- Gas: Nitrogen
- Inflation pressure: 8 to 10 bar

***IMPORTANT:** The pressure should be checked every six months, with the engine stopped.*

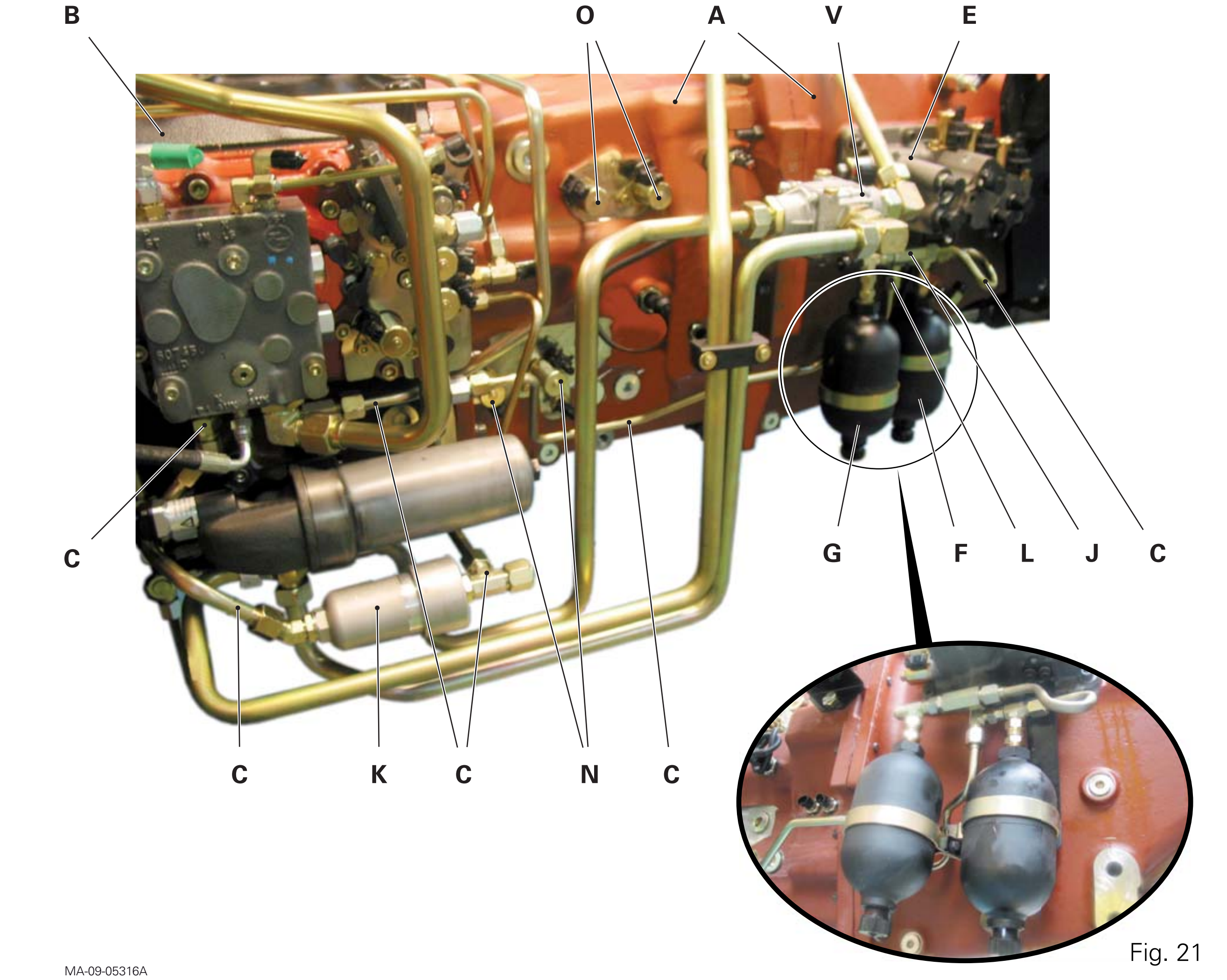

Fig. 21

Low pressure system for gearbox type GBA15 with high pressure braking unit

Legend (Fig. 22)

A Gearbox/Powershift module assembly
B Centre housing
C Low pressure main supply (21 bar)
E Unit housing the control:
- for the Power Shuttle
- for the Dynashift module
- for the multiplier module

F Main accumulator
K Filter
L Low pressure supply (21 bar) for the Powershift module and the Power Shuttle
N Range 1 and 2 solenoid valves
O Range 3 and 4 solenoid valves
P High-pressure braking unit
Q Accumulator

Specifications of accumulators F and Q

- Main low pressure accumulator F
  - Brand: HYDAC
  - Type: 1/20
  - Capacity: 1 l
  - Gas: Nitrogen
  - Inflation pressure: 8 to 10 bar

  IMPORTANT: *The pressure should be checked every 6 months, with the engine stopped.*
- Accumulator Q for high-pressure braking unit
  - Brand: HYDAC
  - Type: SBO210
  - Capacity: 1.4 l
  - Gas: Nitrogen
  - Inflation pressure: 53 to 56 bar

  IMPORTANT: *The pressure should be checked every six months, with the engine stopped.*

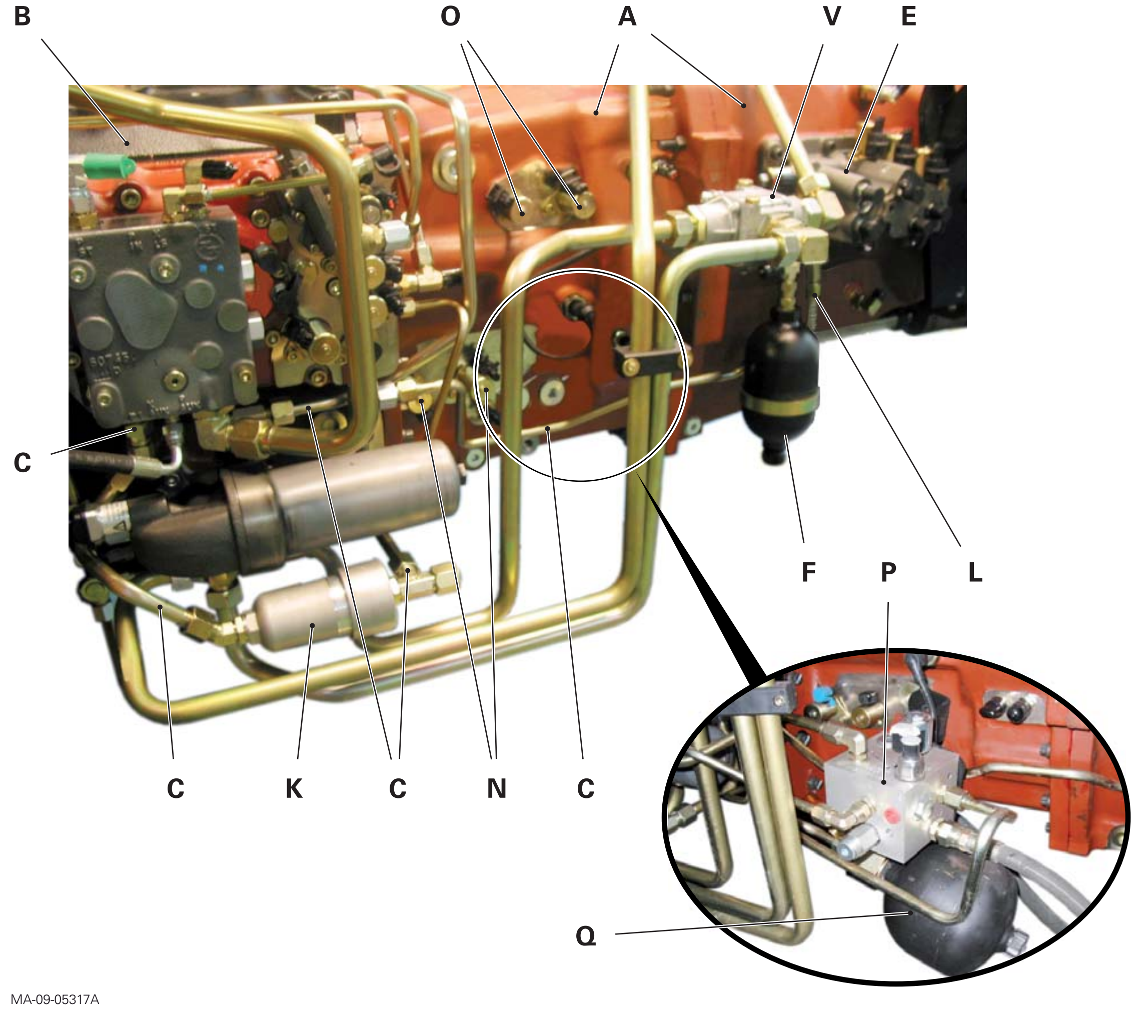

Fig. 22

Low pressure system for gearbox type GBA20

Legend (Fig. 23)

A Gearbox
B Centre housing
C Low pressure main supply (17 bar)
D Low pressure supply (17 bar) for Power Shuttle forward or reverse clutches
E Unit housing the control for the Power Shuttle and for the Dynashift
F Main accumulator
G Accumulator connected to the brake master cylinder hydraulic line
H Return - Power Shuttle forward and reverse clutches
I Supply - A/B clutch (forward travel) for Dynashift
J Non-return valve
K Filter

Low pressure (17 bar)

Nitrogen

NOTE: *The supply line for the C/D clutch (reverse travel) for Dynashift is masked by the control unit. It is located between the latter and the gearbox.*

Specifications of accumulators F and G

Accumulator F assists the low-pressure hydraulic line.

Accumulator G maintains the brake master cylinder hydraulic line under pneumatic pressure as soon as the tractor stops (ignition switched off).

These two accumulators have the same specifications:

- Brand: HYDAC
- Type: 1/20
- Capacity: 1 l
- Gas: Nitrogen
- Inflation pressure: 8 to 10 bar

  IMPORTANT: *The pressure should be checked every six months, with the engine stopped.*

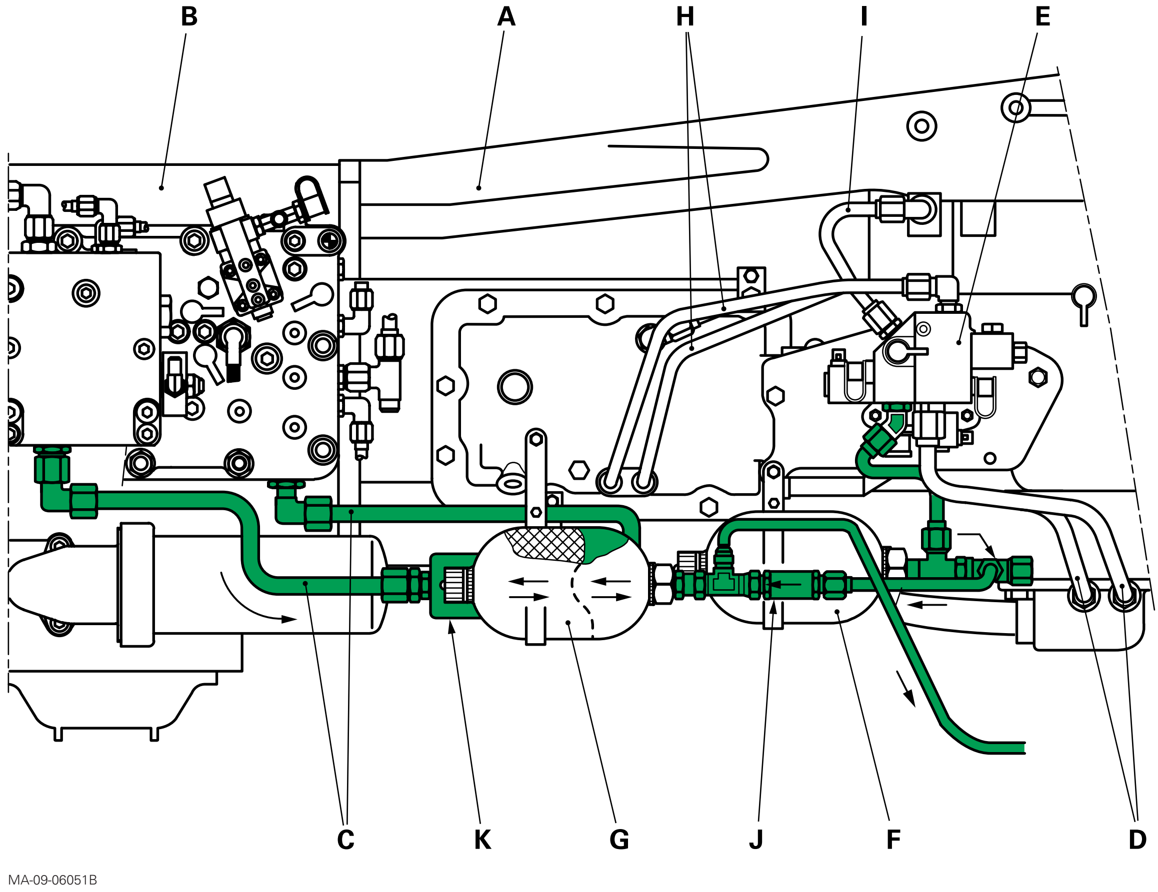

Fig. 23

Description of Load Sensing system

Low pressure system for gearbox type GBA25 (40 kph version)

Legend (Fig. 24, Fig. 25)

A Gearbox/Powershift module assembly
B Centre housing
C Low pressure main supply (21 bar)
E Unit housing the control:
- for the Power Shuttle
- for the Dynashift module
- for the multiplier module

F Main accumulator
G Accumulator connected to the brake master cylinder hydraulic line
K Filter
L Low pressure supply (21 bar) for the Powershift module and the Power Shuttle
M Low pressure supply (21 bar) for range solenoid valves on gearbox type GBA25
N Range 1 and 2 solenoid valves
O Range 3 and 4 solenoid valves

Specifications of accumulators F and G

Accumulator F assists the low-pressure hydraulic line.

Accumulator G maintains the brake master cylinder hydraulic line under pneumatic pressure as soon as the tractor stops (ignition switched off).

These two accumulators have the same specifications:

- Brand: HYDAC
- Type: 1/20
- Capacity: 1 l
- Gas: Nitrogen
- Inflation pressure: 8 to 10 bar

***IMPORTANT:** The pressure should be checked every six months, with the engine stopped.*

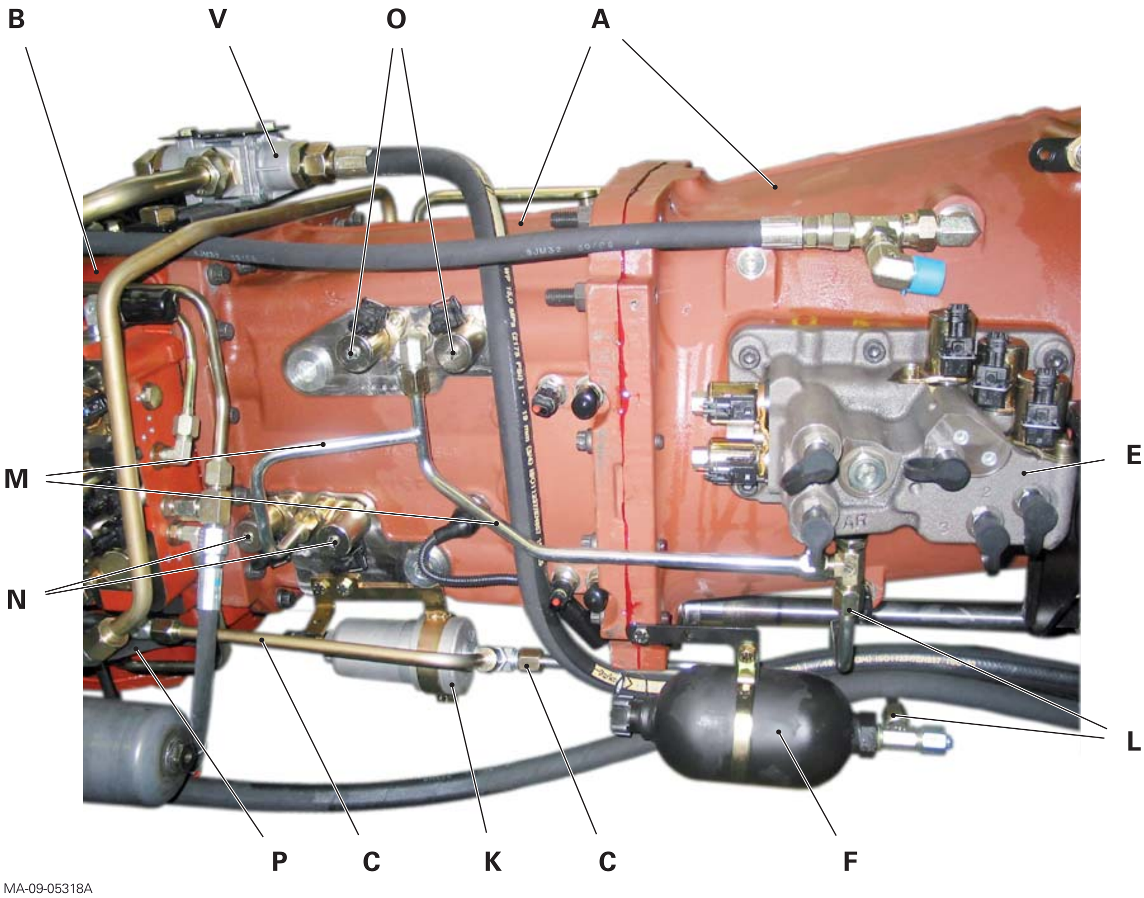

Fig. 24

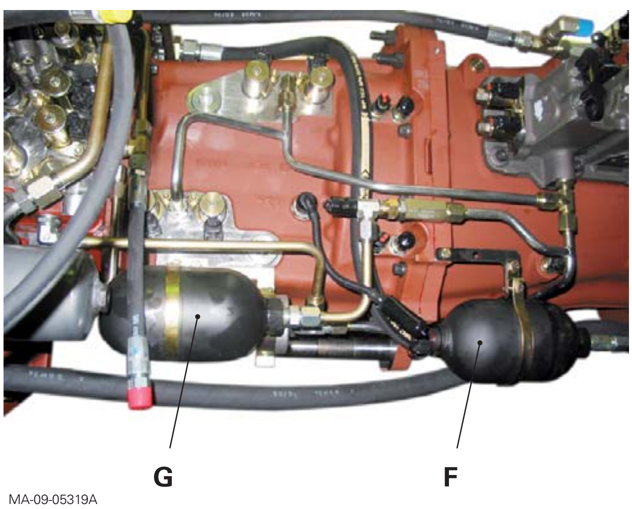

Fig. 25

Low pressure system for gearbox type GBA25 with high pressure braking unit

Legend (Fig. 26)

A Gearbox/Powershift module assembly
B Centre housing
C Low pressure main supply (21 bar)
E Unit housing the control:
- for the Power Shuttle
- for the Dynashift module
- for the multiplier module

F Main accumulator
K Filter
L Low pressure supply (21 bar) for the Powershift module and the Power Shuttle
N Range 1 and 2 solenoid valves
O Range 3 and 4 solenoid valves
P High-pressure braking unit
Q Accumulator

Specifications of accumulators F and Q

- Main low pressure accumulator F
  - Brand: HYDAC
  - Type: 1/20
  - Capacity: 1 l
  - Gas: Nitrogen
  - Inflation pressure: 8 to 10 bar

  IMPORTANT: *The pressure should be checked every six months, with the engine stopped.*
- Accumulator Q for high-pressure braking unit
  - Brand: HYDAC
  - Type: SBO210
  - Capacity: 1.4 l
  - Gas: Nitrogen
  - Inflation pressure: 53 to 56 bar

  IMPORTANT: *The pressure should be checked every six months, with the engine stopped.*

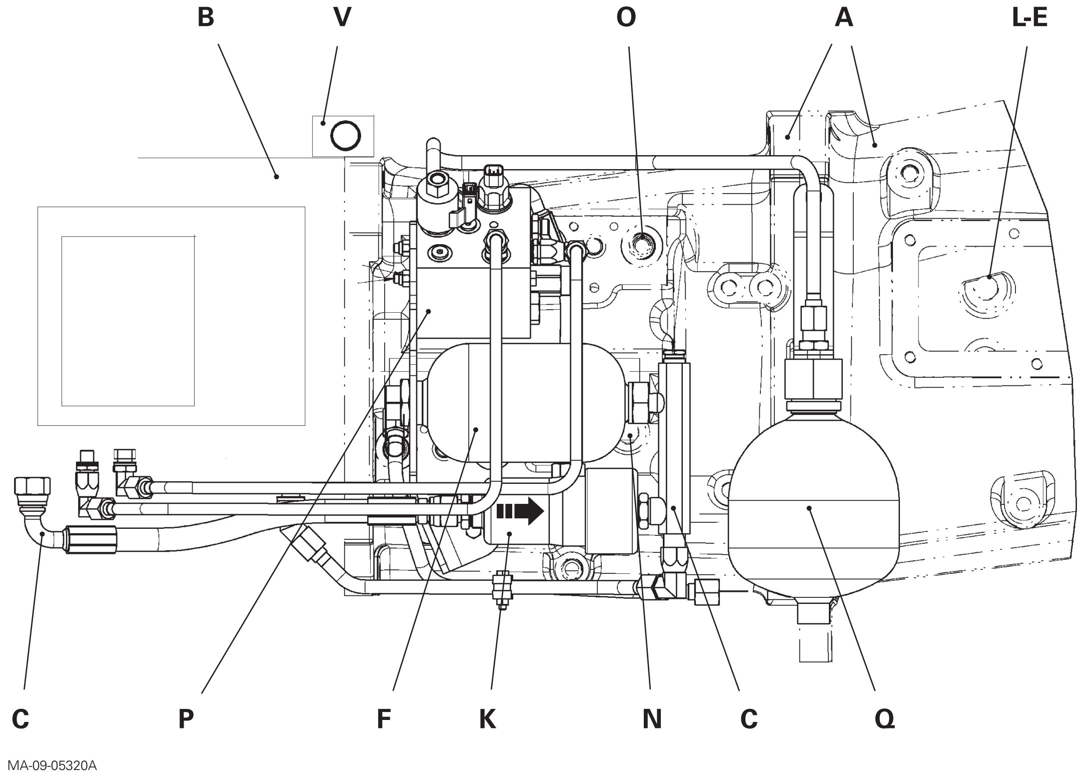

Fig. 26

G . Thermo valve

Legend (Fig. 27)

(1) Thermo valve
E Lubrication system oil inlet
R Routing of oil to the cooler
S Oil outlet to hydraulic components for lubrication

1 Routing of oil being heated (E to S)

2 Routing of hot oil (E to R)

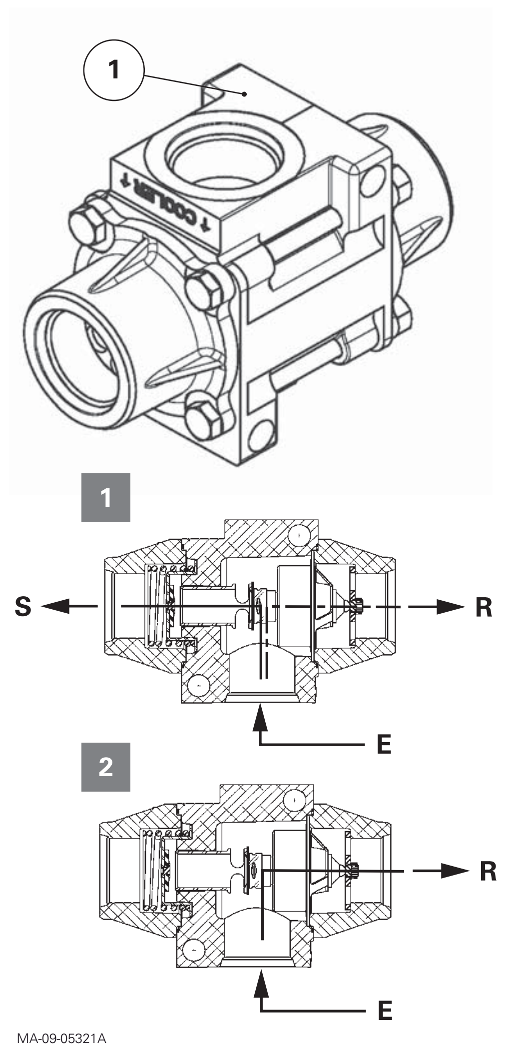

Fig. 27

H . Rear axle lubrication system

Rear axle GPA20

The GPA20 rear axle may be fitted with a gearbox type GBA20 or a gearbox type GBA25.

Legend (Fig. 28, Fig. 29)

A Trumpet housing lubrication
C Valve
D General lubrication
E PTO clutch lubrication
F Lubrication of the pinion rear bearing
G Lubrication of the mechanical components of the rear PTO

1 Right-hand trumpet housing

2 Left-hand trumpet housing

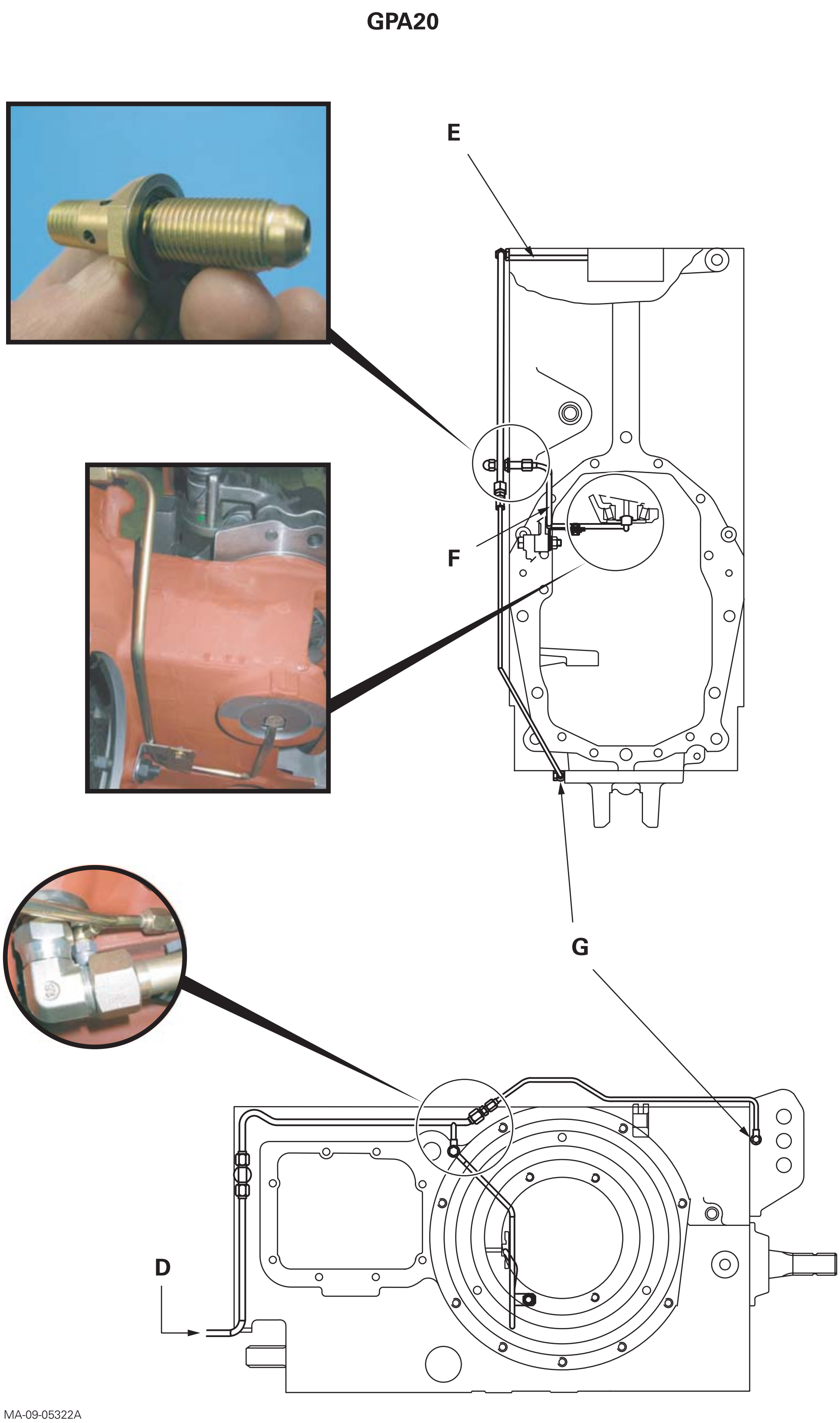

Fig. 28

GPA20

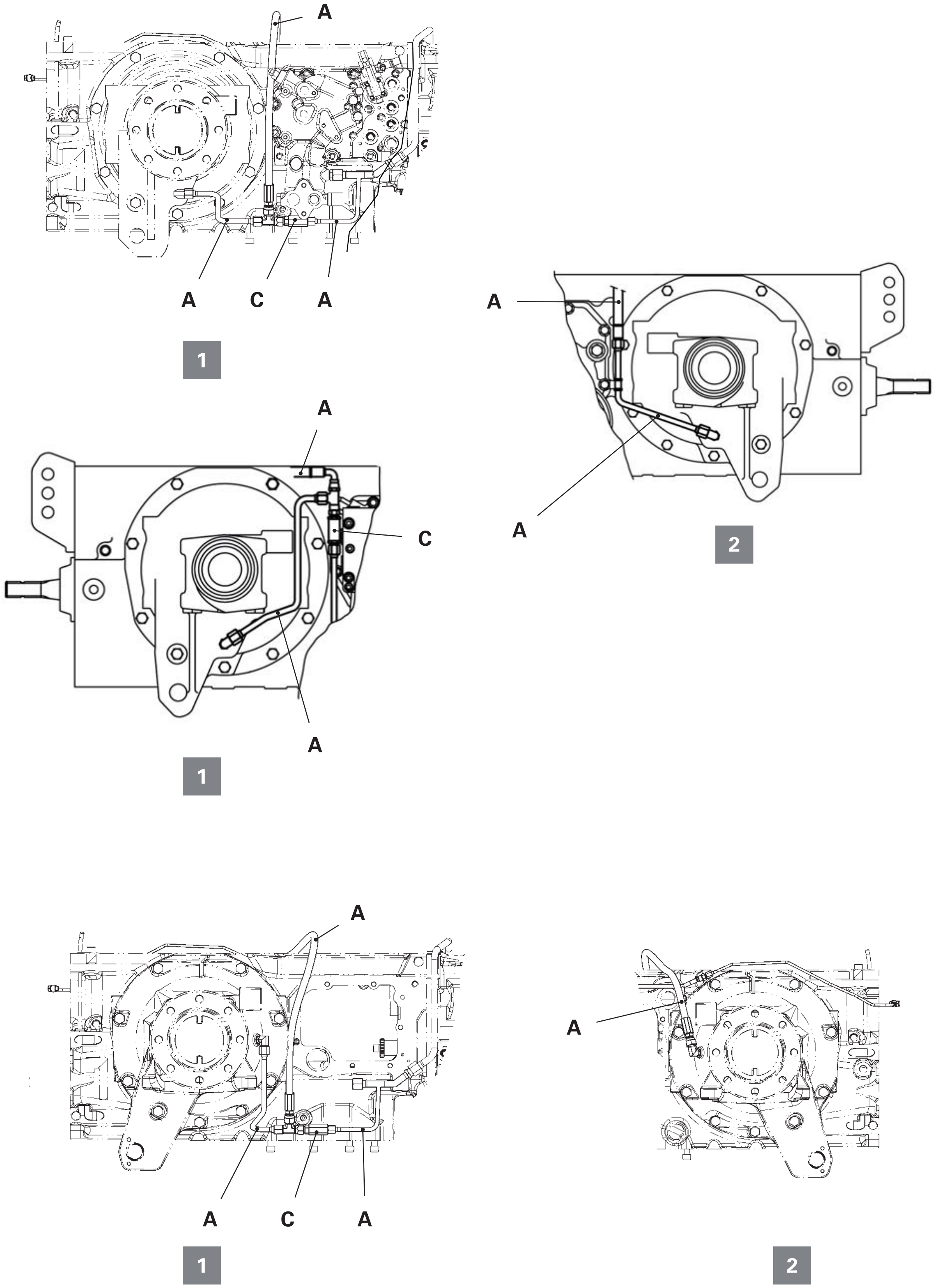

Fig. 29

Rear axle GPA30

The GP30 rear axle is fitted with a gearbox type GBA10 (compulsory).

Legend (Fig. 30)

- A Trumpet housing lubrication
- B Centre housing lubricating manifold
- b Provision for a port (blanked off with a plug)
- C Valve
- D Lubrication pressure coming from the right-hand hydraulic cover plate
- E Lubrication of the hydraulic pump drive gear/bearing
- G Lubrication of the mechanical components of the rear PTO (including clutch)

NOTE 1: *Lubrication of the 4WD unit (if fitted) is provided by a connection fitted in parallel to the lubrication pressure line.*

NOTE 2: *Valve C (Fig. 30) opens at a pressure of 2.8 bar to lubricate the main brakes and the final drive of each trumpet housing.*
Lubrication of the bearing/drive gear of the pumps and the mechanical components of the rear PTO is direct. It does not pass through valve C.

GPA30

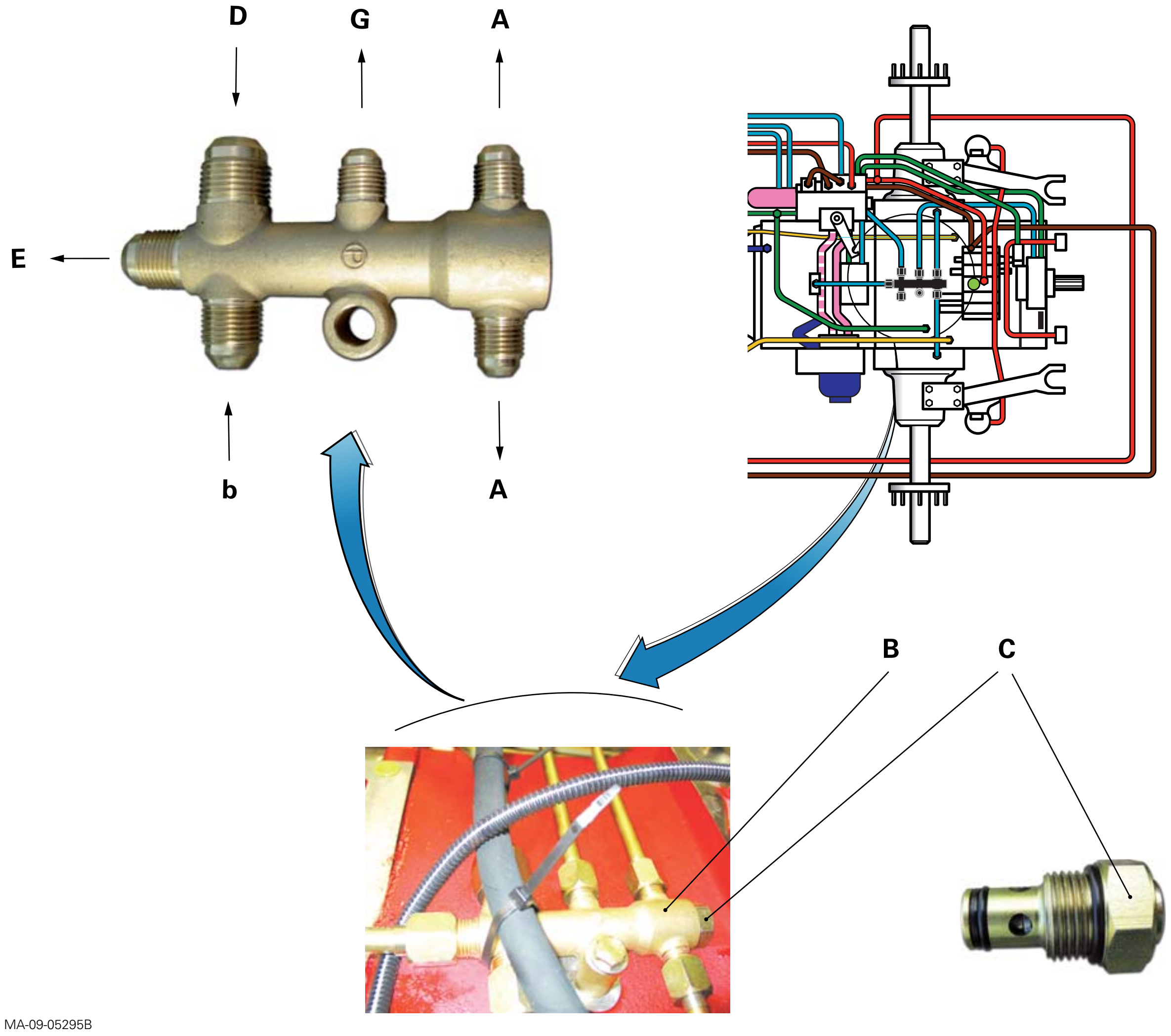

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Fig. 30

Rear axle GPA40 (Fig. 31)

The GPA40 rear axle may be fitted with a gearbox type GBA10 or a gearbox type GBA15.

Legend (Fig. 31)

1 GPA40 rear axle and GBA10 gearbox

2 GPA40 rear axle and GBA15 gearbox

A Trumpet housing lubrication
B Centre housing lubricating manifold
C Valve
D General lubrication
E PTO clutch lubrication
F Lubrication of the pinion bearings and the hand brake mechanism
G Lubrication of the mechanical components of the rear PTO
H Left and right brake pipes

Details of components C, E and H

Lubrication of the PTO clutch and the 4WD mechanism

The lubrication of the PTO clutch and 4WD mechanism is directly linked via the manifold to the main supply.

The pressurised oil passes through unions calibrated differently depending on the functions they serve.

Valve C

Valve C (Fig. 31) opens at a pressure of 2 to 2.2 bar to supply the following functions:

- trumpet housings (brake disc cooling)
- hand brake
- rear PTO

Tractor brake pipes

The brake pipes for (40 kph) tractors fitted with a GTA1040 or GTA1540 transmission are connected to the brake master cylinders.

The brake pipes for (50 kph) tractors fitted with a GTA1540 transmission are connected to the unit/valves that take the place of the brake master cylinders.

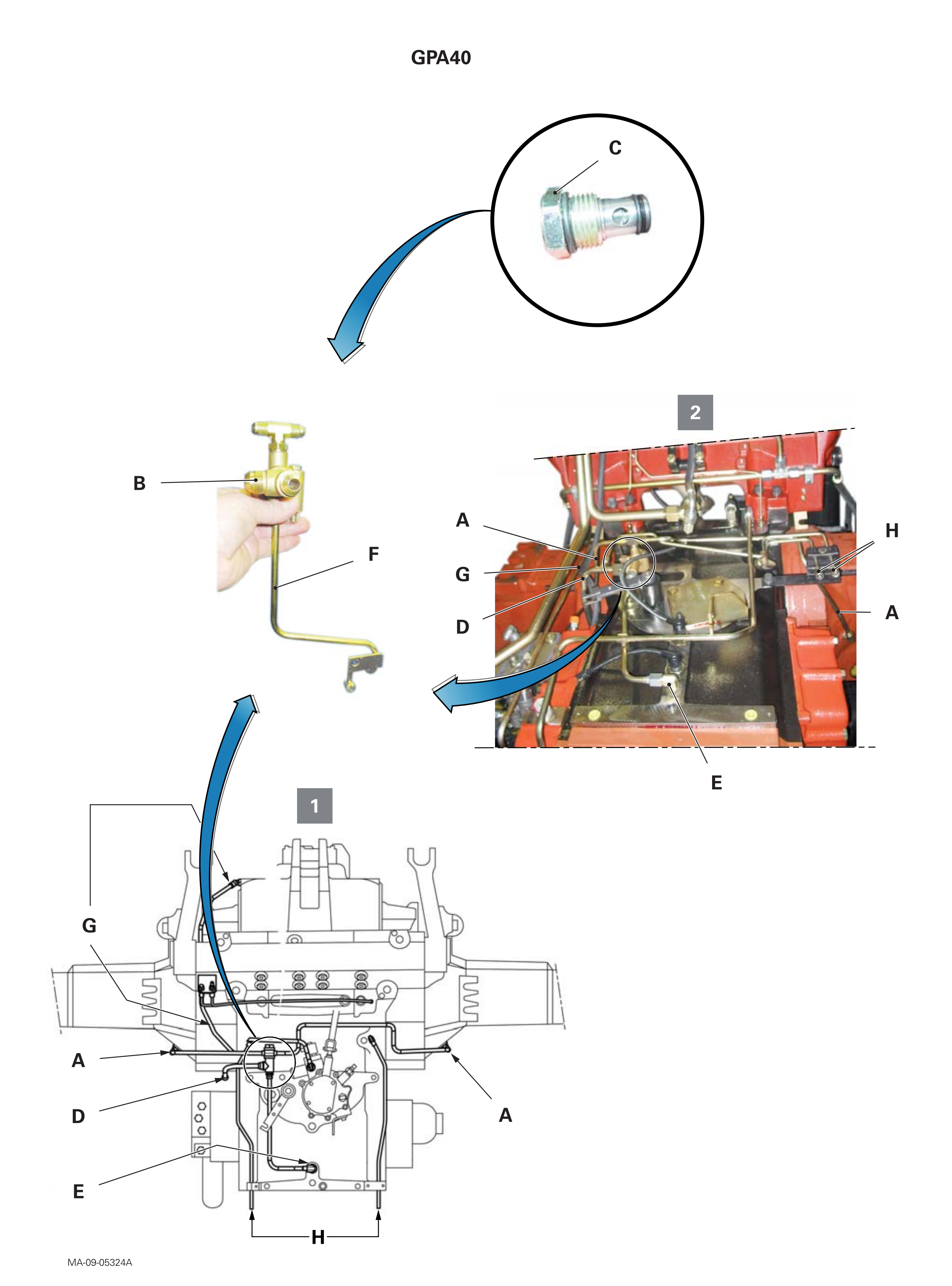

Fig. 31

I . Layout of the main components with diagrams of the low and high pressure systems

Tractors fitted with GTA1030 transmission

Parts list (Fig. 32, Fig. 33)

(1) To front differential lock
(2) Steering ram
(3) Steering spool valve (Orbitrol)
(4) Forward clutch (Power Shuttle)
(5) Reverse clutch (Power Shuttle)
(6) Dynashift
(8) Hare/Tortoise mechanism
(9) To power take-off clutch
(10) Suction strainer (250 µ)
(11) Left-hand hydraulic cover plate
(12) Charge pump
(13) 150 µ suction strainer
(14) Charge pump hydraulic manifold
(15) 4WD clutch
(16) Trumpet housing lubrication
(17) To rear differential lock
(18) Lift rams
(19) Auxiliary spool valves
(20) PTO brake
(21) Cooler
(22) To brake master cylinders
(25) Pressure connector (charge)
(26) Proportional solenoid valves
(27) Hydraulic control unit (Power Shuttle and Dynashift)
(28) Dynashift solenoid valve (clutch A / B)
(29) Dynashift solenoid valve (clutch C / D)
(30) Accumulator
(31) 60 µ filter
(32) Hare/Tortoise solenoid valve
(33) Differential lock solenoid valve
(34) PTO proportional solenoid valve
(35) PTO brake solenoid valve
(36) 4WD solenoid valve (if fitted)
(37) Main filter (15 µ)
(38) Blockage indicator
(39) Variable displacement pump regulator
(40) Low-pressure spool
(41) High-pressure spool
(42) Trailer brake valve (if fitted)
(43) Priority block without trailer braking
(44) Priority block with trailer braking
(45) Right-hand hydraulic cover plate
(46) 22 bar safety valve
(47) Low pressure switch
(48) Lubrication switch
(49) Variable displacement pump
(50) 5 bar safety valve
(51) Pressure relief valve
(52) Left and right brakes
(53) Trailer brake connector
(54) Linkage spool valve
(55) Braking assistance accumulator
(56) Mechanically operated auxiliary spool valves
(57) Hydraulic unit (suspended front axle)
(58) FTE valve
(66) Lubrication pump (Power Shuttle)
(67) 13 bar valve
(68) Steering priority spool

Legend

High pressure
Low pressure
Lubrication
Suction
Return
Brake cone
Control
Charge
Re-supply to variable displacement pump (slave devices not used).

1 Tractors fitted with trailer brake mechanism
2 Tractors not fitted with trailer brake mechanism

F1 Action on left-hand brake
F2 Action on right-hand brake
F3 Pedals locked together for tractor and trailer braking (if trailer hitched): action on F1 and F2 at the same time
F Lubrication of the 4WD clutch
G Lubrication of the hydraulic pump drive gears/bearing
H Lubrication of the mechanical components of the rear PTO
I Trumpet housing lubrication
L Lubrication of the Power Shuttle

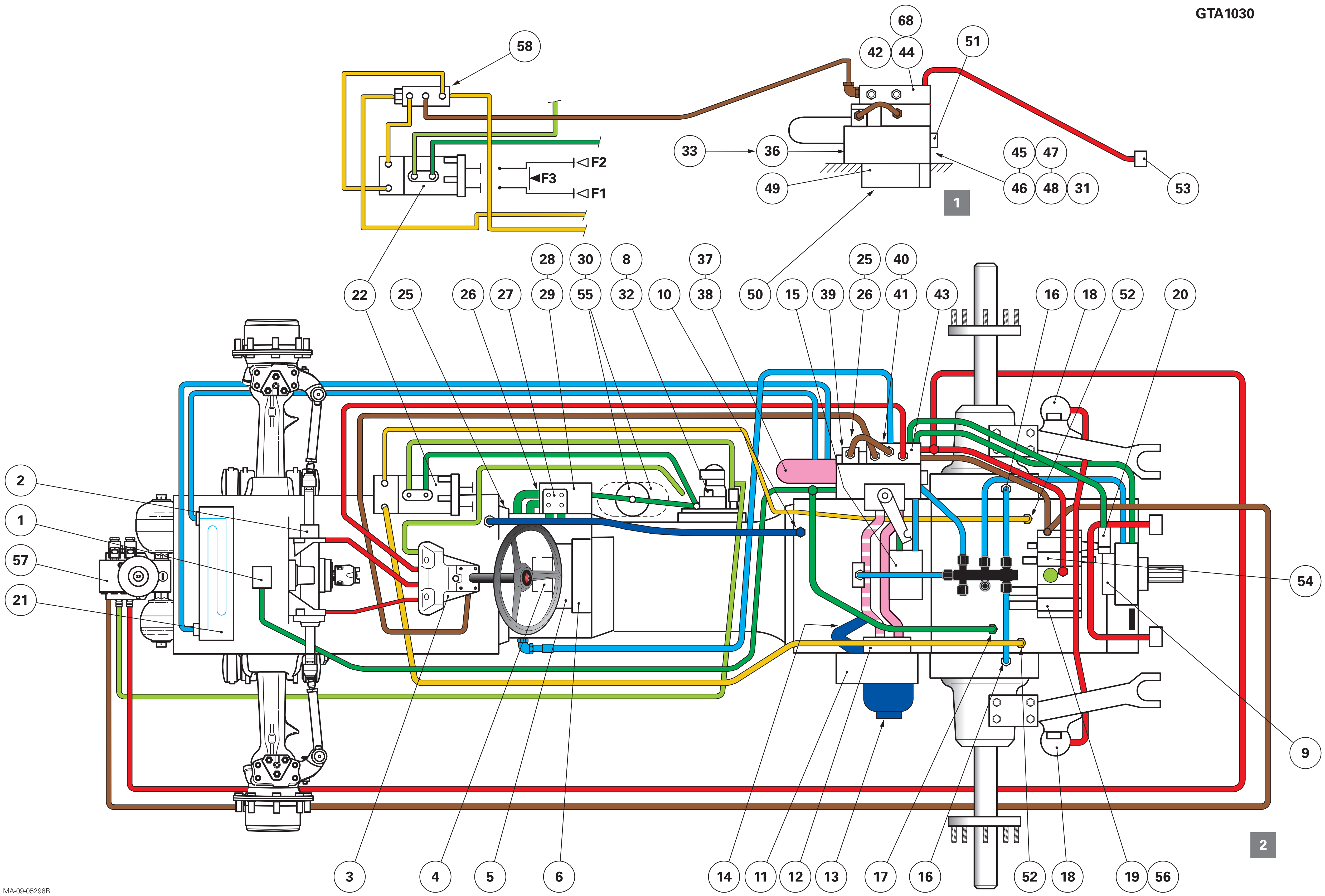
GTA1030
58
68
42
44
51
33
36
49
45
47
46
48
31
53
F2
F3
F1
1
28
30
8
37
25
40
22
25
26
27
29
55
32
10
38
50
15
39
26
41
43
16
18
52
20
2
1
57
21
54
9
2
3
4
5
6
14
11
12
13
17
16
52
18
19
56
MA-09-05296B

Fig. 32

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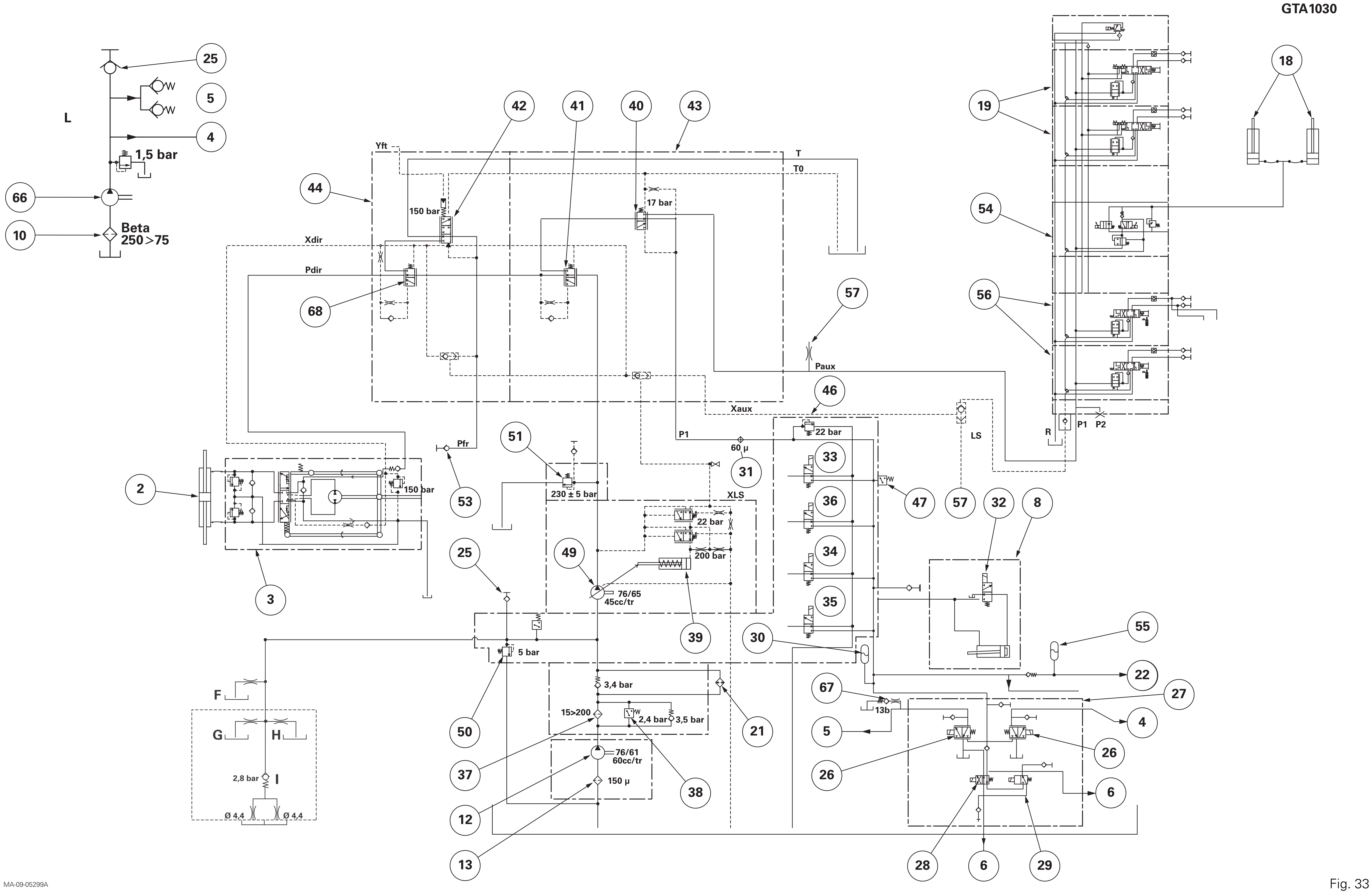
GTA1030
L
1,5 bar
Beta
250>75
Yft
T
T0
150 bar
17 bar
Xdir
Pdir
Paux
Xaux
P1
60 µ
22 bar
LS
R
P1
P2
Pfr
230 ± 5 bar
150 bar
XLS
22 bar
200 bar
76/65
45cc/tr
5 bar
3,4 bar
15>200
2,4 bar
3,5 bar
76/61
60cc/tr
150 µ
13b
F
G
H
2,8 bar
I
Ø 4,4
Ø 4,4
MA-09-05299A

Fig. 33

Tractors fitted with GTA1040 transmission

Parts list (Fig. 34, Fig. 35)

(1) To front differential lock
(2) Steering ram
(3) Steering spool valve (Orbitrol)
(4) Forward clutch (Power Shuttle)
(5) Reverse clutch (Power Shuttle)
(6) Dynashift
(8) Hare/Tortoise mechanism
(9) To power take-off clutch
(10) Suction strainer (250 µ)
(11) Left-hand hydraulic cover plate
(12) Charge pump
(13) 150 µ suction strainer
(14) Charge pump hydraulic manifold
(15) 4WD clutch
(16) Trumpet housing lubrication
(17) To rear differential lock
(18) Lift rams
(19) Auxiliary spool valves
(20) PTO brake
(21) Cooler
(22) To brake master cylinders
(25) Pressure connector (charge)
(26) Proportional solenoid valves
(27) Hydraulic control unit (Power Shuttle and Dynashift)
(28) Dynashift solenoid valve (clutch A / B)
(29) Dynashift solenoid valve (clutch C / D)
(30) Accumulator
(31) 60 µ filter
(32) Hare/Tortoise solenoid valve
(33) Differential lock solenoid valve
(34) PTO proportional solenoid valve
(35) PTO brake solenoid valve
(36) 4WD solenoid valve (if fitted)
(37) Main filter (15 µ)
(38) Blockage indicator
(39) Variable displacement pump regulator
(40) Low-pressure spool
(41) High-pressure spool
(42) Trailer brake valve (if fitted)
(43) Priority block without trailer braking
(44) Priority block with trailer braking
(45) Right-hand hydraulic cover plate
(46) 24 bar safety valve
(47) Low pressure switch
(48) Lubrication switch
(49) Variable displacement pump
(50) 5 bar safety valve
(51) Pressure relief valve
(52) Left and right brakes
(53) Trailer brake connector
(54) Linkage spool valve
(55) Braking assistance accumulator
(56) Mechanically operated auxiliary spool valves
(57) Hydraulic unit (suspended front axle)
(58) FTE valve
(59) ParkLock (optional)
(66) Lubrication pump (Power Shuttle)
(68) Steering priority spool
(69) Cooling system with thermo valve

Legend

- High pressure
- Low pressure
- Lubrication
- Suction
- Return
- Brake cone
- Control
- Charge
- Re-supply to variable displacement pump (slave devices not used).

1 Tractors fitted with trailer brake mechanism
2 Tractors not fitted with trailer brake mechanism

F1 Action on left-hand brake
F2 Action on right-hand brake
F3 Pedals locked together for tractor and trailer braking (if trailer hitched): action on F1 and F2 at the same time
F Lubrication of the 4WD clutch
H Lubrication of the mechanical components of the rear PTO
I Trumpet housing lubrication
J Gearbox lubrication
L Lubrication of the Power Shuttle

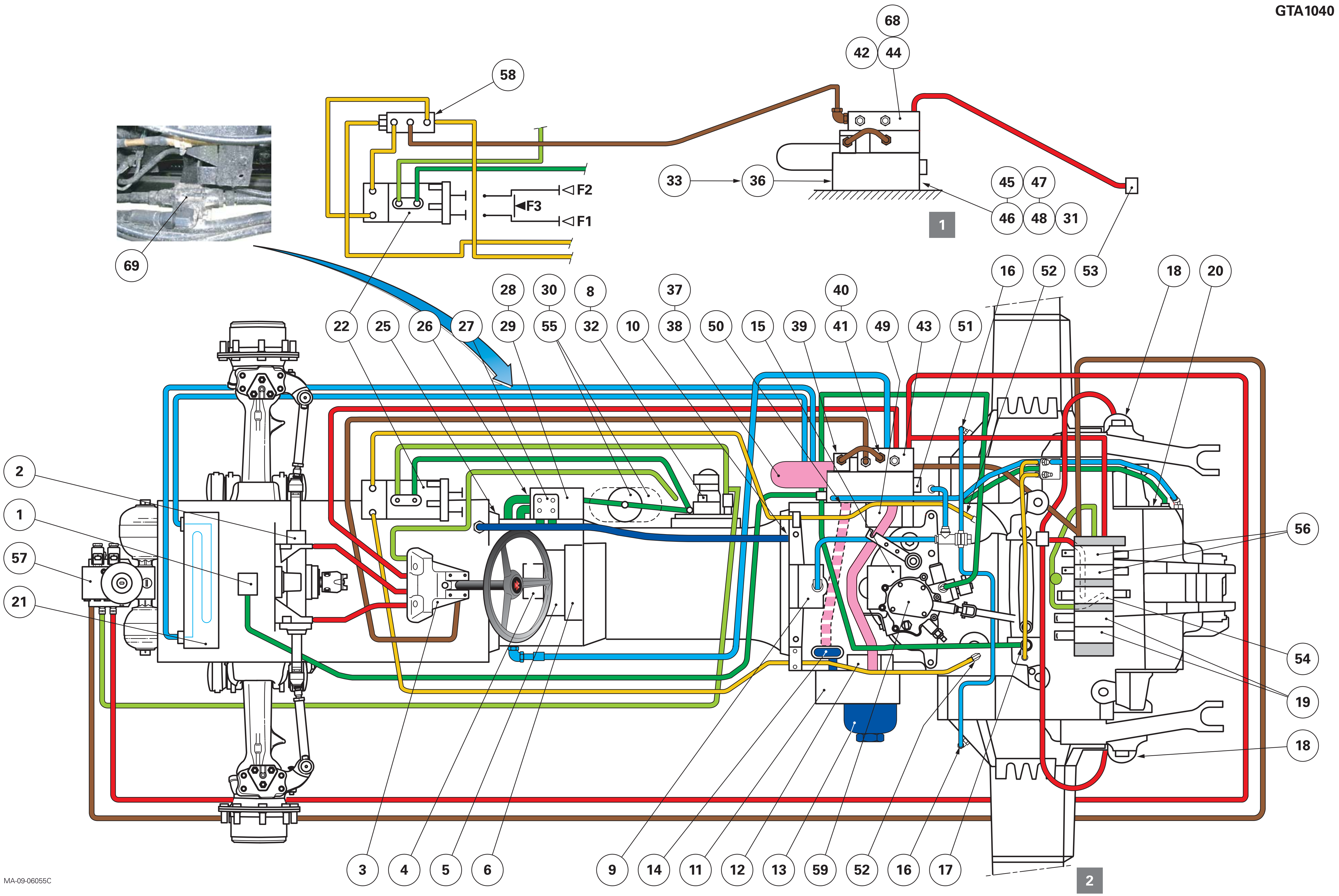
GTA1040
68
42
44
58
33
36
45
47
46
48
31
F2
F3
F1
1
69
16
52
53
18
20
28
30
8
37
40
22
25
26
27
29
55
32
10
38
50
15
39
41
49
43
51
2
1
57
21
56
54
19
18
3
4
5
6
9
14
11
12
13
59
52
16
17
2
MA-09-06055C

Fig. 34

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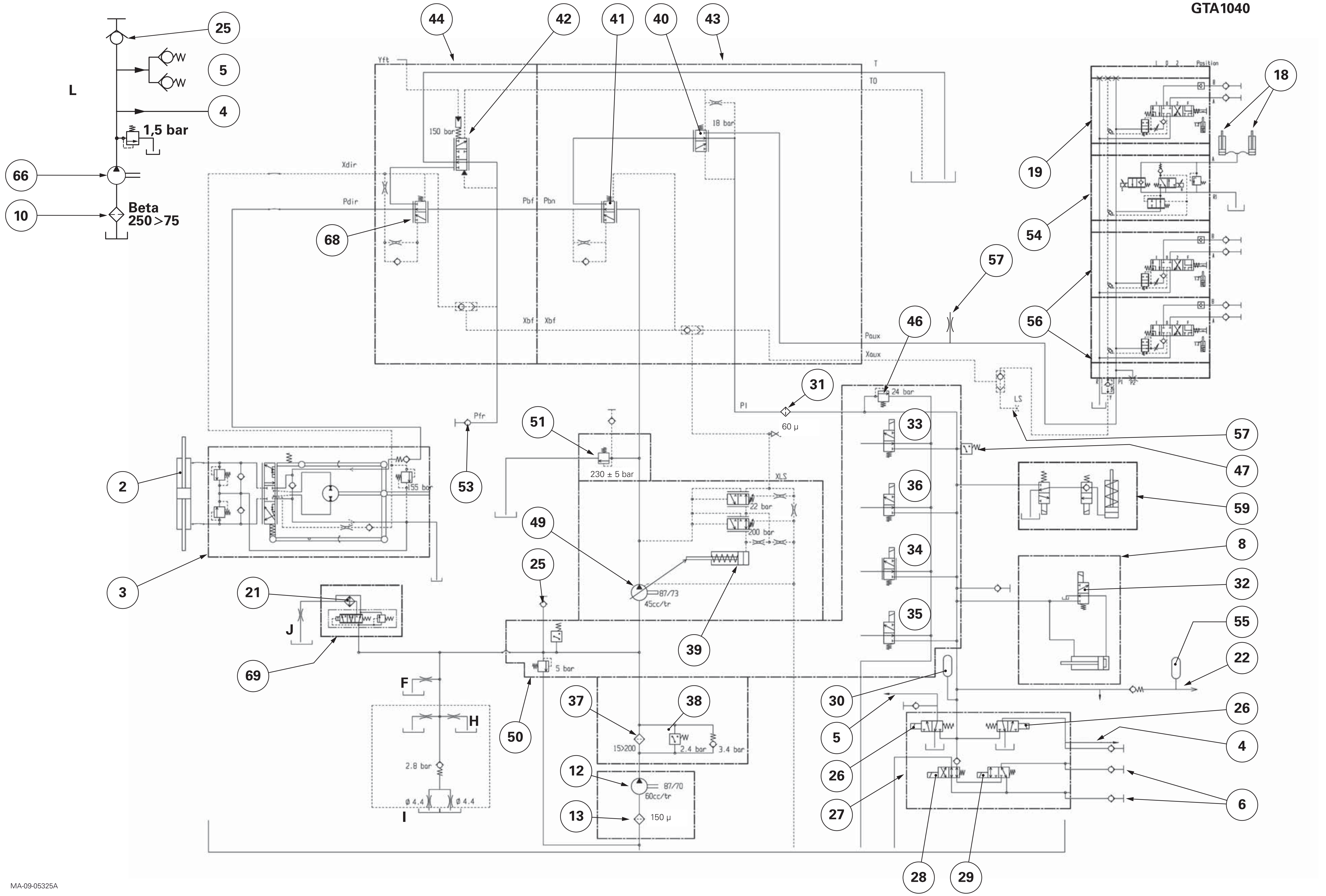
GTA1040
L
1,5 bar
Beta
250>75
150 bar
18 bar
Yft
T
TO
Xdir
Pdir
Pbf
Pbn
Xbf
Xbf
Paux
Xaux
Pl
60 µ
24 bar
LS
Pfr
230 ± 5 bar
55 bar
XLS
22 bar
200 bar
87/73
45cc/tr
5 bar
F
H
2.8 bar
ø 4.4
ø 4.4
I
J
15>200
2.4 bar
3.4 bar
87/70
60cc/tr
150 µ
MA-09-05325A

Fig. 35

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Tractors fitted with GTA1540 transmission (40 kph)

Parts list (Fig. 36, Fig. 37)

(1) To front differential lock
(2) Steering ram
(3) Steering spool valve (Orbitrol)
(4) Power Shuttle (forward clutch)
(5) Power Shuttle (reverse clutch)
(6) Powershift module
(7) Brake master cylinder reservoir
(9) To power take-off clutch
(11) Left-hand hydraulic cover plate
(12) Charge pump
(13) 150 μ suction strainer
(14) Charge pump hydraulic manifold
(15) 4WD clutch
(16) Trumpet housing lubrication
(17) To rear differential lock
(18) Lift rams
(19) Auxiliary spool valves
(20) PTO brake
(21) Oil cooler
(22) To brake master cylinders
(23) EV1 solenoid valve (L52)
(24) EV2 solenoid valve (L53)
(25) EV3 solenoid valve (L54)
(26) EV4 solenoid valve (L55)
(30) Accumulator
(31) 60 μ filter
(32) To front PTO (if fitted)
(33) Differential lock solenoid valve
(34) PTO proportional solenoid valve
(35) PTO brake solenoid valve
(36) 4WD solenoid valve (if fitted)
(37) Main filter (15 μ)
(38) Blockage indicator
(39) Pump regulator
(40) Low-pressure spool
(41) High-pressure spool
(42) Trailer brake valve (if fitted)
(43) Priority block without trailer braking
(44) Priority block with trailer braking
(45) Right-hand hydraulic cover plate
(46) 24 bar safety valve
(47) Low pressure switch
(48) Lubrication switch
(49) Variable displacement pump
(50) 5 bar safety valve
(51) Pressure relief valve
(52) Left and right brakes
(53) Trailer brake connector
(54) Linkage spool valve
(55) Braking assistance accumulator
(56) Mechanically operated auxiliary spool valves
(57) To hydraulic suspension unit (DANA front axle)
(58) FTE valve
(59) ParkLock (optional)
(68) Steering priority spool
(69) Cooling system with thermo valve
(70) Cooling system without thermo valve
(72) Hoses to suspension ram small and large hydraulic chambers
(73) Lock or suspension solenoid valve
(74) Lifting and lowering solenoid valves
(75) Suspension ram with two hydraulic chambers
(76) Accumulator (210 bar)
(77) Proportional solenoid valves for Dynashift and multiplier modules
(78) Parker valve
(79) Power Shuttle and Powershift module hydraulic control unit
(80) Power Shuttle proportional solenoid valves
(81) Hydraulic pressure connectors for multiplier module and Power Shuttle
(82) Non-return valve
(83) Limit switch (ranges 1 to 4)

Legend

- High pressure
- Low pressure
- Lubrication
- Suction
- Return
- Brake cone
- Control
- Charge
- Re-supply to variable displacement pump (slave devices not used).

1 Tractors fitted with trailer brake mechanism
2 Tractors not fitted with trailer brake mechanism

F1 Action on left-hand brake
F2 Action on right-hand brake
F3 Pedals locked together for tractor and trailer braking (if trailer hitched): action on F1 and F2 at the same time
H Lubrication of the mechanical components of the rear PTO
I Trumpet housing lubrication
J Gearbox lubrication
J1 Powershift module lubrication
K Lubrication of hand brake discs

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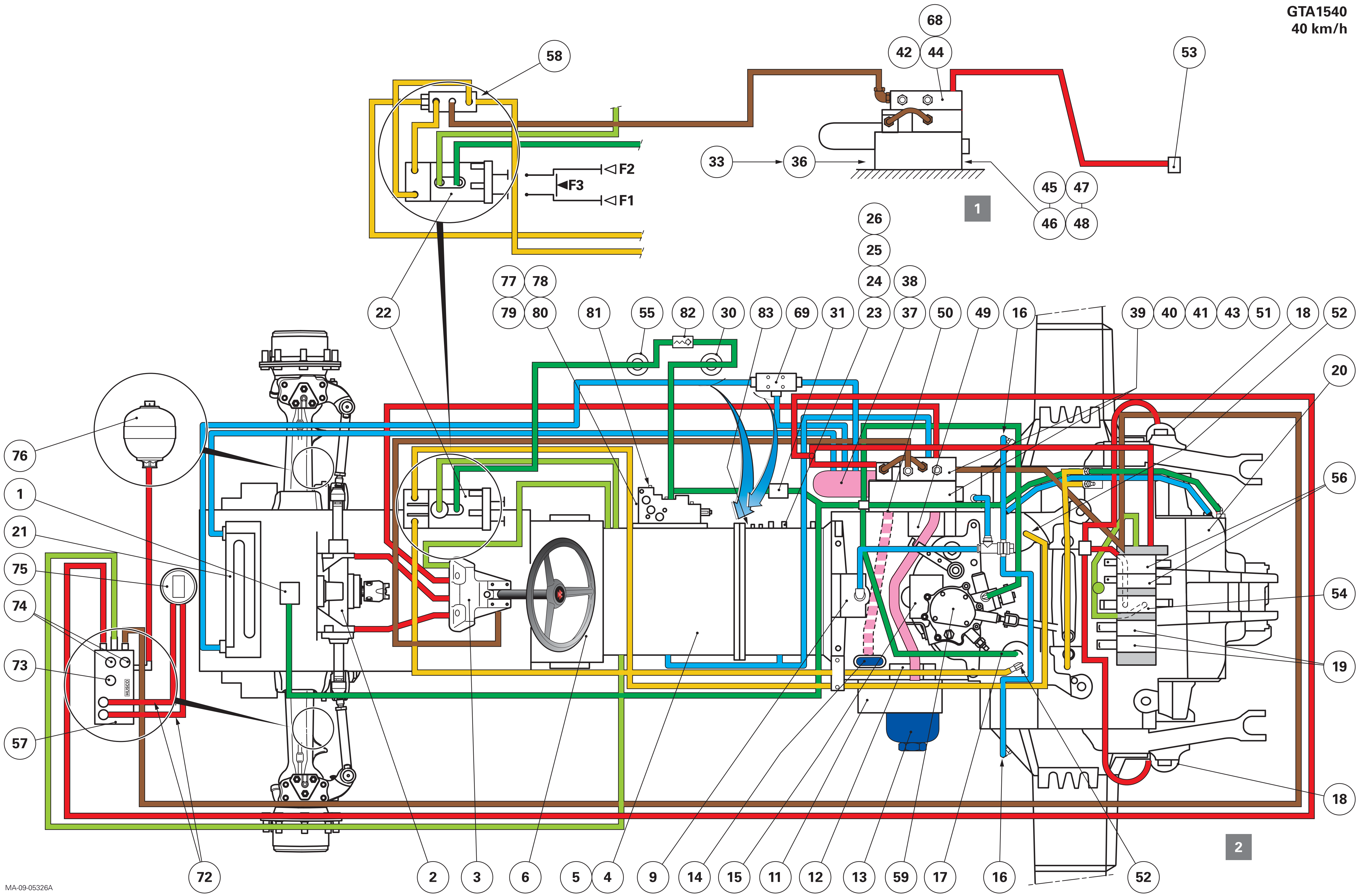
GTA1540
40 km/h
58
68
42
44
53
F2
F3
F1
33
36
45
47
46
48
1
26
25
24
38
77
78
22
79
80
81
55
82
30
83
69
31
23
37
50
49
16
39
40
41
43
51
18
52
20
56
76
1
21
75
74
73
57
54
19
18
2
72
2
3
6
5
4
9
14
15
11
12
13
59
17
16
52
MA-09-05326A

Fig. 36

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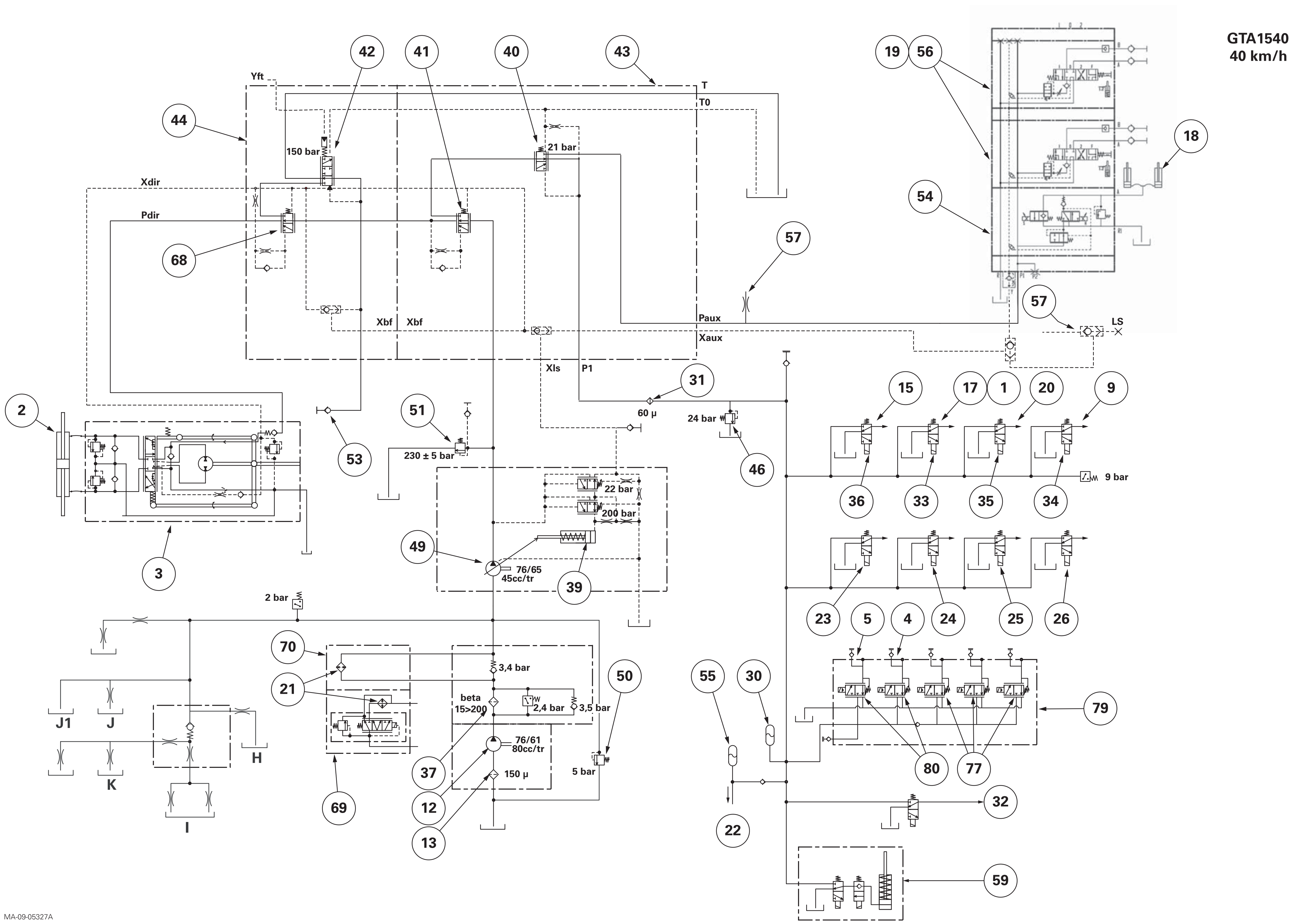
GTA1540
40 km/h
42
41
40
43
19
56
44
Yft
T
T0
150 bar
21 bar
Xdir
Pdir
18
54
68
57
Xbf
Xbf
Paux
57
LS
Xaux
Xls
P1
2
31
51
60 µ
24 bar
15
17
1
20
9
230 ± 5 bar
53
46
22 bar
200 bar
9 bar
36
33
35
34
3
49
76/65
45cc/tr
39
2 bar
23
5
4
24
25
26
70
3,4 bar
50
55
30
21
beta
15>200
2,4 bar
3,5 bar
79
J1
J
H
76/61
80cc/tr
5 bar
80
77
K
37
150 µ
12
32
I
69
13
22
59
MA-09-05327A

Fig. 37

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Tractors fitted with GTA1540 transmission and high pressure (HP) braking

Parts list (Fig. 38, Fig. 39)

(1) To front differential lock
(2) Steering ram
(3) Steering spool valve (Orbitrol)
(4) Power Shuttle (forward clutch)
(5) Power Shuttle (reverse clutch)
(6) Powershift module
(9) To power take-off clutch
(11) Left-hand hydraulic cover plate
(12) Charge pump
(13) 150 μ suction strainer
(14) Charge pump hydraulic manifold
(15) 4WD clutch
(16) Trumpet housing lubrication
(17) To rear differential lock
(18) Lift rams
(19) Auxiliary spool valves
(20) PTO brake
(21) Oil cooler
(23) EV1 solenoid valve (L52)
(24) EV2 solenoid valve (L53)
(25) EV3 solenoid valve (L54)
(26) EV4 solenoid valve (L55)
(30) Accumulator
(31) 60 μ filter
(33) Differential lock solenoid valve
(34) PTO proportional solenoid valve
(35) PTO brake solenoid valve
(36) 4WD solenoid valve (if fitted)
(37) Main filter (15 μ)
(38) Blockage indicator
(39) Pump regulator
(40) Low-pressure spool
(41) High-pressure spool
(42) Trailer brake valve (if fitted)
(43) Priority block without trailer braking
(44) Priority block with trailer braking
(45) Right-hand hydraulic cover plate
(46) 24 bar safety valve
(47) Low pressure switch
(48) Lubrication switch
(49) Variable displacement pump
(50) 5 bar safety valve
(51) Pressure relief valve
(52) Left and right brakes
(53) Trailer brake connector
(54) Linkage spool valve
(56) Mechanically operated auxiliary spool valves
(57) To hydraulic suspension unit (DANA front axle)
(59) ParkLock (optional)
(68) Steering priority spool
(69) Cooling system with thermo valve
(70) Cooling system without thermo valve
(72) Hoses to suspension ram small and large hydraulic chambers
(73) Lock or suspension solenoid valve
(74) Lifting and lowering solenoid valves
(75) Suspension ram with two hydraulic chambers
(76) Accumulator (210 bar)
(77) Proportional solenoid valves for Dynashift and multiplier modules
(78) Parker valve
(79) Power Shuttle and Powershift module hydraulic control unit
(80) Power Shuttle proportional solenoid valves
(81) Hydraulic pressure connectors for multiplier module and Power Shuttle
(83) Limit switch (ranges 1 to 4)
(85) High pressure brake valves/unit assembly
(87) Accumulator (210 bar)
(88) Non-return valve
(89) Drain screw
(90) Pressure relief valve
(91) Filter (25 μ)
(92) High-pressure braking unit
(93) Solenoid valve (0/12 volts)

Legend

- High pressure
- Low pressure
- Lubrication
- Suction
- Return
- Brake cone
- Control
- Charge
- Re-supply to variable displacement pump (slave devices not used).

1 Tractors fitted with trailer brake mechanism

__Note:__ On tractors not fitted with the trailer brake mechanism, the pipes (T) and the connector (53) are not fitted.

F1 Action on left-hand brake
F2 Action on right-hand brake
F3 Pedals locked together for tractor and trailer braking (if trailer hitched): action on F1 and F2 at the same time
H Lubrication of the mechanical components of the rear PTO
I Trumpet housing lubrication
J Gearbox lubrication
J1 Powershift module lubrication
K Lubrication of hand brake discs

__Important:__ The letters B, J, O, R and V correspond to the colour marks (rings) used to identify the hydraulic pipes located to the right of the cab and their routing between the cab and the transmission.

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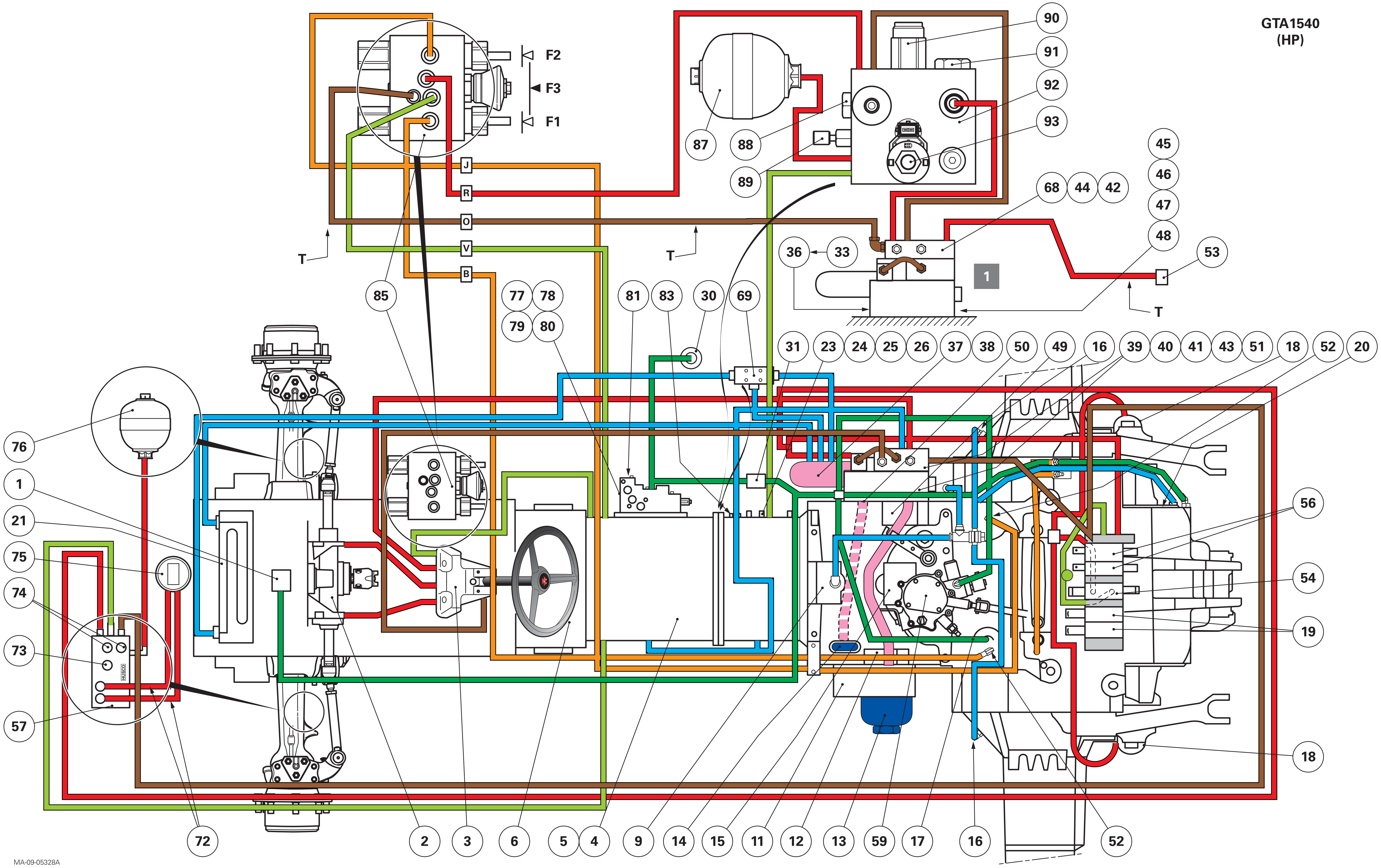
GTA1540
(HP)
F2
F3
F1
J
R
O
V
B
T
T
T
1
90
91
92
93
87
88
89
45
46
47
48
68
44
42
36
33
53
85
77
78
79
80
81
83
30
69
31
23
24
25
26
37
38
50
49
16
39
40
41
43
51
18
52
20
76
1
21
75
74
73
57
56
54
19
18
72
2
3
6
5
4
9
14
15
11
12
13
59
17
16
52
MA-09-05328A

Fig. 38

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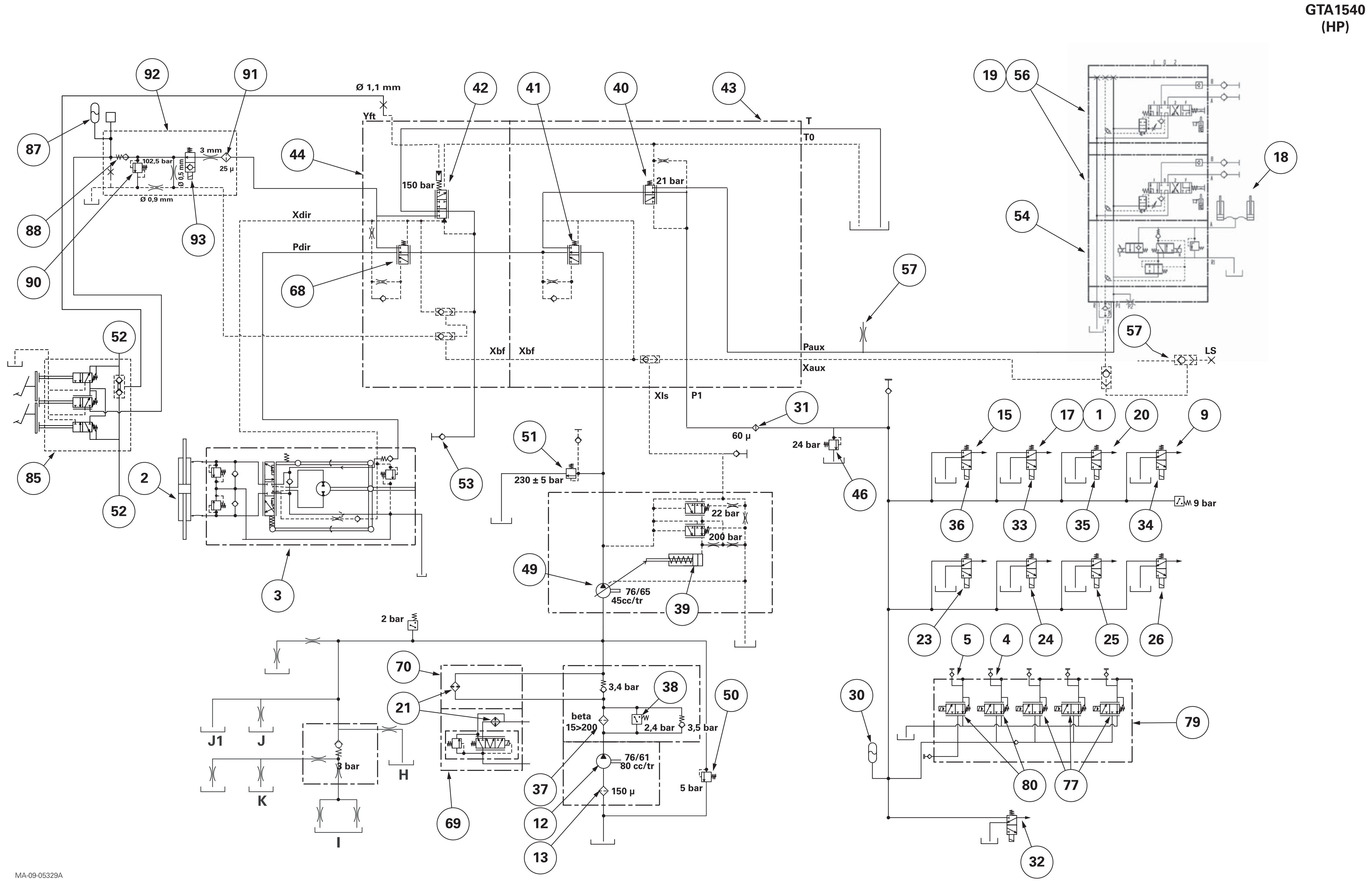
GTA1540
(HP)
Ø 1,1 mm
Yft
T
T0
3 mm
25 µ
102,5 bar
Ø 0,5 mm
Ø 0,9 mm
150 bar
21 bar
Xdir
Pdir
Xbf
Xbf
Paux
Xaux
LS
Xls
P1
60 µ
24 bar
230 ± 5 bar
22 bar
200 bar
76/65
45cc/tr
9 bar
2 bar
3,4 bar
beta
15>200
2,4 bar
3,5 bar
76/61
80 cc/tr
150 µ
5 bar
3 bar
J1
J
K
H
I
MA-09-05329A

Fig. 39

Tractors fitted with GTA2020 transmission

Parts list (Fig. 40, Fig. 41)

(1) To front differential lock
(2) Steering ram
(3) Steering spool valve (Orbitrol)
(4) Forward clutch (Power Shuttle)
(5) Reverse clutch (Power Shuttle)
(6) Dynashift
(7) 1.5 bar valve
(8) Hare/Tortoise mechanism
(9) To power take-off clutch
(10) Suction strainer (250 µ)
(11) Left-hand hydraulic cover plate
(12) Charge pump
(13) 150 µ suction strainer
(14) Charge pump hydraulic manifold
(15) 4WD clutch
(16) Trumpet housing lubrication
(17) To rear differential lock
(18) Lift rams
(19) Auxiliary spool valves
(20) PTO brake
(21) Cooler
(22) To brake master cylinders
(25) Pressure connector (charge)
(26) Proportional solenoid valves
(27) Hydraulic control unit (Power Shuttle and Dynashift)
(28) Dynashift solenoid valve - Clutch A/B
(29) Dynashift solenoid valve - Clutch C/D
(30) Accumulator
(31) 60 µ filter
(32) Hare/Tortoise solenoid valve
(33) Differential lock solenoid valve
(34) PTO proportional solenoid valve
(35) PTO brake solenoid valve
(36) 4WD solenoid valve (if fitted)
(37) Main filter (15 µ)
(38) Blockage indicator
(39) Pump regulator
(40) Low-pressure spool
(41) High-pressure spool
(42) Trailer brake valve (if fitted)
(43) Priority block without trailer braking
(44) Priority block with trailer braking
(45) Right-hand hydraulic cover plate
(46) 22 bar safety valve
(47) Low pressure switch
(48) Lubrication switch
(49) Variable displacement pump
(50) 5 bar safety valve
(51) Pressure relief valve
(52) Left and right brakes
(53) Trailer brake connector
(54) Linkage spool valve
(55) Braking assistance accumulator
(56) Mechanically operated auxiliary spool valves
(57) Hydraulic unit (suspended front axle)
(58) FTE valve
(67) 13 bar valve
(68) Steering priority spool
(69) Cooling system with thermo valve (if fitted)

Legend

High pressure
Low pressure
Lubrication
Suction
Return
Brake cone
Control
Charge
Re-supply to variable displacement pump (slave devices not used).

1 Tractors fitted with trailer brake mechanism
2 Tractors not fitted with trailer brake mechanism

F1 Action on left-hand brake
F2 Action on right-hand brake
F3 Pedals locked together for tractor and trailer braking (if trailer hitched): action on F1 and F2 at the same time
H Lubrication of the mechanical components of the rear PTO
H1 PTO clutch lubrication
I Trumpet housing lubrication
J Gearbox lubrication
K Lubrication of the pinion rear bearing
L Lubrication of the Power Shuttle

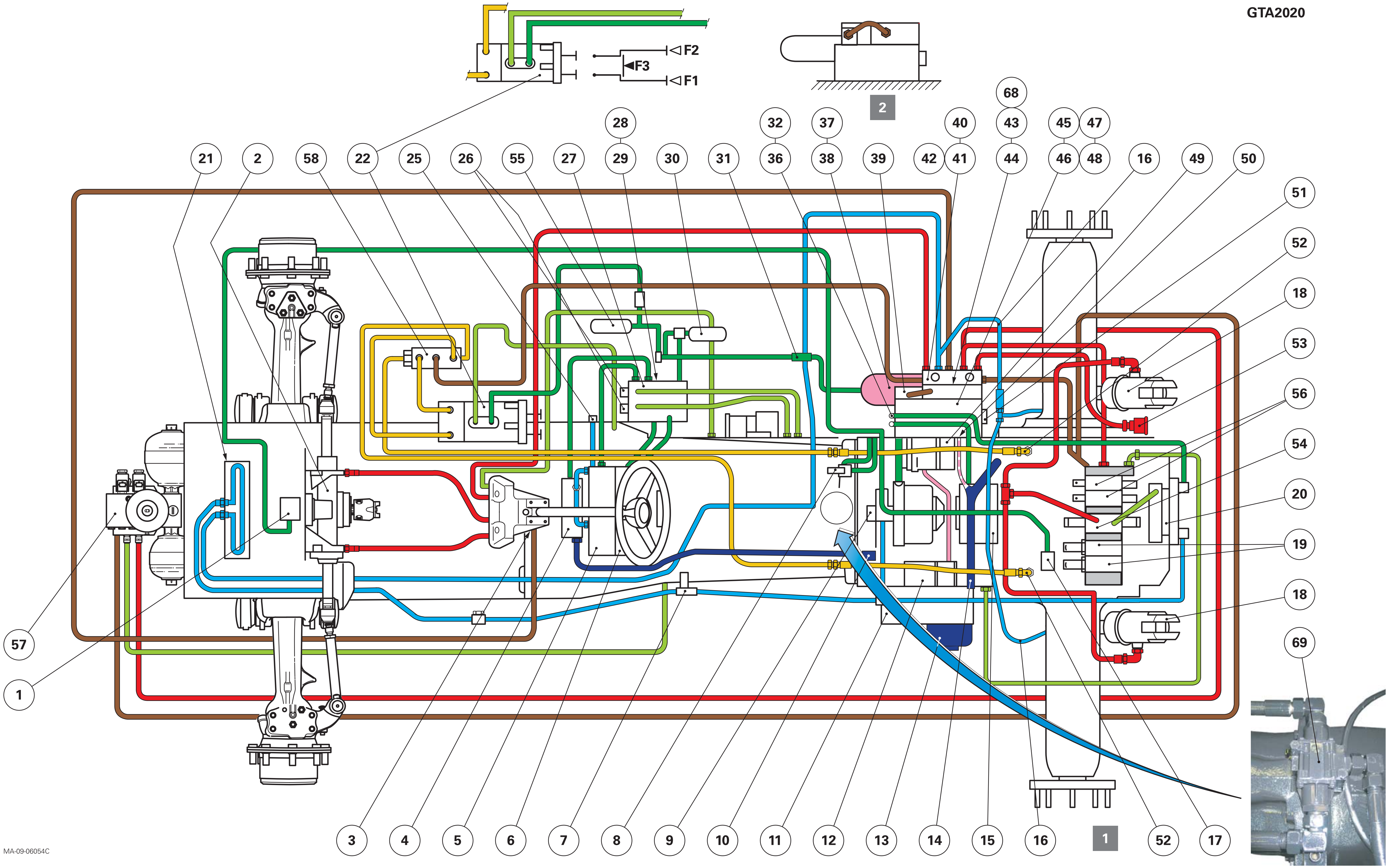
GTA2020
F2
F3
F1
2
68
28 32 37 40 43 45 47
21 2 58 22 25 26 55 27 29 30 31 36 38 39 42 41 44 46 48 16 49 50
51
52
18
53
56
54
20
19
18
69
57
1
3 4 5 6 7 8 9 10 11 12 13 14 15 16 1 52 17
MA-09-06054C

Fig. 40

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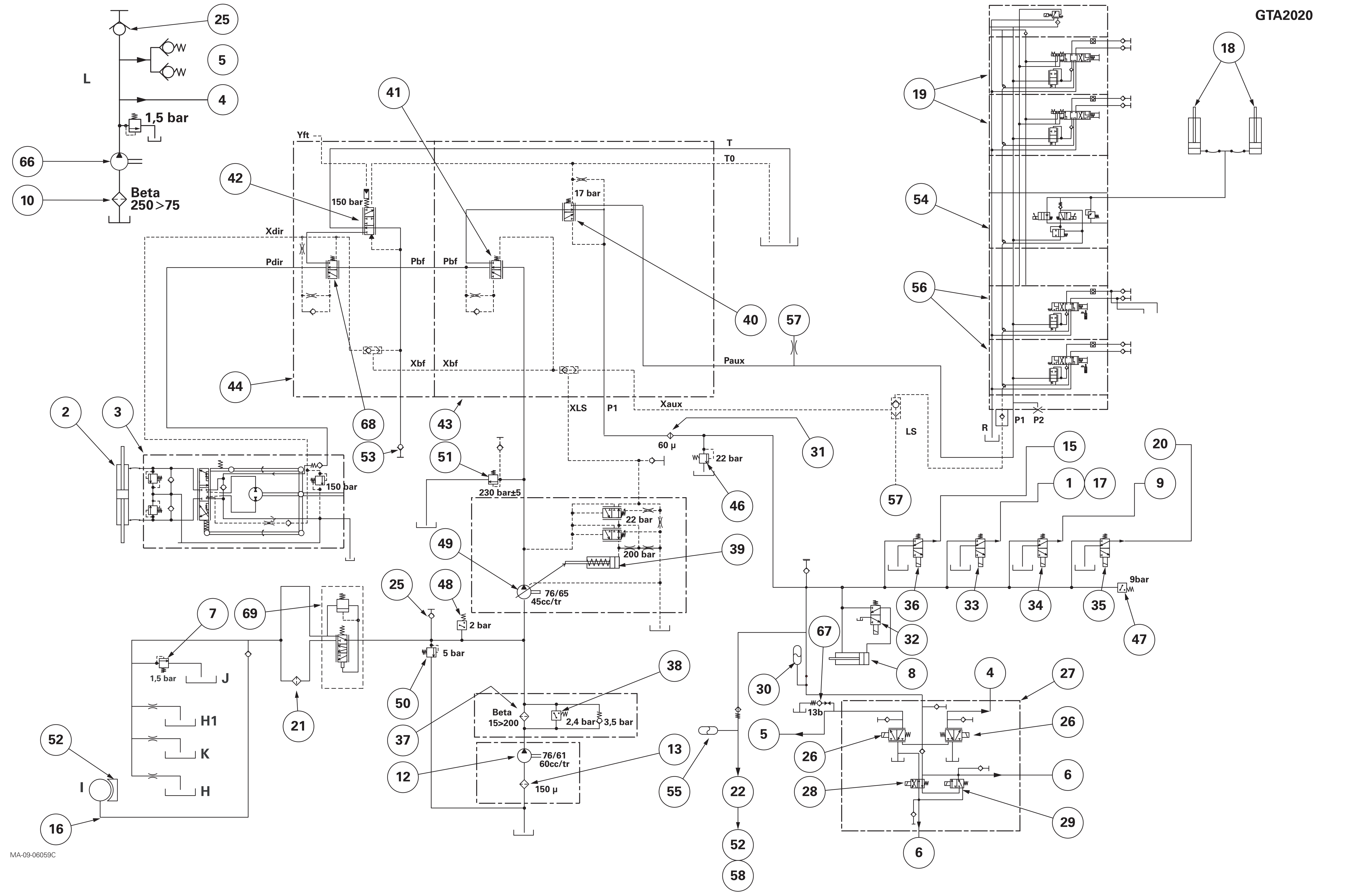
GTA2020
L
1,5 bar
Beta
250>75
Yft
T
T0
150 bar
17 bar
Xdir
Pdir
Pbf
Pbf
Xbf
Xbf
Paux
XLS
P1
Xaux
LS
R
P1
P2
60 µ
22 bar
150 bar
230 bar±5
22 bar
200 bar
76/65
45cc/tr
9bar
2 bar
5 bar
1,5 bar
J
H1
K
H
I
Beta
15>200
2,4 bar
3,5 bar
76/61
60cc/tr
150 µ
13b
MA-09-06059C

Fig. 41

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Tractors fitted with GTA2520 transmission (40 kph)

Parts list (Fig. 42, Fig. 43)

(1) To front differential lock
(2) Steering ram
(3) Steering spool valve (Orbitrol)
(4) Power Shuttle (forward clutch)
(5) Power Shuttle (reverse clutch)
(6) Powershift module
(9) To power take-off clutch
(11) Left-hand hydraulic cover plate
(12) Charge pump
(13) 150 µ suction strainer
(14) Charge pump hydraulic manifold
(15) 4WD clutch
(16) Trumpet housing lubrication
(17) To rear differential lock
(18) Lift rams
(19) Auxiliary spool valves
(20) PTO brake
(21) Oil cooler
(22) To brake master cylinders
(23) EV1 solenoid valve (L52)
(24) EV2 solenoid valve (L53)
(25) EV3 solenoid valve (L54)
(26) EV4 solenoid valve (L55)
(30) Accumulator
(31) 60 µ filter
(33) Differential lock solenoid valve
(34) PTO proportional solenoid valve
(35) PTO brake solenoid valve
(36) 4WD solenoid valve (if fitted)
(37) Main filter (15 µ)
(38) Blockage indicator
(39) Pump regulator
(40) Low-pressure spool
(41) High-pressure spool
(42) Trailer brake valve (if fitted)
(43) Priority block without trailer braking
(44) Priority block with trailer braking
(45) Right-hand hydraulic cover plate
(46) 24 bar safety valve
(47) Low pressure switch
(48) Lubrication switch
(49) Variable displacement pump
(50) 5 bar safety valve
(51) Pressure relief valve
(52) Left and right brakes
(53) Trailer brake connector
(54) Linkage spool valve
(55) Braking assistance accumulator
(56) Mechanically operated auxiliary spool valves
(57) Suspended front axle hydraulic unit (if fitted)
(58) FTE valve
(68) Steering priority spool
(69) Cooling system with thermo valve
(70) Cooling system without thermo valve
(72) Hoses to suspension ram small and large hydraulic chambers
(73) Lock or suspension solenoid valve
(74) Lifting and lowering solenoid valves
(75) Suspension ram with two hydraulic chambers
(76) Accumulator (210 bar)
(77) Proportional solenoid valves for Dynashift and multiplier modules
(78) Parker valve
(79) Power Shuttle and Powershift module hydraulic control unit
(80) Power Shuttle proportional solenoid valves
(81) Hydraulic pressure connectors for multiplier module and Power Shuttle
(83) Limit switch (ranges 1 to 4)

Legend

- High pressure
- Low pressure
- Lubrication
- Suction
- Return
- Brake cone
- Control
- Charge
- Re-supply to variable displacement pump (slave devices not used).

1 Tractors fitted with trailer brake mechanism
2 Tractors not fitted with trailer brake mechanism

F1 Action on left-hand brake
F2 Action on right-hand brake
F3 Pedals locked together for tractor and trailer braking (if trailer hitched): action on F1 and F2 at the same time
H Lubrication of the mechanical components of the PTO
I Trumpet housing lubrication
J Gearbox lubrication
J1 Powershift module lubrication
K Lubrication of the pinion rear bearing

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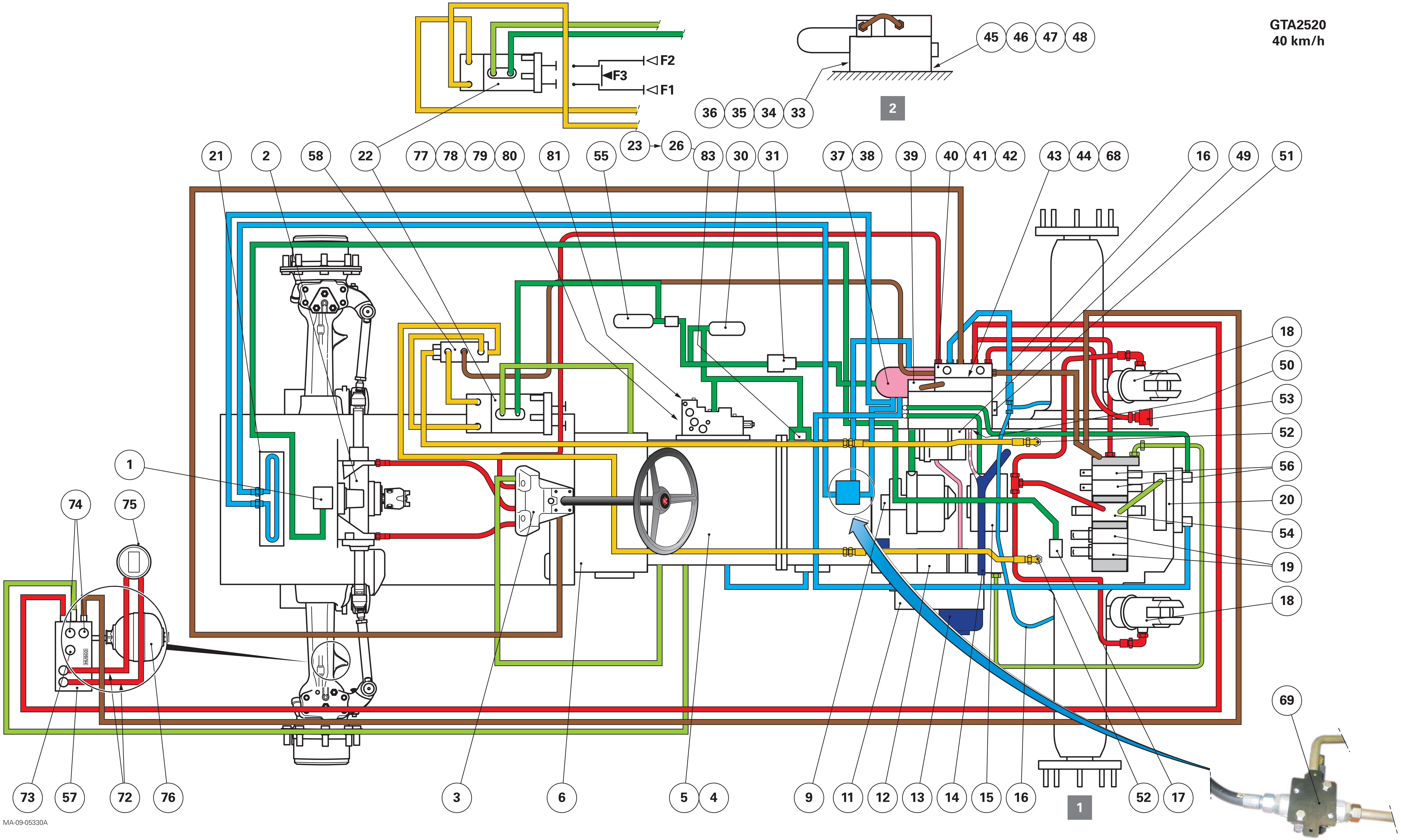
GTA2520
40 km/h
F1
F2
F3
1
2
3
4
5
6
9
11
12
13
14
15
16
17
18
19
20
21
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81
83
HUSCO
MA-09-05330A

Fig. 42

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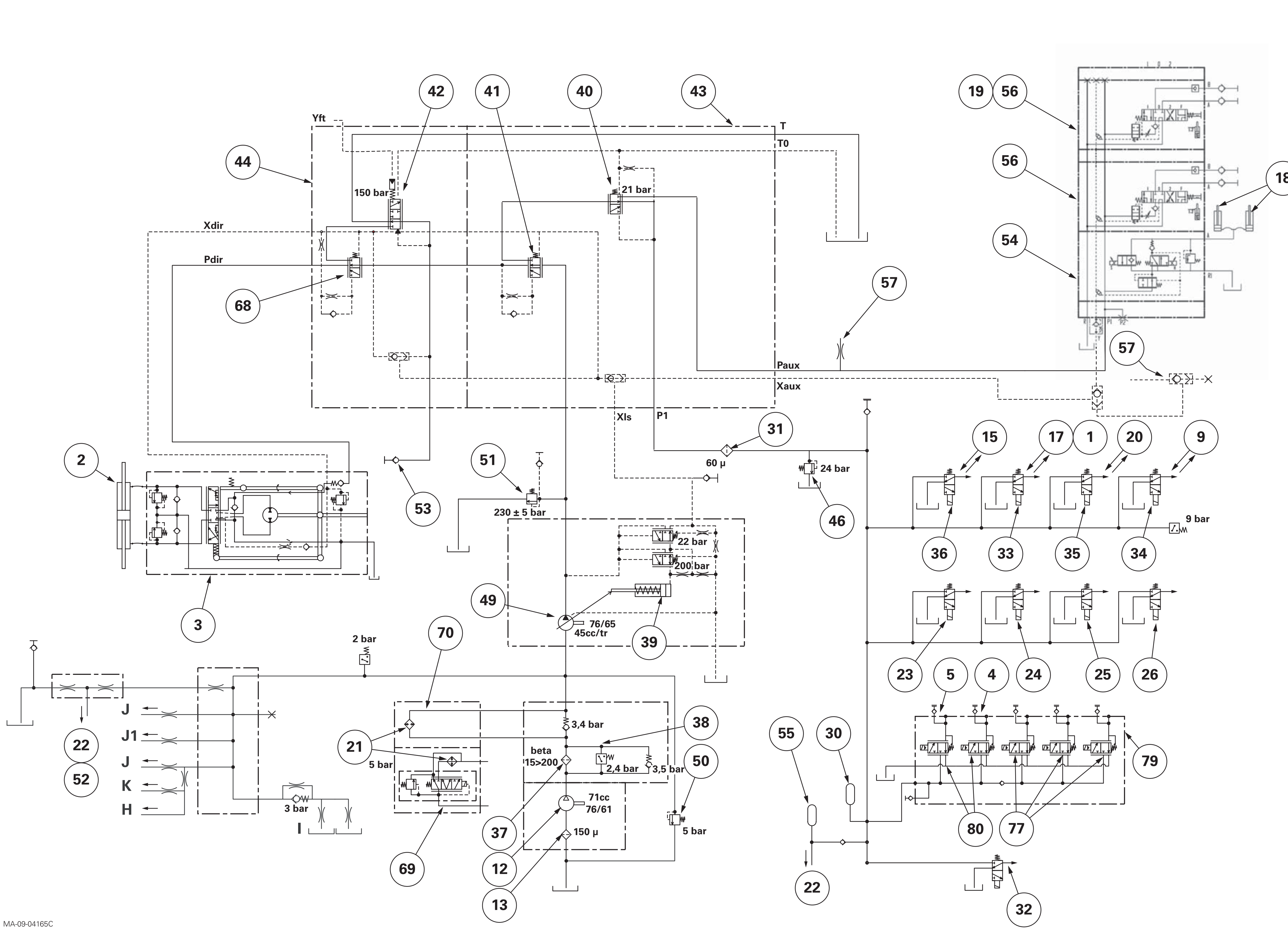
GTA 2520
40 km/h
T
T0
Yft
Xdir
Pdir
150 bar
21 bar
Paux
Xaux
Xls
P1
60 µ
24 bar
230 ± 5 bar
22 bar
200 bar
76/65
45cc/tr
9 bar
2 bar
J
J1
J
K
H
I
3 bar
5 bar
3,4 bar
beta
15>200
2,4 bar
3,5 bar
71cc
76/61
150 µ
5 bar
MA-09-04165C

Fig. 43

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Tractors fitted with GTA2520 transmission and high pressure (HP) braking

Parts list (Fig. 44, Fig. 45)

(1) To front differential lock
(2) Steering ram
(3) Steering spool valve (Orbitrol)
(4) Power Shuttle (forward clutch)
(5) Power Shuttle (reverse clutch)
(6) Powershift module
(9) To power take-off clutch
(11) Left-hand hydraulic cover plate
(12) Charge pump
(13) 150 μ suction strainer
(14) Charge pump hydraulic manifold
(15) 4WD clutch
(16) Trumpet housing lubrication
(17) To rear differential lock
(18) Lift rams
(19) Auxiliary spool valves
(20) PTO brake
(21) Oil cooler
(23) EV1 solenoid valve (L52)
(24) EV2 solenoid valve (L53)
(25) EV3 solenoid valve (L54)
(26) EV4 solenoid valve (L55)
(30) Accumulator
(31) 60 μ filter
(33) Differential lock solenoid valve
(34) PTO proportional solenoid valve
(35) PTO brake solenoid valve
(36) 4WD solenoid valve (if fitted)
(37) Main filter (15 μ)
(38) Blockage indicator
(39) Pump regulator
(40) Low-pressure spool
(41) High-pressure spool
(42) Trailer brake valve (if fitted)
(43) Priority block without trailer braking
(44) Priority block with trailer braking
(45) Right-hand hydraulic cover plate
(46) 24 bar safety valve
(47) Low pressure switch
(48) Lubrication switch
(49) Variable displacement pump
(50) 5 bar safety valve
(51) Pressure relief valve
(52) Left and right brakes
(53) Trailer brake connector
(54) Linkage spool valve
(56) Mechanically operated auxiliary spool valves
(57) Suspended front axle hydraulic unit (if fitted)
(68) Steering priority spool
(69) Cooling system with thermo valve
(70) Cooling system without thermo valve
(72) Hoses to suspension ram small and large hydraulic chambers
(73) Lock or suspension solenoid valve
(74) Lifting and lowering solenoid valves
(75) Suspension ram with two hydraulic chambers
(76) Accumulator (210 bar)
(77) Proportional solenoid valves for Dynashift and multiplier modules
(78) Parker valve
(79) Power Shuttle and Powershift module hydraulic control unit
(80) Power Shuttle proportional solenoid valves
(81) Hydraulic pressure connectors for multiplier module and Power Shuttle
(83) Limit switch (ranges 1 to 4)
(85) High pressure brake valves/unit assembly
(87) Accumulator (210 bar)
(88) Non-return valve
(89) Drain screw
(90) Pressure relief valve
(91) Filter (25 μ)
(92) High-pressure braking unit
(93) Solenoid valve (0/12 volts)

Legend

- High pressure
- Low pressure
- Lubrication
- Suction
- Return
- Brake cone
- Control
- Charge
- Re-supply to variable displacement pump (slave devices not used).

1 Tractors fitted with trailer brake mechanism

***Note:** On tractors not fitted with the trailer brake mechanism, the pipes (T) and the connector (53) are not fitted.*

F1 Action on left-hand brake
F2 Action on right-hand brake
F3 Pedals locked together for tractor and trailer braking (if trailer hitched): action on F1 and F2 at the same time
H Lubrication of the mechanical components of the PTO
I Trumpet housing lubrication
J Gearbox lubrication
J1 Powershift module lubrication
K Lubrication of the pinion rear bearing

***Important:** The letters B, J, O R and V correspond to the colour marks (rings) used to identify the hydraulic pipes located to the right of the cab and their routing between the cab and the transmission.*

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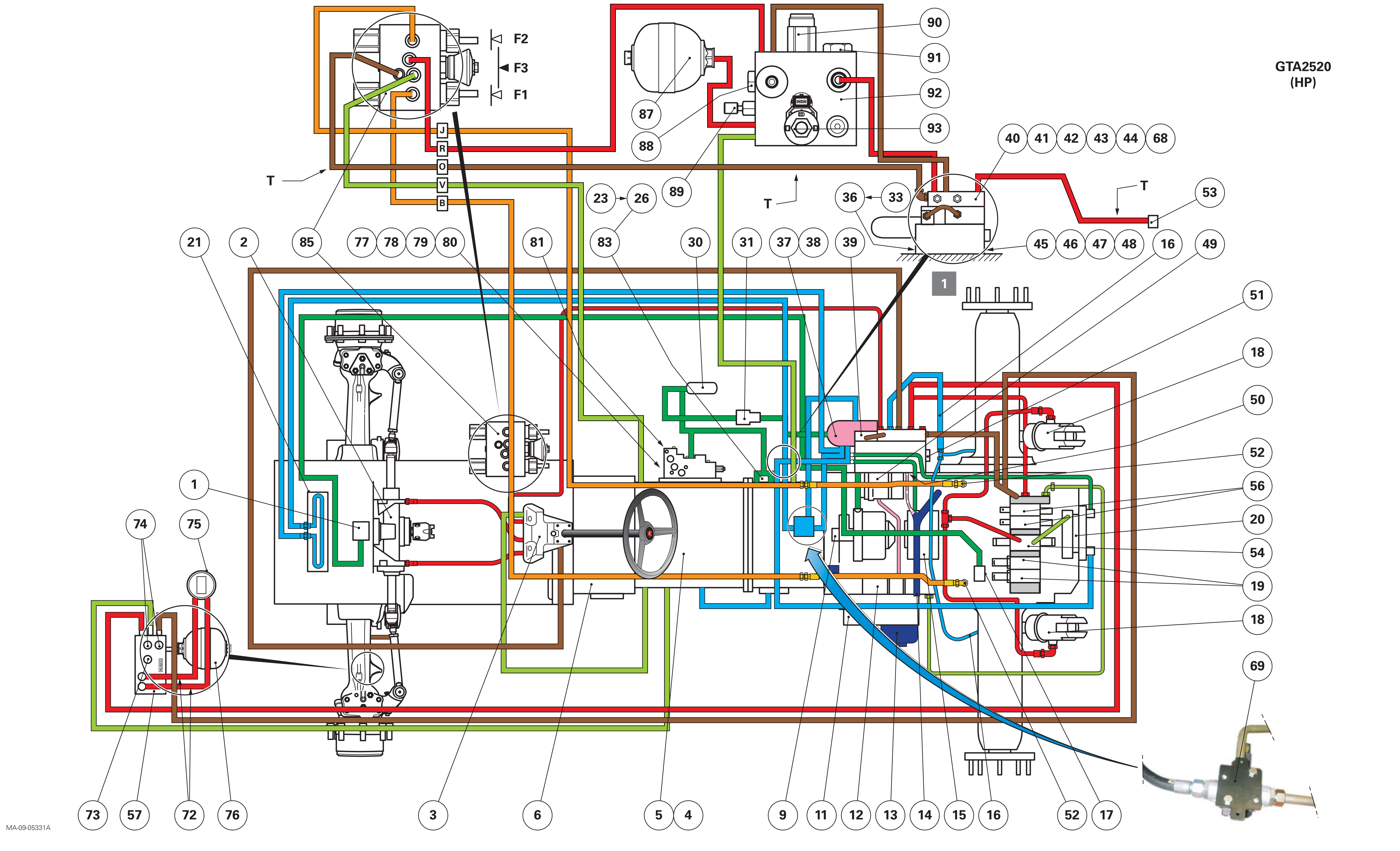
F2
F3
F1
J
R
O
V
B
T
90
91
92
93
87
88
89
23
26
36
33
40 41 42 43 44 68
53
GTA2520
(HP)
21
2
85
77 78 79 80
81
83
30
31
37 38
39
45 46 47 48
16
49
1
51
18
50
52
56
20
54
19
18
69
1
74
75
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72
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5 4
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16
52
17
MA-09-05331A

Fig. 44

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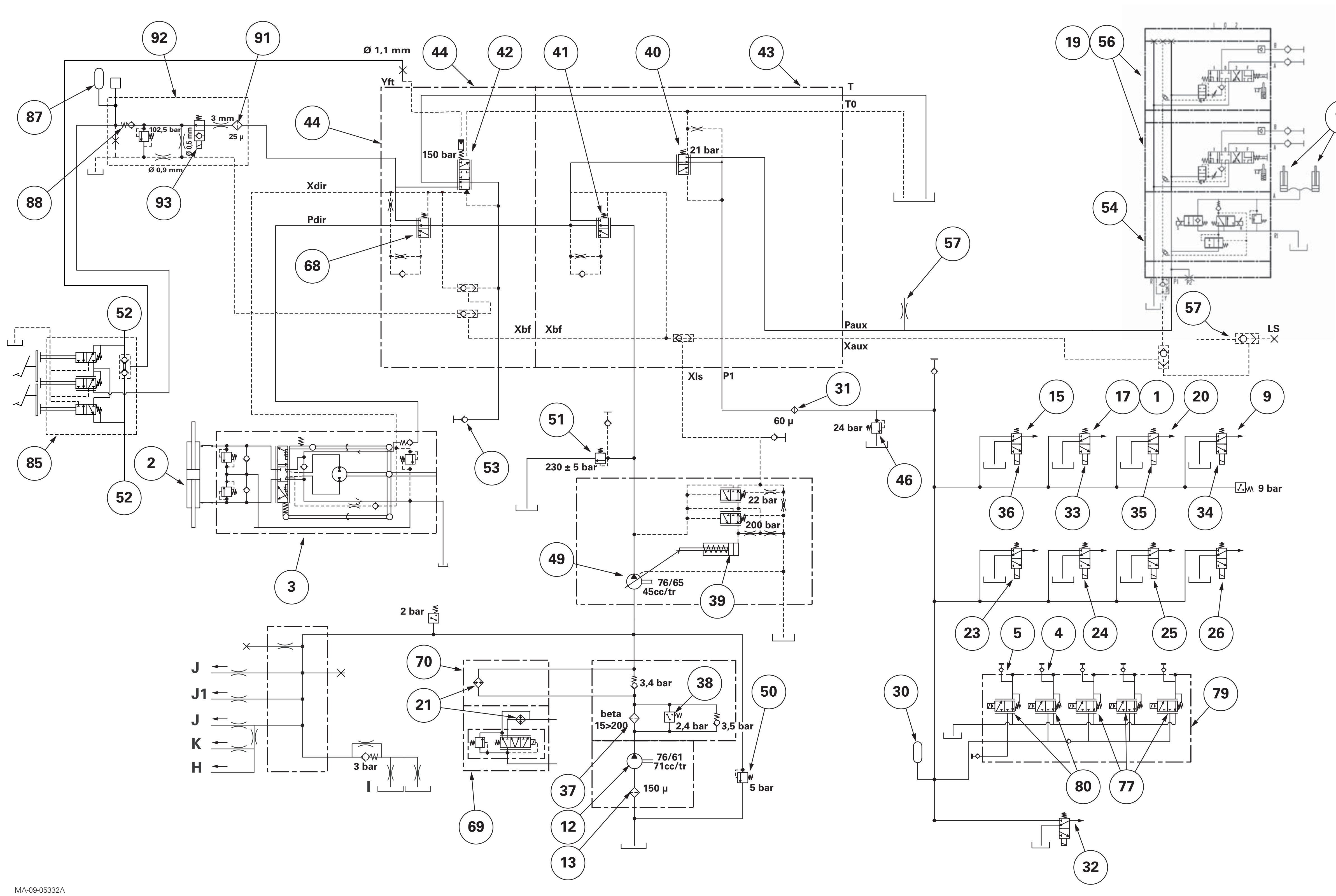
GTA2520
(HP)
Ø 1,1 mm
Yft
T
T0
3 mm
25 μ
102,5 bar
0,5 mm
Ø 0,9 mm
150 bar
21 bar
Xdir
Pdir
Paux
Xaux
Xbf
Xbf
Xls
P1
LS
60 μ
24 bar
230 ± 5 bar
22 bar
200 bar
76/65
45cc/tr
9 bar
2 bar
J
J1
J
K
H
I
3 bar
3,4 bar
beta
15>200
2,4 bar
3,5 bar
76/61
71cc/tr
150 μ
5 bar
MA-09-05332A

Fig. 45

9B20 - LS hydraulic tests

CONTENTS

A . General

The Load Sensing (closed centre) hydraulic system with pressure and flow control consists of two separate circuits: the low pressure circuit and the high pressure circuit.

- **Low pressure (17 bar) circuit functions (GTA2020, GTA1030 and GTA1040)**
  - PowerShuttle
  - Dynashift
  - Power take-off brake and clutch
  - Front power take-off clutch (if fitted)
  - 4 WD clutch
  - Front and rear differential lock (if fitted)
  - Hare/Tortoise range
- **Functions of the low pressure (20 bar) circuit (GTA2520)**
  - PowerShuttle
  - Powershift module
  - Power take-off brake and clutch
  - Front power take-off clutch (if fitted)
  - 4 WD clutch
  - Front and rear differential lock (if fitted)
  - Powershift transmission range 1 to 4
- **Functions of the high pressure circuit**
  - Steering spool valve (Orbitrol)
  - Trailer braking spool valve (if fitted)
  - Auxiliary spool valves
  - Linkage spool valve
  - Suspended front axle (if fitted)

Preliminary operations

Before starting the tests, run the engine at 2000 rpm to raise the oil temperature to 60°C (132°F) minimum.

To assist the rise in temperature, connect a flow meter to an auxiliary spool valve and limit the flow rate in the flow meter.

As soon as the oil temperature exceeds 60°C (132°F), release the lever of the auxiliary spool valve and open the flowmeter valve to the maximum.

To carry out the tests indicated in this section, it is recommended to use the following equipment, available in the AGCO network:

- **MF 3001**: Pressure gauge kit
- **MF 3016**: 4 - 160 l/min (0.9 - 36 gal/min) turbine flow meter kit
- **MF 3017**: Pipe assembly for MF 3016 flow meter
- **3582045M1**: Female diagnostics connector. If not available, use equivalent equipment.

IMPORTANT: *In all cases, ensure the direction of oil flow is correct in order to avoid any damage to the flow meter.*

Also choose pressure gauges, pipes and unions of sufficient capacity and strength for the checks to be carried out.

Values measured during the tests

- Max. flow rate: 105 l/min
- Min. flow rate: 5 l/min
- Max. pressure: 200 bar
- Min. pressure: 0.4 bar

B . High pressure circuit

The high pressure circuit supplies the following functions:
- steering
- trailer braking
- auxiliary spool valves
- linkage.

The hydraulic unit of the suspended front axle (if fitted) is also connected to the high pressure circuit.

Checking the booster pressure

The booster pressure is measured at the 15 µ filter outlet between the booster pump and the variable displacement pump.

Check

- Connect a pressure gauge with a capacity of approximately 11 bar to the diagnostics connector (1) located on the right-hand cover (Fig. 1 and Fig. 2).
- Check **P1.**

Engine speed (rpm)	P1 (1) (bar)
1000	5 ± 1
2200	6 ± 1

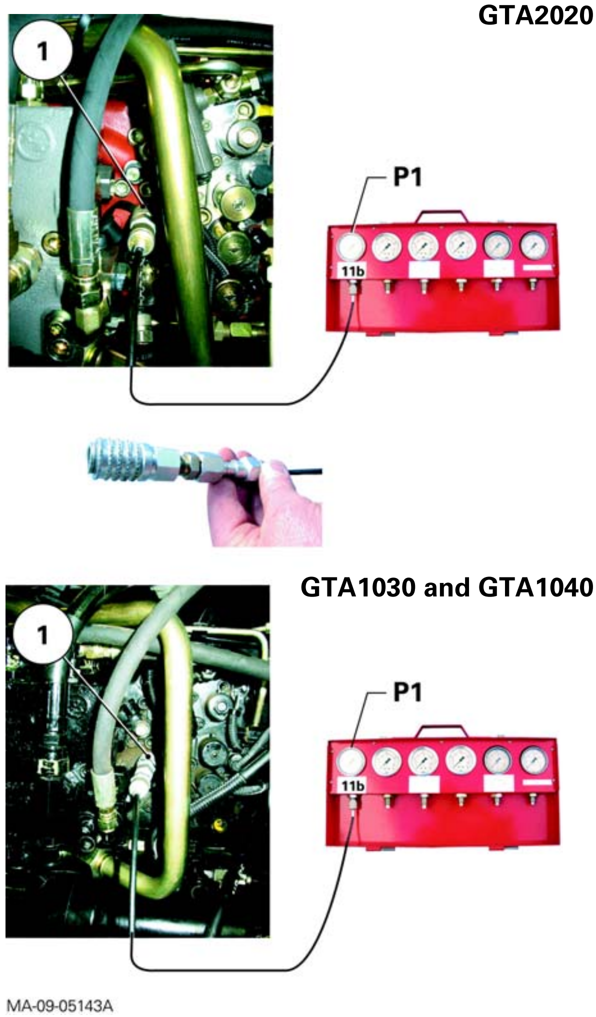

Fig. 1

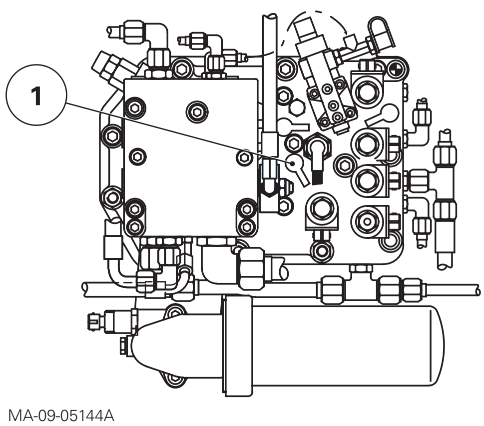

Fig. 2

Checking the discharge pressure and XLS pressure

Definition of pressures

- The discharge pressure is measured at the variable displacement pump outlet.
- The XLS pressure is the pressure necessary to activate the requested function.
- The standby pressure or regulating pressure allows a constant differential pressure between the discharge pressure and the XLS pressure to be maintained.

  The standby pressure is measured on the pump discharge pressure connector, with the engine running and the high pressure functions at rest.

  Important: *In order to avoid damage to the low capacity pressure gauges used during these tests, do not activate any high pressure components (for example, steering).*

Check

- Connect a pressure gauge of approximately 11 bar capacity to the connector (2), then a second pressure gauge of approximately 30 bar capacity to the connector (3) (Fig. 3 and Fig. 4).

  These diagnostics connectors are located as follows:
  - on the pump regulator for the connector (2)

    XLS pressure = P2
  - on the right-hand cover for the connector (3)

    pump discharge pressure = P3.
- Check **P2** and **P3**.

Engine speed (rpm)	P2 (2) (bar)	P3 (3) (bar)
1000	4 ± 1	26 ± 1
2200	4 ± 1	26 ± 1

Discharge pressure = XLS pressure + 22 ± 1 bar

P3 = P2 + 22 ± 1 bar

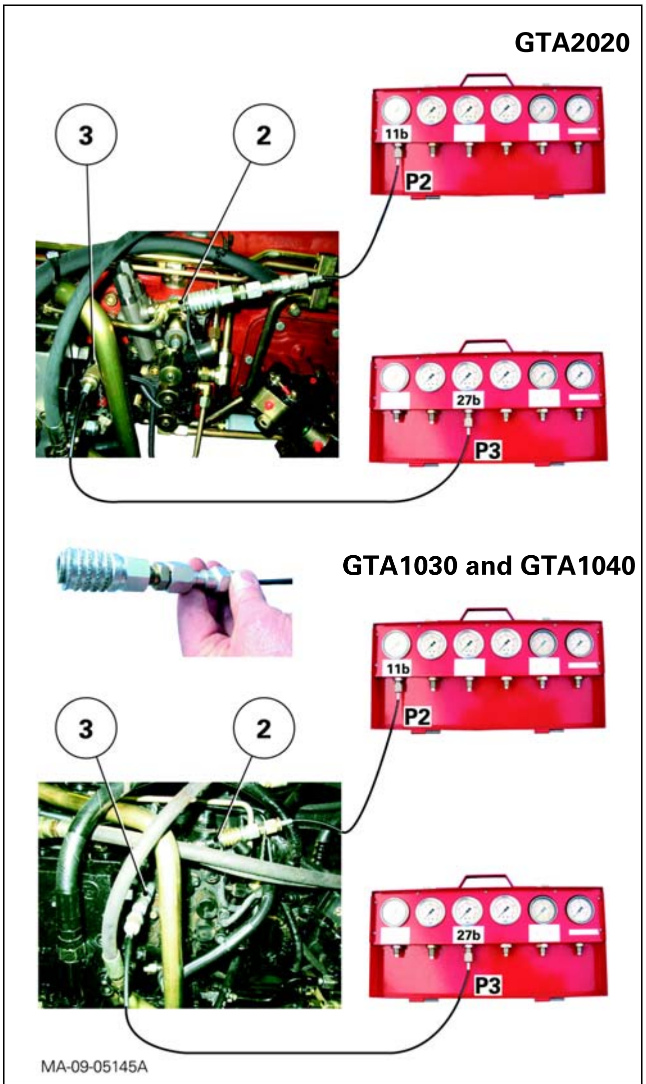

Fig. 3

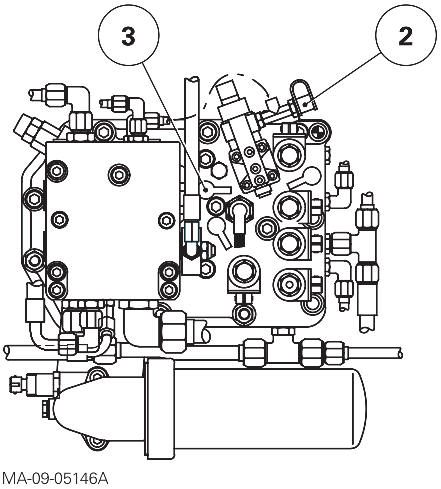

Fig. 4

Checking maximum flow rate and pressure of the variable displacement pump

- Connect the flowmeter inlet and return to quick-disconnect couplings on an auxiliary spool valve other than the one fitted with an automatic return to neutral (Kick-out) (Fig. 7, Fig. 8).
- Connect a pressure gauge with a capacity of around 270 bar to connector (2), then a second one with a similar capacity to connector (3) (Fig. 5 and Fig. 6).

  These diagnostics connectors are located as follows:
  - on the pump regulator for the connector (2)

    XLS pressure = P2
  - on the right-hand cover for the connector (3)

    pump discharge pressure = P3.
- Set the auxiliary spool valve flow rate regulator (1) (Fig. 7, Fig. 8) to maximum flow rate.
- Activate the auxiliary spool valve and gradually close the load valve on the flowmeter in order to reduce the flow and increase the pressure.
- Check **Q1** (Fig. 7, Fig. 8).

Engine speed (rpm)	P2 (2) (bar)	P3 (3) (bar)	Q1 (l/min) 45 cm³
2200	110	(a)	100 ± 5
2200	130	(a)	100 ± 5
2200	150	(a)	100 ± 5
2200	170	(a)	100 ± 5
2200	200	200	0

(a): P3 = P2 + 22 ± 1 bar

NOTE: *Do not take into consideration the value of the pressure gauge fitted to the flowmeter. Read the values on the individual pressure gauges connected to connector (2) and connector (3) to check Q1.*

Checking the auxiliary spool valves flow rate regulating system

- Connect the flowmeter to each of the relevant spool valves as shown in Fig. 7 and Fig. 8 to check **Q2**.
- Connect a pressure gauge with a capacity of around 270 bar to connector (2), then a second pressure gauge with the same capacity as connector (3) (Fig. 5 and Fig. 6).

  These diagnostics connectors are located as follows:
  - on the pump regulator for the connector (2)

    XLS pressure = P2
  - on the right-hand cover for the connector (3)

    pump discharge pressure = P3.
- Tighten the load valve on the flowmeter to obtain an XLS pressure of 130 bar.
- Slowly turn the regulator (1) (Fig. 7, Fig. 8) to the minimum stop (approximately 2 turns). Q2 must drop to a minimum flow rate of 5 ± 1 l/min. P2 also drops.

  If the flow rate is incorrect, see auxiliary spool valve operation (chapter 9).

Regulator position	Engine speed (rpm)	P2 (2) (bar)	P3 (3) (bar)	Q2 (l/min) 45 cm³
max.	2200	130	(a)	100 ± 5
min.	2200	35	(a)	5 ± 1

(a): P3 = P2 + 22 ± 1 bar

NOTE: *Do not take into consideration the value of the pressure gauge fitted to the flowmeter. Read the values on the individual pressure gauges connected to connector (2) and connector (3) to check Q2.*

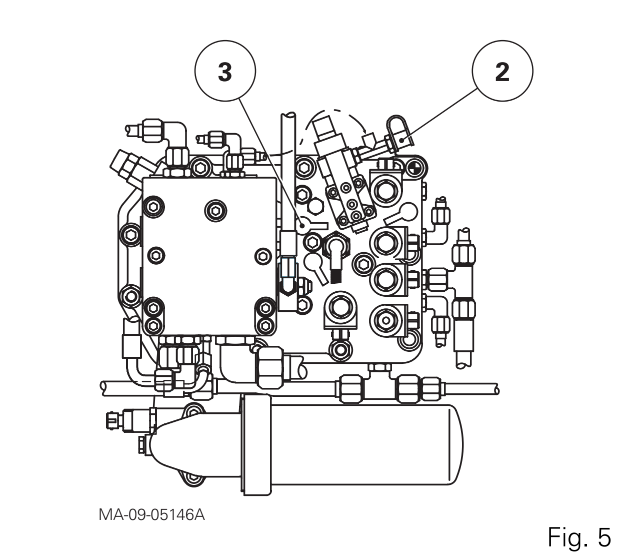
3
2
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Fig. 5

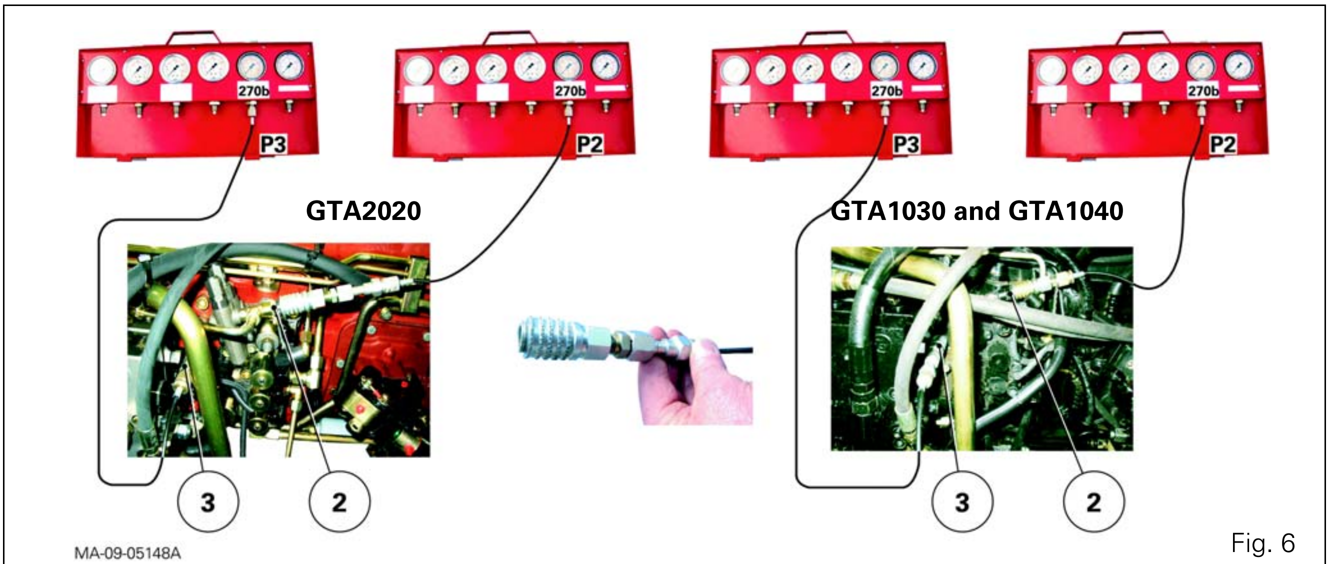

270b
P3
270b
P2
270b
P3
270b
P2
GTA2020
GTA1030 and GTA1040
3
2
3
2
MA-09-05148A

Fig. 6

GTA2020 and GTA1040

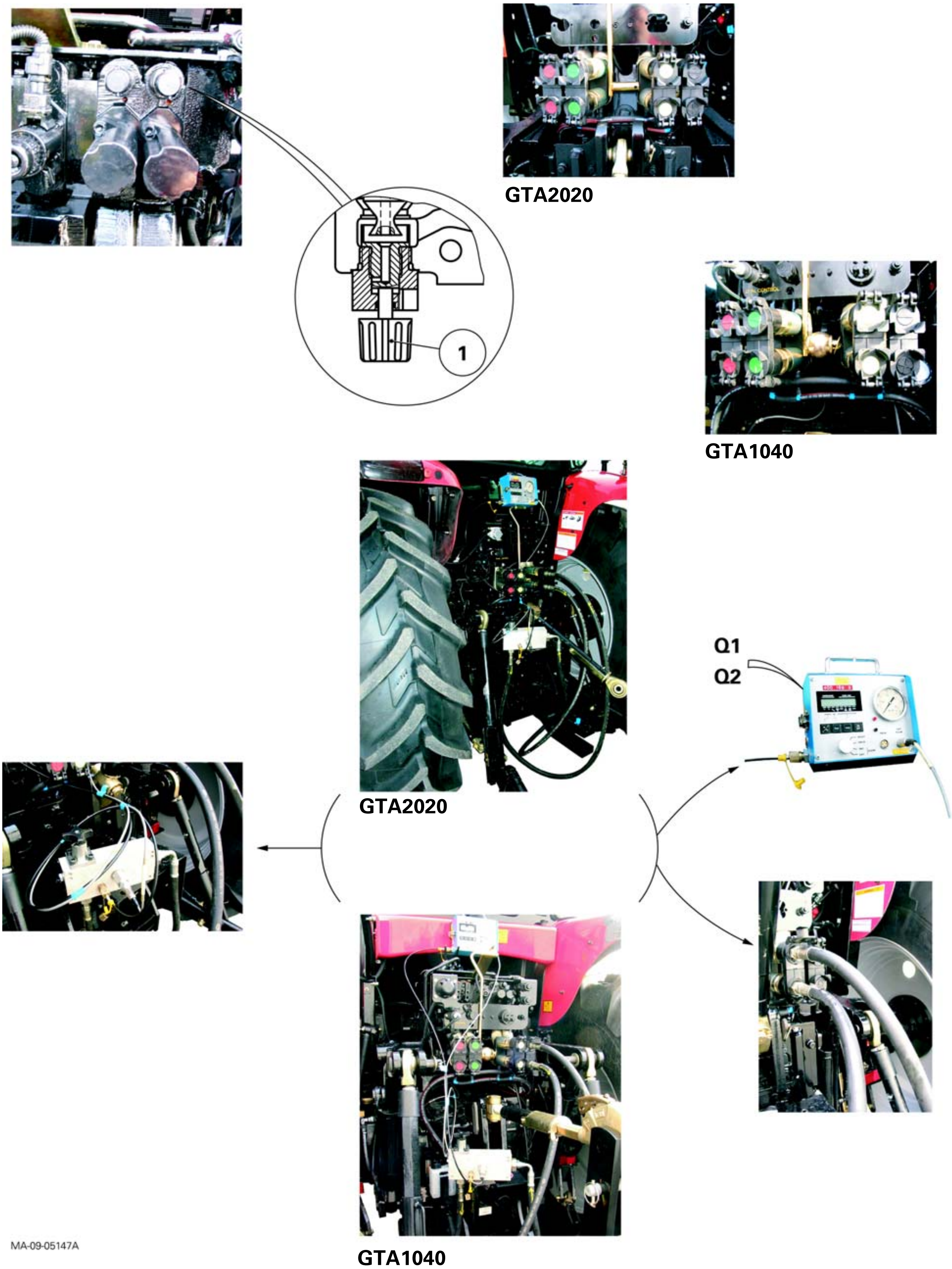
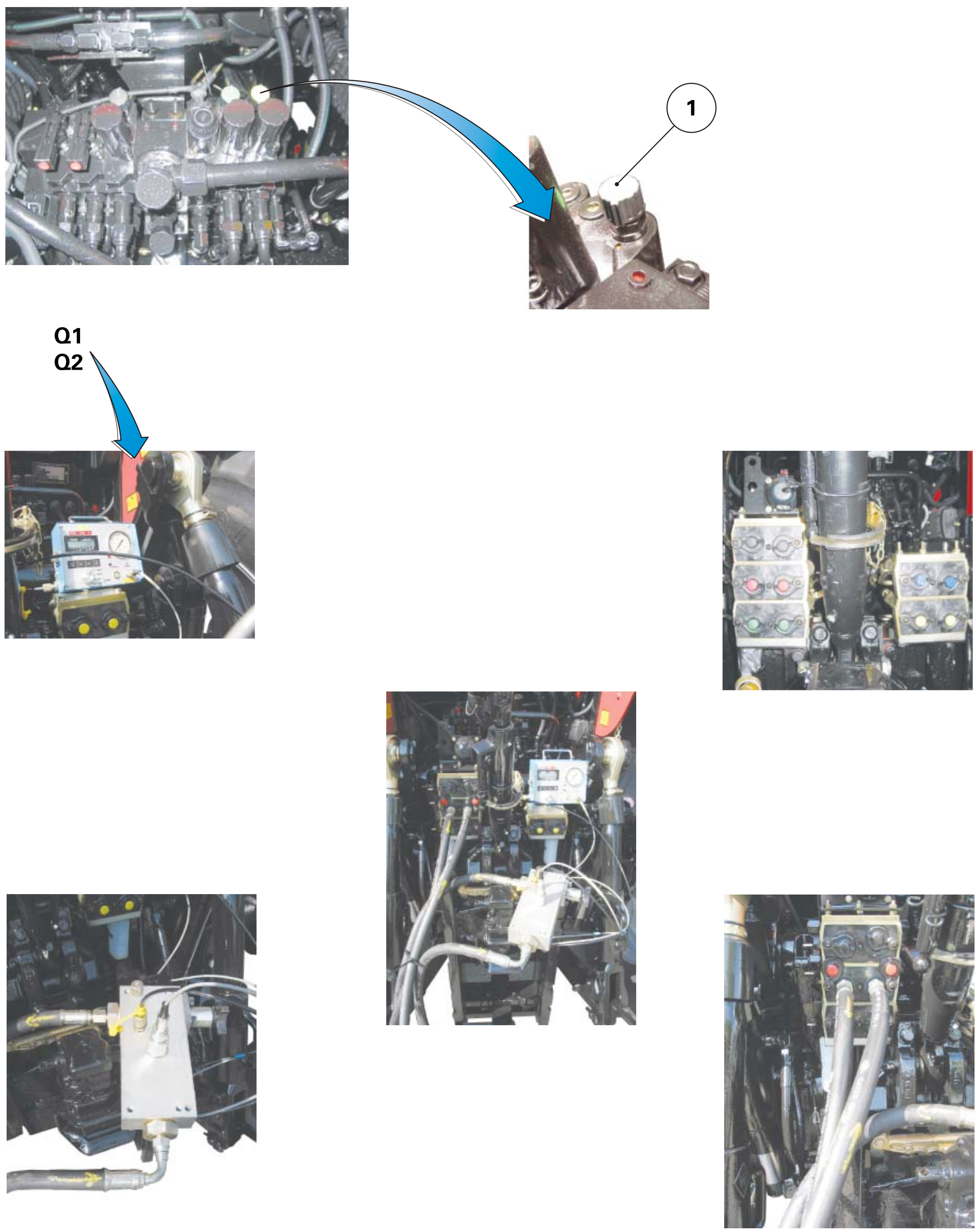


Fig. 7

GTA1030



MA-09-05297A

Fig. 8

Checking kick-out pressure on an auxiliary spool valve fitted with automatic return to neutral (Fig. 9, Fig. 12)

- Connect a flowmeter to the spool valve concerned.
- Connect a pressure gauge with a capacity of approximately 270 bar to connector (2) of the pump regulator (Fig. 10, Fig. 11) to check **P2** (XLS pressure).
- Run the engine at 1000 rpm.
- Activate the spool valve in the automatic return position, release the lever and progressively close the flowmeter load valve until the lever returns to the neutral point.
- Check the kick-out pressure:

  P2 = 155 - 175 bar.

__IMPORTANT:__ Ensure that the spool valve is in the automatic return position and not in the floating position.

__NOTE:__ Do not take into consideration the value of the pressure gauge fitted to the flowmeter. Look at the separate pressure gauge connected to connector (2) to check P2.

GTA1030

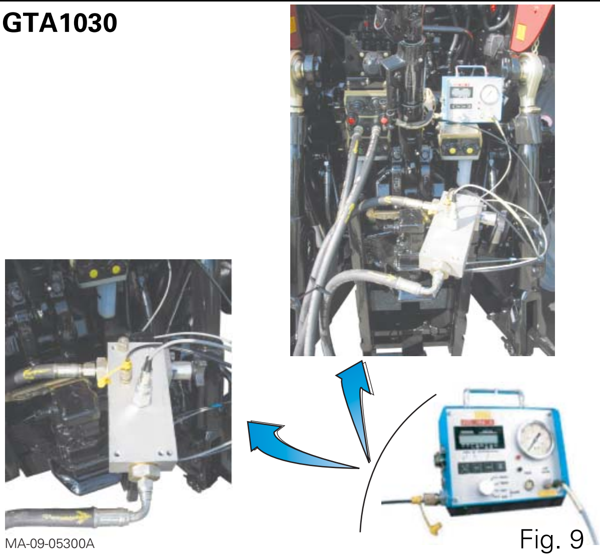


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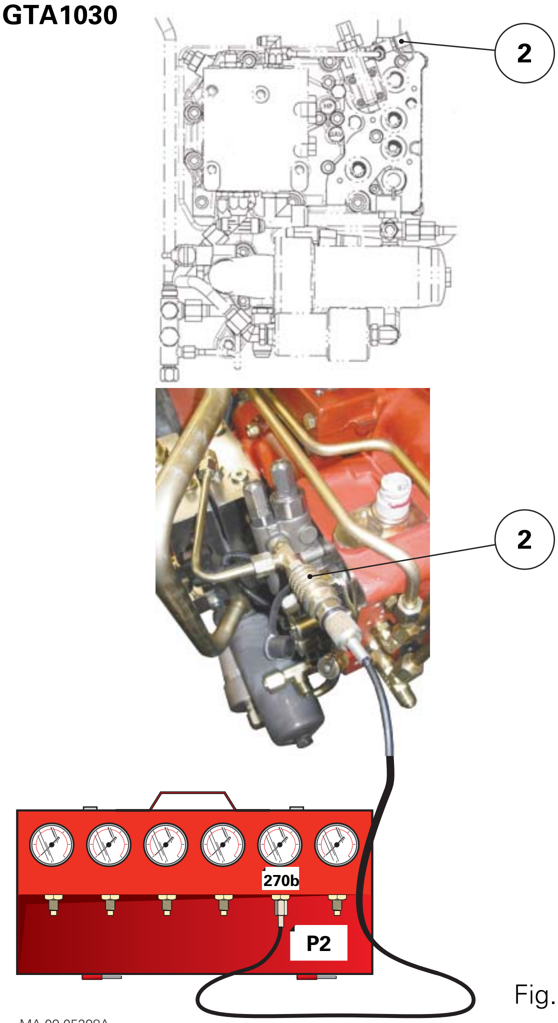
Fig. 9

GTA1030



MA-09-05298A

Fig. 10

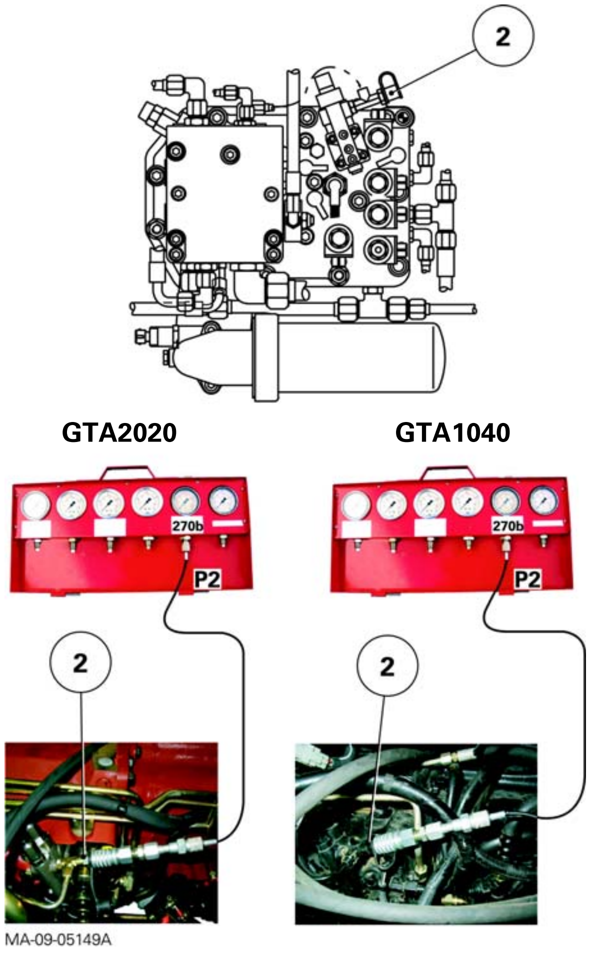

2
GTA2020
GTA1040
270b
270b
P2
P2
2
2
MA-09-05149A

Fig. 11

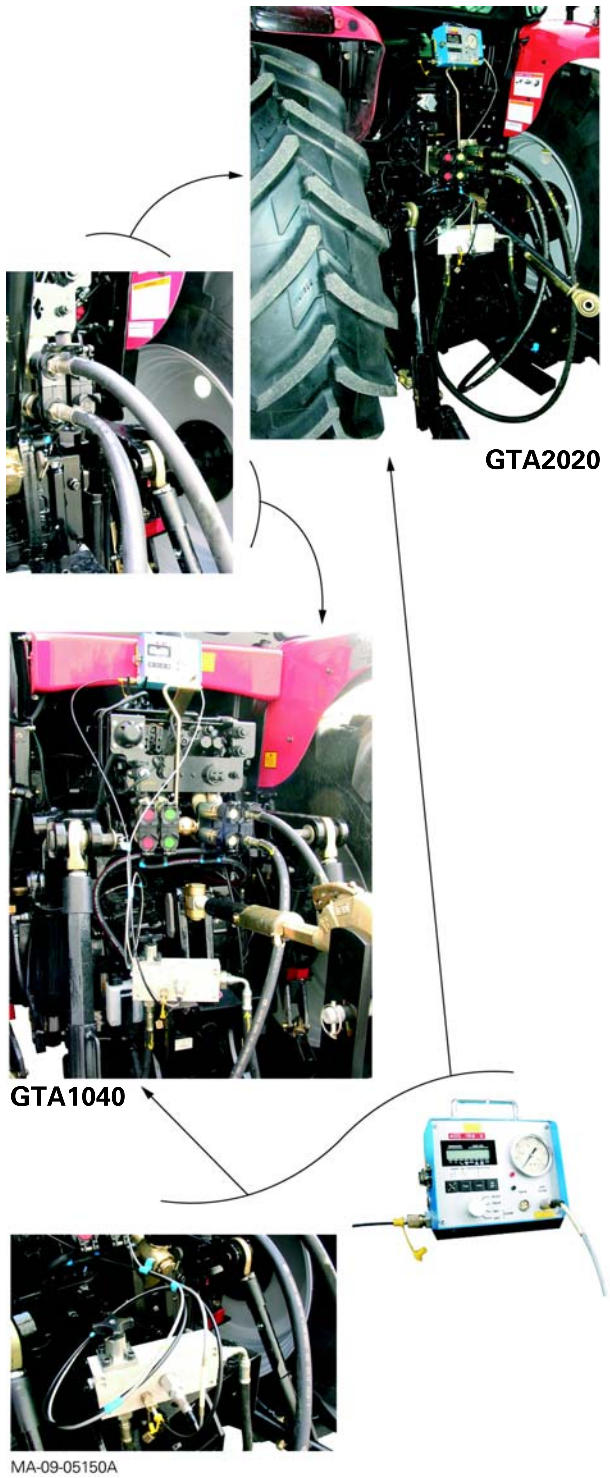

GTA2020
GTA1040
MA-09-05150A

Fig. 12

Checking the management system (SMS) of an electrohydraulic auxiliary spool valve

The spool valve management system (SMS) is intended to enhance quality of service and ease of use.

This management system (SMS) is only fitted to electrohydraulic auxiliary spool valves.

The electrohydraulic auxiliary spool valve or valves (connector Fig. 13) is/are controlled electrically via a joystick located on the armrest inside the cab. This joystick, which is linked to the SMS, allows oil flows to be set and regulated.

IMPORTANT: *Before carrying out any hydraulic tests, refer to chapter 11 on handling joysticks.*

To check the floating position or adjust the flow rate and Kick-out function, a flowmeter can be connected to the relevant auxiliary spool valve.

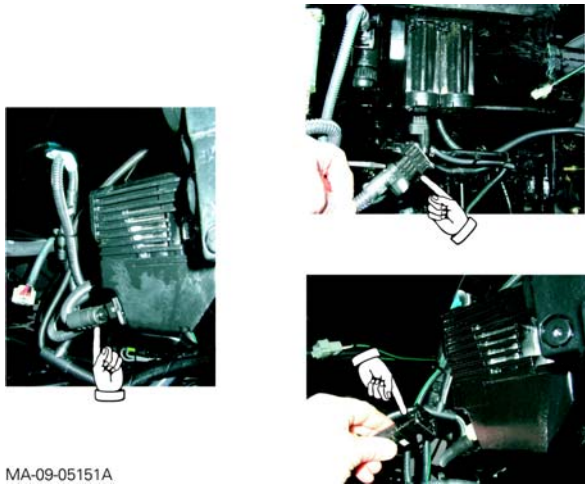


Fig. 13

Checking the pressure of the 3-way relief valve

The three-way pressure relief valve fitted to the end-plate (6) (Fig. 14, Fig. 15) operates as a safety valve (see chapter 9).

In the event a control solenoid valve on an SMS-managed electrohydraulic auxiliary spool valve seizes, the linkage controller will disable the supply to the reduction unit and cause an error code to be sent (see chapter 11).

Check (Fig. 14, Fig. 15)

- Unscrew the plug (1) from the end-plate (6).
  In its place, fit a 3384387M1 adapter or a locally manufactured connector to suit the type of end-plate.
- Connect a pressure gauge with a full-scale reading of approximately 30 bar to the adapter or connector.
- Start the engine. Activate the joystick (see chapter 11) and read off the pressure **X3 = 21 - 24 bar**.
- Remove the pressure gauge and adapter/connection assembly.
- Check the condition of the "O" ring on the plug.
- Fit the plug. Tighten it moderately.

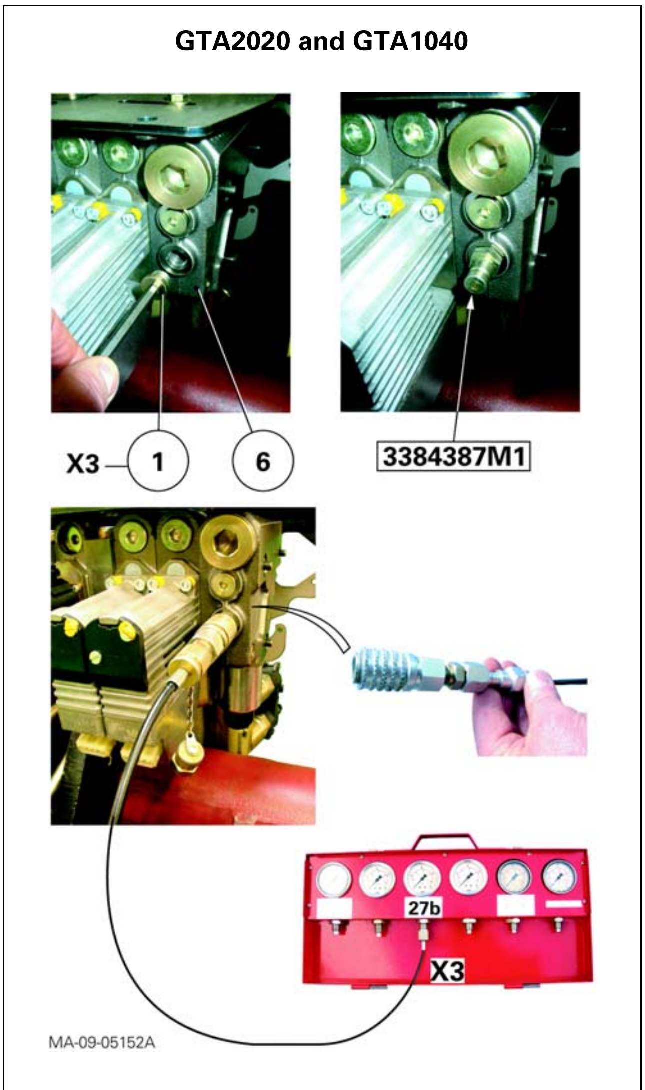


Fig. 14

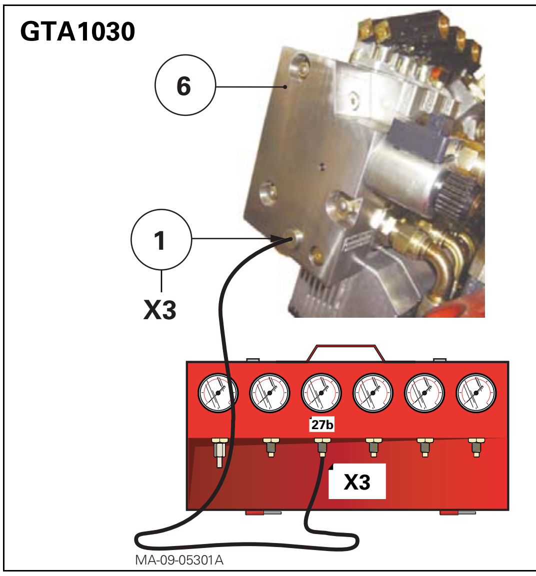


Fig. 15

Checking the maximum linkage pressure

- Connect a pressure gauge with a capacity of around 270 bar to connector (2), then a second pressure gauge with the same capacity as connector (3) (Fig. 16 and Fig. 17).

  These diagnostics connectors are located as follows:
  - on the pump regulator for the connector (2)

    XLS pressure = P2
  - on the right-hand cover for the connector (3)

    pump discharge pressure = P3.
- Run the engine at 1000 rpm.
- Use the external linkage control buttons to reach the maximum raised position where

  P2 = P3 = 195 ± 1 bar.

Shock valves

- With the engine stopped, connect a hand calibration pump to the unions (2) of the pipes supplying the lift rams (Fig. 18, Fig. 19).
- Use this pump to apply pressure.
- Check the valve opening pressure:

  P4 = 220 - 240 bar.

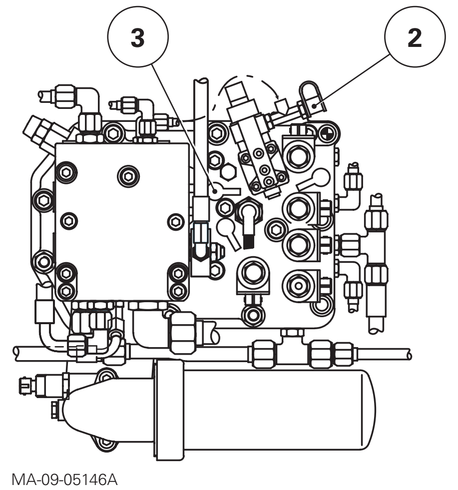


Fig. 16

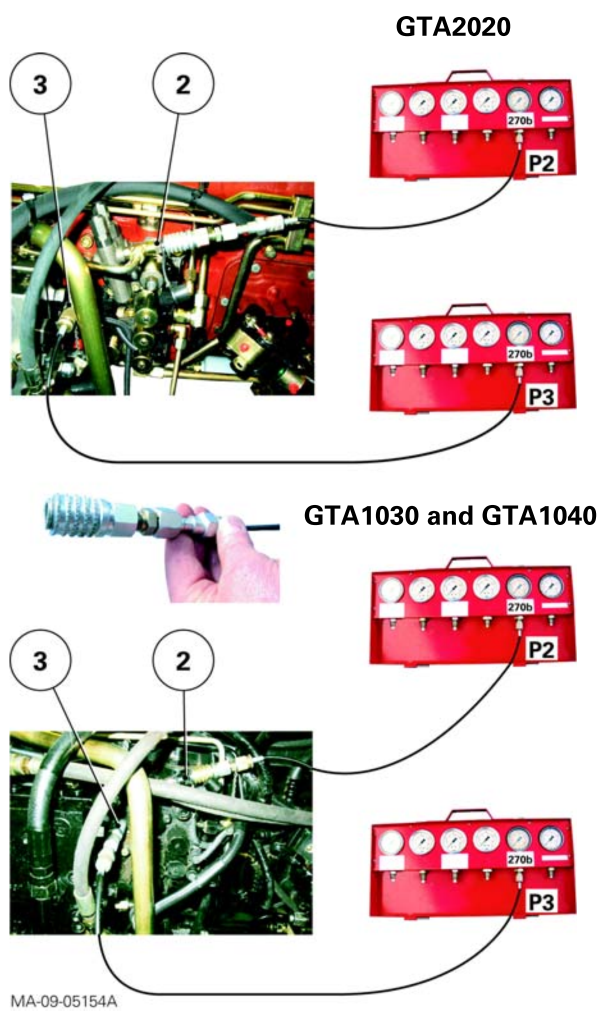


Fig. 17

Checking the maximum steering pressure

- Connect a pressure gauge with a capacity of approximately 270 bar to each diagnostics connector (2) and (3) (Fig. 16 and Fig. 17).
- Slowly turn the steering and make sure that P2 and P3 gradually increase to:

  P2 = 146 ± 1 bar and **P3 = 169 ± 1 bar**.

Shock valves

- With the engine stopped, connect a hand pump to one of the two steering ram supplies (3) (Fig. 18, Fig. 19).
- Use this pump to apply pressure to the circuit.
- Check the valve opening pressure (Fig. 18, Fig. 19):

  P5 = 220 - 240 bar.
- Apply the same procedure to the second ram supply.

Steering circuit leak

- Run the engine at 1000 rpm.
- Turn the steering on full lock and apply a torque of 4 Nm to the axis of the steering wheel. The wheel must not turn more than 2 rpm.

  If the wheel turns more than 2 rpm, disconnect the pipes that supply the rams, block the two ports and then apply the same torque (4 Nm) to the steering wheel. If it turns at less than 2 rpm, there is a leak at the ram.

Checking the trailer braking pressure and flow rate (if fitted)

Pressure

- Connect a pressure gauge with a capacity of around 270 bar to the quick-disconnect coupling (1) of the trailer braking circuit (Fig. 18, Fig. 19) in order to read **P6**.
- Run the engine at 2200 rpm.
- With the brake pedals latched, apply a progressive pressure.

  The pressure read should increase gradually until it reaches **P6 = 120 - 150 bar max**.

  If the pressure does not increase gradually, bleed the brake circuit (see chapter 9).

Flow rate

- Connect a flowmeter to the trailer braking quick-disconnect coupling (1) mentioned above (Fig. 18, Fig. 19) and check that the load valve is fully open.

  Connect the return to the filler port and check **Q3** (Fig. 18, Fig. 19).
- Connect a pressure gauge with a capacity of approximately 270 bar to connector (2) of the pump regulator to check **P2** (XLS pressure) (Fig. 16).

Engine speed (rpm)	P2 (2) (bar)	Q3 (l/min)
1100	125 - 150	25 ± 1
1100	0	49 ± 2

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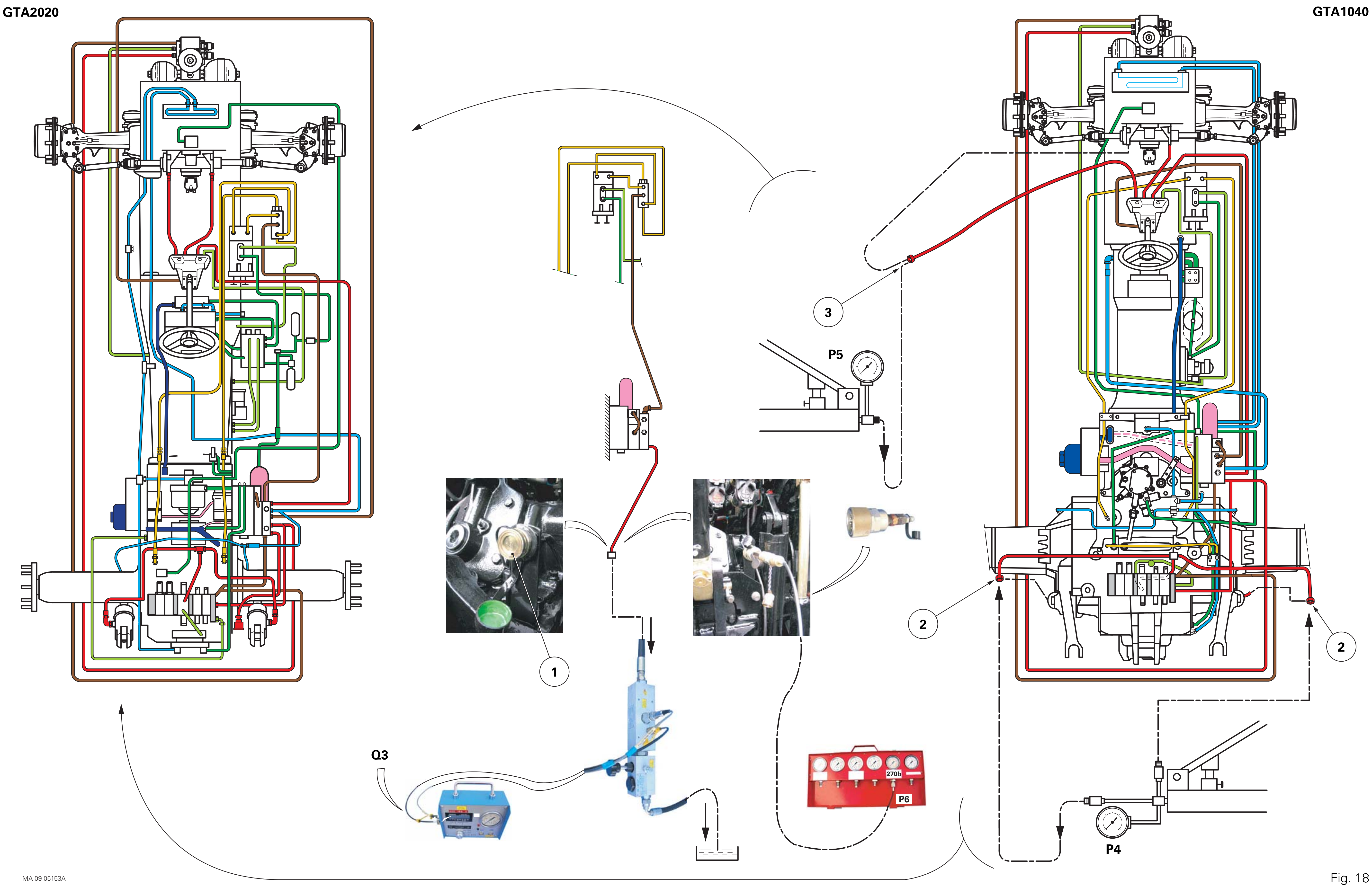

Fig. 18

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GTA1030

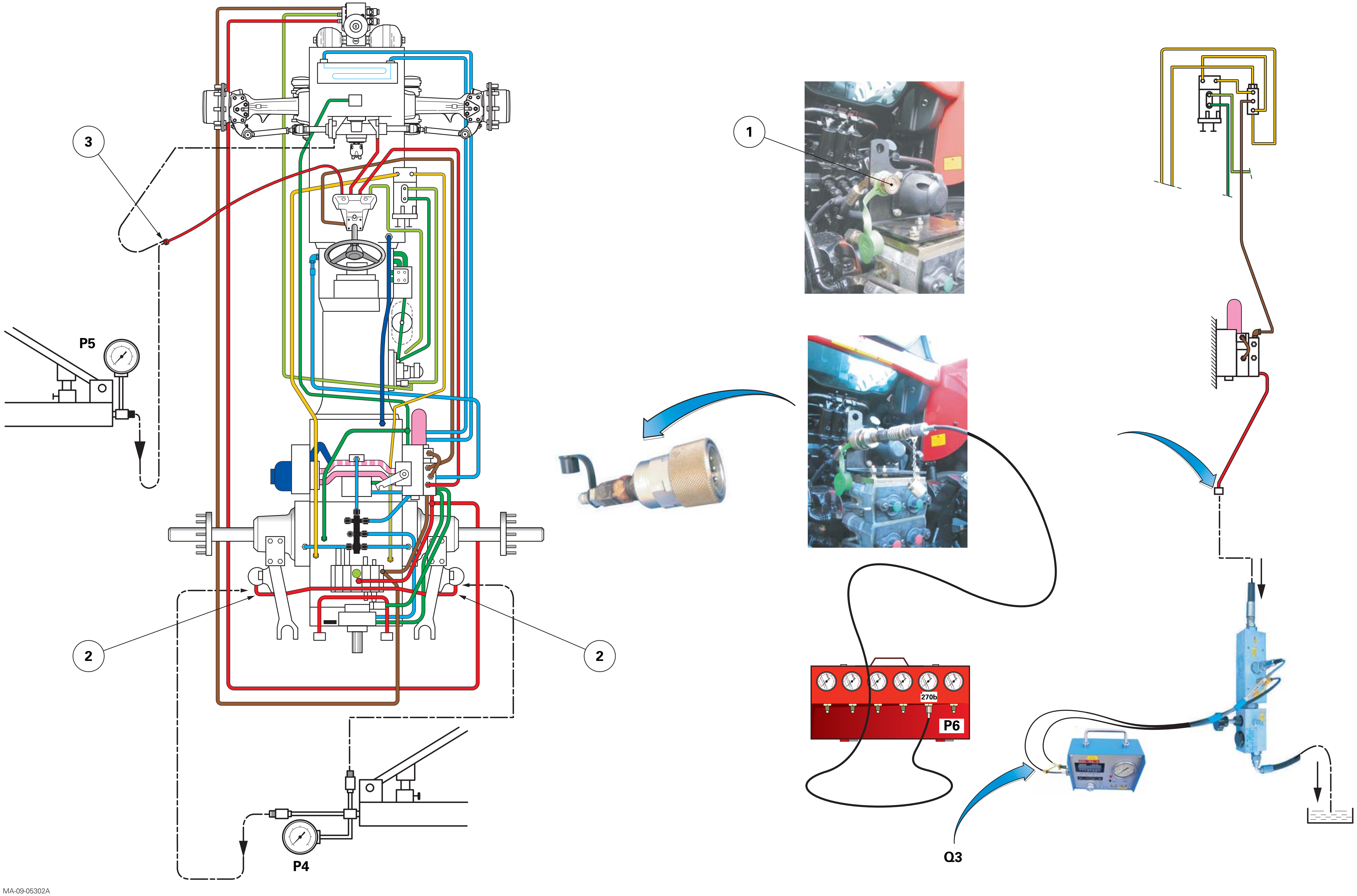


Fig. 19

C . Low pressure circuit (17 bar or 20 bar)

Reminder: *Hydraulic unions used for flowmeter connections when carrying out the various tests in this paragraph, should be made locally.*

According to the particular characteristics of the tractor, the 17 bar or 20 bar low pressure circuit supplies (Fig. 20, Fig. 21):
- the PowerShuttle control unit (**P8**, **P9**, **P10**, **P11**)
- Dynashift (**P12**, **P13**)
- the GBA20 PowerShuttle
- the Hare/Tortoise range (**P7**)
- the front axle clutch (4 WD) (**P7**)
- the front and rear differential lock (if fitted) (**P7**)
- the power take-off clutch (**P7**)
- the power take-off brake (**P7**)
- the front power take-off (if fitted) (**P7**)
- the GBA25 Powershift module
- the GBA25 PowerShuttle
- the GBA25 Powershift transmission.

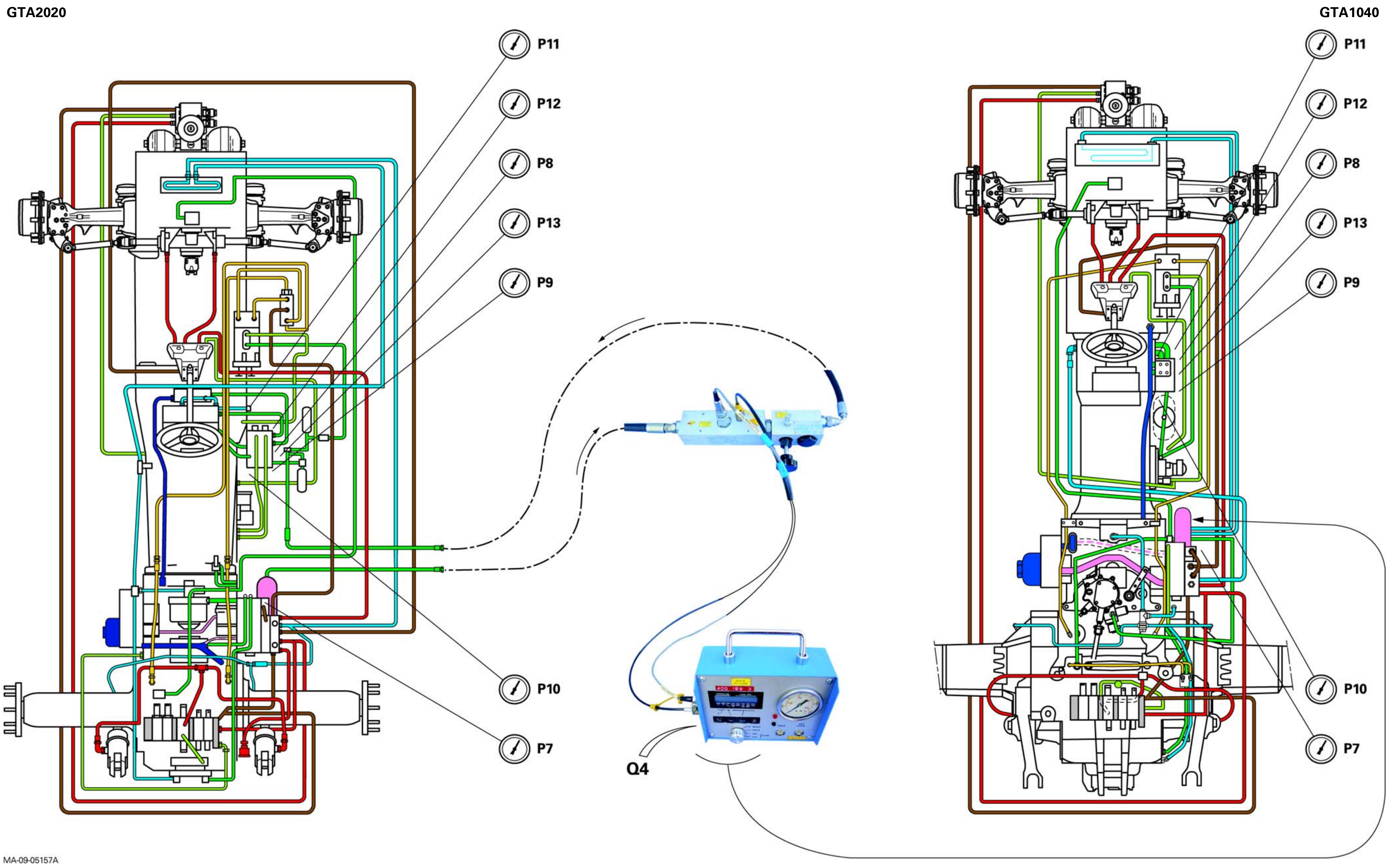

GTA2020
GTA1040
P11
P12
P8
P13
P9
P10
P7
P11
P12
P8
P13
P9
P10
P7
Q4
MA-09-05157A

Fig. 20

GTA1030

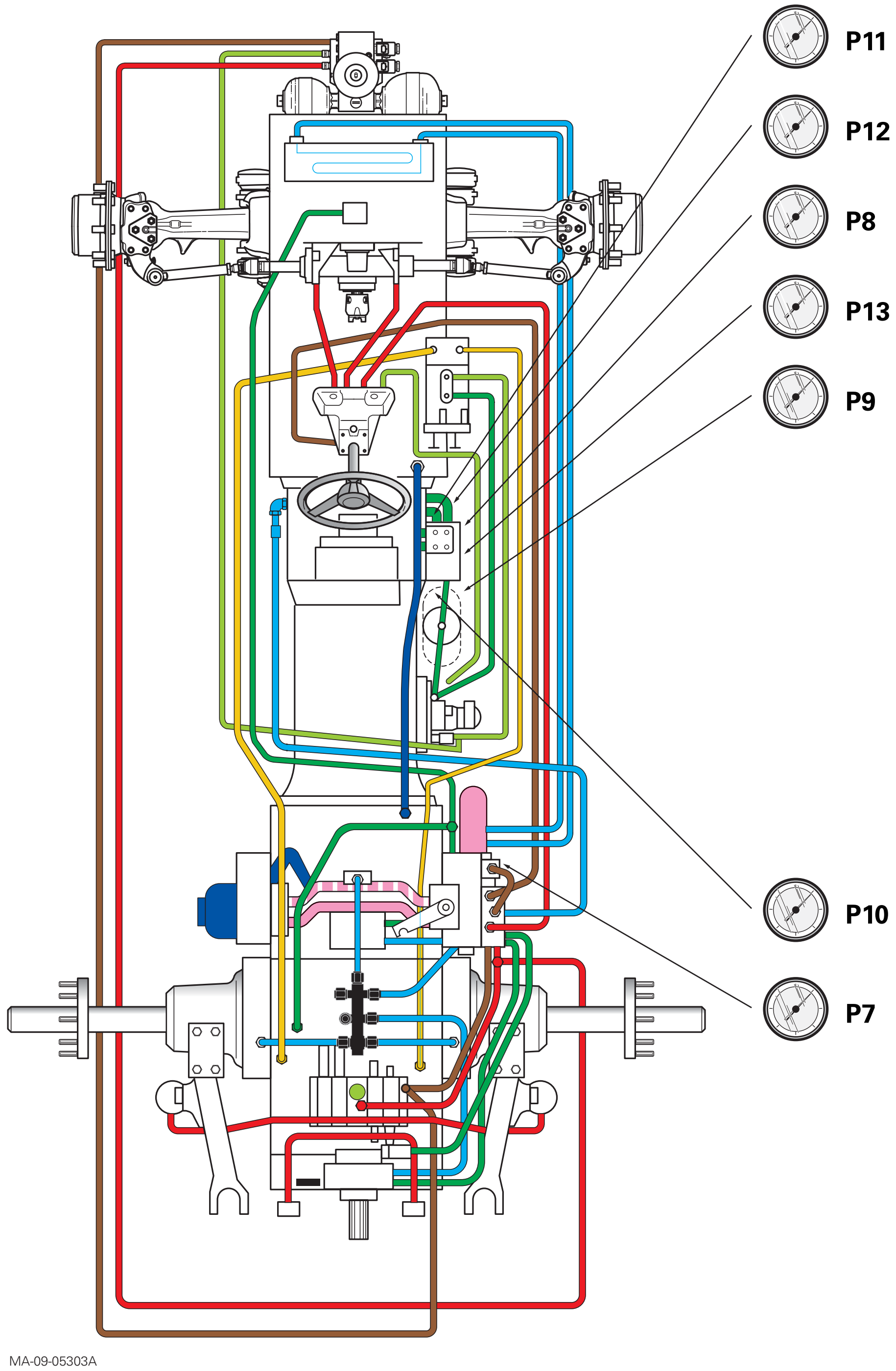


Fig. 21

Checking the pressure of clutches and slave devices in the 17 bar or 20 bar circuit

DANGER

- ***Tractors with GTA2020, GTA1030 or GTA1040 transmission***

  To keep the tractor stationary, ensure that the gear lever is in neutral.

- ***Tractors with GTA2520 transmission***

  Place the tractor on axle stands and remove the wheels in order to prevent it from moving in any way.

- Connect a pressure gauge with a capacity of approximately 30 bar to the 17 bar or 20 bar diagnostics connector (4) (Fig. 22) to check **P7**.

  The 17 bar or 20 bar diagnostics connector (4) is located:

  - at the front and top of the right-hand hydraulic cover (GTA2020)
  - at the front and bottom of the right-hand hydraulic cover (GTA1030 and GTA1040)
  - at the front of the control unit or at the front and top of the right-hand hydraulic cover (GTA2520).
- Run the engine at 1000 rpm.

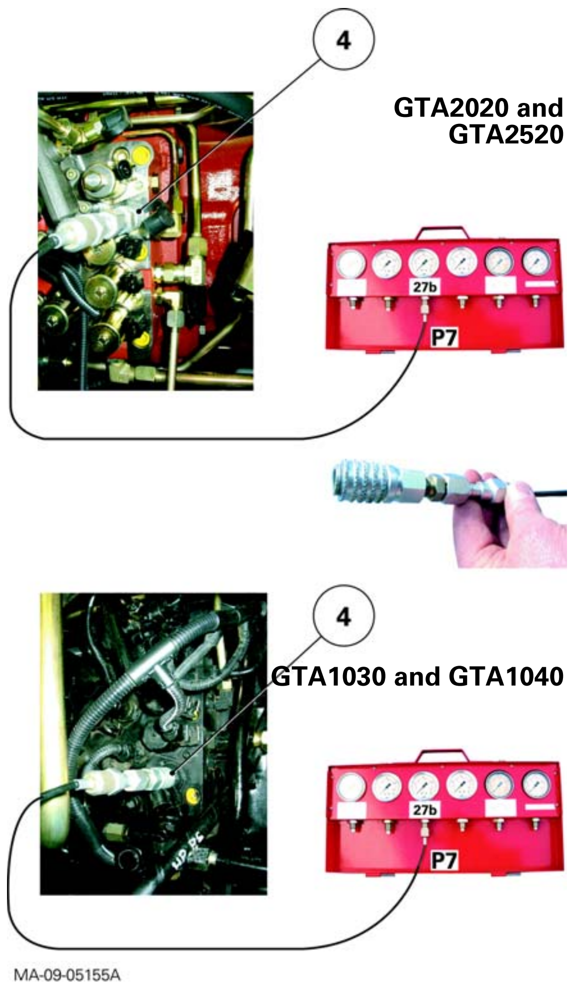


Fig. 22

GTA2020, GTA1030 and GTA1040

- Check that all the low pressure functions are at neutral.
  Specific features of the following functions:
  - The front axle should be engaged (clutch not supplied, indicator light on).
  - The range control should be in Tortoise position.
  - The PowerControl lever located on the left-hand side under the steering wheel must be in the D position for the Dynashift unit and in the neutral position for the PowerShuttle unit.
- Note the initial pressure. This should be **18 ± 1 bar**.
- Test each function individually.
  Whilst the function is being engaged, the pressure **must not** drop **below 14 bar**.
  After the function has been engaged, the pressure must return to its initial value of **18 ± 1 bar**.
  Return the tested function to neutral before testing the next function.

GTA2520

- Check that all the low pressure functions are in rest position.
  Specific features of the following functions:
  - The front axle should be engaged (clutch not supplied, indicator light on).
  - The PowerControl lever located on the left-hand side under the steering wheel must be in the neutral position.
- After waiting a few minutes, note the initial pressure, which should be **20 ± 1 bar**.
- Test functions.
  The design of the GBA25 Powershift transmission prevents separate pressure readings being taken for certain hydraulic functions.
  Whilst the function is being engaged, the pressure **must not** drop **below 14 bar**.
  After the function has been engaged, the pressure must return to its initial value of **20 ± 1 bar**.
  Disengage the function or functions that have been tested before testing the next function or functions.

Special point:

For the differential lock function on 4 WD tractors, an additional test is necessary:

Checking method

- Disconnect a lock part (front or rear).
- Block its supply.
- Check if the leak persists.

Checking the supply pressure of the PowerShuttle control unit

- Connect a pressure gauge with a capacity of approximately 30 bar to the diagnostics connector (1) of the control unit located at the front right-hand side of the gearbox (Fig. 23).
- Check **P8**:

Engine speed, (rpm)	P8 (1) (bar)	
	GTA2020 GTA1030 GTA1040	GTA2520
1000	18 ± 1	20 ± 1
2200	18 ± 1	20 ± 1

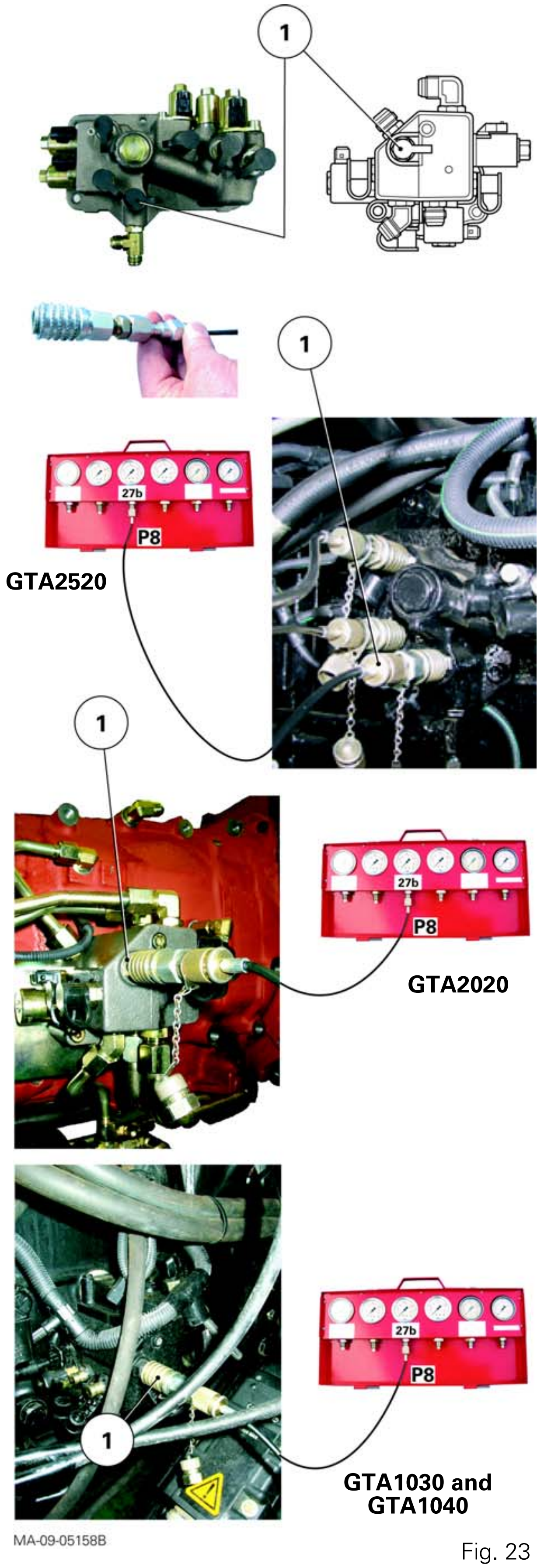


Fig. 23

Checking the (forward and reverse) clutch pressure of the PowerShuttle

DANGER

- ***<u>Tractors with GTA2020, GTA1030 or GTA1040 transmission</u>***
  To keep the tractor stationary, ensure that the gear lever is in neutral.
- ***<u>Tractors with GTA2520 transmission</u>***
  Place the tractor on axle stands and remove the wheels in order to prevent it from moving in any way.

NOTE 1: *The diagnostics connectors (1) (forward) and (2) (reverse) of the shuttle clutches are on the control unit fitted to the front right of the gearbox as shown in Fig. 24.*

NOTE 2: *The shuttle control lever is located to the left beneath the steering wheel:*

- *lever up: forward (letter F displayed on instrument panel)*
- *lever down: reverse (letter R displayed on instrument panel).*

Check (Fig. 24)

- Connect a pressure gauge with a capacity of approximately 30 bar to each diagnostics connector (1) and (2).
- Run the engine at 1000 rpm.
- Activate the lever to select the direction (forward/reverse) and the neutral position.
- Check **P9** and **P10.**

Position of lever	**Forward clutch (1) P10 (bar)**		**Reverse clutch (2) P9 (bar)**	
	GTA2020 GTA1030 GTA1040	**GTA2520**	**GTA2020 GTA1030 GTA1040**	**GTA2520**
Forward	18 ± 1	20 ± 1	0	0
Neutral or declutched	0	0	0	0
Reverse	0	0	18 ± 1	20 ± 1

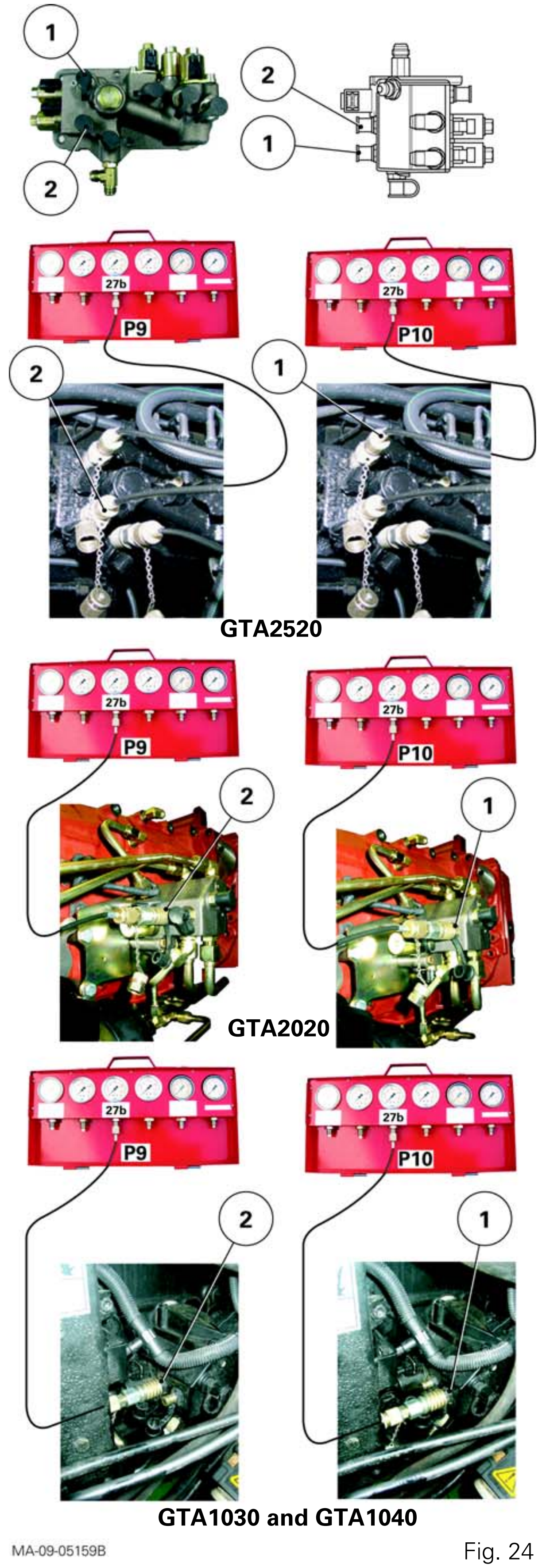


Fig. 24

Checking the lubricating pressure of the PowerShuttle clutches (forward and reverse)

Note 1: *The clutches are lubricated from a gear pump which is independent of the pump used for the conventional lubrication system. This pump is supplemented by two spools which act as valves and which are fitted in the front cover of the Powershift unit (GTA2020, GTA1030 and GTA1040). They thus lubricate the reverse position (see chapter 5).*

The design of the GBA25 PowerShuttle (forward and reverse) clutch lubrication is different, but the pressure check remains similar.

Note 2: *The check is carried out with the assistance of another operator seated at the tractor controls.*

Check (Fig. 25)

- Connect a pressure gauge with a capacity of approximately 11 bar to the diagnostics connector (1) located at the front of the gearbox.
- For the GTA2520, insert a tee fitting in the lubrication line on the left-hand side.
- Check **P11** as indicated in the table.

Position of lever	Engine speed (rpm)	P11 (bar) (1)	
		Pedal engaged	Pedal dis-engaged
Forward ratio (letter F)	1000	0.5 ± 0.1	1.5 ± 0.1
	2200	0.9 ± 0.1	2.0 ± 0.1
Neutral	1000	1.5 ± 0.1	1.5 ± 0.1
	2200	2.0 ± 0.1	2.0 ± 0.1
Reverse ratio (letter R)	1000	0.4 ± 0.1	1.5 ± 0.1
	2200	0.8 ± 0.1	2.0 ± 0.1

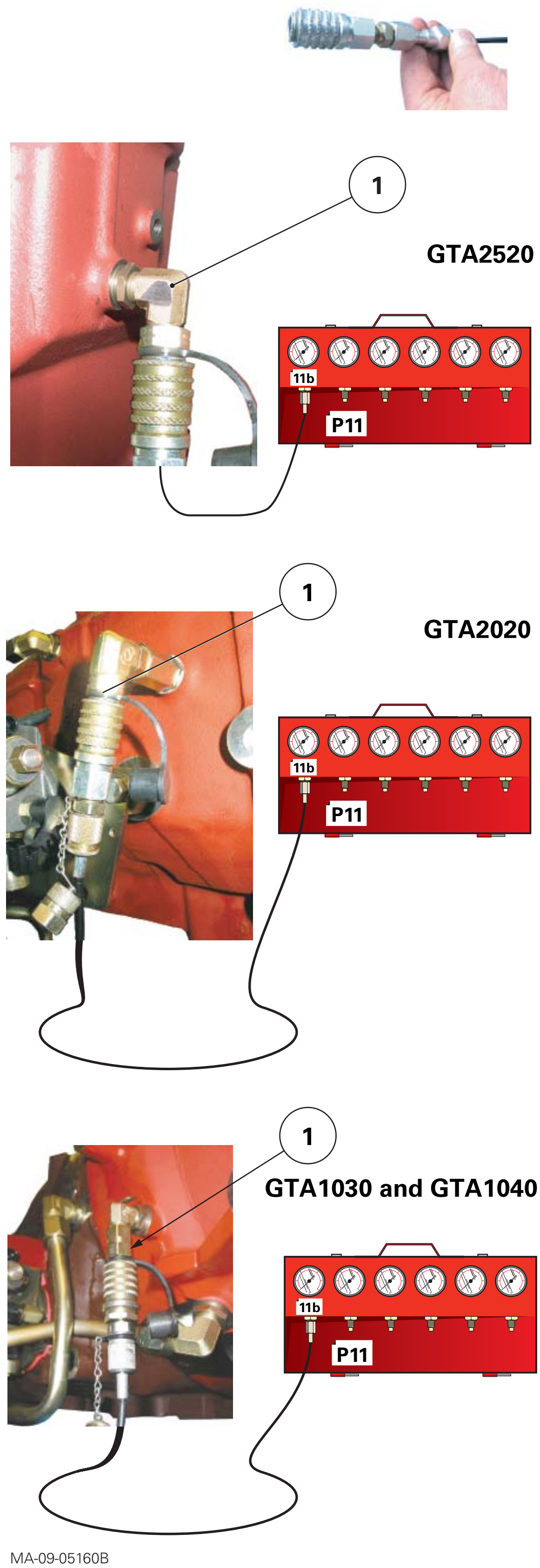


Fig. 25

Checking Dynashift piston pressure (GTA2020, GTA1030 and GTA1040)

- Connect a pressure gauge with a capacity of approximately 30 bar and fitted with a coupler ref. 3582045M1, to each male connector (2) and (3) (Fig. 26).

  Note: *The correspondence between the position of diagnostics connectors a and b, and the position of the clutches in the input unit is as follows:*
  - *connector (a) (2) EV2: clutch located at the front of the Dynashift unit*
  - *connector (b) (3) EV1: clutch located at the rear of the Dynashift unit.*
- Run the engine at 1000 rpm.
- Activate the PowerShuttle lever to select each ratio (A-B-C-D) successively.

  Danger: Ensure that the gear shift lever is in neutral position before activating the PowerShuttle lever.
- Check **P12** and **P13**.

Ratio	Front piston (2) P12 (bar)	Rear piston (3) P13 (bar)	EV1 (Volt)	EV2 (Volt)
A	18 ± 1	18 ± 1	12	0
B	18 ± 1	0	12	12
C	0	18 ± 1	0	12
D	0	0	0	0

If the pressures are incorrect, check the movement of the solenoid valve spools or refer to the electrical tests.

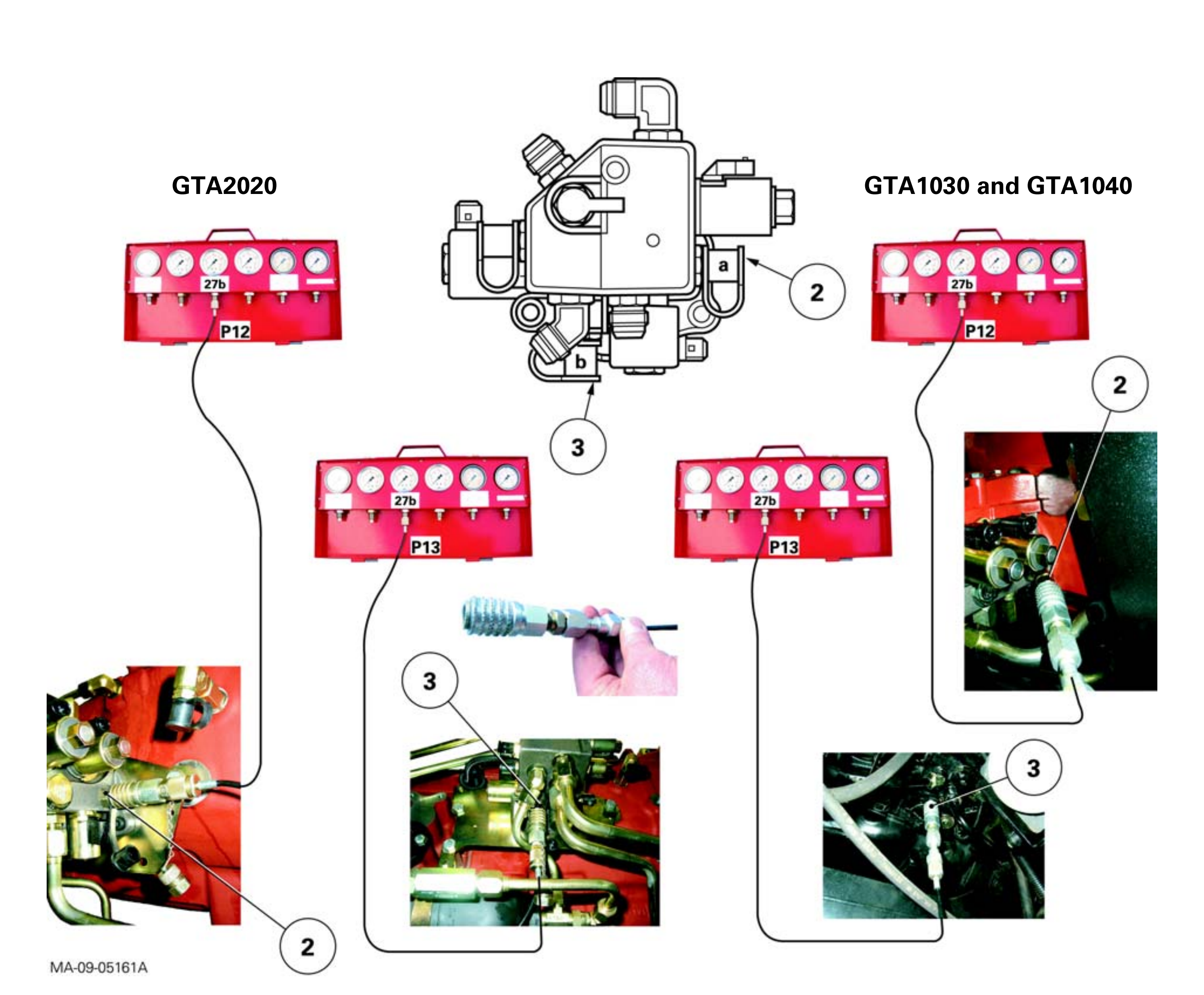


Fig. 26

Checking the pressure of the Dyna-6 transmission Powershift module

DANGER: Place the tractor on axle stands and remove the wheels in order to prevent it from moving in any way.

- Connect a pressure gauge with a capacity of approximately 30 bar and fitted with a coupler ref. 3582045M1, to each male connector L, N and P (Fig. 27).

  NOTE: *The relationship between the position of the diagnostic connectors and the location of the brakes in the Powershift module is as follows:*
  - *connector (L): Dynashift module front brake*
  - *connector (N): Dynashift module rear brake*
  - *connector (P): Speed multiplier brake*
- Run the engine at 1000 rpm.
- Set the PowerControl lever to forward and operate the armrest lever to select each ratio (A-B-C-D-E-F) in succession.
- Check **P12**, **P13 and P14**.

Ratio	**Piston L P14 (bar)**	**Piston N P12 (bar)**	**Piston P P13 (bar)**	**EVL (Volt)**	**EVN (Volt)**	**EVP (Volt)**
A	20 ± 1	20 ± 1	0	12	12	0
B	20 ± 1	0	0	12	0	0
C	0	20 ± 1	0	0	12	0
D	0	0	0	0	0	0
E	0	20 ± 1	20 ± 1	0	12	12
F	0	0	20 ± 1	0	0	12

If the pressures are incorrect, check the movement of the solenoid valve spools or refer to the electrical tests.

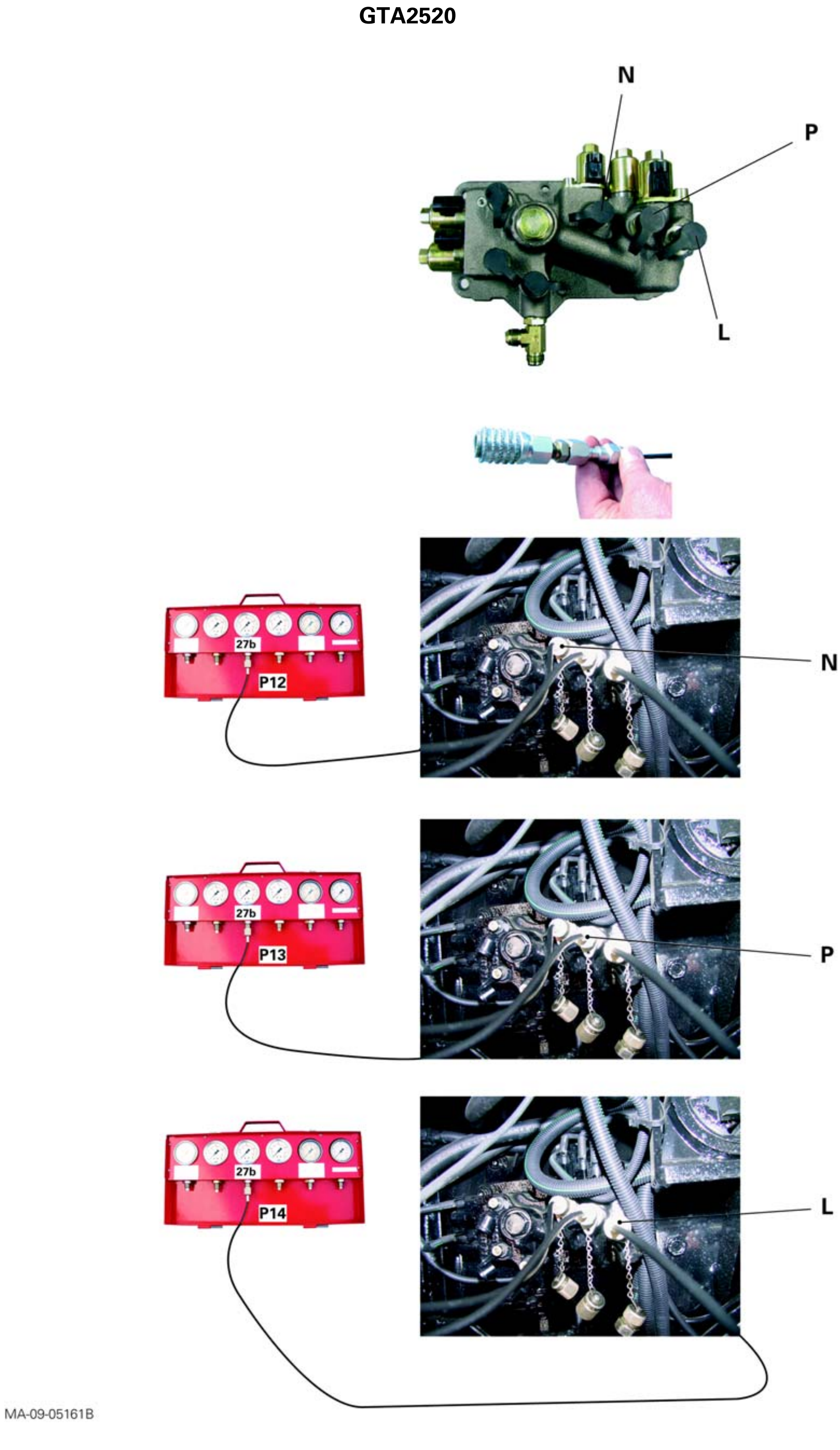


Fig. 27

Checking for leaks at clutches and slave devices

Reminder

- *The Closed Centre circuit pump flows only to maintain its standby pressure, unlike the Open Centre circuit pump, which flows continuously.*
- *The oil flow circulating in the 17 bar line corresponds to the leaks of the clutches and slave devices.*
- *To check the Q4 reference flow rate, all the low pressure 17 bar functions must be engaged.*

Test conditions

- Front axle disengaged (solenoid valve supplied, indicator light off)
- Differential lock on
- Dynashift at A
- Hare range engaged
- Shuttle in forward position
- PTO engaged

Check:

- Connect the flowmeter between the right-hand hydraulic cover and the hydraulic line (L) of the 17 bar couplings (Fig. 20, Fig. 21 and Fig. 28).

  Important: Check that the flowmeter load valve remains fully open throughout the test.
- Connect a 30 bar pressure gauge to the connector (1) (Fig. 28) to check **P7**.
- Note the **Q4** reference flow rate at 2000 rpm.
- Cut the supply to the tested function.

  Read the new flow rate **Q5**.

  Return the tested function to operating conditions.
- Proceed in the same manner to test the next function.
- Difference **Q4 - Q5** represents the leak detected. The value read should not exceed the values indicated in the "Identifying leaks at clutch and slave devices" table below.

Special point:

For the differential lock function, an additional test is necessary to determine the difference between the front and rear.

<u>Checking method</u>

- Disconnect and block one of the piston supplies.
- Check if the leak persists.

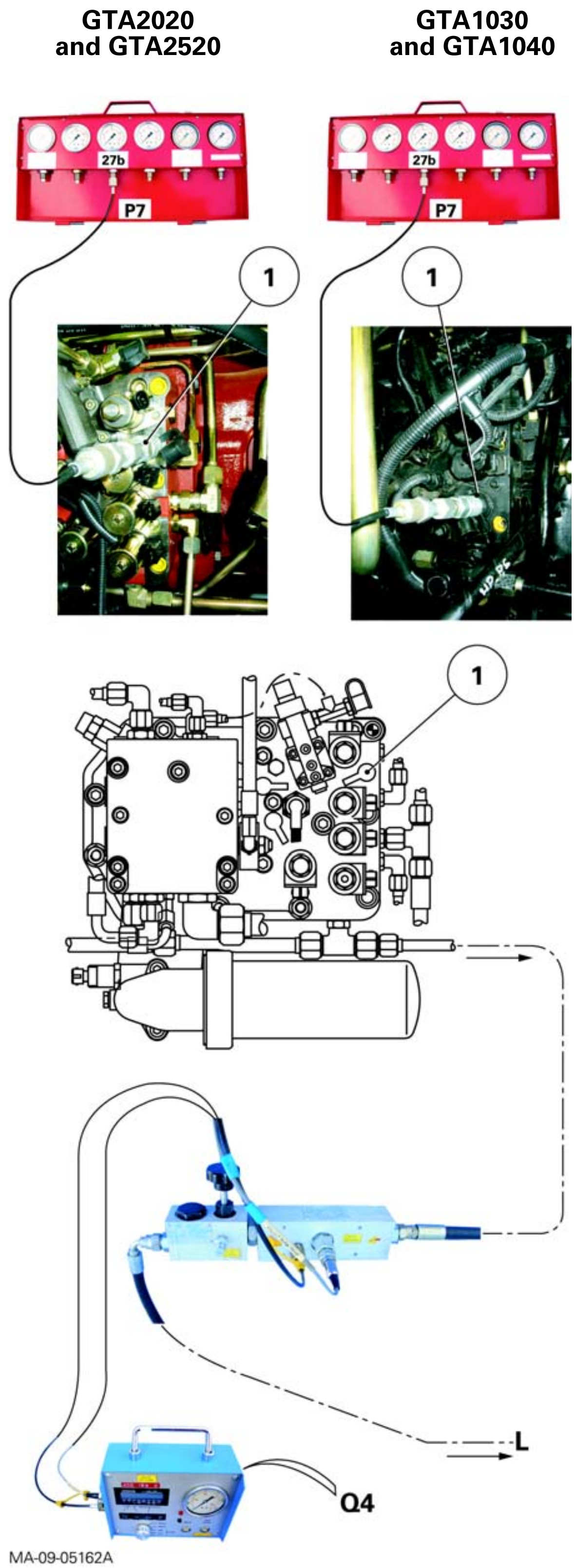


Fig. 28

	PowerShuttle control unit Forward clutch	**PowerShuttle control unit** Neutral	**PowerShuttle control unit** Reverse clutch	Dynashift or Dyna-6
Reference flow rate **Q4**				
Flow rate measured **Q5**				
Leak detected (l/min) **Q4-Q5**				
Maximum allowable leak (l/min)	1.5	-	1.5	0
Pressure **P7** (bar)	18 ± 1			

	Hare range	**Power take-off clutch**	**Power take-off brake**	**Differential lock** FWD	**Differential lock** REV	**4WD clutch (front axle)**	**Front power take-off** *optional*
Reference flow rate **Q4**							
Flow rate measured **Q5**							
Leak detected (l/min) **Q4-Q5**							
Maximum allowable leak (l/min)	0.5	1.5	2	0.5	0.5	1.5	1.5
Pressure **P7** (bar)	18 ± 1						

Identifying leaks at clutch and slave devices

Example of a test on a GTA2020, GTA1030 or GTA1040 transmission

	PowerShuttle control unit			Dynashift **A-B-C-D**
	Forward clutch	Neutral	Reverse clutch	
Reference flow rate **Q4**	-	2.20	-	2.4
Flow rate measured **Q5**	2.5	-	2.4	2.4
Leak detected (l/min) **Q4-Q5**	0.3	-	0.2	0
Maximum allowable leak (l/min)	1.5	-	1.5	0
Pressure **P7** (bar)	18 ± 1			

	Hare range	**Power take-off clutch**	**Power take-off brake**	**Differential lock**		**4WD clutch (front axle)**	**Front power take-off**
				FWD	REV		*optional*
Reference flow rate **Q4**	2.4	2.4	2.4	2.4	2.4	2.4	-
Flow rate measured **Q5**	2.4	1.5	1.5	2.3	2.3	1.9	-
Leak detected (l/min) **Q4-Q5**	0	0.9	0.9	0.1	0.1	0.5	-
Maximum allowable leak (l/min)	0.5	1.5	2	0.5	0.5	1.5	1.5
Pressure **P7** (bar)	18 ± 1						

D . Cooling and lubricating circuit

Checking cooler inlet and outlet pressure (GTA1030, GTA1040 and GTA2020)

If necessary, connect a pressure gauge with a capacity of around 11 bar to the oil cooler inlet (2) in order to check **P16** and to the outlet (3) in order to test **P17** (Fig. 29, Fig. 30, Fig. 31).

Engine speed (rpm)	P16 (2) (bar)	P17 (3) (bar)
1000	2	1.9
2200	2.3	2

Checking the transmission lubricating flow rate and pressure

Assemblies concerned

- Input unit
- Gearbox
- Power take-off
- Pinion rear bearings (GTA2020)
- Handbrake discs (GTA1040)
- Trumpet housings
- Hydraulic pump drive bearing/pinion (GTA1030)

Checking the flow rate

Note: *Due to the bulkiness of the fuel tank located on the left-hand side of the tractor, it is impossible to directly connect a flowmeter to the lubricating union of the gearbox inlet.*

- Connect a flowmeter to the lubricating line located:
  - on the right-hand side of the tractor (GTA2020 and GTA2520) (Fig. 31, Fig. 32)
  - under the right-hand hydraulic cover of the rear axle (GTA1030 and GTA1040) (Fig. 29, Fig. 30).

  Important: *Check that the flowmeter load valve remains fully open throughout the test.*
- Check **Q5** (Fig. 29, Fig. 30, Fig. 31, Fig. 32).

Engine speed (rpm)	Q5 minimum (l/min)
1000	17.8
2200	19.9

Reminder: *If an auxiliary spool valve is activated (a flowmeter or slave device must be connected to it), the flow must not drop by more than 2 l/min.*

Checking the pressure

- Connect a pressure gauge with a capacity of approximately 11 bar:
  - on the lubrication line located on the right-hand side of the tractor (GTA2020) (Fig. 31)
  - under the right-hand hydraulic cover of the rear axle [GTA1030 and GTA1040 (Fig. 29, Fig. 30)] and [GTA2520 (Fig. 32)].
- Run the engine at:
  - 1000 rpm (GTA1030, GTA1040 and GTA2020)
  - 1500 rpm (GTA2520).
- Check that:
  - **P18 = 1.5 ± 1 bar** (GTA1030, GTA1040 and GTA2020)
  - **P18** is in accordance with the values specified in the following table (GTA2520).

t° (°C)	P18 min. (bar)	P18 max. (bar)
20	2.69	3.63
40	2.69	3.63
70	2.71	3.67

Reminder: *If an auxiliary spool valve is engaged (a flowmeter or slave device must be connected to it), the flow must not drop by more than 1 bar.*

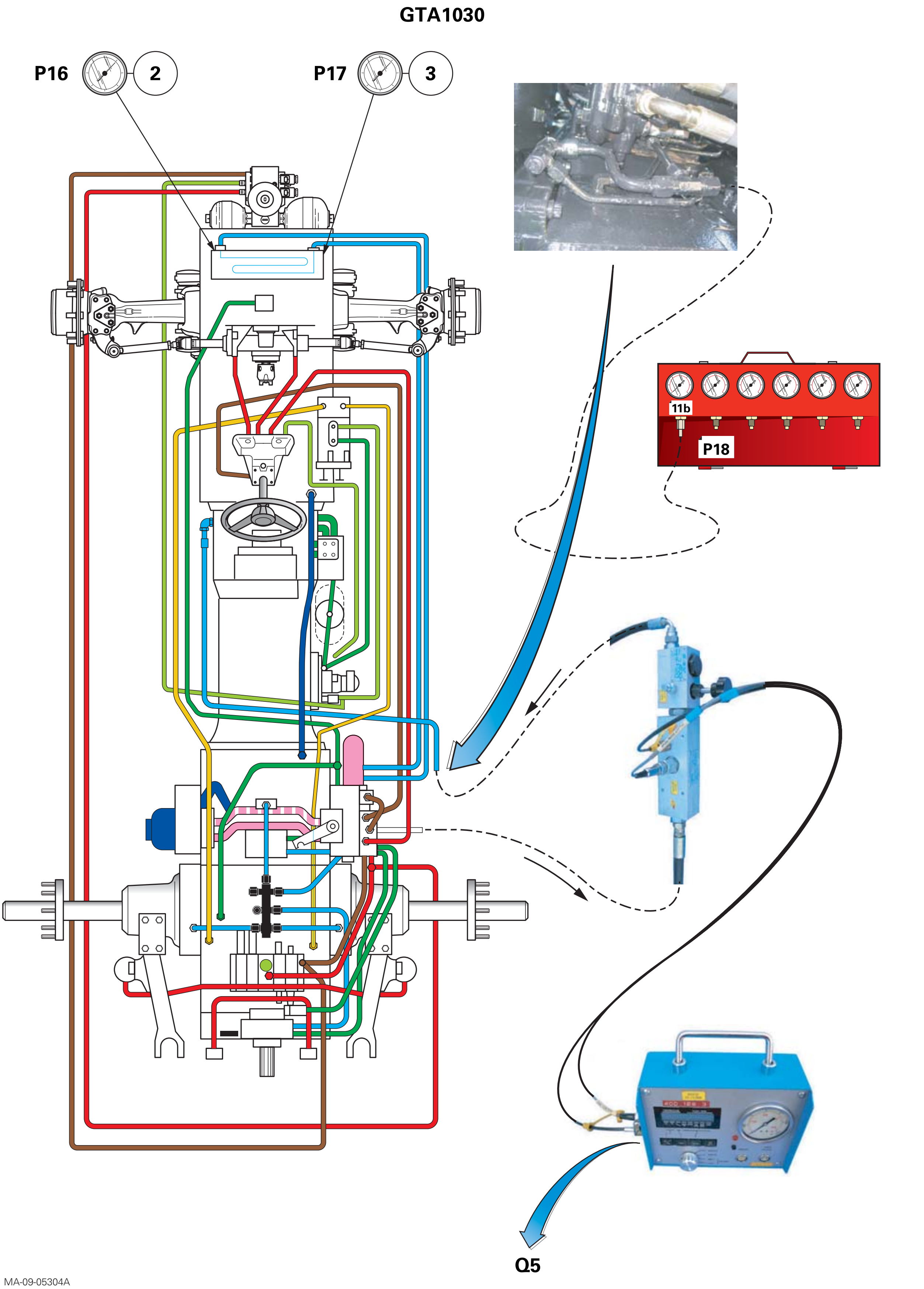


Fig. 29

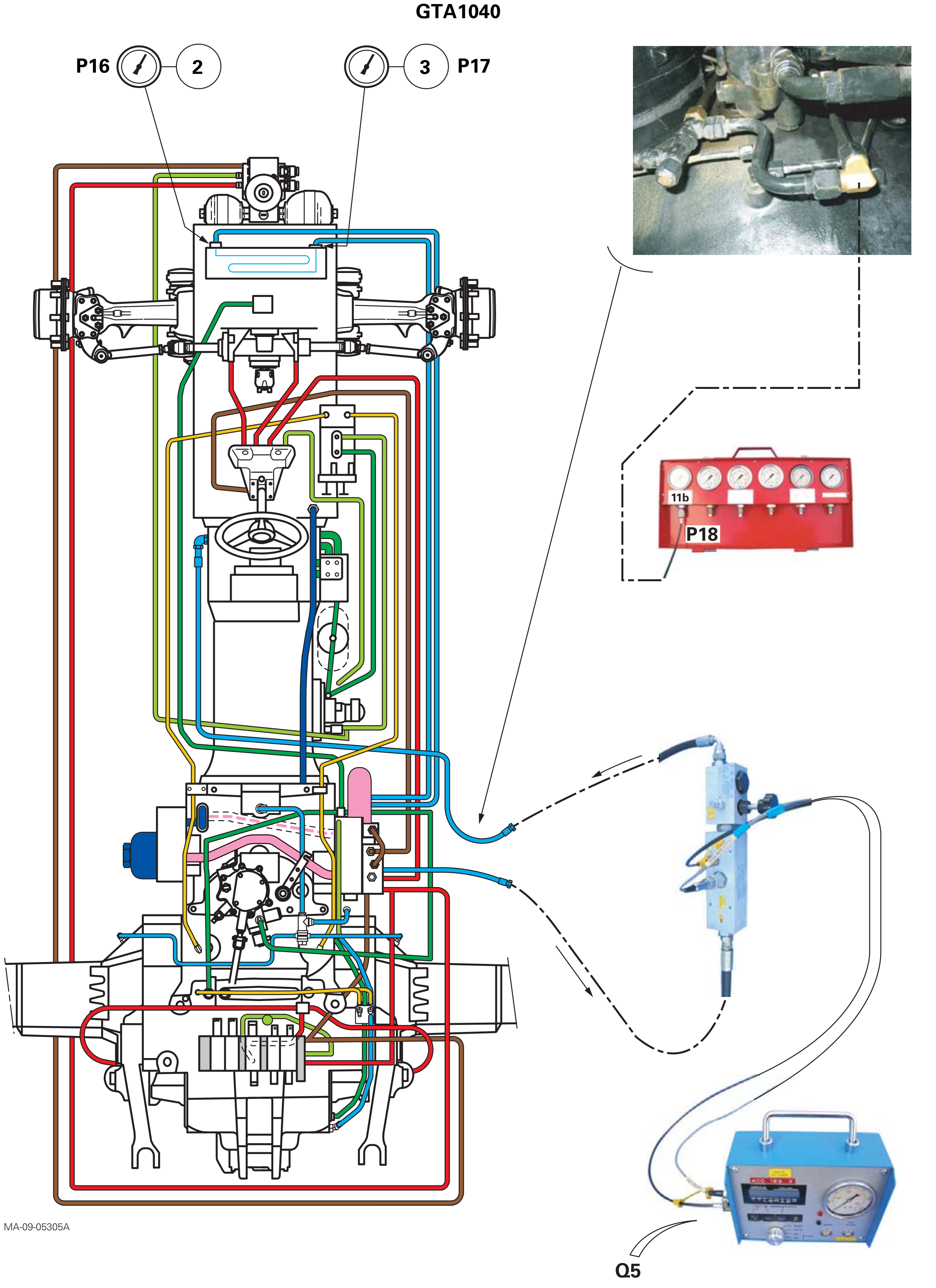


Fig. 30

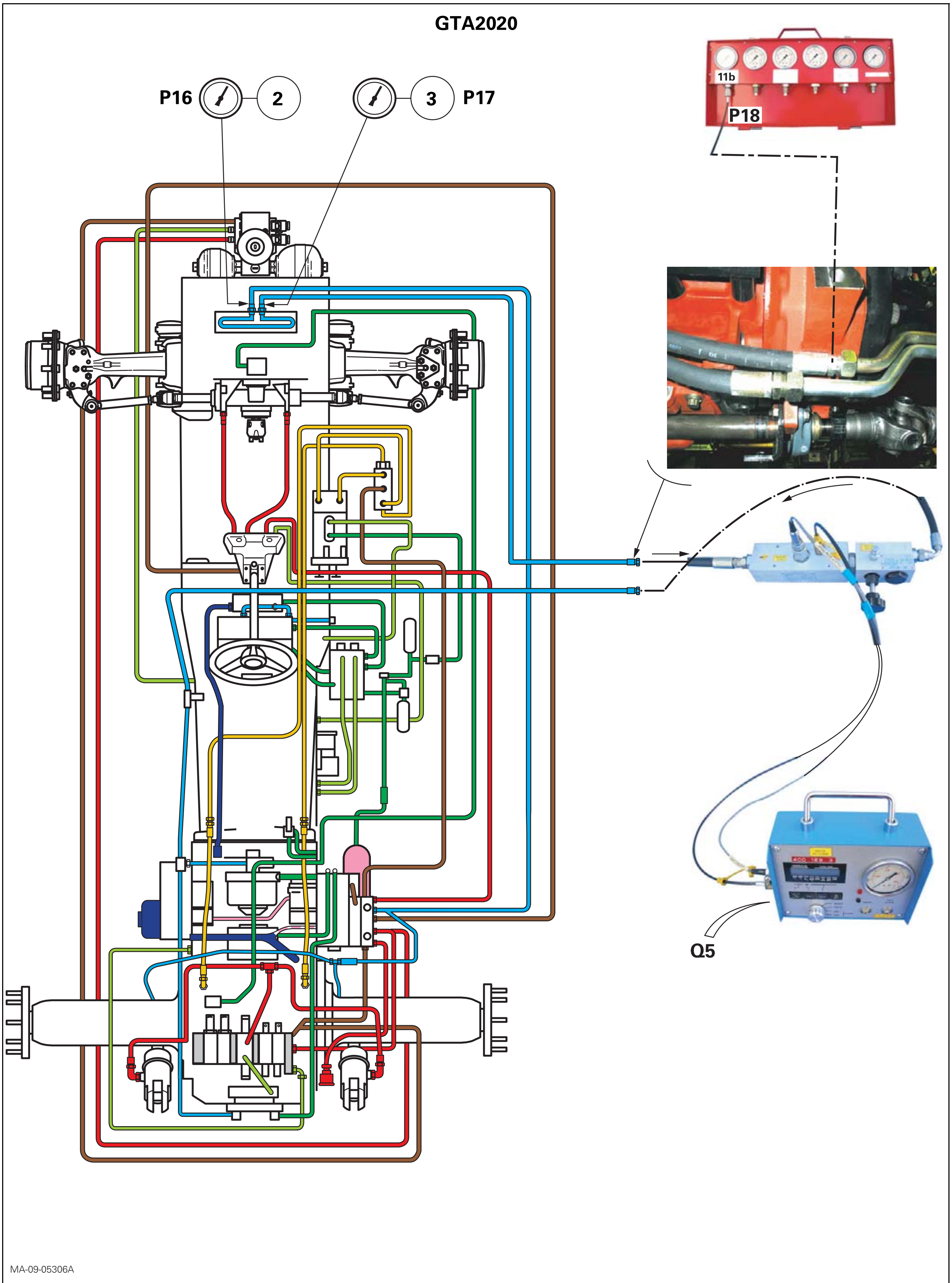


Fig. 31

GTA2520

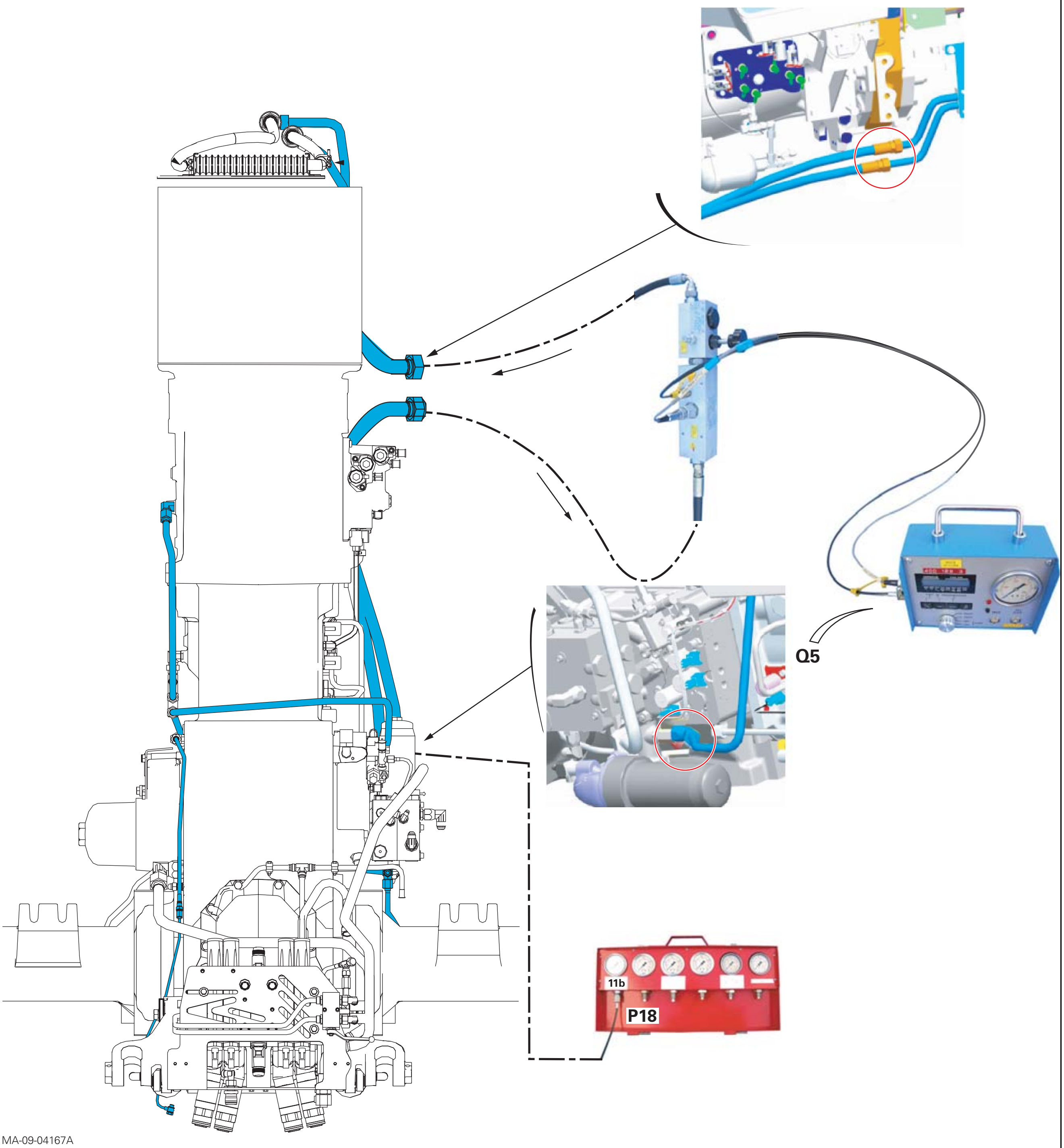


Fig. 32

E . Hydraulic tests on suspended front axle

Identifying the various hydraulic connections

Legend (Fig. 33, Fig. 34)

A Supply under pressure from hydraulic pump
B Return to tank
C Steering

Test procedure for front axle suspension control

1. Open the bleed screw before splitting hydraulic connections (Fig. 35).

***DANGER:* The pressure in the front axle must be released in order to avoid any risk of injury.**

NOTE: Whilst the pressure is being bled off, the front axle may rise before dropping, depending on how the tractor is equipped. This phenomenon is associated with the weight/pressure ratio on the front of the tractor.

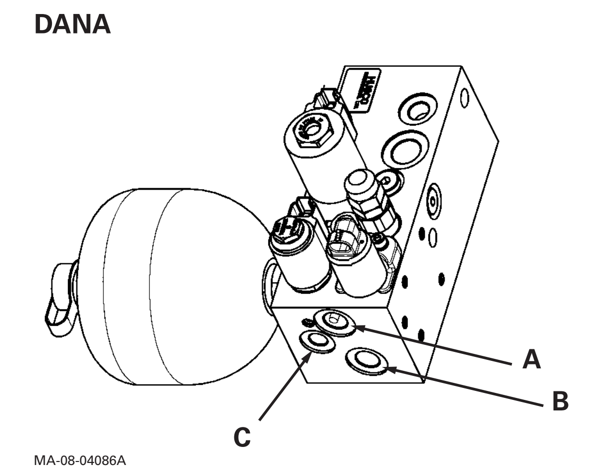


Fig. 33

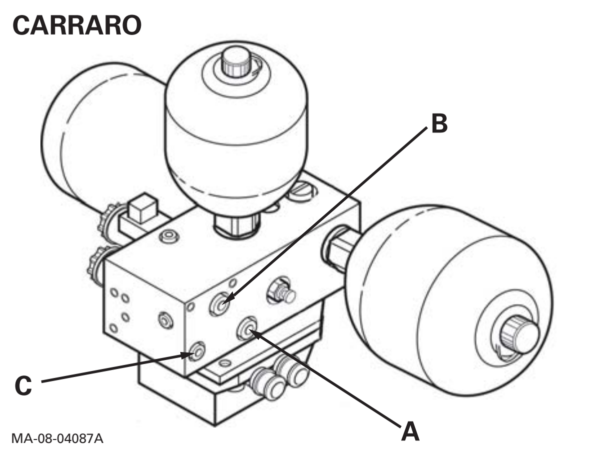


Fig. 34

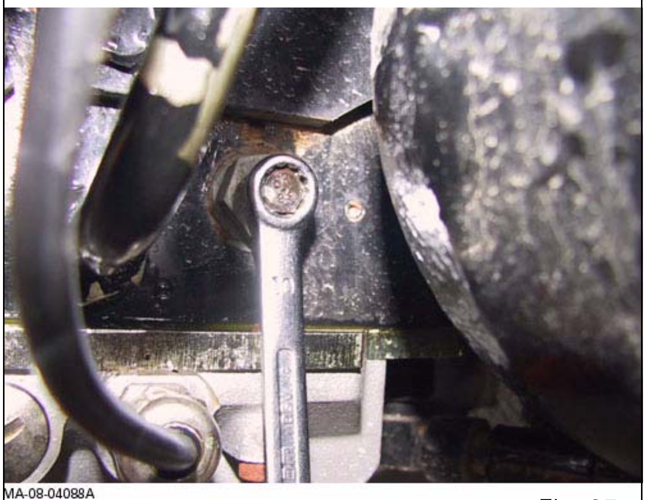
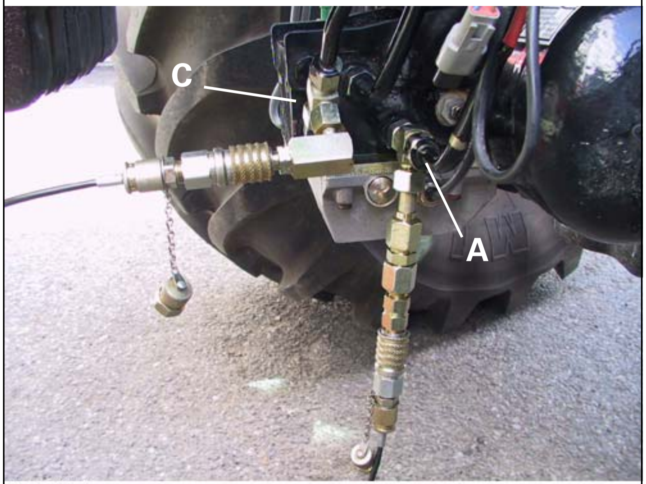


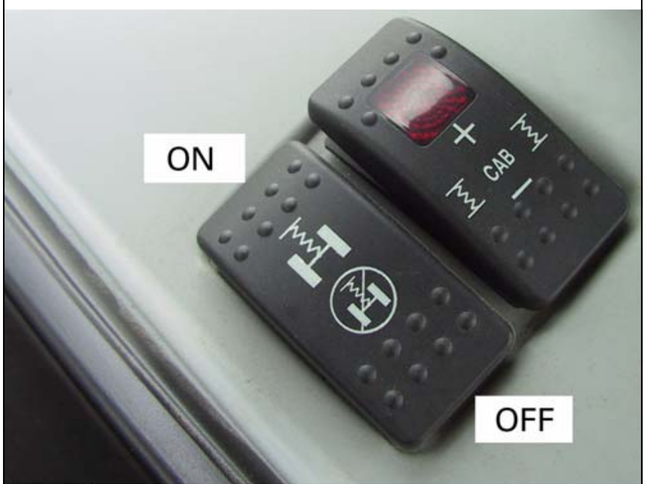
Fig. 35

2. Disconnect hydraulic fittings A and C (Fig. 33 or Fig. 34).
3. Fit the relevant tappings (Fig. 36 and section G).
   Reconnect hydraulic fittings A and C.
4. Retighten the bleed screw (Fig. 37).
   Connect the pressure gauges to the pressure connectors on the tappings.
   ***Note:** Use pressure gauges reading up to at least 300 bar.*
5. Start the tractor. After a few minutes, press the front axle suspension button (ON, Fig. 38) to lift the axle.



MA-08-04089A
Fig. 36


MA-08-04090A
Fig. 37



MA-08-04091A
Fig. 38

6. Read off the following pressures on the pressure gauges (Fig. 39).

Lifting phase		
Union	**Circuits LS (bar)**	**Circuits TFLS and OC**
A	200 bar ± 10	80 bar ± 10
C	200 bar ± 10	80 bar ± 10

Working position		
Union	**Circuits LS**	**Circuits TFLS and OC**
A	25 bar ± 10	25 bar ± 5
C	0 bar ± 10	0 bar ± 5

7. Press the front axle suspension button (OFF, Fig. 38) to lower the axle.
8. Read off the following pressures on the pressure gauges (Fig. 39).

Lowering phase		
Union	**Circuits LS**	**Circuits TFLS and OC**
A	80 bar ± 10	60 bar ± 10
C	80 bar ± 10	60 bar ± 10

Working position		
Union	**Circuits LS**	**Circuits TFLS and OC**
A	25 bar ± 10	25 bar ± 5
C	0 bar ± 10	0 bar ± 5

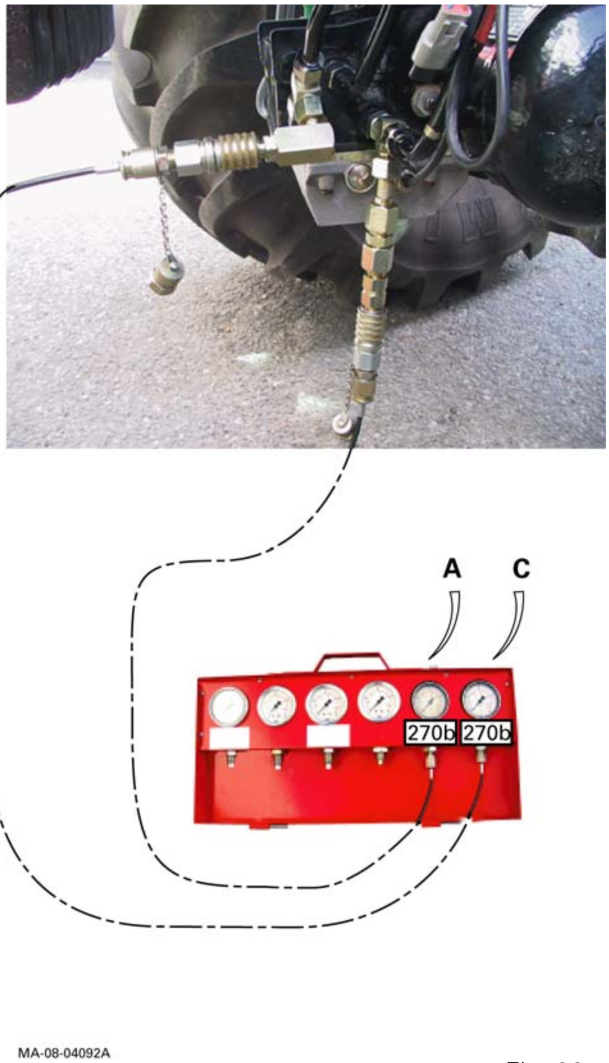


Fig. 39

9. Open the bleed screw (Fig. 40).
10. Remove the tappings from A and C.
11. Reconnect fittings A and C to the hydraulic block.
12. Retighten the bleed screw (Fig. 41).
13. Recalibrate the front axle if any axle components have been replaced (see chapter 11).

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Fig. 40

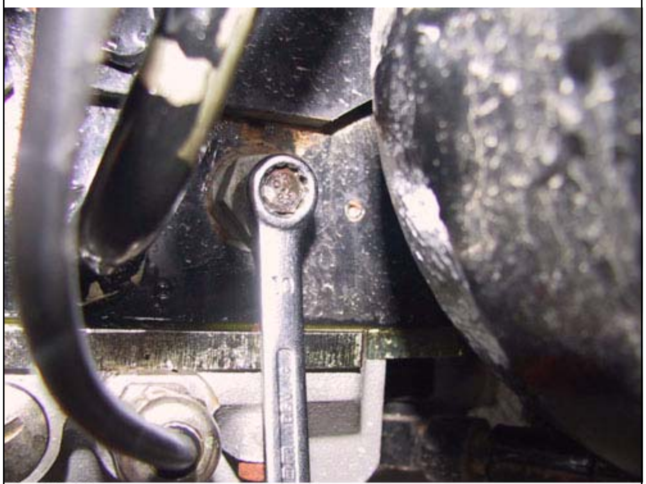

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Fig. 41

F . Checking the pressure of front axle accumulators

***DANGER:* Hydraulic pressure in the front axle must be released before carrying out this operation (see section E, operation 1).**

14. Unscrew the protective plastic plug from the accumulator.

15. Loosen the Allen screw by a maximum of 1/10th of a turn.

16. Fit service tool 3378059M1.

17. Check the pressure in the accumulator (Fig. 42, Fig. 43).

Accumulator	Axle type	Pressure (bar)
1	DANA	24 ± 1
2	CARRARO	40 ± 3
3	CARRARO	40 ± 3
4	CARRARO	140 ± 3

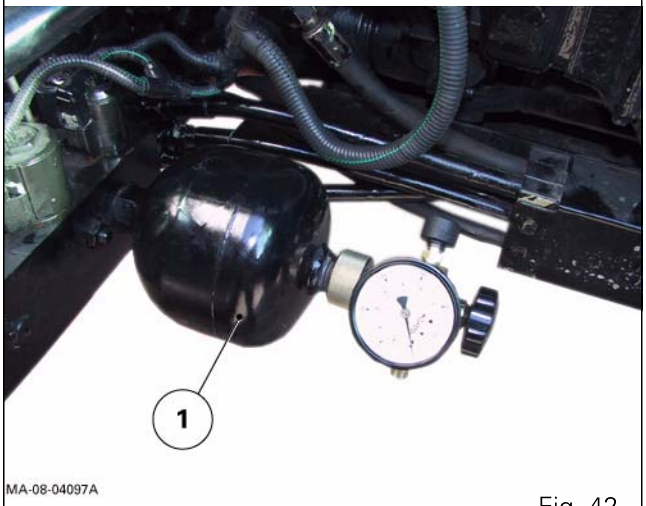


Fig. 42

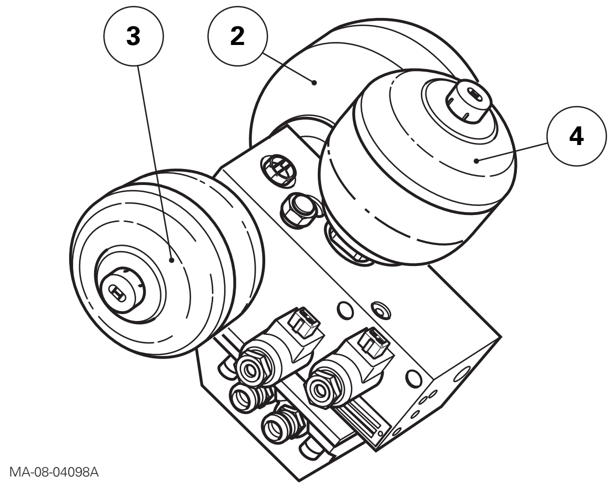


Fig. 43

G . Tappings used

Tapping at A (Fig. 45)
Tapping at C (Fig. 44)

Ref.	Reference
1	3384387M1
2	4276989M1
3	3311298X91
4	3011289X91
5	3011118X1
6	Hydraulic pipe 12mm dia., 50mm length
7	195960M1
8	355528X1
9	195960M1
10	356627X1
11	3793689M1

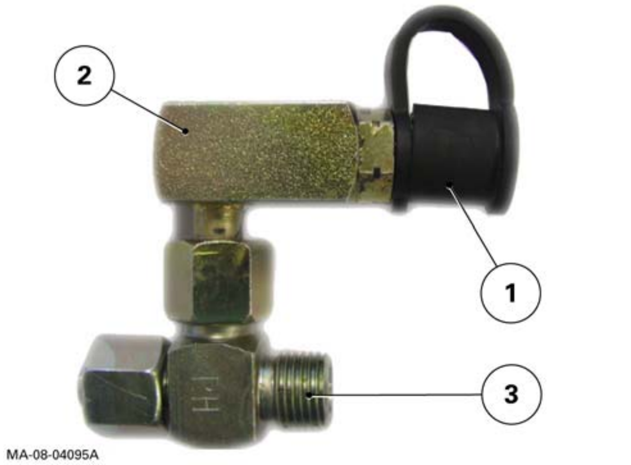


Fig. 44

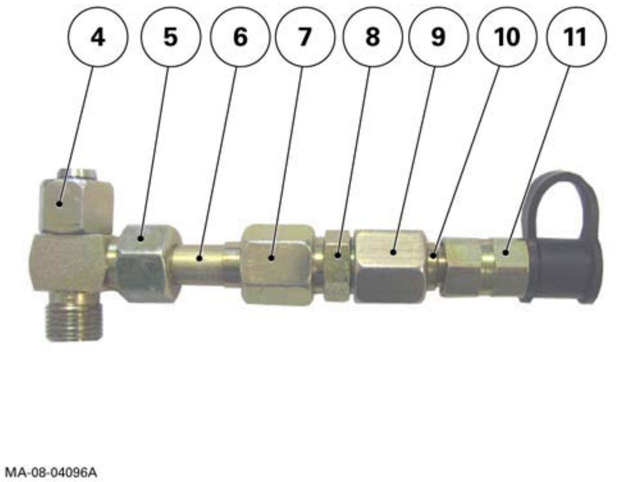


Fig. 45

9C20 - Right-hand LS cover plate

CONTENTS

A . General

The right-hand cover plate is fitted on the intermediate housing (GPA30) or the centre housing (GPA20 and GPA40). It is the main support for a number of components. It incorporates the various channels for the charge system, the lubrication system and the low flow rate and high flow rate systems of the 110 l/min or 150 l/min Load Sensing system.

On its internal face, the cover contains:

- the variable displacement pump (41) with a capacity of 45 cm^3/revolution (GPA20, GPA30 and GPA 40) (110 l/min Load Sensing hydraulic system) or the variable displacement pump (41) with a capacity of 60 cm^3/revolution (GPA 40) 150 l/min Load Sensing hydraulic system)
- its drive gear (39) fitted to the variable displacement pump
- the safety valve (45) of the low pressure system set to 24 bar,
- the safety valve (44) of the charge and lubrication system set to 5 bar. This safety valve differs depending on the tractor's Load Sensing hydraulic equipment (110 l/min or 150 l/min).

On its external face, the cover contains:

- the main filter 15 µ (27); this differs depending on the tractor's Load Sensing hydraulic equipment (110 l/min or 150 l/min).
- one or two priority blocks serving different functions of the low and high flow rate systems.

  Note 1: *For the 40 kph version with trailer braking, the tractors are fitted with a hydraulic unit with two priority blocks.*

  Note 2: *For the 50 kph version with or without trailer braking, the tractors are systematically fitted with a hydraulic unit with two priority blocks. These priority blocks can be distinguished from the priority blocks on the 40 kph version with trailer braking by a higher number of hydraulic ports. These additional hydraulic ports are used by the high-pressure braking unit;*
- the pressure relief-valve (2);
- the variable displacement pump hydraulic regulator (12);
- the three or four flanged solenoid valves (2 or 4WD) that control the low pressure functions (17 or 21 bar);
- diagnostics connectors for high and low pressure (11) (20), lubrication charge (29), LS (9);
- the engine speed sensor (25) (if fitted);
- the low pressure (14) and charge (42) switches as well as the main filter blockage indicator (34).

Right-hand LS cover plate

Description

The engine movement transmitted to the gear (1) via the shaft (2) drives the gear (39) of the variable displacement pump (41) (Fig. 1, Fig. 2, Fig. 3,). The shaft (2) is splined to the engine flywheel vibration damper via the PTO shaft.

The oil coming from the charge pump located on the left-hand cover plate (see chapter 9) is directed towards the priority block via the pipe (3) (GPA20 and GPA40) (Fig. 4, Fig. 5, Fig. 6) or the pipe (54) (GPA30) (Fig. 7) via the variable displacement pump (41), to supply the required function.

The pipe (1) (GPA20 and GPA40) (Fig. 4, Fig. 5, Fig. 6) or the pipe (55) (GPA30) (Fig. 7) carries the oil coming from the 5 bar safety valve (44) to the suction manifold (4) fitted on the left-hand cover plate (see chapter 9).

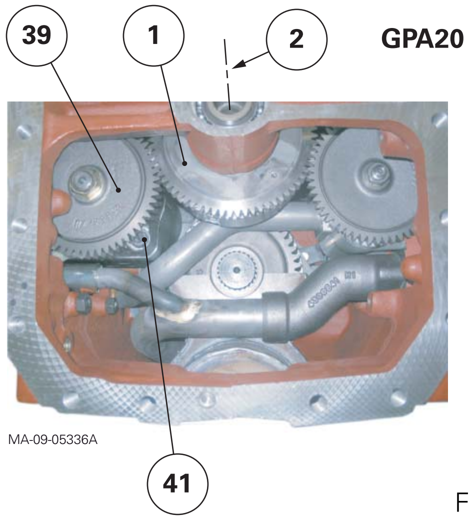


Fig. 1

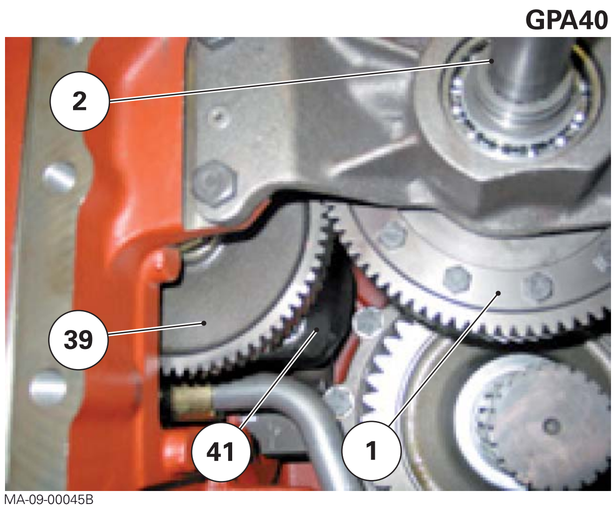


Fig. 2

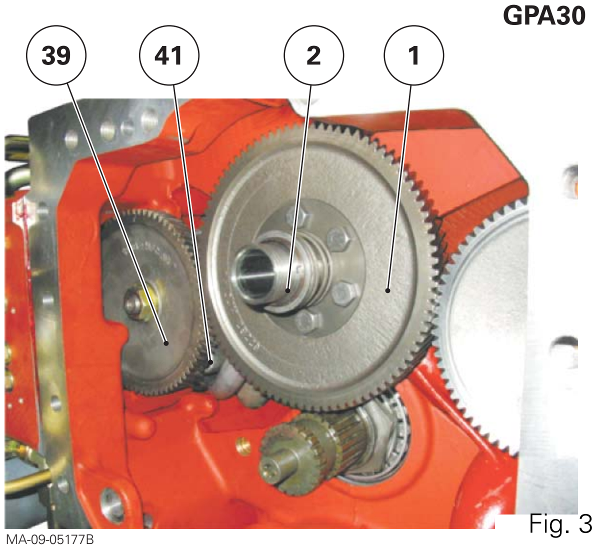


Fig. 3

GPA20 and GPA40 assemblies (Fig. 4, Fig. 5, Fig. 6)

1-	GPA20 LS 110 l/min
2	GPA40 LS 110 l/min
3	GPA40 LS 150 l/min

Parts list

(1) Continuity pipe from safety valve (44)
(2) Charge pump
(3) Charge pipe
(4) Suction manifold
(41) Variable displacement pump
(44) 5 bar safety valve

Legend

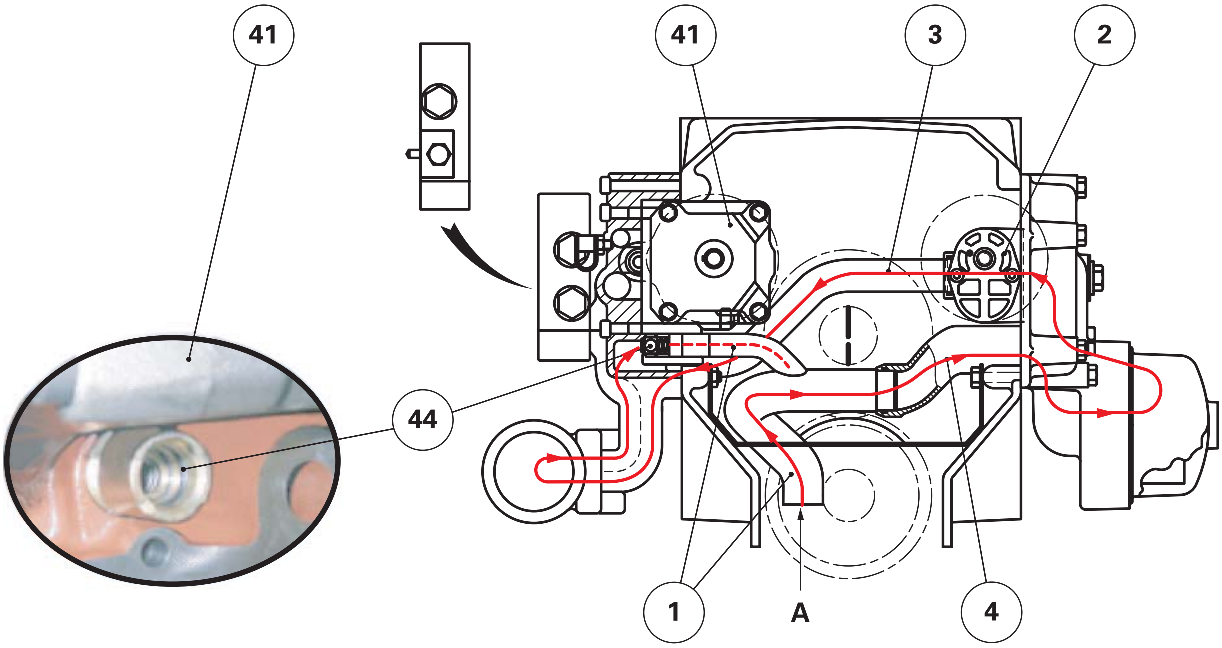
A Source of suction

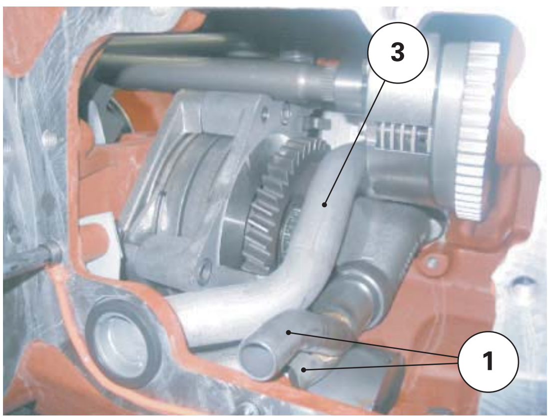
Movement of the fluid

Suction of oil from the charge pump (2) and delivery of this oil to the variable displacement pump (slave devices used).

Re-supply to variable displacement pump (slave devices not used).

1





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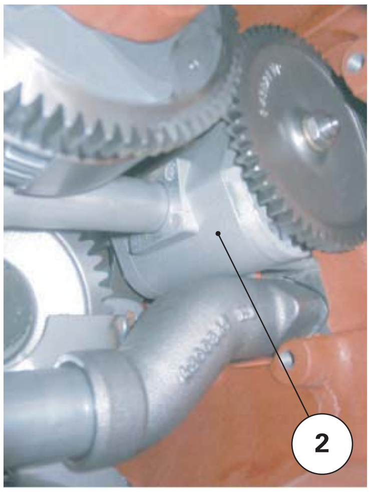


Fig. 4

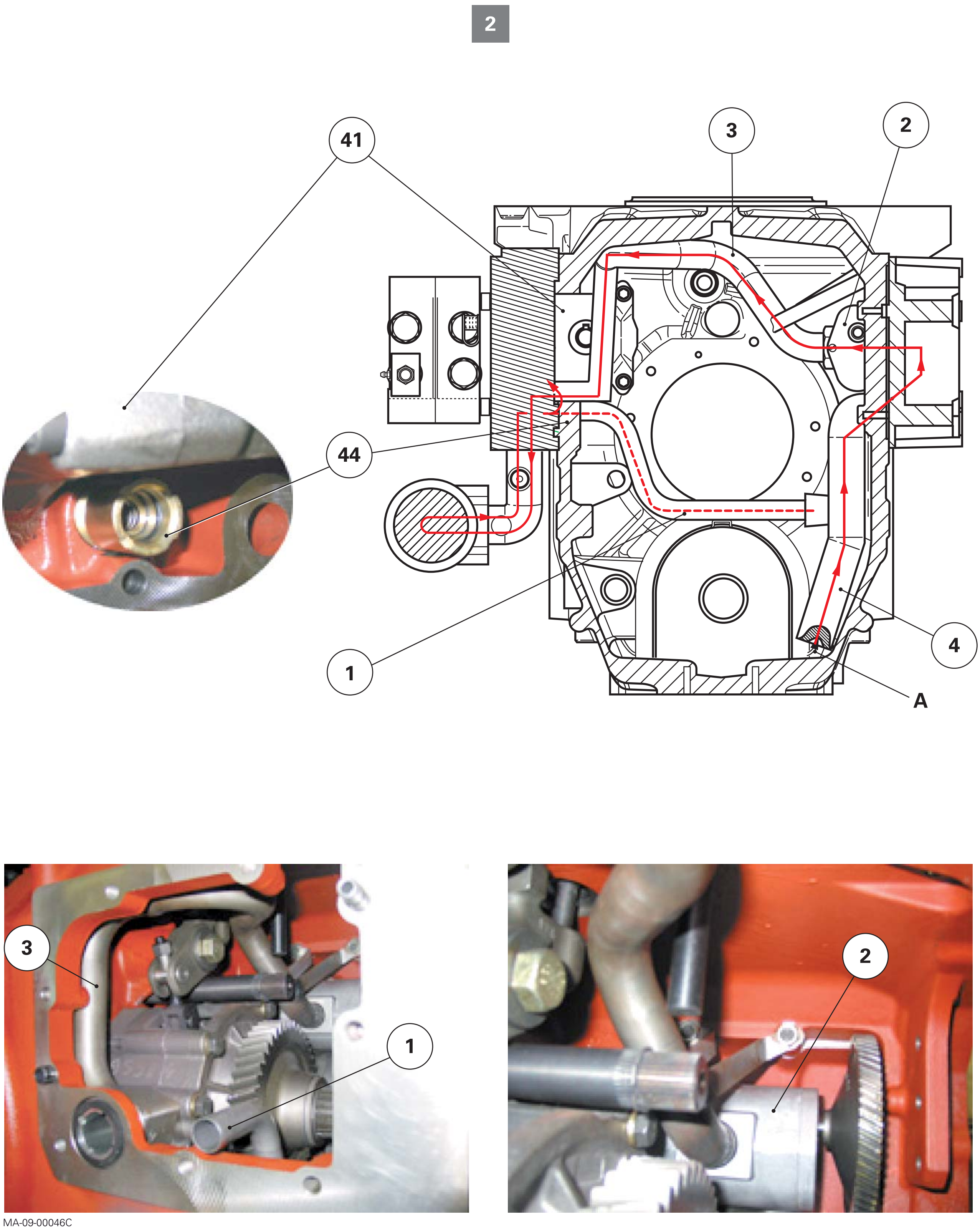


Fig. 5

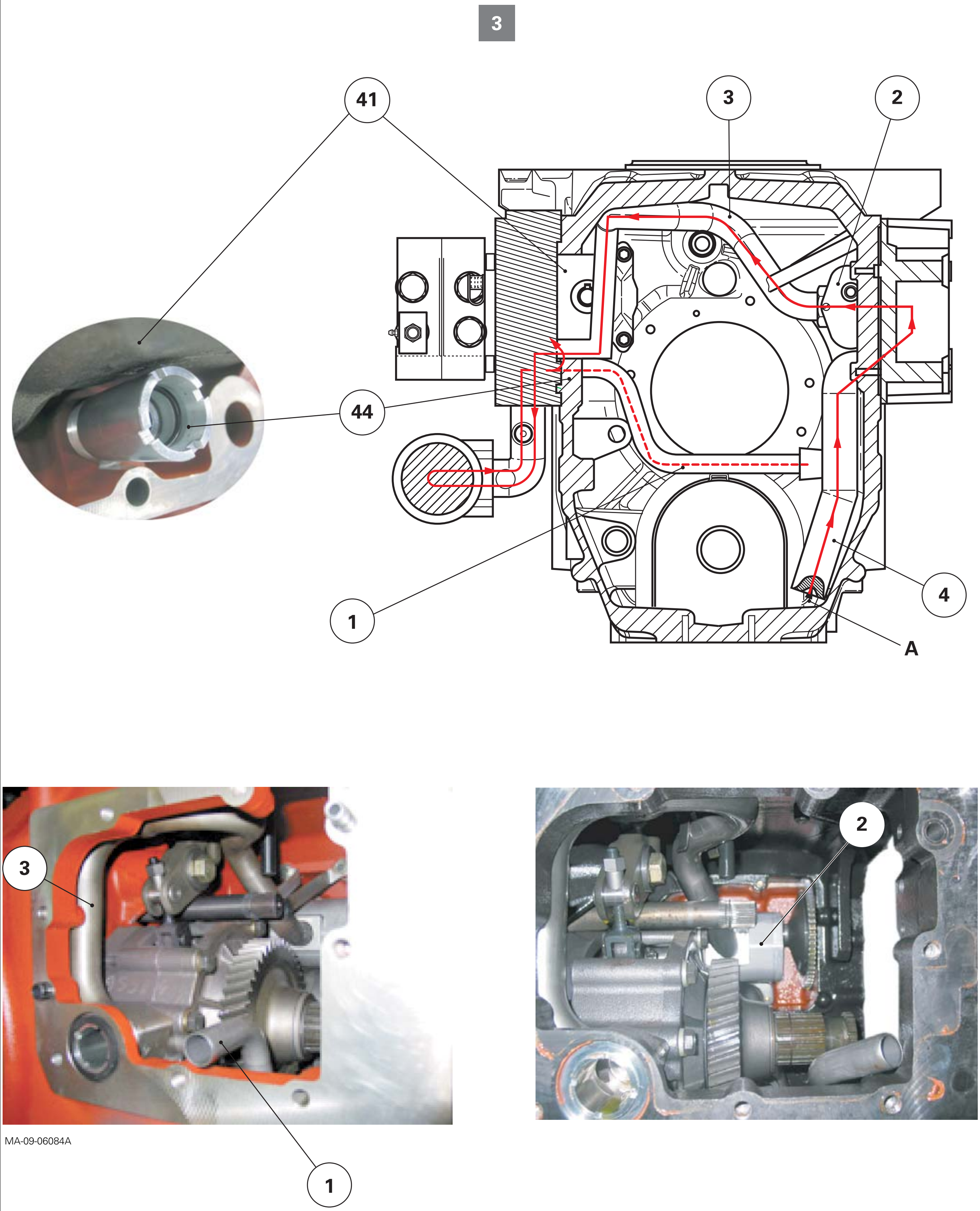


Fig. 6

Right-hand LS cover plate

GPA30 assembly (Fig. 7)

4 GPA30 LS110 l/min

Parts list

(2) Charge pump
(4) Suction manifold
(22) Mecanindus pin
(41) Variable displacement pump
(44) 5 bar safety valve
(52) "O" ring
(53) "O" ring
(54) Charge pipe
(55) Continuity pipe linked to the 5 bar valve

Legend

A Source of suction
C Compartment

<u>Movement of the fluid</u>

Suction of oil from the charge pump (2) and delivery of this oil to the variable displacement pump (slave devices used).

Re-supply to variable displacement pump (slave devices not used).

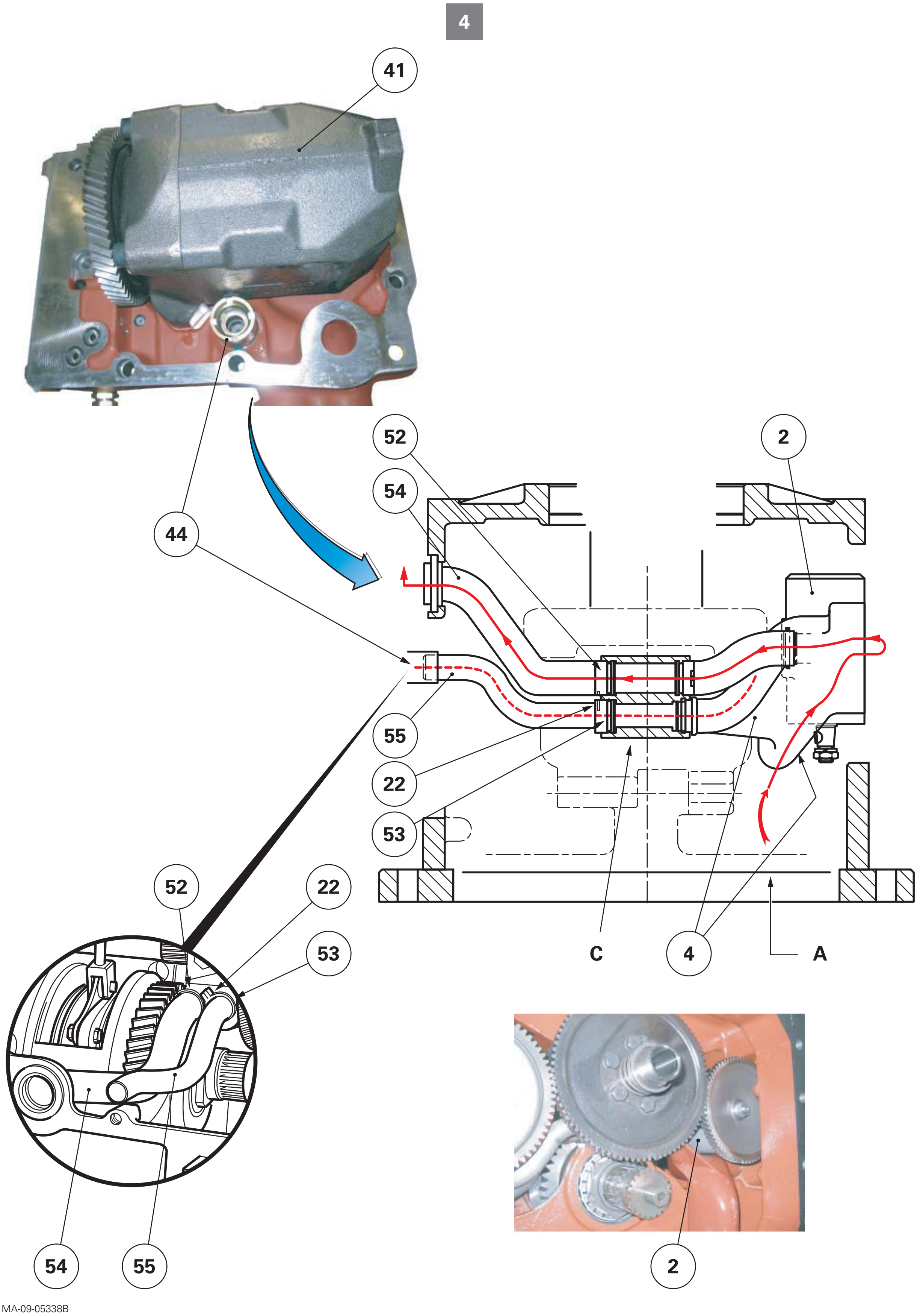


Fig. 7

Right-hand LS cover plate

Parts list (Fig. 8)

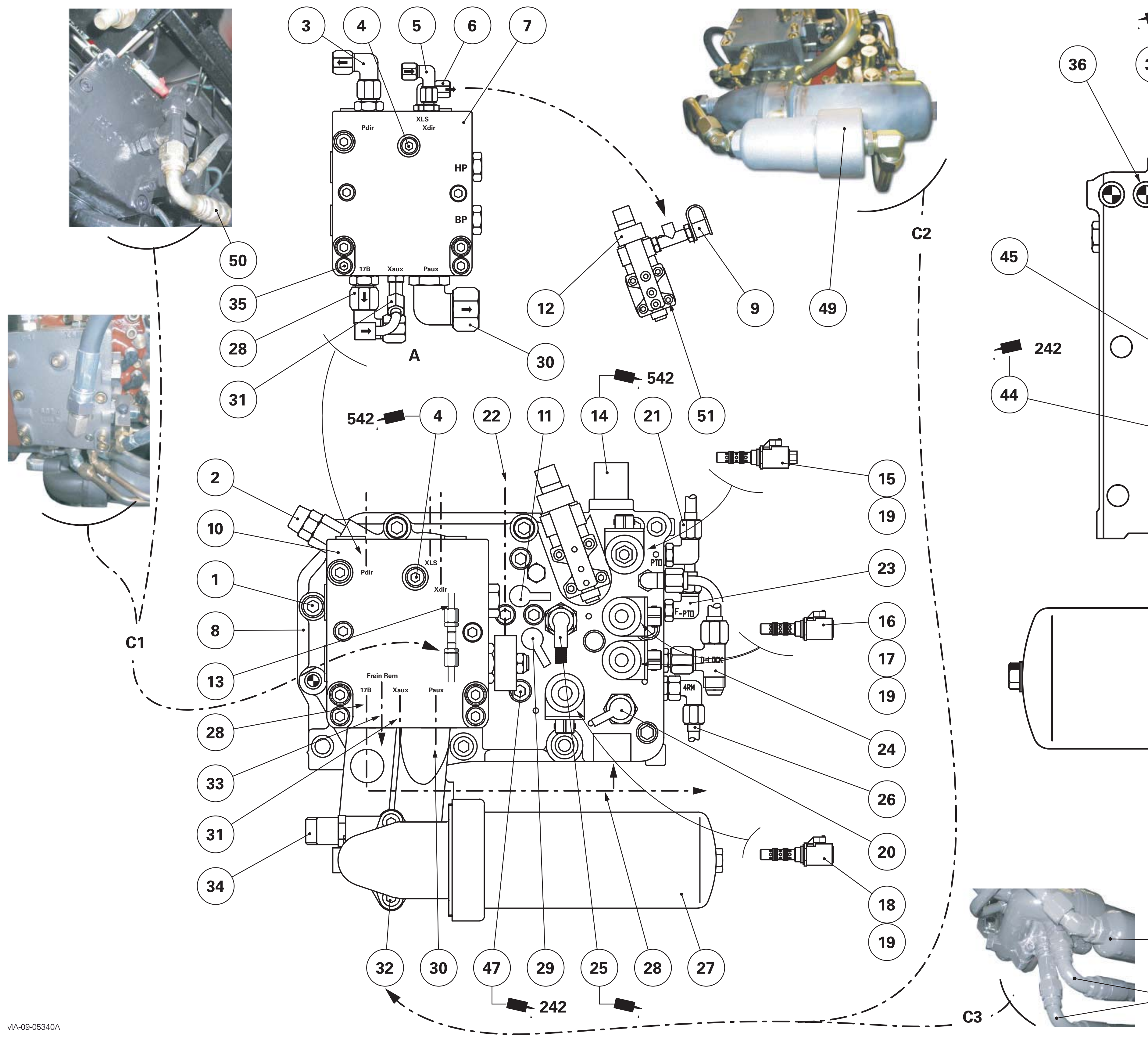
Note: *In addition to the assembly views, the figure also shows hydraulic components C1, C2 or C3, which may be fitted on or around the LS right-hand hydraulic cover plate depending on the tractor hydraulic update level and the type of rear axle (GPA20, GPA30 or GPA40).*

(1) Screw
(2) High-pressure (HP) relief valve
(3) Supply to the Orbitrol spool valve
(4) Screw
(5) LS pilot flow from the Orbitrol spool valve
(6) LS pilot flow to the variable displacement pump hydraulic regulator
(7) Single priority block (40 kph tractors without trailer braking)
(8) Hydraulic cover plate
(9) LS diagnostics connector
(10) Hydraulic unit with two priority blocks (40 kph tractors with trailer braking) (if fitted)
(11) High-pressure (HP) diagnostics connector
(12) Pump hydraulic regulator
(13) Trailer brake unit vent line
(14) Low pressure (BP) switch (17 or 21 bar)
(15) to (18)
Solenoid valves (PTO, PTO brake, front and rear differential lock, 4WD (if fitted))
(19) Flanges
(20) Low-pressure (BP) diagnostics connector (17 or 21 bar)
(21) PTO pipe
(22) Trailer brake control from brake master cylinders (40 kph tractors) or block/valve assembly (tractors fitted with high-pressure braking)
(23) PTO brake pipes
(24) 2WD or 4WD differential lock pipes
(25) Engine speed sensor (if fitted)
(26) 4WD pipes
(27) Main filter (15 µ)
(28) Hydraulic line (17 or 21 bar)
(29) Lubrication and charge pressure diagnostics connector
(30) Supply to the linkage valve and auxiliary spool valves
(31) LS pilot flow from auxiliary spool valves and linkage valve
(32) Screw
(33) Hydraulic line supply to trailer brake rear coupler
(34) Blockage indicator (there are two types of fitting, depending on tractor serial number)
(35) Screw
(36) Locating pins
(37) Nut
(38) Washer
(39) Gear
(40) Key
(41) Variable displacement pump
(42) Lubrication and charge pressure switch
(43) Hydraulic lines (running to and from the cooler)
(44) 5 bar safety valve
(45) 22 or 24 bar safety valve
(46) Temperature switch or plug and "O" ring (there are two types of fitting depending on tractor serial number)
(47) Variable displacement pump screw
(48) Hydraulic lubrication line
(49) 60 micron filter element
(50) Charge hose (GTA1040)
(51) Screw

Legend

A Single priority block (40 kph tractors without trailer braking)
TR16 Connector
TR17 Connector

View of external assembly



View of internal assembly

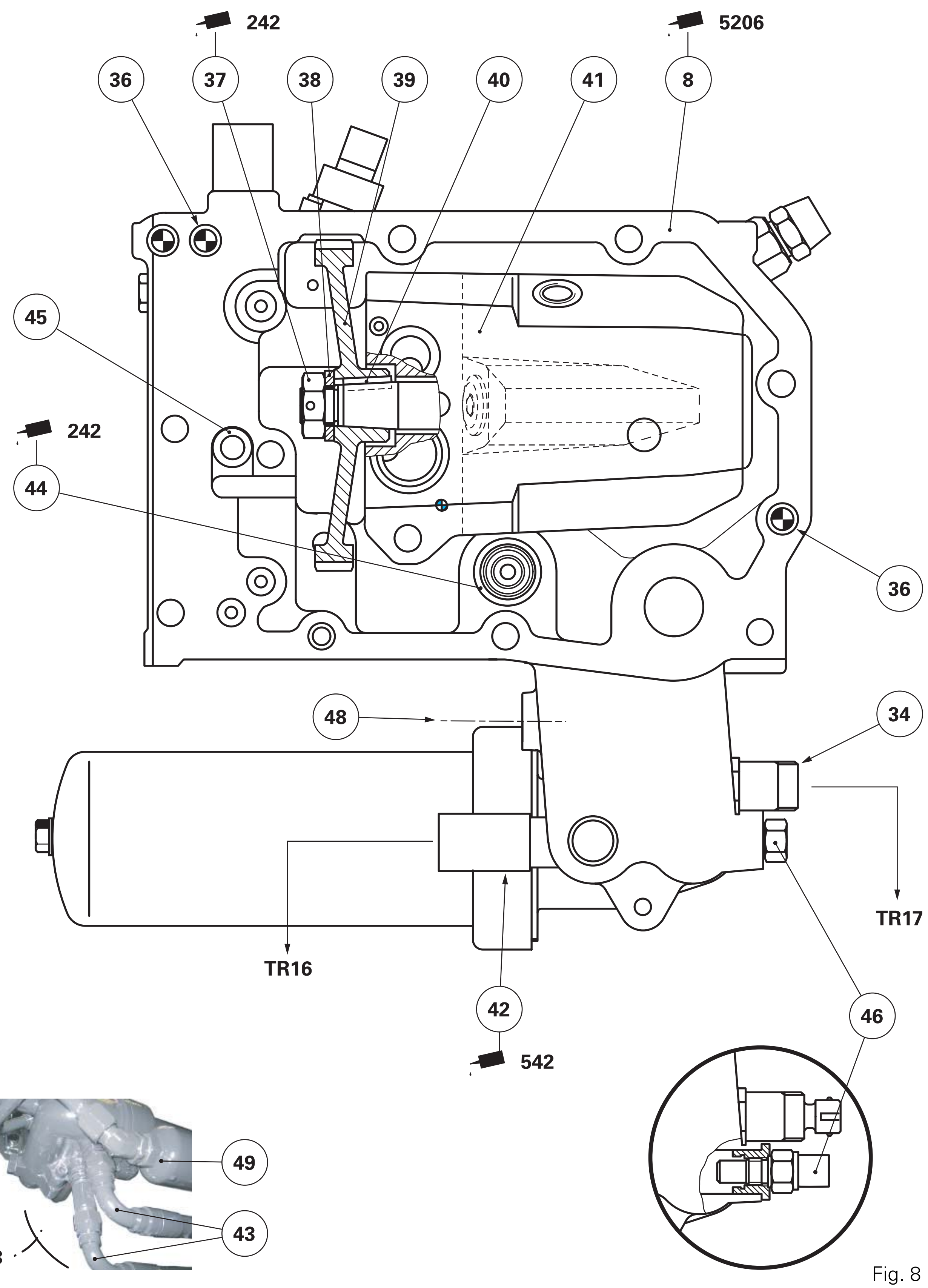


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Fig. 8

Parts list (Fig. 9)

(1) Screw
(2) High-pressure (HP) relief valve
(4) Screw
(7) Single priority block (40 kph tractors without trailer braking)
(8) Hydraulic cover plate
(9) LS diagnostics connector
(10) Hydraulic unit with two priority blocks (40 kph tractors with trailer braking) (if fitted)
(11) High-pressure (HP) diagnostics connector
(12) Pump hydraulic regulator
(13) Trailer brake unit vent line
(14) Low pressure (BP) switch (17 or 21 bar)
(15) to (18) Solenoid valves (PTO, PTO brake, front and rear differential lock, 4WD (if fitted))
(19) Flanges
(20) Low-pressure (BP) diagnostics connector (17 or 21 bar)
(25) Engine speed sensor (if fitted)
(27) Main filter (15 µ)
(29) Lubrication and charge pressure diagnostics connector
(32) Screw
(34) Blockage indicator (there are two types of fitting, depending on tractor serial number)
(35) Screw
(36) Locating pins
(37) Nut
(38) Washer
(39) Gear
(40) Key
(41) Variable displacement pump
(42) Lubrication and charge pressure switch
(43) Hydraulic lines (flow and return)
(44) 5 bar safety valve
(45) 22 or 24 bar safety valve
(47) Variable displacement pump screw
(51) Screw

Legend

R Red mark on switch (14)
V Green mark on switch (42)

<u>40 kph version</u>

A+B Hydraulic unit with two priority blocks (tractors with trailer braking)
B Single priority block (tractors without trailer braking)

<u>Version for tractors fitted with high-pressure braking</u>

A+B Hydraulic unit with two priority blocks (tractors with or without trailer braking)

***Note:** On the version without a trailer braking, a hydraulic unit with two priority blocks is also used, but the hydraulic control line and the trailer rear brake coupler are not fitted. The hydraulic ports for this line are plugged on priority block A with threaded plugs.*

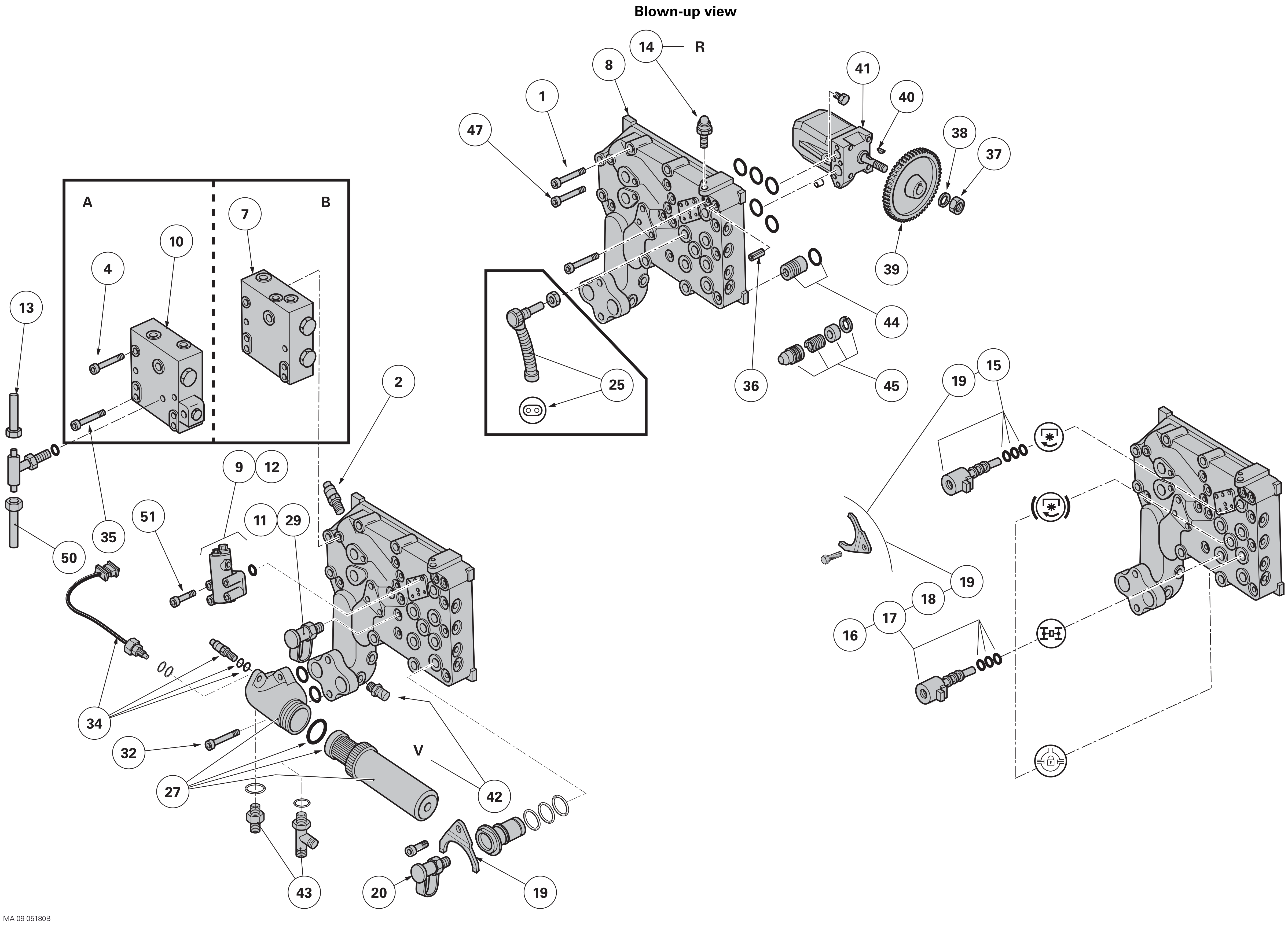
Blown-up view
14 R
8
41
1
40
47
38
37
A
B
7
10
39
4
13
44
25
2
36
45
19
15
9
12
51
11
29
35
50
19
18
17
16
34
32
V
27
42
43
20
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Fig. 9

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B . Identification of channels and ports…

… on the hydraulic regulator (12) (Fig. 10)

C 22 bar adjustment screw
D 200 bar adjustment screw
P High pressure (HP) from variable displacement pump
R To variable displacement pump control piston
S Hydraulic regulator return

(8) Hydraulic cover plate
(9) LS diagnostics connector

IMPORTANT: *Screws C and D are factory set. Do not modify these settings.*

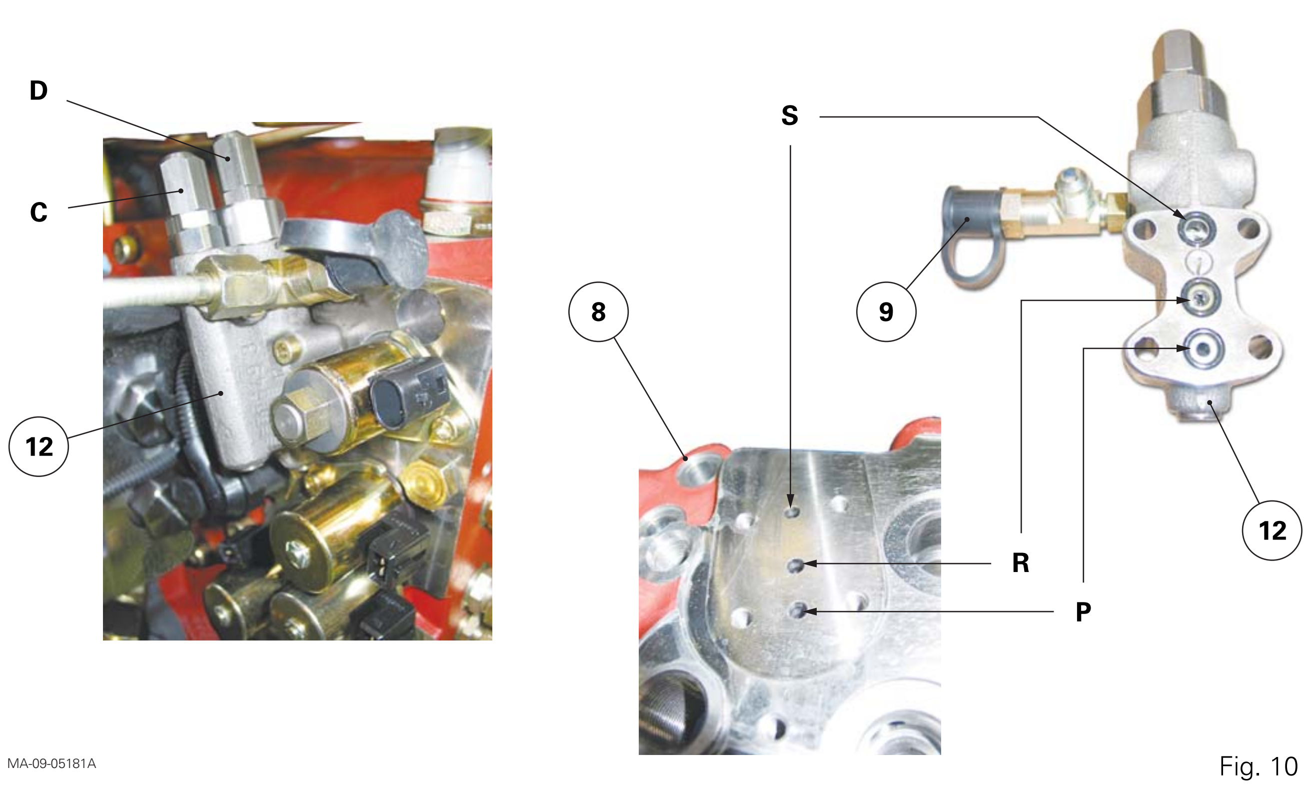

Fig. 10

Right-hand LS cover plate

... on the hydraulic cover plate (8) and the variable displacement pump (41) (Fig. 11, Fig. 12, Fig. 13)

F To main filter (15 µ)
G Charge line
L Lubrication line
P High pressure (HP) outlet from variable displacement pump
PTO PTO supply line (GPA20 and GPA40)
R Line to variable displacement pump control piston
S Hydraulic regulator return line
S1 Priority block(s) return line (depending on version)

(2) 230 bar high-pressure (HP) relief valve
(11) High pressure diagnostics connector
(29) Lubrication and charge pressure diagnostics connector
(44) 5 bar safety valve
(45) 22 or 24 bar safety valve

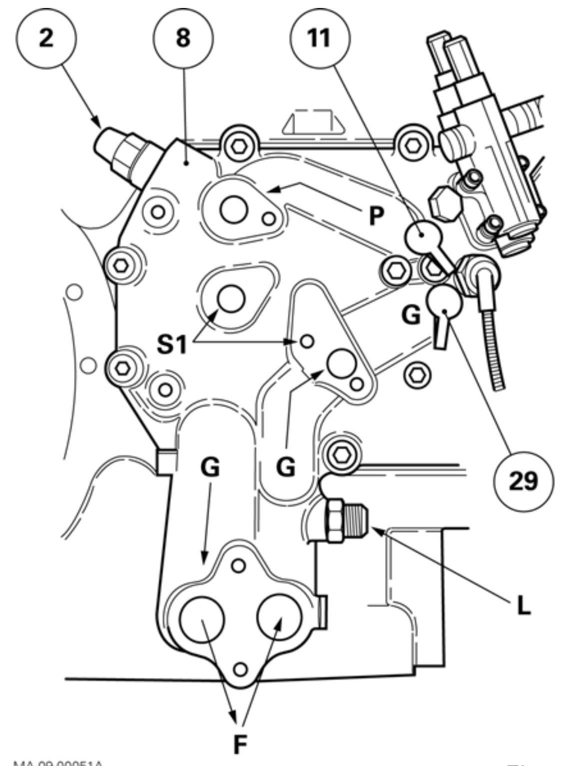

Fig. 12

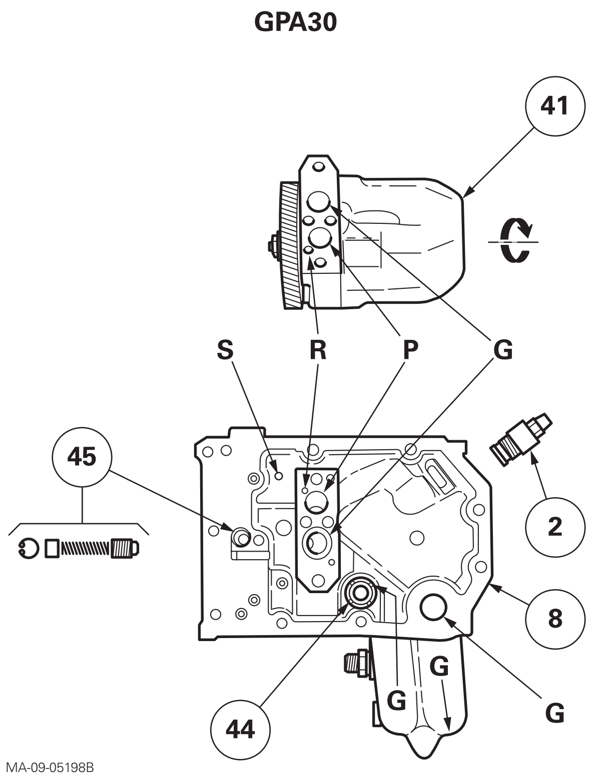

Fig. 11

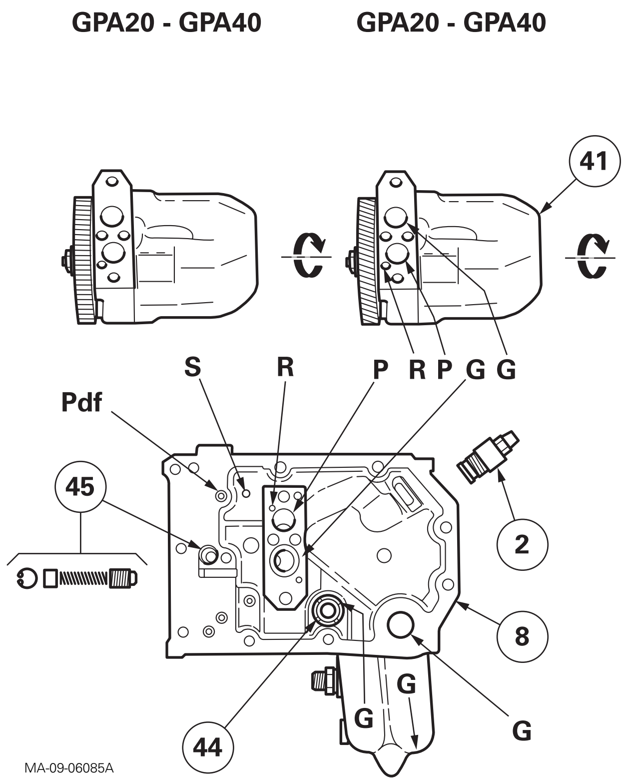

Fig. 13

C . Removing and refitting the hydraulic cover plate

Removal

1. Immobilise the tractor. Chock the left rear wheel.
2. If the tractor is not fitted with a ParkLock device, engage the hand brake.
3. Chock between the frame and the front axle (optional).
4. Partially drain the intermediate housing (GPA30) or the centre housing (GPA20 and GPA40).
5. Remove the rear right-hand wheel. Place a safety stand under the trumpet housing.
6. Mark and disconnect the pipes or hoses, the solenoid valve harnesses (depending on version), switches and the engine speed sensor connected to the hydraulic cover plate (8).
7. Remove the 60 µ filter (49) (GPA30, GPA40)
8. Unscrew:
- the screws (32). Remove the main filter assembly (27);
- the screws (4). Remove the single priority block (B) or the hydraulic unit with two priority blocks (A+B) (Fig. 9).

Note: *In order to avoid draining the trailer brake system on tractors fitted with a two-priority block hydraulic unit, it is recommended to remove the complete unit from the hydraulic cover plate without disconnecting the control hose (22) from the brake master cylinders (40 kph tractors) or from the block/valve assembly (tractors fitted with high-pressure braking).*

9. Unscrew the screws (1). Release and remove the hydraulic cover plate.
10. Remove the seal (4). Discard this seal (Fig. 14).
11. If necessary (Fig. 15, Fig. 16), remove the safety valve (45) from the low pressure system by proceeding as follows:
- Compress the spring (3) using a screwdriver.
- Remove the circlip (1).
- Remove the components (2) to (4).

12. If necessary (Fig. 14), unscrew the castellated collar (2) (GPA40) using pin wrench 3378466M1 (see § I).
13. If necessary (Fig. 14), discard and replace the "O" ring (1).

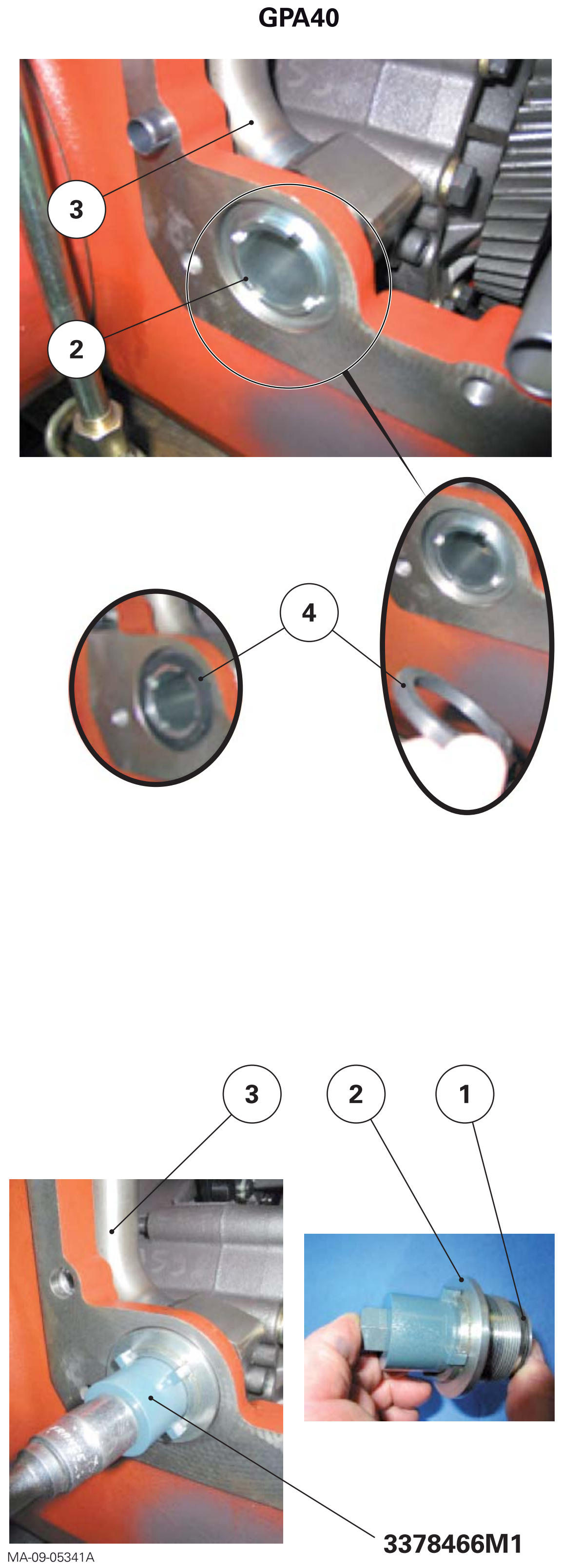

Fig. 14

Right-hand LS cover plate

Refitting

14. Clean the mating face of the intermediate housing (GPA30) or centre housing (GPA20 and GPA40) and the mating face of the right-hand hydraulic cover plate.

15. If necessary, screw on and tighten the castellated collar (2) using the pin wrench used in step 12.

16. If necessary, refit the safety valve (45) (Fig. 15, Fig. 16) by carrying out step 11 in reverse order. Check that the component (4) slides freely in its housing after refitting.

17. Depending on the parts removed, proceed as indicated in the following table.

Parts removed	Smear the thread with...
- 5 bar valve (44) - Screw (47)	Loctite 242 or equivalent:
- Lubrication and charge switch (42) (green mark) - Low pressure switch (14) (red mark)	Loctite 542 or equivalent
- Engine speed sensor (25) (if fitted)	Loctite 5922 or equivalent

18. Depending on the parts removed, tighten to the torque given in the following table.

Parts removed	Tighten...	To a torque of...
Proportional solenoid valve (15)	Solenoid nut	1.7 to 2.8 Nm
5 bar valve (44)	Castellated end of 5 bar valve	10 to 20 Nm, using a makeshift tool.
Engine speed sensor (25) (if fitted)	Sensor counter-nut	5 to 7 Nm
Pressure relief valve (2)	Hexagonal pressure relief valve body	150 Nm

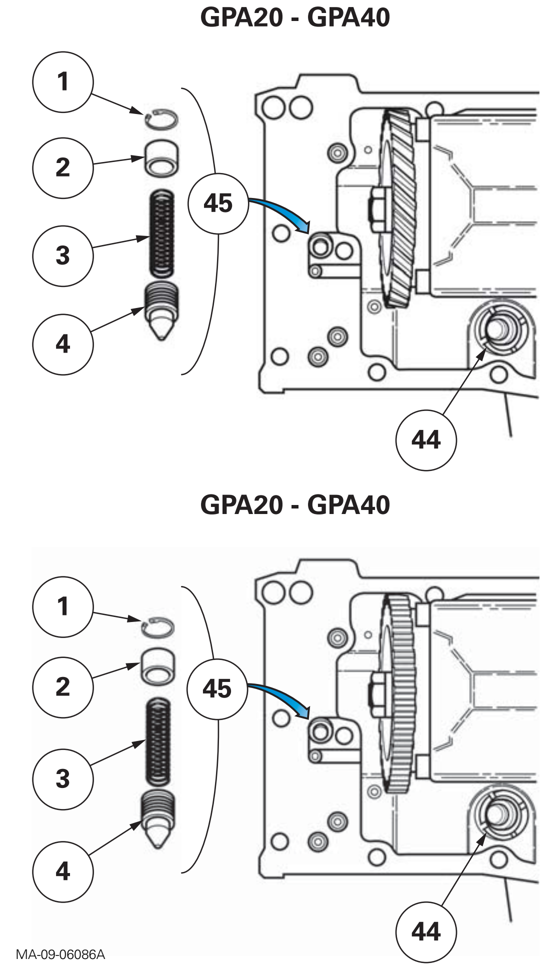

Fig. 15

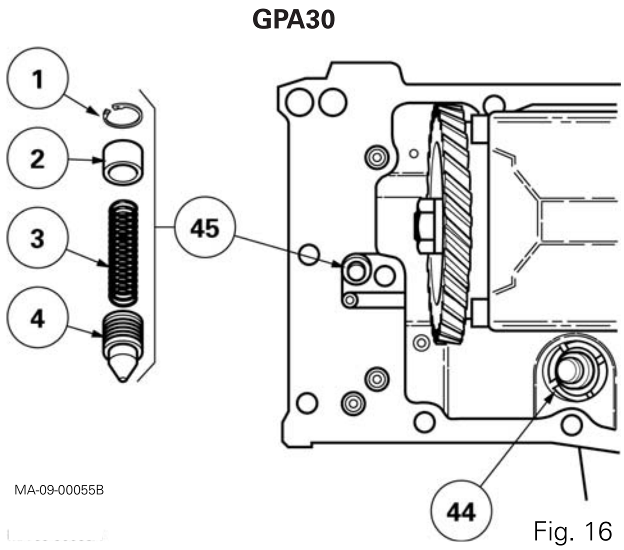

Fig. 16

19. Check the hydraulic cover plate for presence of:
- the locating pins (36) (Fig. 17, Fig. 18);
- the rivets obstructing the end of the hydraulic channels of the hydraulic cover plate faces (external and internal).

20. For GPA30, if necessary (Fig. 7):
- position the pipe (55) of the 5 bar safety valve in the intermediate housing by placing its end, fitted with a seal (53), in the Mecanindus pin (22). This pin is located on partition C of the intermediate housing;
- fit the charge pipe (54) fitted with an "O" ring (52) in the intermediate housing by placing the pipe notch in the pin (1) (Fig. 19).

21. Lightly smear the seal (4) with miscible grease.

Position this seal:
- on the collar of the pipe (54) (Fig. 19) (GPA30);
- on the castellated collar (2) screwed onto the pipe (3) (Fig. 14) (GPA40).

22. Lightly smear the mating face of the intermediate housing (GPA30) or centre housing (GPA20 and GPA40) with a sealing product such as Loctite 5206 or equivalent.

***IMPORTANT:** For the GPA20 and GPA40 rear axles, do not obstruct the PTO hydraulic port.*

23. If necessary, screw on two diametrically opposed guide studs (G) onto the intermediate housing (GPA30) (Fig. 19) or centre housing (GPA20 and GPA40).

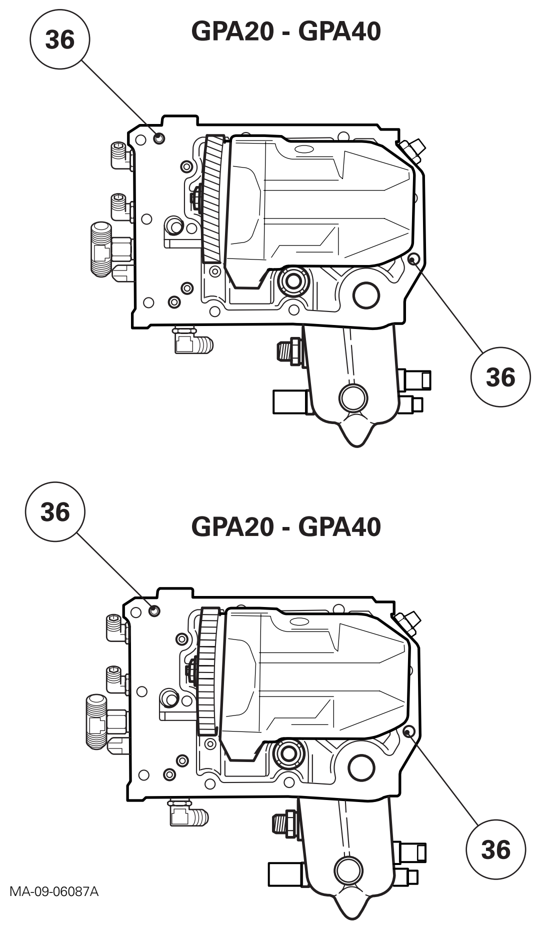

Fig. 17

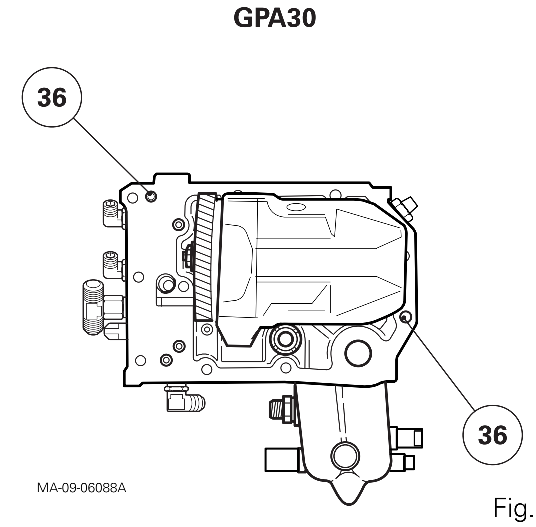

Fig. 18

24. Fill the variable displacement pump (41) with clean transmission oil through port O (Fig. 21).

25. Slide the cover plate onto the guide studs (G) previously screwed onto the intermediate housing (GPA30) or centre housing (GPA20 and GPA40).

Using a bronze hammer, gently tap the rim of the hydraulic cover plate (8) to begin engagement of the locating pins (36) in the intermediate or centre housing.

IMPORTANT: *When fitting the hydraulic cover plate to the intermediate or centre housing, check between the mating faces (cover plate and housing) to ensure that the continuity pipe (1) (GPA20 and GPA40) or (55) (GPA30) is correctly fitted in the 5 bar safety valve (44) as per the GPA40 example (Fig. 20).*

26. Screw in the screws (1) and simultaneously remove guide studs G (if used). Tighten these screws to a torque of 120-160 Nm.

IMPORTANT: *If resistance is felt during tightening, do not continue. Move aside the hydraulic cover plate for the intermediate housing (GPA30) or centre housing (GPA20 and GPA40) and check that the continuity pipe (1) or (55) is fitted in the 5 bar safety valve (44) (Fig. 4, Fig. 5, Fig. 6, Fig. 7). Also turn the driven gear (39) of the variable displacement pump to assist with gear engaging.*

27. Replace the "O" rings (1) to (3) for the single priority block (7) (tractors without trailer braking) (Fig. 22) or for the hydraulic unit with two priority blocks [(7) and (10)] (tractors with trailer braking) (Fig. 23).

28. Refit the single priority block or the hydraulic unit with two priority blocks (7) or [(7) and (10)].

Lightly smear the thread of the screws (4) (Fig. 8) with Loctite 542 or equivalent. Tighten these screws to a torque of 25 - 35 Nm.

29. For tractors fitted with a GPA30 rear axle and a trailer brake mechanism (Fig. 24):

- Tighten the T connector (1) in the vertical position.

  IMPORTANT: *Never replace the T connector (1) with a standard plug.*

- Tighten the hose (13).
- Temporarily tighten the hose (50) while awaiting the filling operation.

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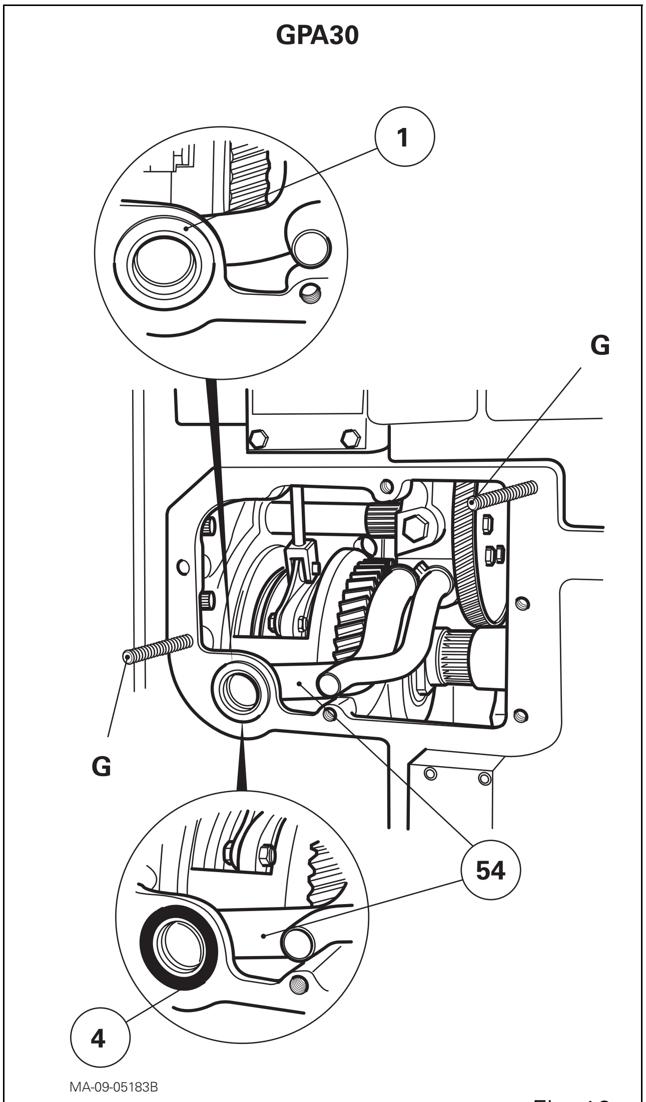


Fig. 19

30. For tractors fitted with a GPA20 or GPA40 rear axle and a trailer brake mechanism (Fig. 25):
- Tighten the elbow union (1).

  IMPORTANT: *Never replace the elbow union 1) with a standard plug.*
- Tighten the pipe or hose (13) (depending on version).

31. If necessary, adjust the engine speed sensor located on the hydraulic cover plate (see § F).

32. Reconnect:
- the switches;
- the solenoid valve harnesses;
- the pipes and hoses.

33. Top up the rear axle oil level. Check using the dipstick or the sight glass (depending on version).

34. For tractors fitted with a GPA30 rear axle and a trailer brake mechanism (Fig. 24):
- Charge the hose (50) for the priority block (10).
- Definitively tighten the hose (50).

35. If the variable displacement pump had to be replaced, perform the hydraulic tests (see chapter 9).

36. Lift the right-hand side of the tractor rear axle.

Refit the wheel.

Remove the axle stand.

Tighten the wheel nuts (see chapter 6).

37. Check for correct operation:
- of the electrical and electronic circuits;
- of the switches;
- of the solenoid valves.

38. Carry out a road test.

39. Check tightness of:
- the right-hand hydraulic cover plate;
- the mating faces;
- Hydraulic unions

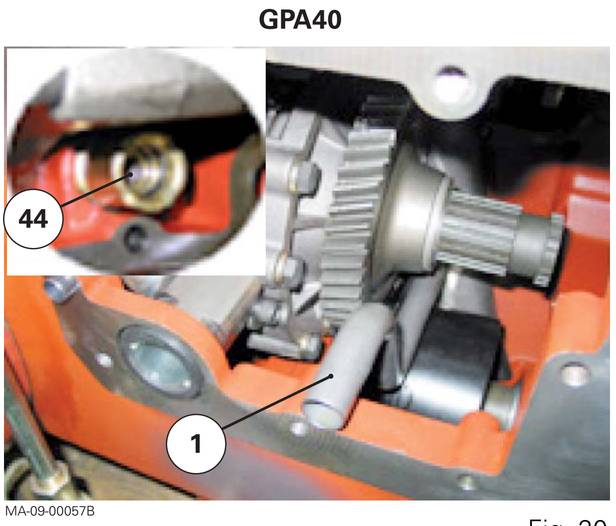


Fig. 20

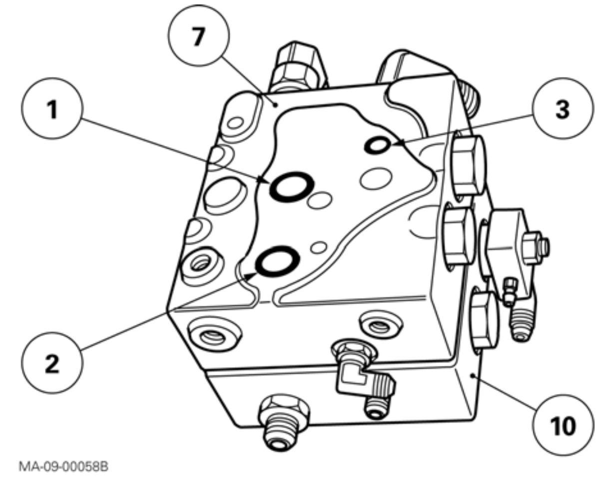


Fig. 23

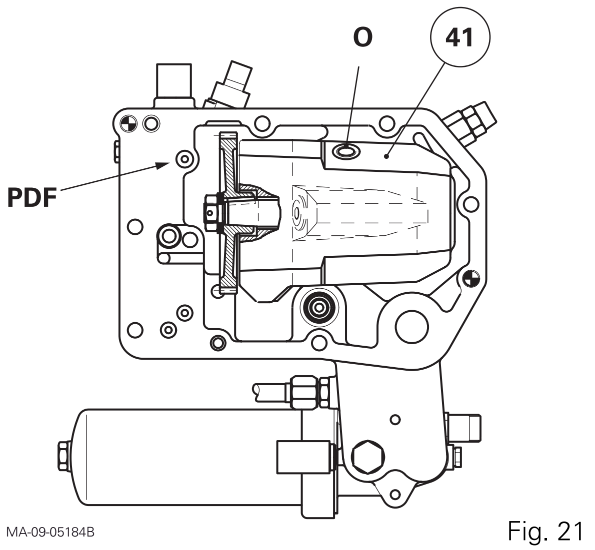


Fig. 21

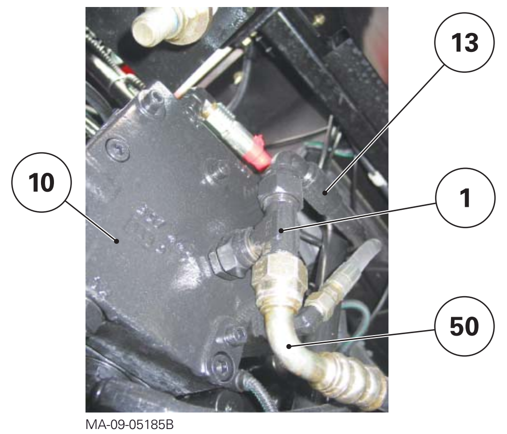


Fig. 24

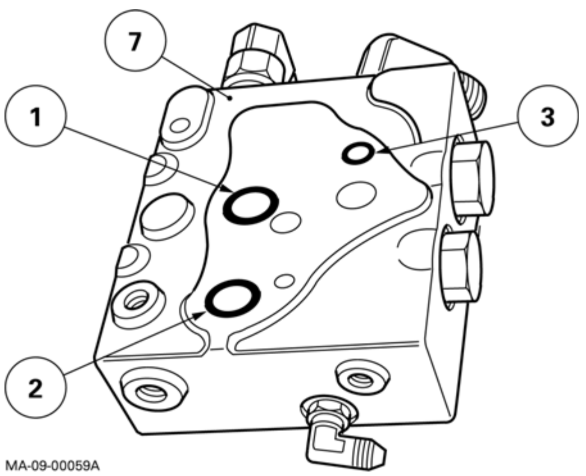


Fig. 22

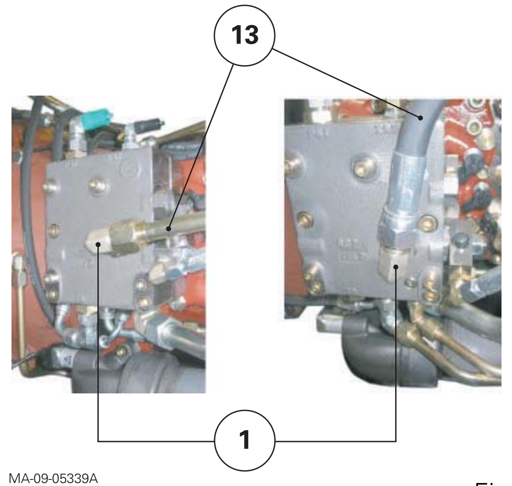


Fig. 25

D . Description and operation of the variable displacement pump

Description (Fig. 29, Fig. 30)

The variable displacement pump (41) fitted inside the right-hand cover plate is driven by:

- the gears (1) and (39) (Fig. 28) (GPA30);
- the PTO clutch housing teeth (1) (GPA20 and GPA40) (Fig. 26, Fig. 27).

  Note: *The helical teeth of the gear (39) (GPA20 and GPA40) and its connected gear (Fig. 26, Fig. 27) is replaced by spur cut teeth.*

It comprises a body (1) and a cylinder (3) driven by the shaft (13). The cylinder contains nine axial pistons (4) thrust against ball joints (5) in contact with plate (6) via the pads (7).

The angle of the plate is obtained by the equilibrium between the spring (8), the pushrod (9) and the piston (14) controlled by a hydraulic regulator receiving the LS pilot flow pressure from the high pressure (HP) components via the single priority block or the hydraulic unit with two priority blocks.

Depending on the angle of the plate, the length of travel of the axial pistons (4) is modified, thus permitting the flow rate to adapt to the operating conditions.

The distribution plate (11) at the rear of the cylinder, places the piston chambers in communication with the suction ports and the pump delivery.
The ball joints (5) are drilled to provide lubrication between the pads (7) and plate (6). The oil is then sent to the housing via port O (Fig. 21).

The pressure relief valve (2) is screwed into the upper left of the right-hand hydraulic cover plate (Fig. 8).

The hydraulic regulator (12) is fitted with a diagnostics connector (9) (LS signal) (Fig. 10). This is linked to the variable displacement pump (41) via the ports drilled in the right-hand hydraulic cover plate.

The diagnostics connector (11) is used to control the high pressure (HP) at the variable displacement pump outlet (Fig. 8).

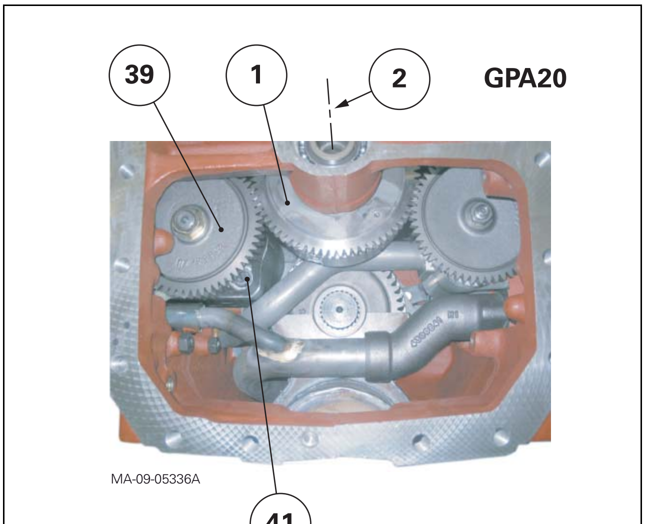


Fig. 26

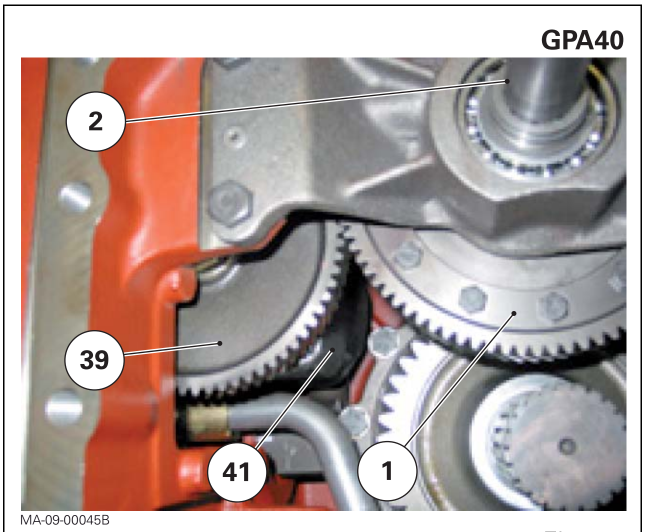


Fig. 27

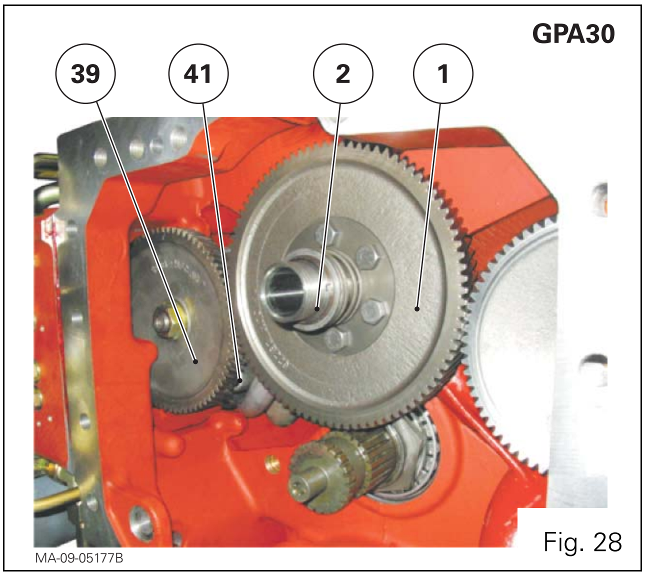


Fig. 28

Right-hand LS cover plate

Operation (Fig. 29 to Fig. 33)

Standby position

When the engine stops, the spring (8) automatically places the pump in its maximum flow rate position. When the engine is started, all ports are closed, and in theory no flow is required. The pressure increases in line P. When it reaches 22 bar, it pushes the hydraulic regulator spool "a" and connects with port R. The pressure acts on the piston (14) and the pushrod (9) of the pump, which moves the plate (6) into zero flow rate position. In practice, a weak 3 to 5 bar flow rate remains in the steering system, increasing the standby pressure to 28 bar.

Working position

When a function is activated (e.g.: an auxiliary spool valve), the 22 bar standby pressure drops as the system is opened. The 22 bar spring restores the hydraulic regulator spool "a" to its initial position. The piston (14) is linked to the return via S and R. The spring (8) returns the pump plate (6) to full flow rate.

The flow rate from the pump creates the LS pressure required to activate the function.

The LS function then created balances the piston between, on the one hand, the LS pressure plus the 22 bar pressure of the spring and, on the other hand, the pump output pressure P.

As long as the spool "a" has not been balanced and is not maintained by the pump supply, the piston (14) remains connected to the return and the pump plate (6) at full flow rate **(pump pressure P = LS pressure + 22 bar).**

NOTE 1: *The closed centre system varies the pressure and flow rate in the hydraulic system.*

NOTE 2: *Pump delivery pressure = XLS use pressure + standby pressure (22 bar).*

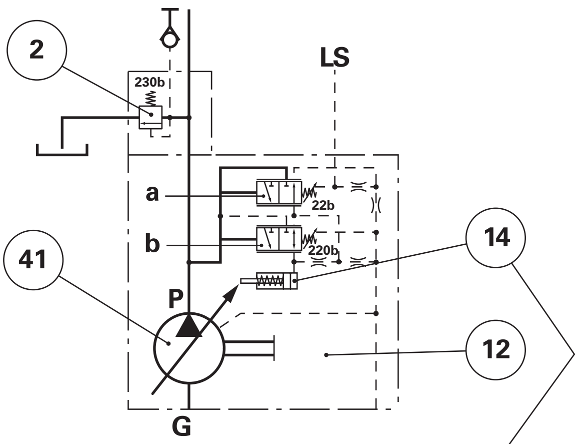
NOTE 3: *Sufficient flow rate, determined by the inner section of the spool valve, is supplied by the pump to maintain the pressure difference at the spool valve terminals (22 bar).*

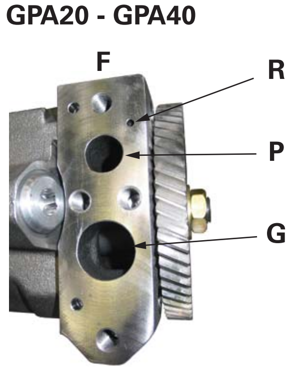
Parts list (Fig. 29, Fig. 30)

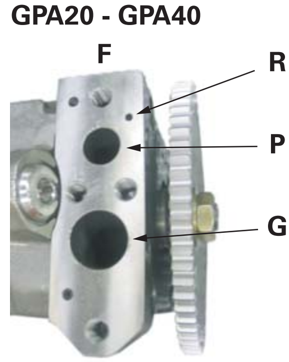
- G — From charge pump
- P — High pressure (HP) outlet to single priority block or hydraulic unit with two priority blocks
- R — To control piston (14)

Parts list (Fig. 31, Fig. 32)

- (1) Linkage spool valve
- (2) Auxiliary spool valves
- (7) or [(7) and (10)]
  Single priority block or hydraulic unit with two priority blocks with or without trailer braking
- (12) Variable displacement pump hydraulic regulator
- (14) Piston







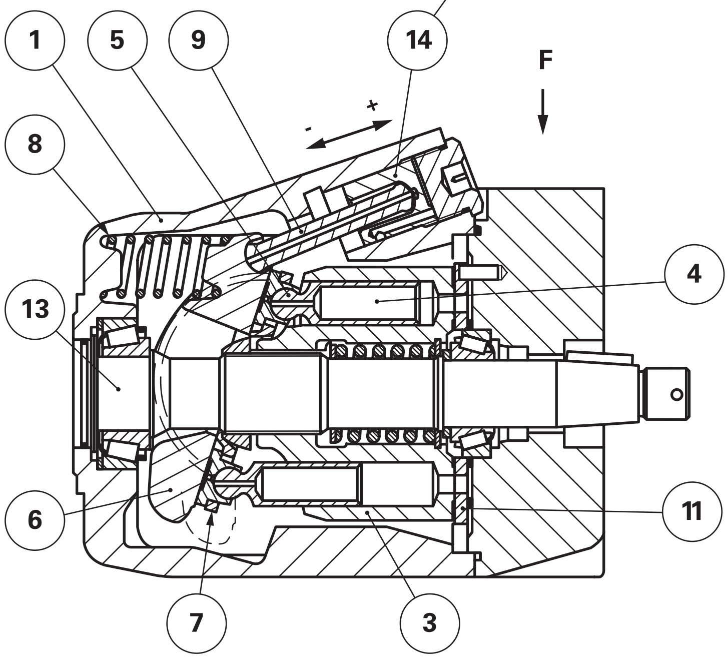


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Fig. 29

Right-hand LS cover plate

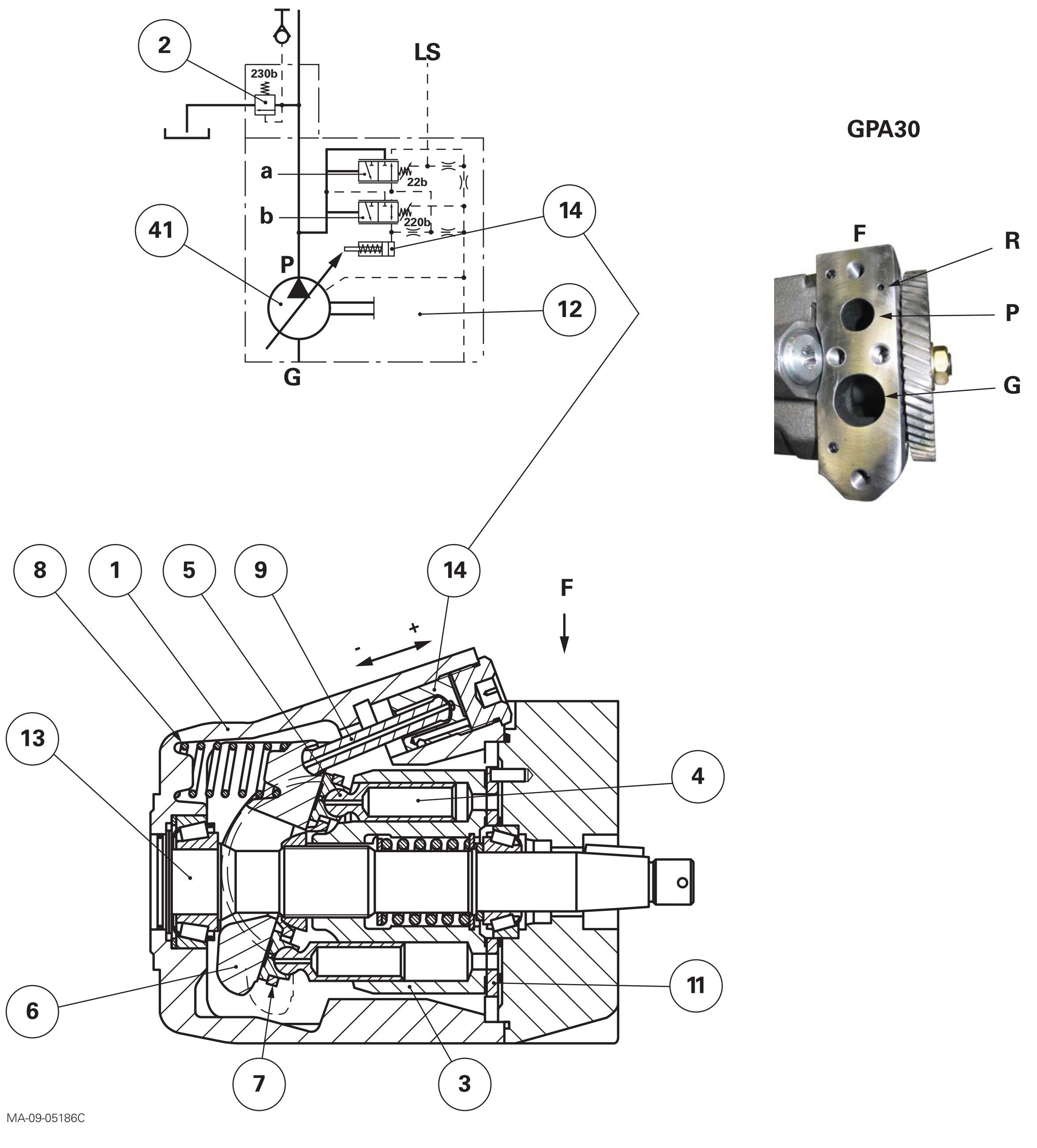

Fig. 30

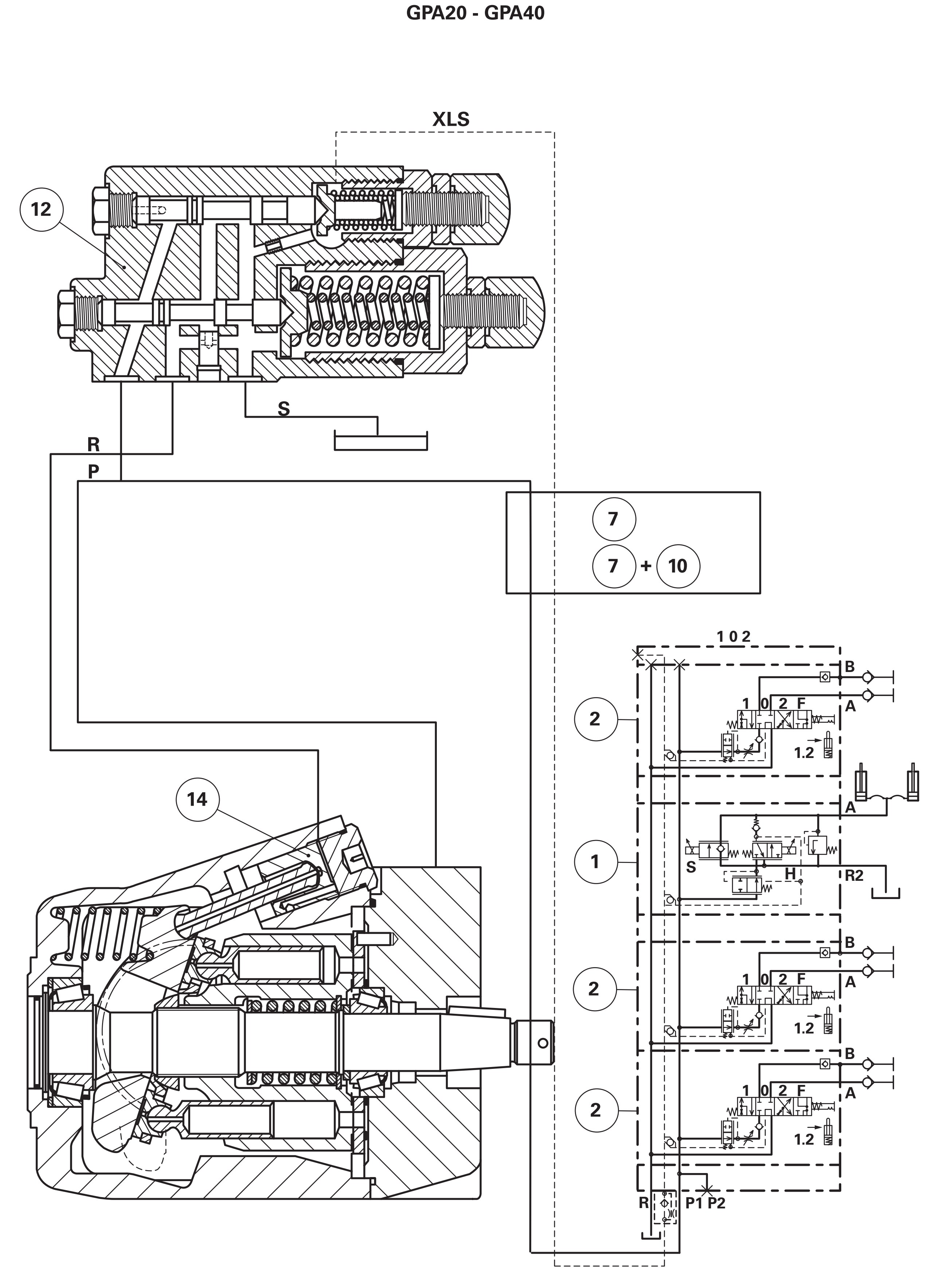
GPA20 - GPA40
XLS
12
S
R
P
7
7 + 10
14
1 0 2
2
1
2
2
B
A
1 0 2 F
1.2
S
H
R2
R
P1 P2
MA-09-00061B

Fig. 31

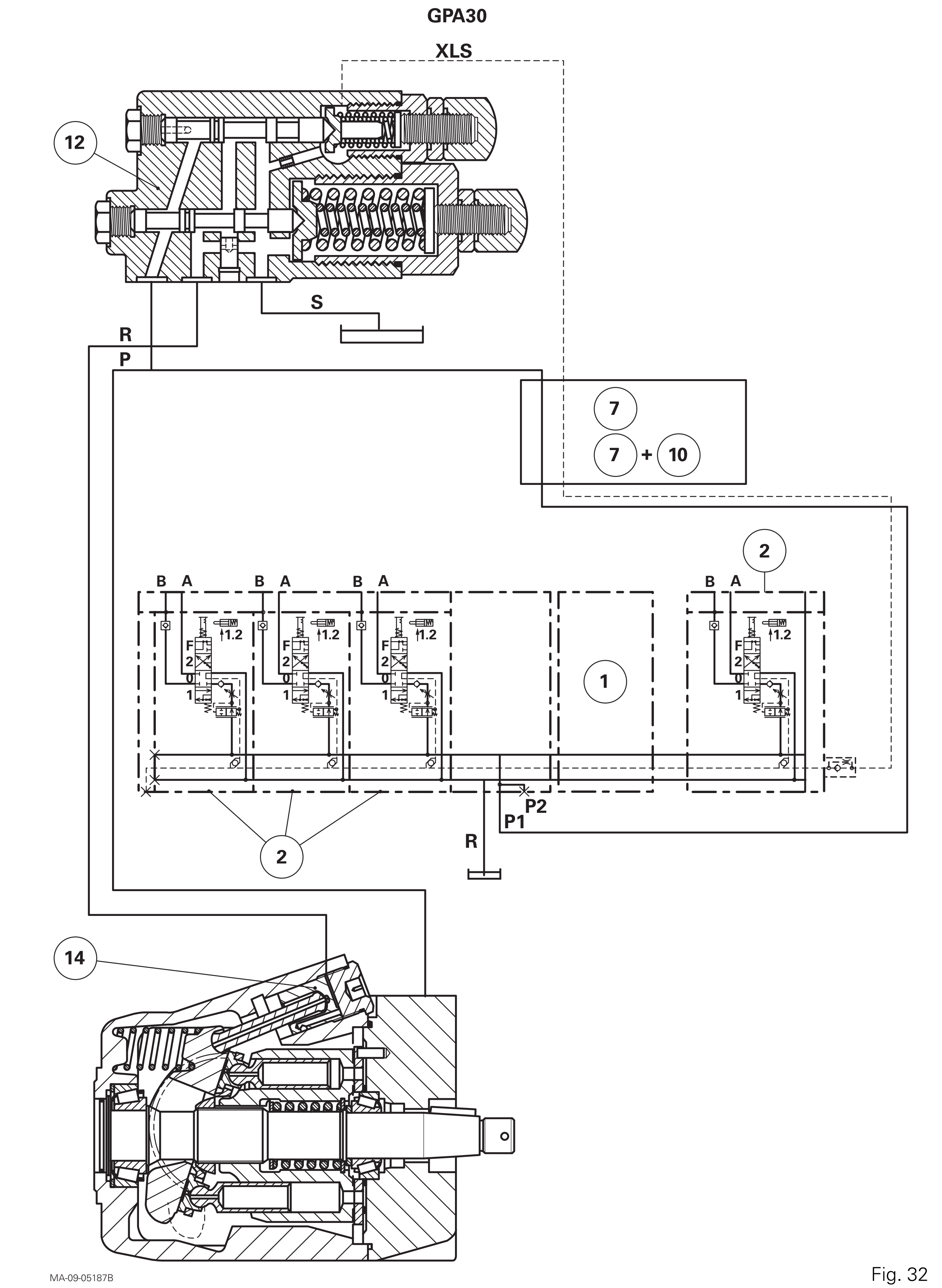
GPA30
XLS
12
S
R
P
7
7 + 10
2
B A
B A
B A
B A
F
2
0
1
1.2
1
P2
P1
R
2
14
MA-09-05187B

Fig. 32

Maximum position - zero flow rate

When the pressure at port P reaches 200 bar, spool "b" is pushed forwards compressing its spring. The ports P and R are placed in communication and piston (14) is brought to the zero flow rate position.

The hydraulic regulator (12) (Fig. 33), fitted on the hydraulic cover plate (8) regulates the variable displacement pump pressure and flow rate according to information transmitted by the LS signal.

***IMPORTANT:** Screws C and D are factory set. Do not modify these settings.*

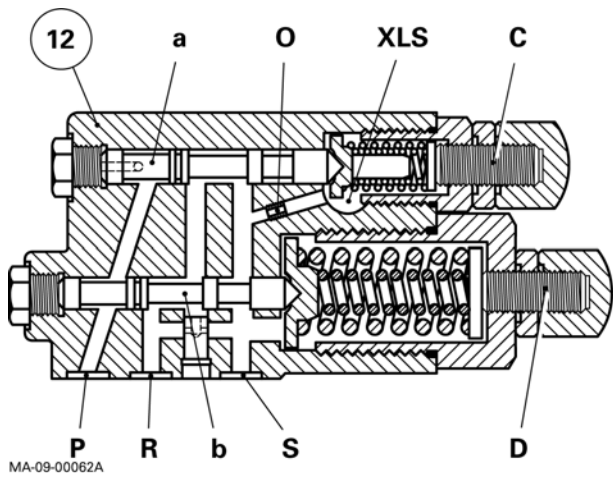

Fig. 33

Legend (Fig. 33)

- C 22 bar adjustment screw
- D 200 bar adjustment screw
- O Decompression port
- P Variable displacement pump pressure
- R To piston (14)
- S Return
- XLS Signal

Pressure relief-valve (2) (Fig. 34)

The high pressure flow delivered by the variable displacement pump passes through channel P in the hydraulic cover plate (8) (Fig. 10) and is directed towards the single priority block or to the hydraulic unit with two priority blocks (depending on version).

The pressure relief valve (2) set to 230 bar ± 5 and screwed into the hydraulic cover plate, ensures the safety of the high pressure (HP) system.

In case of any abnormal increase in pressure, valve (1) raises and the oil is directed to the housing via ports R in the relief valve.

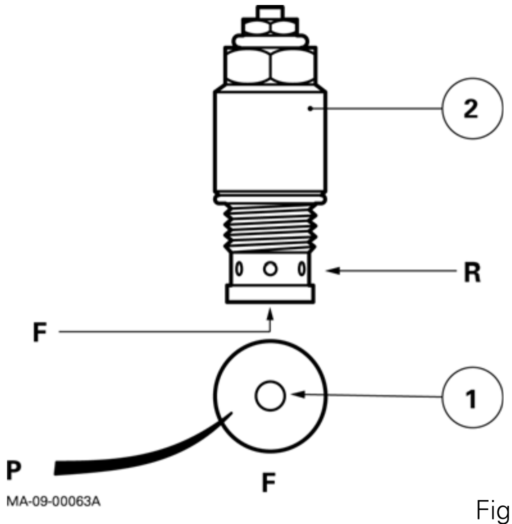

Fig. 34

E . Removing and refitting the variable displacement pump

Preliminary step

40. Remove the right-hand hydraulic cover plate (see § C).

Removal

41. Immobilise the driven gear (39) of the variable displacement pump (41) by inserting a bronze drift between this gear and the hydraulic cover plate. Release and slightly loosen the nut (37) (Fig. 35, Fig. 36).

42. Unscrew the screws that secure the variable displacement pump to the hydraulic cover plate. Separate the pump from the cover plate.

43. Place the variable displacement pump (41) on a workbench (Fig. 38). Completely unscrew the nut (37). Recover the washer (38).

44. Using a suitable extractor, release and remove the driven gear (39) from the tapered section of the shaft.

Recover the key (40).

45. If necessary, remove the safety valve (45) (Fig. 35, Fig. 36) from the low pressure system (see step 11).

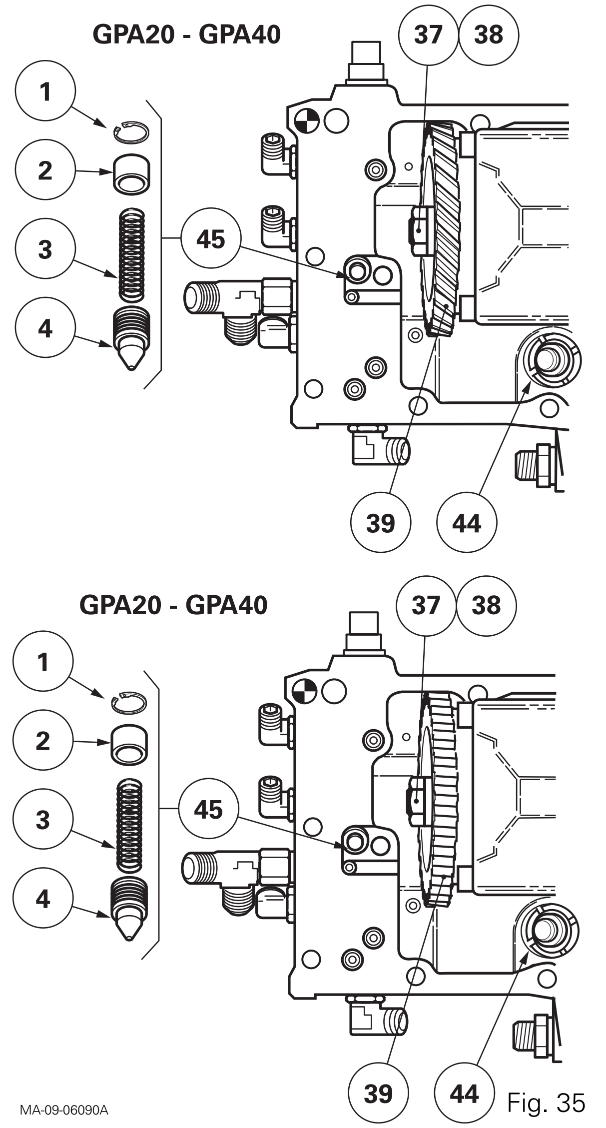

Fig. 35

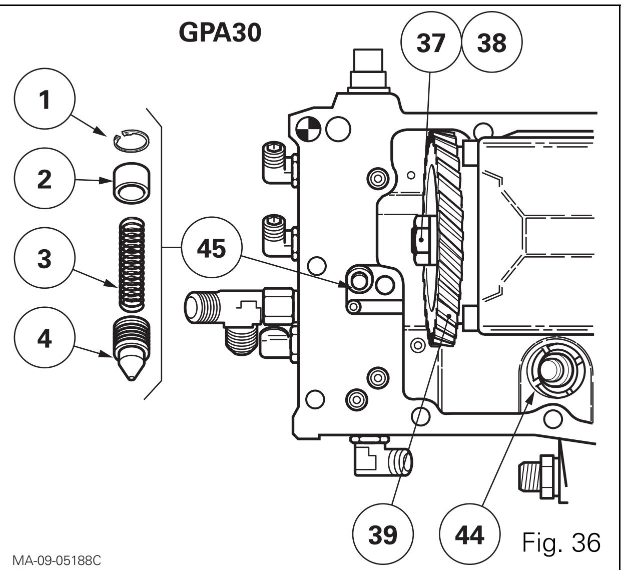

Fig. 36

Refitting

46. Clean the components. Replace those that are defective.

Check that none of the hydraulic cover plate channels are obstructed.

47. Check the presence of dowels (4) (Fig. 37).

48. Replace the "O" rings (1) to (3) (Fig. 37).

49. Repeat the pump removal operations in reverse order.

Important: *Inside the cover plate, apply a small bead of Loctite 574 or equivalent around the holes of screws (47) to seal these holes. Apply the same method as used with the left-hand cover plate (see chapter 9).*

Tighten the screws and nuts as indicated in the following table.

Nuts and bolts	Tightening torque	Sealing product
Nut (37)	50-60 Nm	Loctite 242 or equivalent:
Screw (47)	120 - 160 Nm	Loctite 242 or equivalent:
Screw (4)	25-35 Nm	Loctite 542 or equivalent

50. Lightly smear the thread of the engine speed sensor (25) (if fitted) with Loctite 5922 or equivalent.

Adjust the sensor (see § F).

Final step

51. Refit the right-hand hydraulic cover plate (see § C).

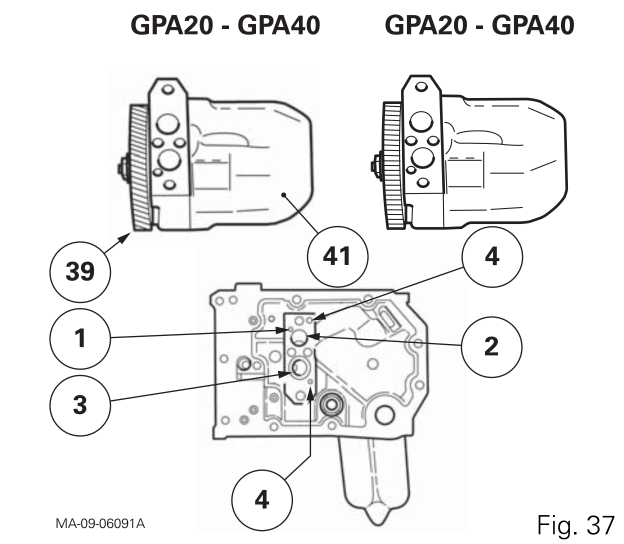

Fig. 37

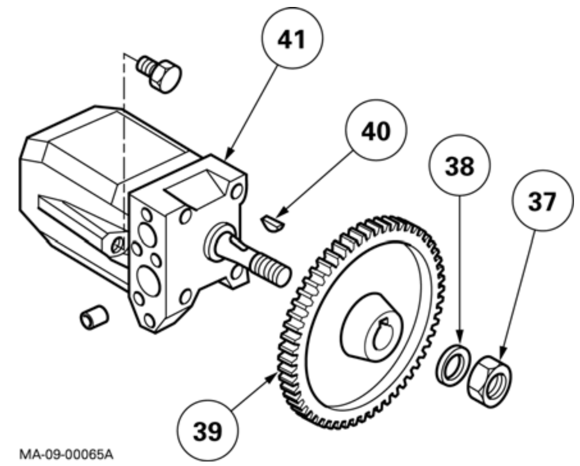

Fig. 38

F . Adjusting the engine speed sensor

Depending on the type of transmission, the LS right-hand hydraulic cover plate (8) may or may not be fitted with an engine speed sensor. If a sensor is fitted, adjust it by carrying out the following steps.

52. Manually tighten the sensor (25) home, without forcing it, until it comes into contact with the teeth of the driven gear (39) of the variable displacement pump.

53. Loosen the sensor by a ½ to ¾ turn to obtain approximately 1 mm clearance between the sensor and the driven gear.

54. Tighten the nut to 5-7 Nm without turning the sensor.

G . Priority block

Description

The single priority block (7) (Fig. 39), fitted to the right-hand hydraulic cover plate (8) (Fig. 42), is fitted to 40 kph tractors without trailer braking.

This block has two spools (Fig. 45) and receives the flow rate from the variable displacement pump. It ensures priority for the steering system and the 17 or 21 bar low pressure system. The oil is then directed to the auxiliary spool valves and linkage spool valve (see chapter 9).

This section primarily describes the single priority block (7) without trailer braking. The hydraulic unit with two priority blocks and with 40 kph trailer braking or trailer braking for tractors fitted with a high-pressure braking unit is described in its own section.

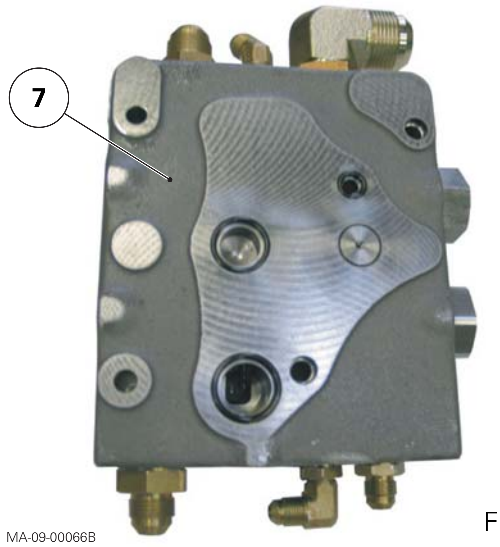

Fig. 39

Identification of 110 l/min or 150 l/min Load Sensing ports on the single priority block (7) (Fig. 40 to Fig. 44)

A	Orbitrol supply
B	High pressure (HP) supply from variable displacement pump (drilled port on the mating face of priority block and cover plate)
C	LS pilot flow to the variable displacement pump hydraulic regulator
D	LS pilot flow from the Orbitrol
F	Spool valve (auxiliary and linkage) supply.
G	LS pilot flow from spool valves (auxiliary and linkage).
H	Internal channel (Fig. 45)
I	17 or 21 bar outlet
J	Plug
HP	High-pressure (HP) spool
BP	Low-pressure (BP) spool

A	GPA20
B	GPA30 and GPA40

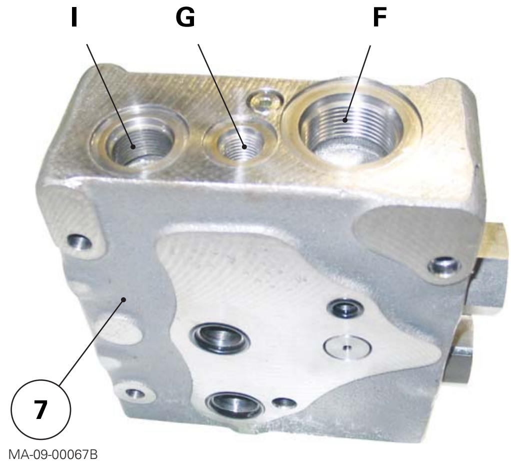

Fig. 40

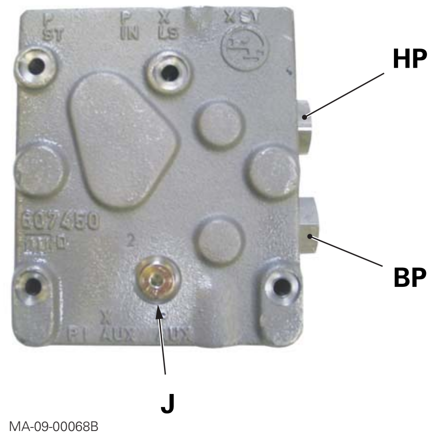

Fig. 41

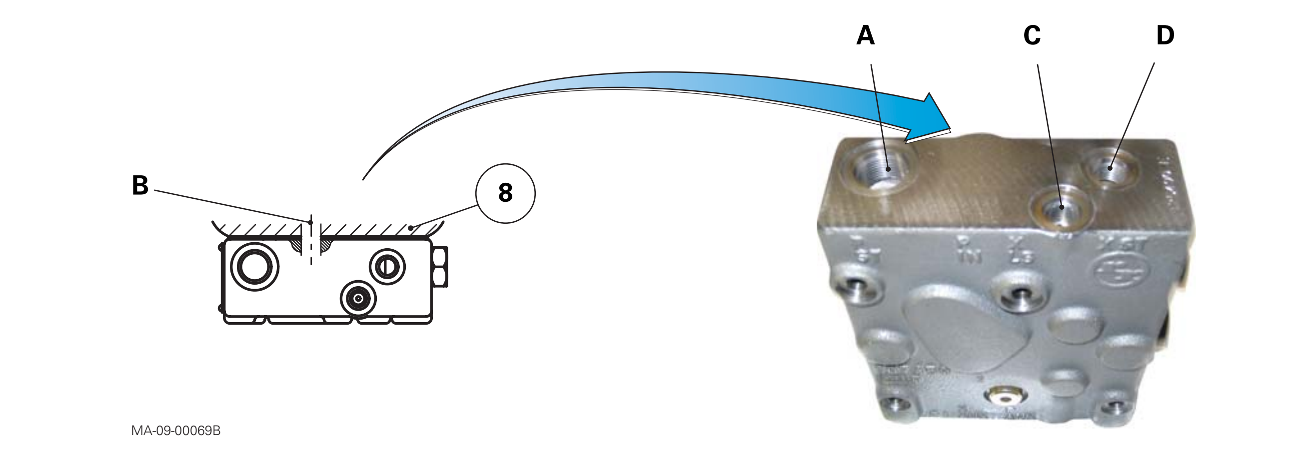

Fig. 42

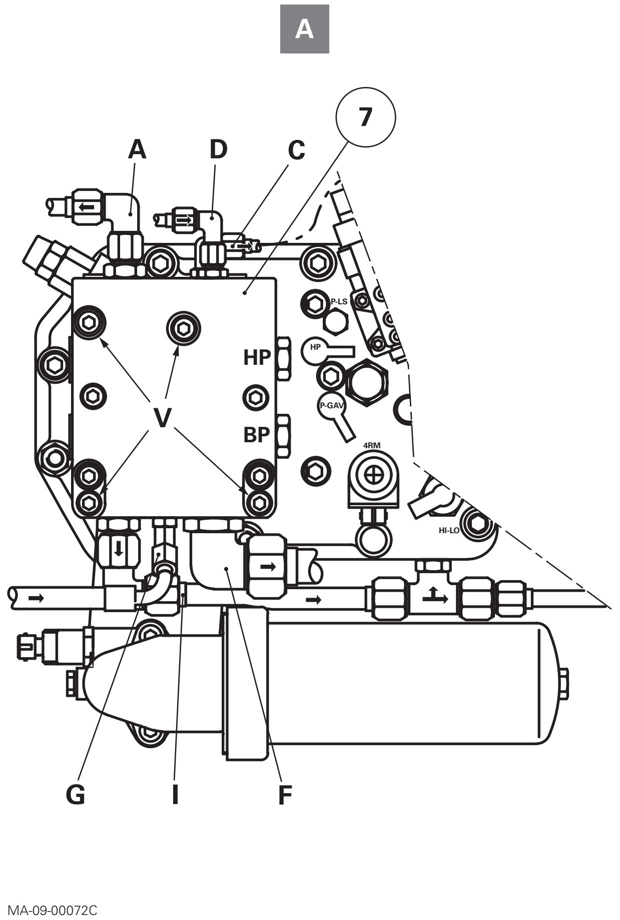

Fig. 43

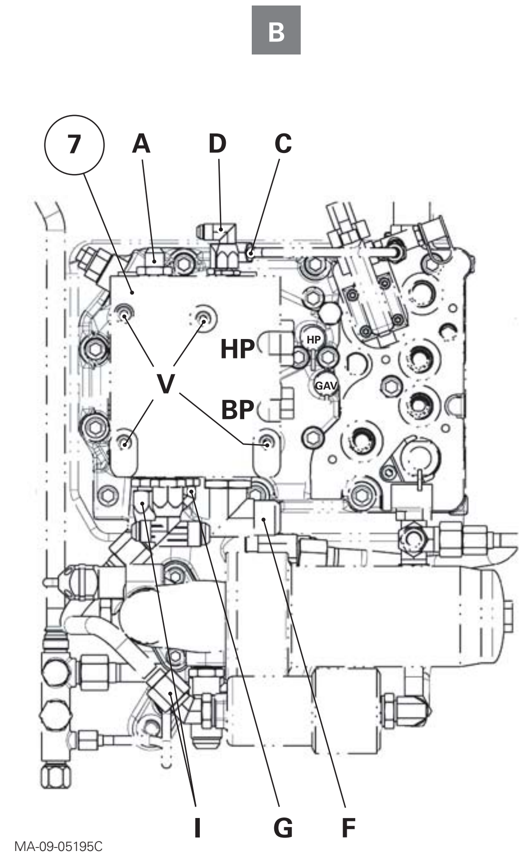

Fig. 44

Operation (Fig. 45 to Fig. 47)

1st priority: Steering

The spool (2) moves to the left under the action of spring (3).

The flow coming from the variable displacement pump via channel B (Fig. 42) is by priority directed towards the Orbitrol spool valve via channel A.

- **Steering at neutral**: The steering spool valve (Orbitrol) is in closed position. The pump pressure moves spool (2) to the right and the flow is directed into channel H.
- **Steering activated:** A pilot flow pressure from the Orbitrol arrives at port D and pushes the spool (2) to the left, allowing the flow to enter port A and supply the Orbitrol.

  Note: *A flow of approximately 0.5 l/min is directed through port A towards port D via a drilled hole and restrictor in spool (2). This flow rate creates pressure of approximately 6 bar at port D. The LS line directs this pressure to the variable displacement pump regulator which is adjusted to 22 bar in order to obtain a standby pressure of 28 bar.*

2nd priority: 17 or 21 bar pressure control valve

The spool (4) moves to the left under the action of the spring (5), allowing the flow from channel H to be directed into port I (17 or 21 bar low pressure). As soon as the pressure in this port reaches 17 or 21 bar, the spool reaches equilibrium thus allowing the low pressure to be maintained and the flow to be directed towards port F (linkage and auxiliary).

When the linkage and auxiliary spool valves are used, an LS pilot flow pressure is sent to the block via port G to join the LS line at port C.

Checking after servicing

55. If the single priority block (7) had to be replaced (Fig. 43, Fig. 44):
- Lightly smear the thread of screws V with Loctite 542 or equivalent. Tighten these screws to a torque of 25 - 35 Nm.
- Carry out hydraulic tests (see chapter 9).

56. Check the tightness of the unions and "O" rings fitted between the single priority block and the right-hand hydraulic cover plate.

57. Carry out a road test.

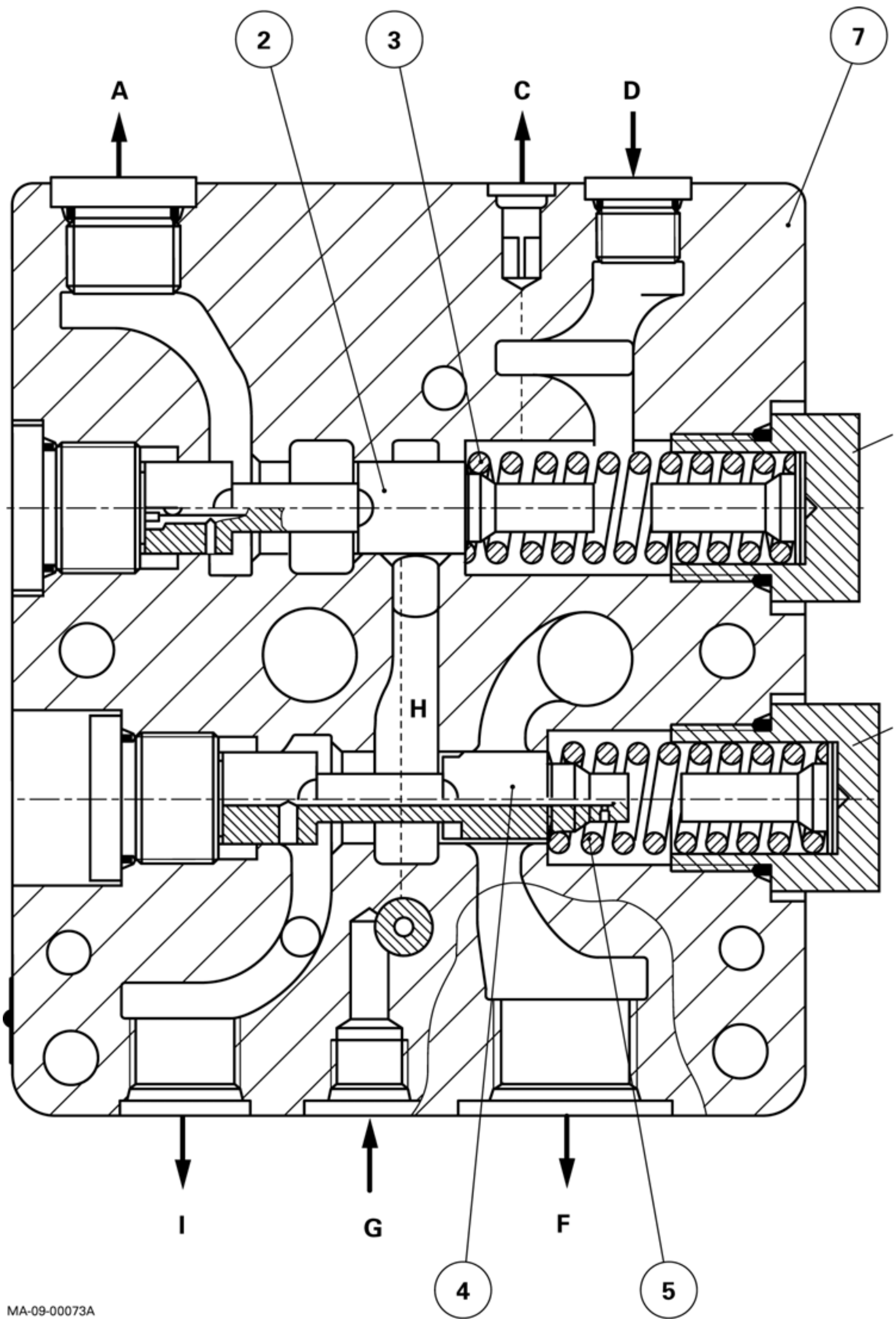

Fig. 45

Right-hand LS cover plate

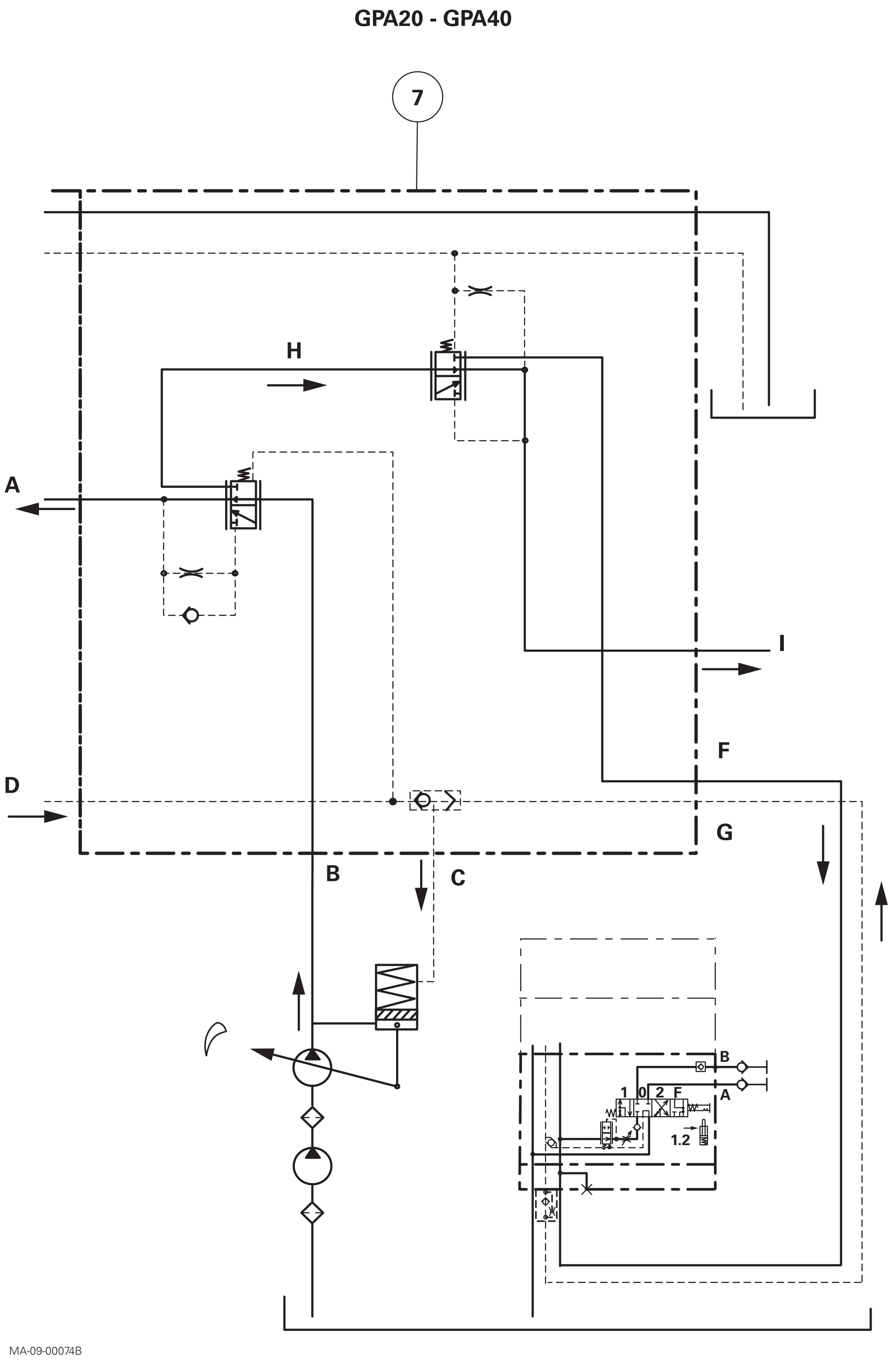

Fig. 46

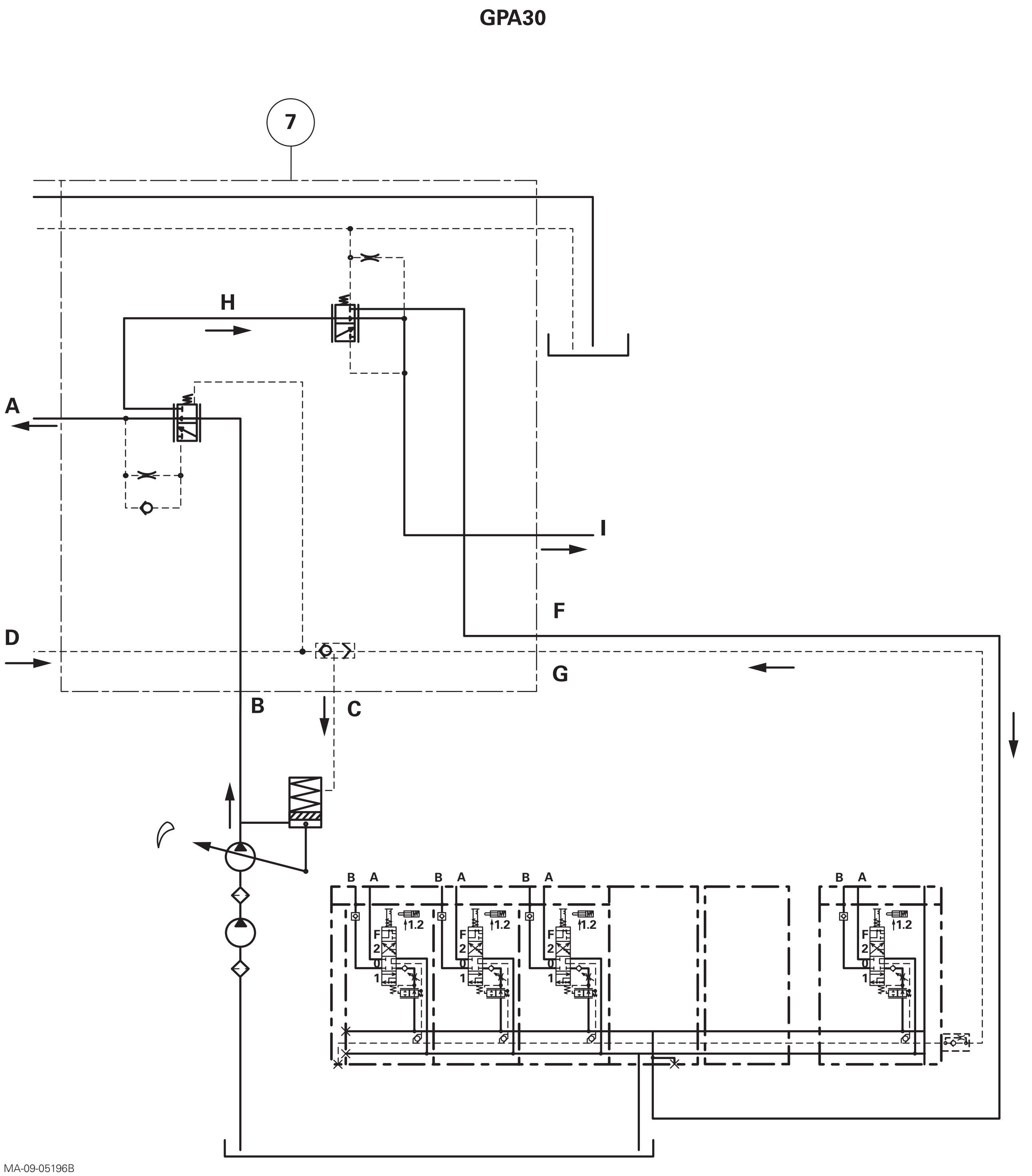

Fig. 47

H . Removing and refitting and disassembling and reassembling the hydraulic pump drive bearing (GPA30)

Preliminary steps

58. Disconnect the tractor between the gearbox and the intermediate housing (see chapter 2).

59. Remove the components of the creeper unit (if fitted) that might hinder the removal of the hydraulic pump drive gear (1) (Fig. 48).

60. Remove (Fig. 48):
- the stop ring (2)
- the tab washer (3)
- the spring (12)
- the drive gear (1) fixed to the bearing (11)

Removing the bearing (11) (Fig. 48)

61. Unscrew the plug (8).

62. Pull:
- the pin (7) using a threaded rod, such as to free the spacer (5);
- the bearing (11) such as to remove it from its bore through the front of the intermediate housing.

Refitting the bearing (11) (Fig. 48)

63. Check that:
- neither the channel nor drilled hole in the spacer (5) is blocked;
- the circlip (14) is present on the upper PTO shaft.

64. Refit the bearing (11).

65. Position the groove of spacer (5) along the axis of the port provided for plug (8).

66. Slide the pin (7) into its bore, inserting its flat sections into the groove of the spacer (5).
Tighten the plug (8).

67. Ensure that the bearing is correctly held by the pin (7) and that it rotates freely.

68. Refit the gear (1).

69. Lightly smear the thread of the screws (4) with Loctite 242 or equivalent. Tighten these screws to 72-96 Nm.

70. Refit:
- the spring (12)
- the tab washer (3)
- the stop ring (2)

Disassembling the hydraulic pump drive bearing (11) (Fig. 48)

71. Remove the circlip (10).
Extract the rollers (6) from the bearing.
Remove the spacer (5).

Reassembling the bearing (11) (Fig. 48)

72. Clean and check all components. Replace those that are defective.

73. Using a press and a suitable fixture, insert the rollers (6), separated by the spacer (5), into the bearing (11).
IMPORTANT: *The force of the press must be applied to the internal ring of the rollers.*

74. Refit the circlip (10).

NOTE: *The rollers of the hydraulic pump drive bearing (11) are lubricated by an oil flow from the right-hand hydraulic cover plate via the union (9) (Fig. 48).*

Final steps

75. Refit and adjust the creeper unit components (if fitted, see chapter 5).

76. Reconnect the tractor between the gearbox and the intermediate housing (see chapter 2).

77. Carry out a road test of all controls.

78. Check the tightness of the mating faces and hydraulic unions.

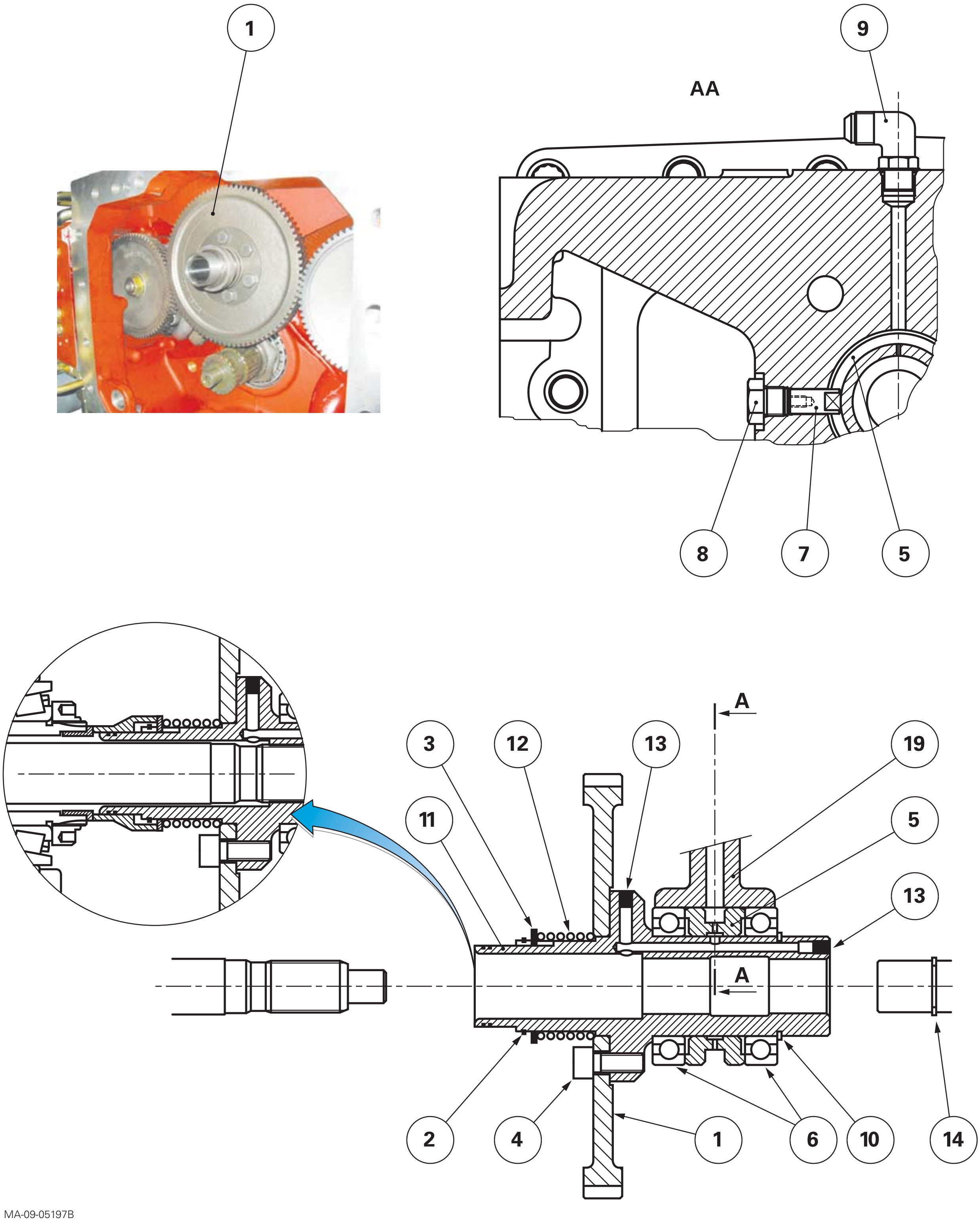

Fig. 48

I . GPA40 service tool

Tools available in the AGCO network

- 3378466M1: Pin wrench for removing and refitting the castellated collar (GPA40)

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Fig. 49

9C30 - Twin flow load sensing right-hand hydraulic cover

CONTENTS

A . General

The 6400 series tractors may be fitted with an open centre, closed centre or Twin flow load sensing hydraulic circuit. For the right-hand cover with open centre hydraulic circuit, see section 9B01. For the right-hand cover with closed centre circuit, see section 9B02.

The right-hand cover is fitted to the rear axle housing and has two main functions:
- it supports numerous hydraulic system components
- it incorporates various suction and cooling channels of the high and low flow circuits (high and low pressure).

On its inside face, the cover receives:
- two-stage hydraulic pump and its drive pinion
- suction pipe
- inlet manifold
- left-hand cover transfer pipe.

On its outside faces, it receives:
- four or five control solenoid valves for low pressure functions (depending on option) including one "proportional" solenoid valve for the PTO clutch function
- safety valve in the high pressure circuit
- trailer brake valve (if fitted) or a closing plate (depending on option)
- three “diagnostic” connectors
- strainer
- main 15 micron cylinder and its base
- low pressure switch (17 bar)
- filtration switch
- engine speed sensor.

Parts list

(1) Cover
(2) Screw
(3) High pressure (high flow rate) valve
(4) Screw
(5) Low pressure 17 bar diagnostics connector
(6) 17 bar low pressure switch
(7) Proportional solenoid valve (PTO clutch)
(8) PTO brake solenoid valves
(9) Front and rear differential lock solenoid valves
(10) 4WD solenoid valves
(11) Hare / Tortoise solenoid valve
(12) Engine speed sensor
(13) Low flow rate diagnostics connector
(14) Strainer
(15) Filtration switch
(16) High flow rate, high pressure diagnostics connector
(17) Balance block
(18) Brake valve
(19) Screw
(21) Locating pins
(22) O’ring
(23) O’ring
(24) Seal
(25) Transfer pipe
(26) O’rings
(27) Nut
(28) Washer
(29) Pinion
(30) Key
(31) Screw
(32) Hydraulic pump
(33) Pin
(34) Flange
(35) Screw
(36) Screw
(37) Deflector
(38) Suction pipe
(39) Seal
(40) Inlet manifold
(41) O’rings
(42) Pipe
(43) Threaded end-piece
(44) Seal

Twin flow load sensing right-hand hydraulic cover

External overall view

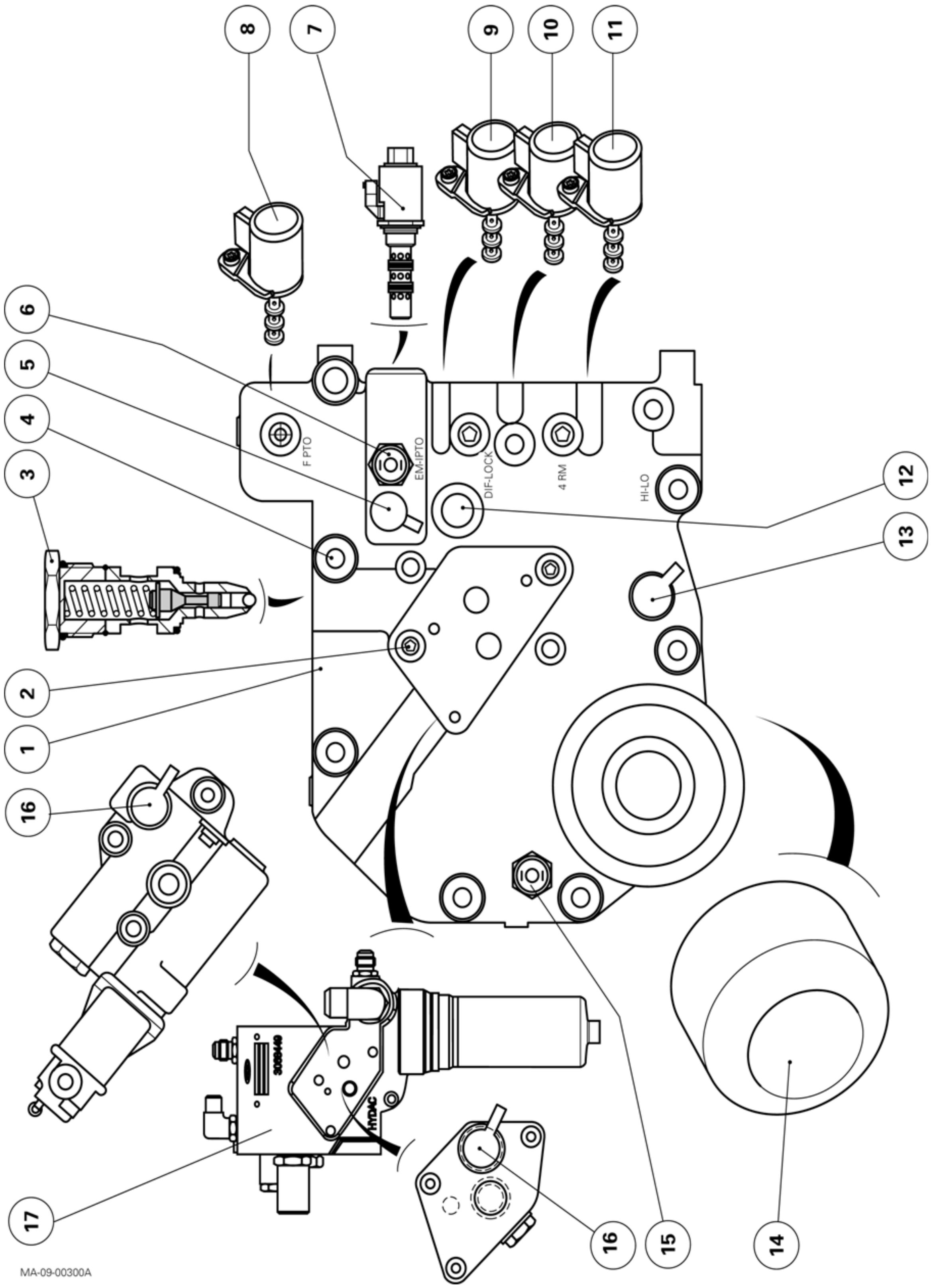


Fig. 1

Internal overall view

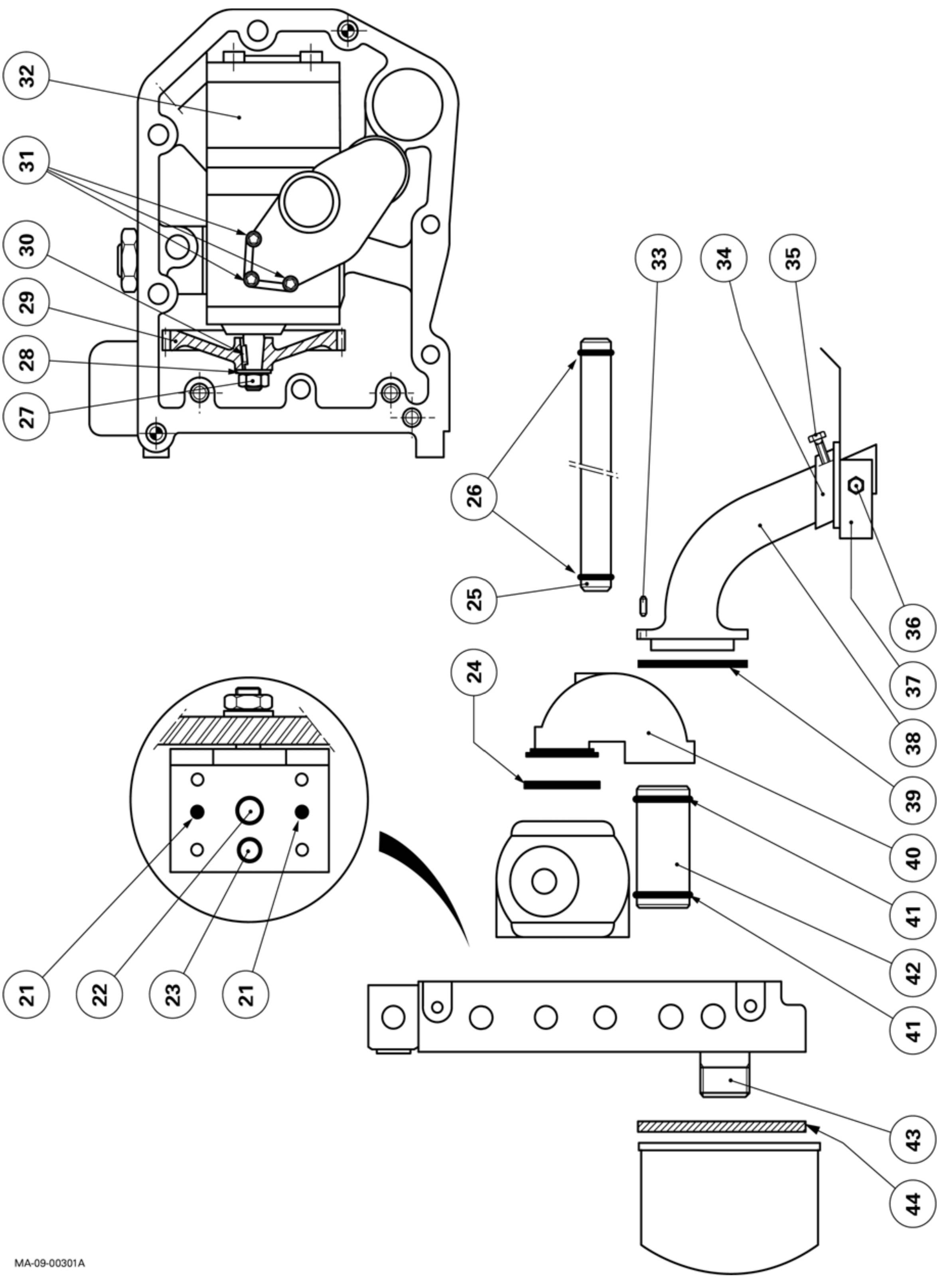


Fig. 2

Twin flow load sensing right-hand hydraulic cover

Exploded view

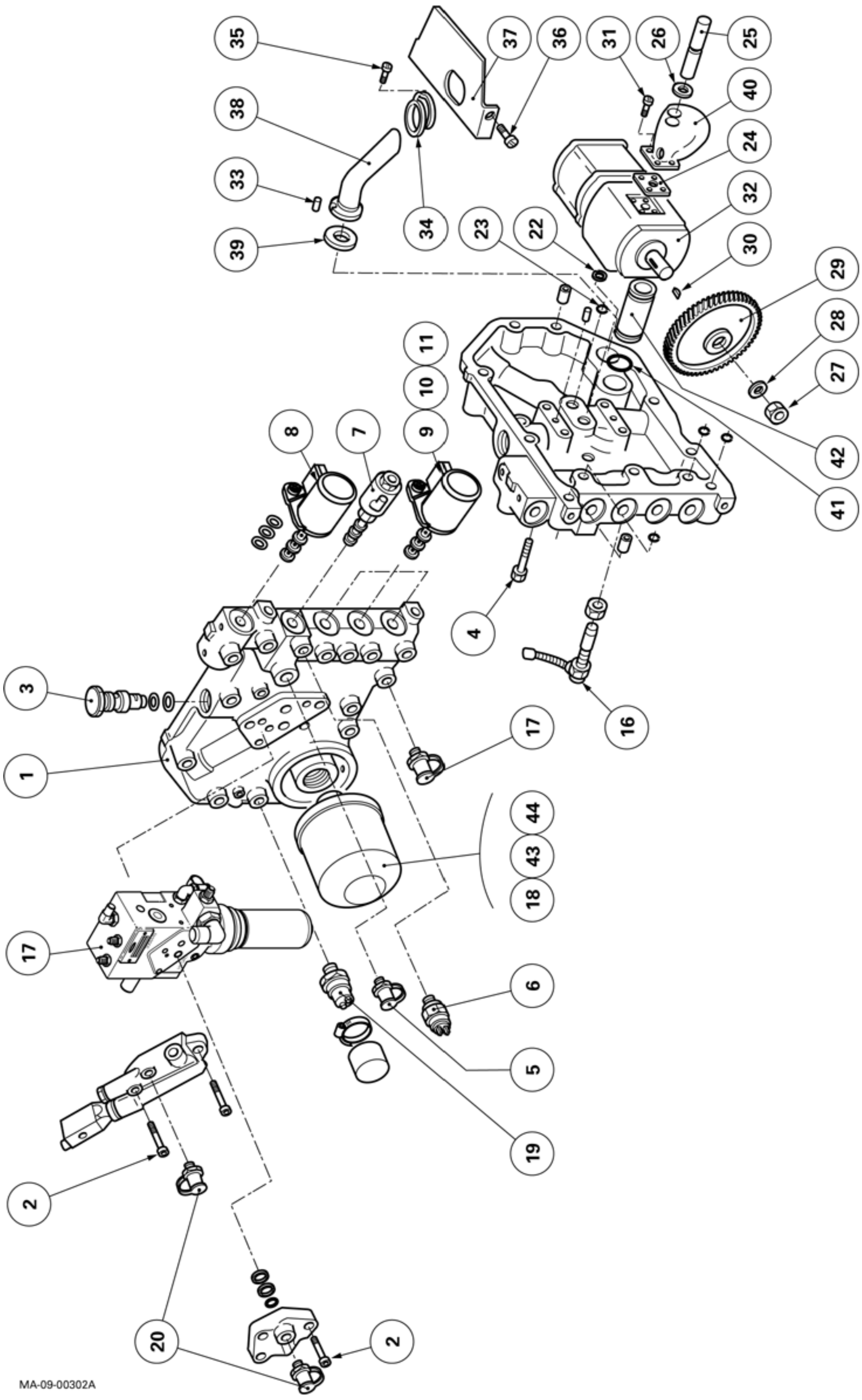


Fig. 3

B . Identification of channels and ports

Under the cover (1) (Fig. 7)

A : Channel to auxiliary spool valves
B : Port to front and rear differential locks (if fitted)
C : 17 bar pressure inlet from distribution block
D : Low flow rate channel to main filter (15 microns) and Orbitrol steering unit
E : Port to 4WD clutch port (if fitted)
F : Suction
G : Oil outlet to pump via strainer
H : Port for filtration switch
I : Continuity port towards auxiliary spool valves
J : High pressure port, pump outlet
K : Port to PTO brake
L : Port to PTO clutch

On the solenoid valves

Proportional solenoid valve (Fig. 4) fitted only to PTO clutch circuit
A : Supply ports to PTO clutch
P : 17 bar low pressure inlet
R : Port to return line

Solenoid valve (Fig. 5)
Standard (8) to (11): PTO brake – differential lock – 4WD – Hare / Tortoise circuit

On the high pressure, low flow rate valve (3) (Fig. 6)
P : 200 bar high pressure inlet
R : Port to return line

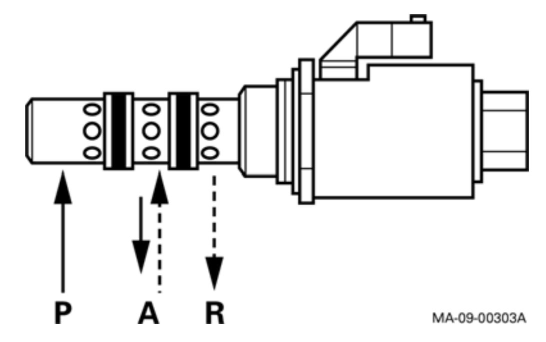


Fig. 4

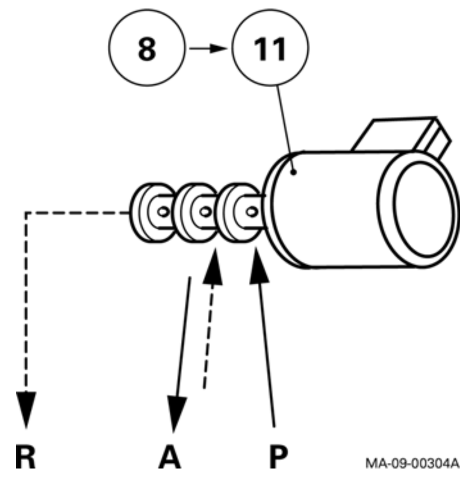


Fig. 5

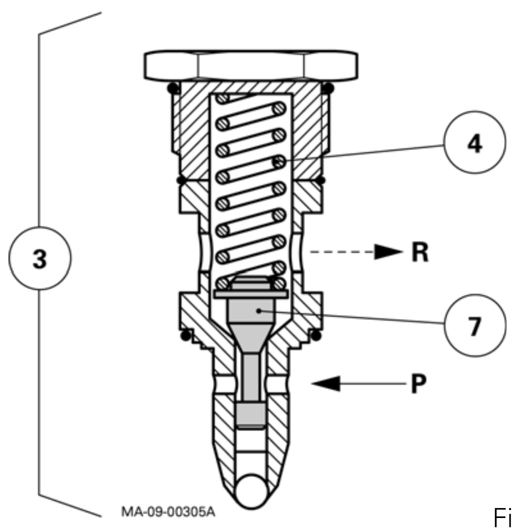


Fig. 6

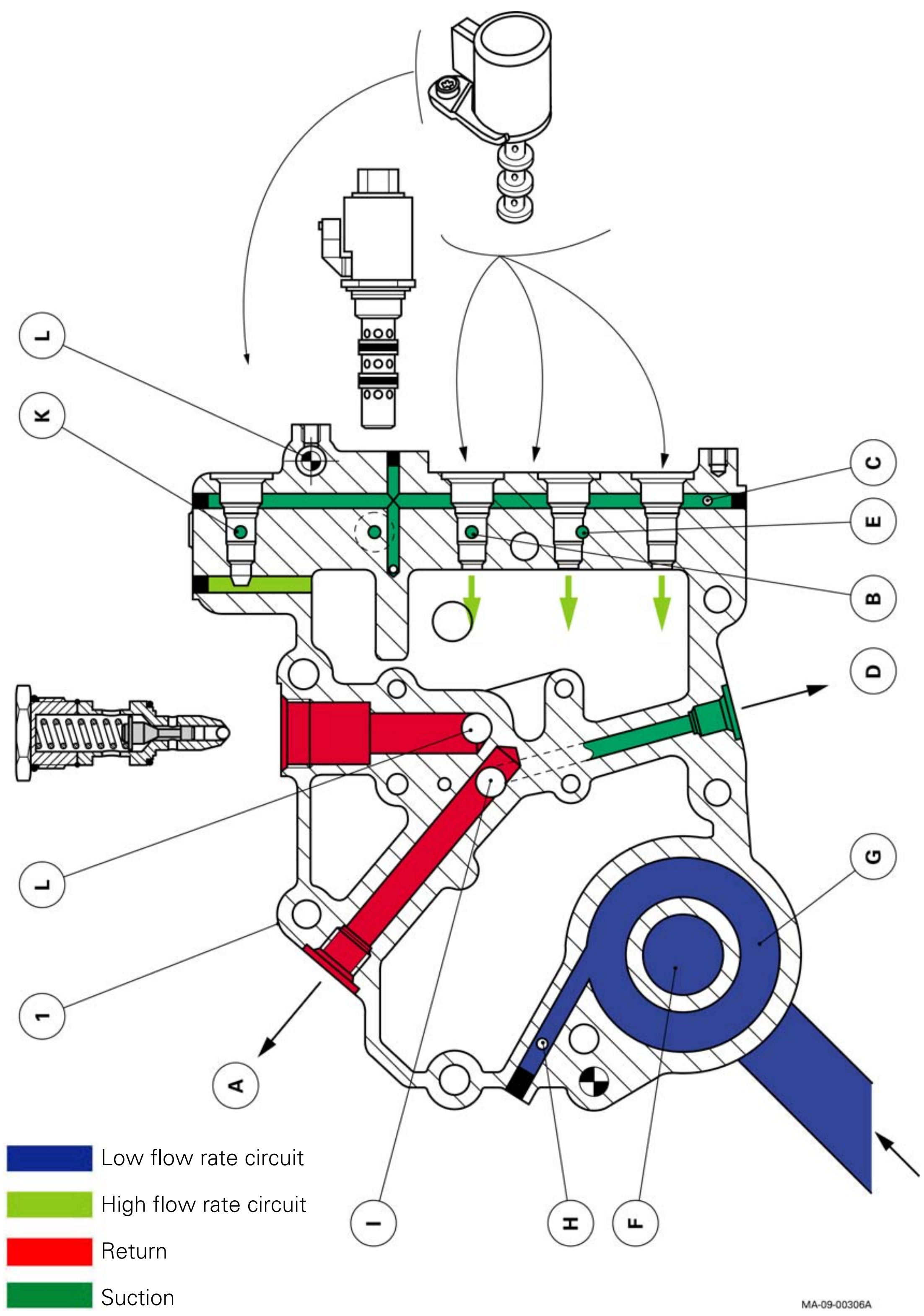

L
K
C
E
B
D
L
G
1
A
I
H
F
Low flow rate circuit
High flow rate circuit
Return
Suction
MA-09-00306A

Fig. 7

C . Removing and refitting the cover

Preliminary operations

1. Immobilise the tractor. Chock the left rear wheel.
2. Put on the handbrake.
3. Chock between the frame and the front axle.
4. Partially bleed the rear axle housing.
5. Take off the wheel concerned. Position an axle stand.

Removal

6. Disconnect the clogging indicator harness (12) (Fig. 8), and remove the 15 micron filter (14) and its base.

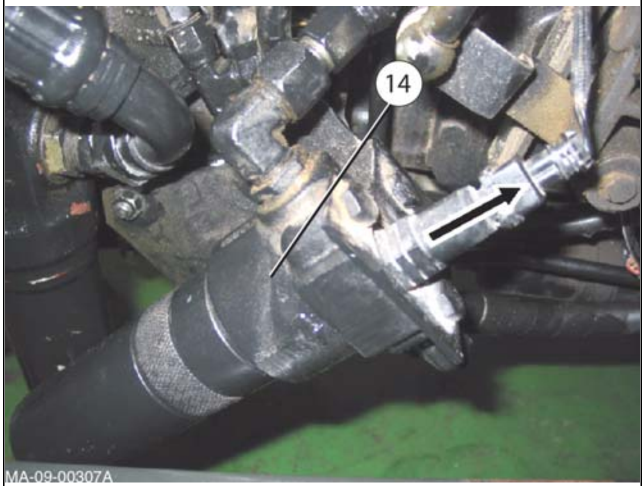


Fig. 8

7. Disconnect and block off the hydraulic unions supplying the spool valves.

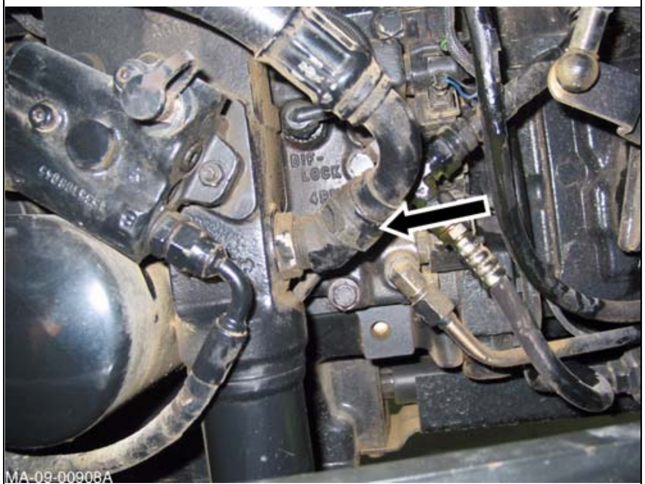


Fig. 9

Twin flow load sensing right-hand hydraulic cover

8. If the tractor is fitted with a trailer braking system, take out the screw and (19) remove the valve (18) (Fig. 10) (see section 09D03).

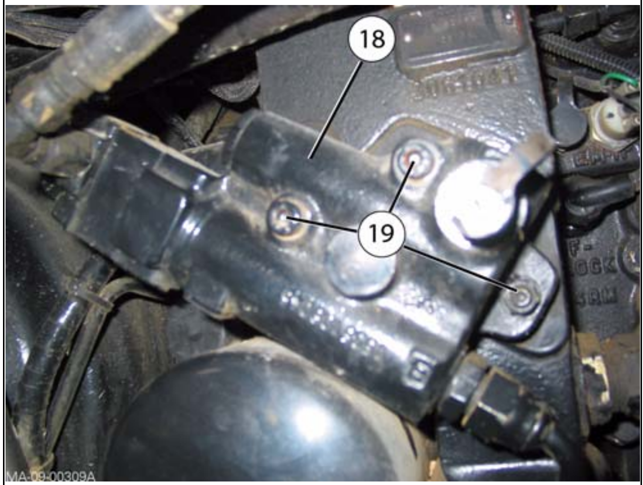


Fig. 10

9. Disconnect and block off the hydraulic unions on the block (17) (Fig. 11).

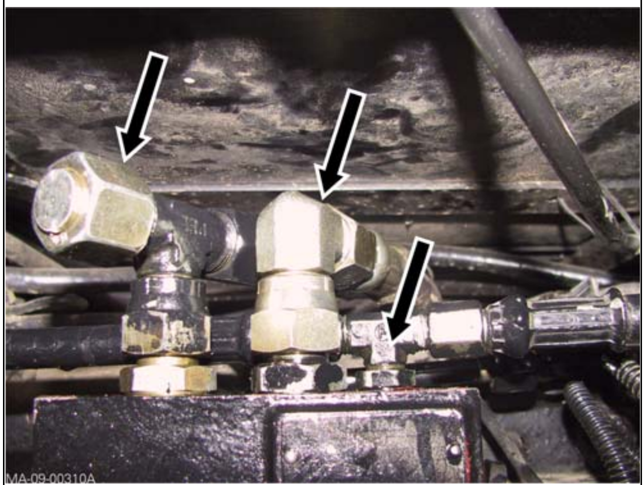


Fig. 11

10. Remove the block (17) (Fig. 12).

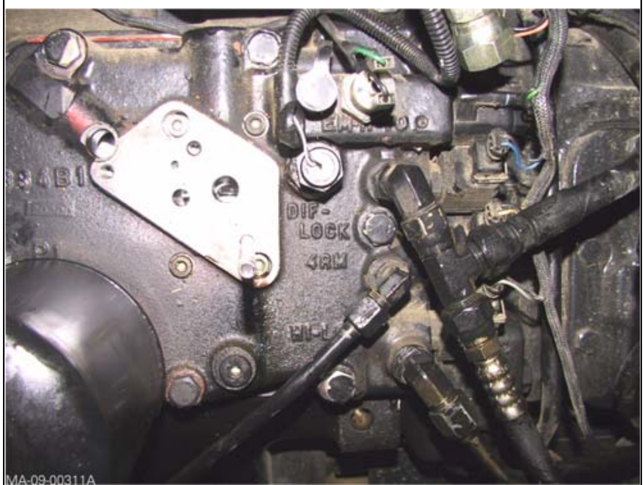


Fig. 12

11. Disconnect and block off the hydraulic unions (A) (B) (C) on the right-hand cover (Fig. 13).

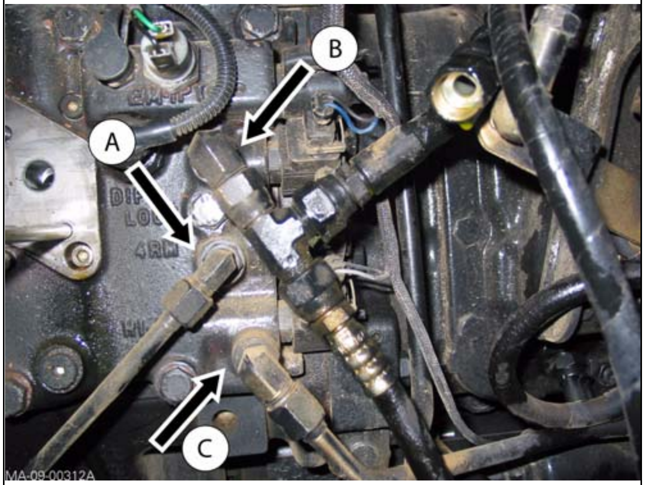


Fig. 13

12. Disconnect and block off the hydraulic union (D) on the right-hand cover (Fig. 14).

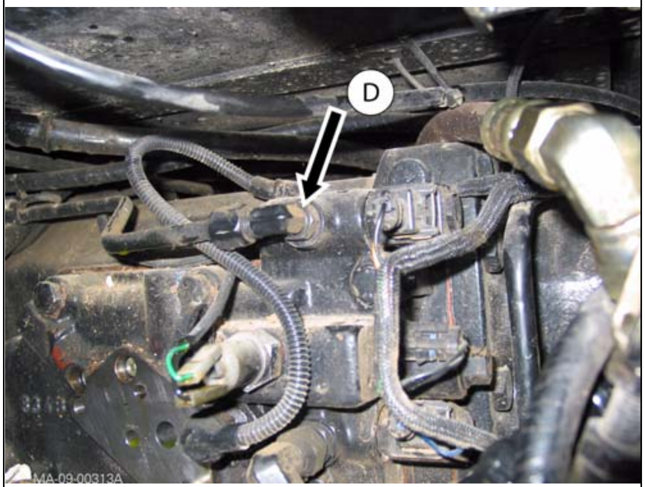


Fig. 14

13. Locate and disconnect the solenoid valve electrical connectors (Fig. 15).

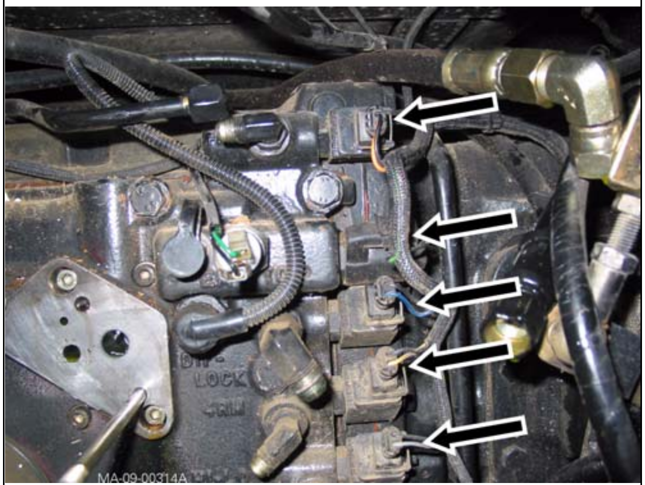


Fig. 15

14. Remove the suction strainer (18).

Fig. 16

15. Disconnect and remove the filtration switch (19).

Fig. 17

16. Loosen and remove the screws (4) securing the right-hand cover.

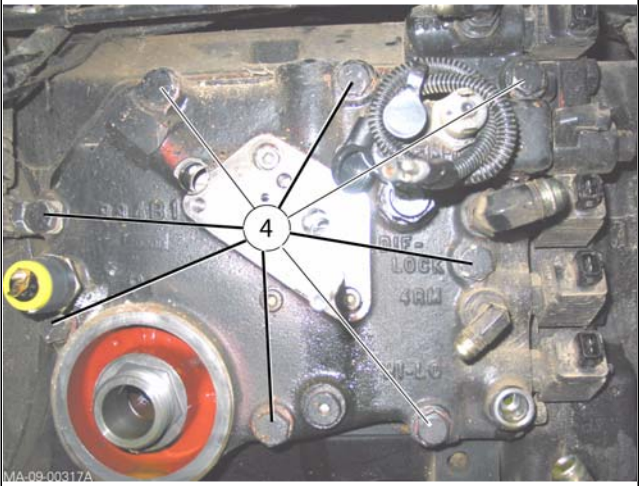


Fig. 18

17. Fit a guide stud (G1) to prevent the cover from falling. Release and remove the housing cover.

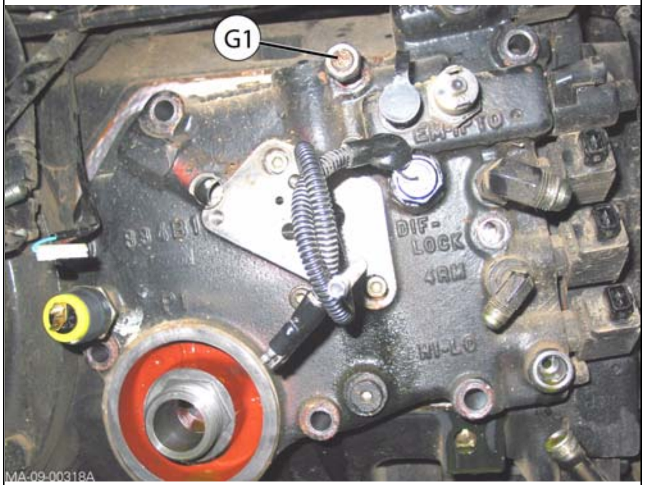


Fig. 19

Refitting

18. Clean the mating face of the housing and check the transfer pipe (25) is in place. Fit a new seal (39). Check the two locating pins (1) are in place (Fig. 20).

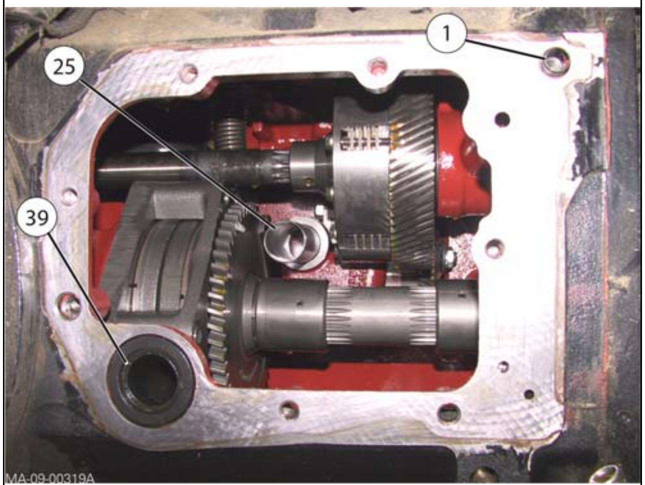


Fig. 20

19. Clean the mating face of the right-hand cover, smear it with Loctite 510 or equivalent, and fit the new seals (39) (2) (3). (Fig. 21).

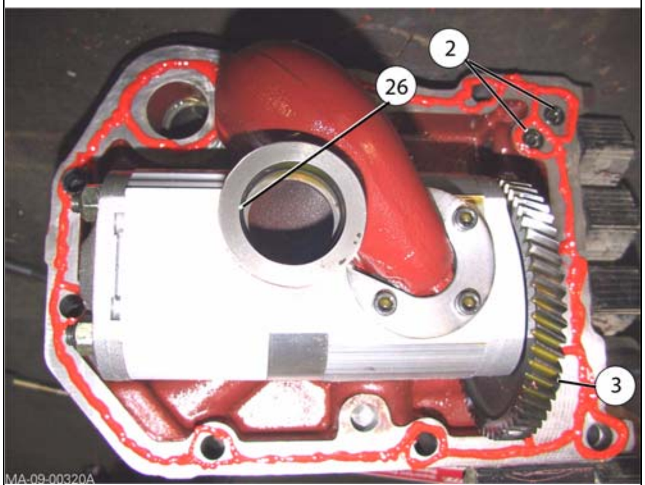


Fig. 21

Twin flow load sensing right-hand hydraulic cover

20. Fit two guide pins (G1) to the housing, and fit the cover onto (G1).

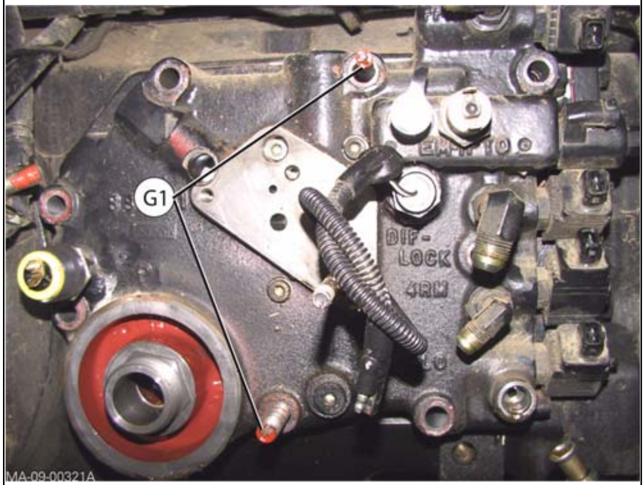


Fig. 22

21. Place the cover on the housing and fit two diametrically opposing screws (4).

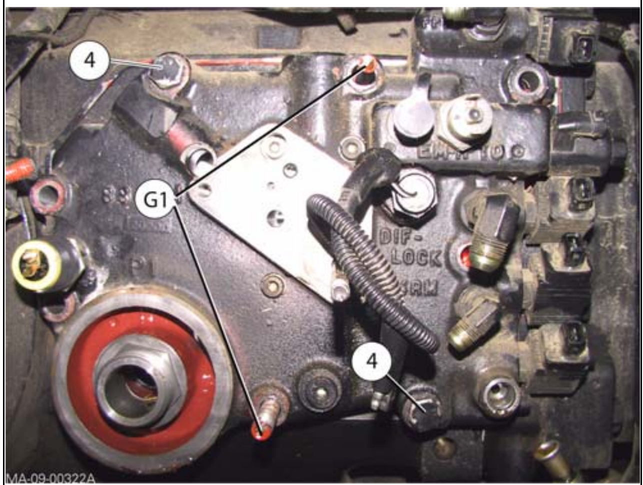


Fig. 23

22. Remove the guide pins (G1), and fit and tighten all screws (4) to a torque of 72 - 96 Nm (Loctite 241).

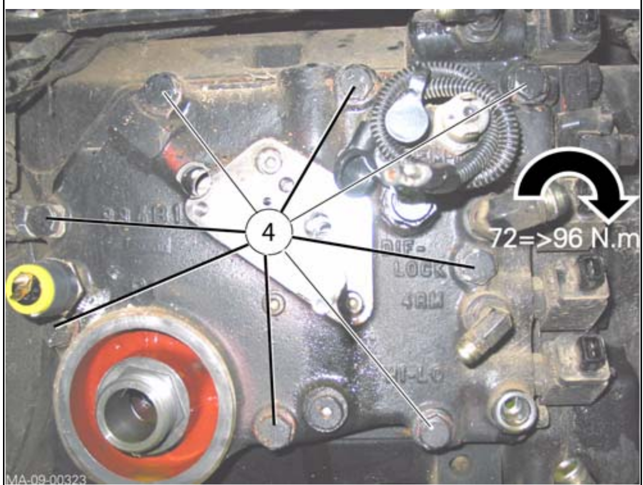


Fig. 24

23. Connect the filtration switch (19) connector.

Fig. 25

24. Fit the suction strainer (18) and the filtration switch protector. Direct the discharge hole on the latter downwards.

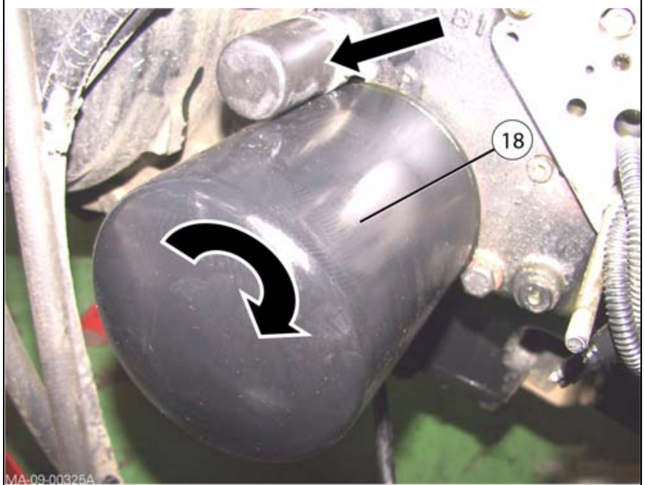


Fig. 26

25. Connect the electrical connectors on the solenoid valves according to the marks made at disassembly.

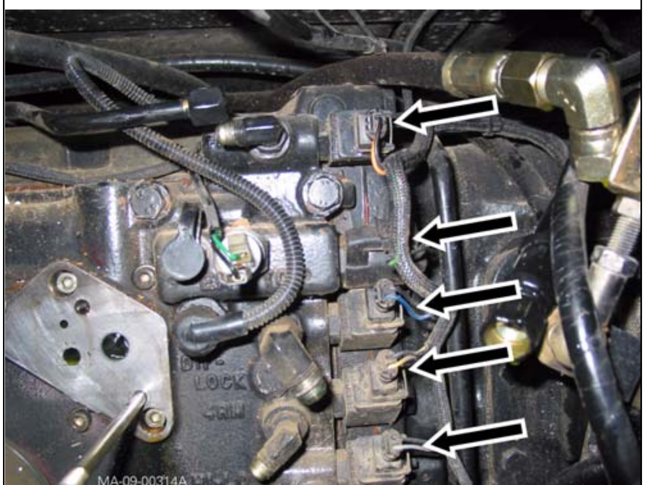


Fig. 27

26. Connect the hydraulic union (D).

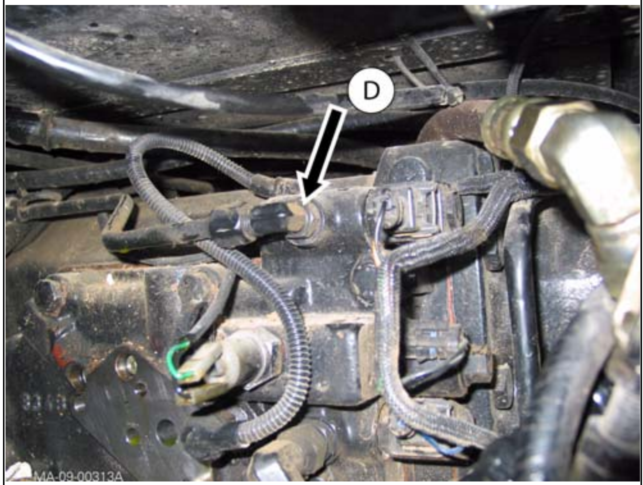


Fig. 28

27. Connect the hydraulic unions (A) (B) (C).

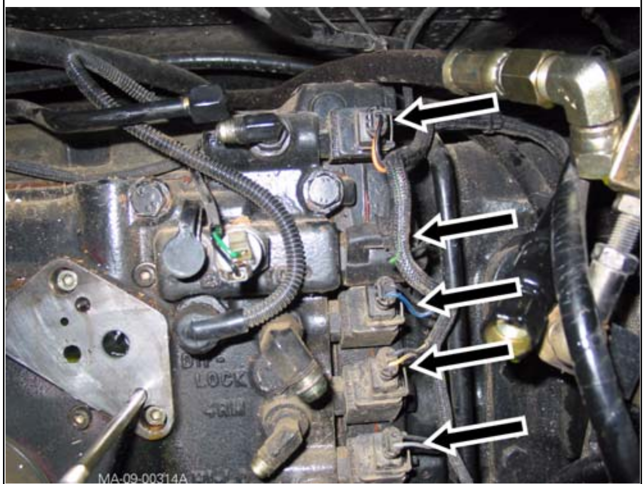


Fig. 29

28. Fit the block (17).

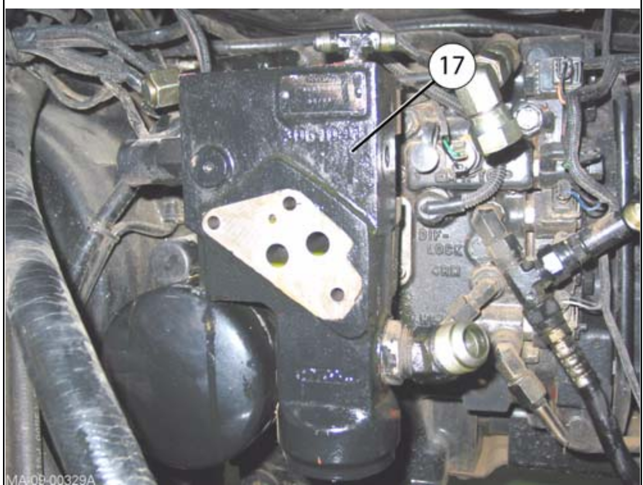


Fig. 30

29. Connect the hydraulic unions on the block (17).

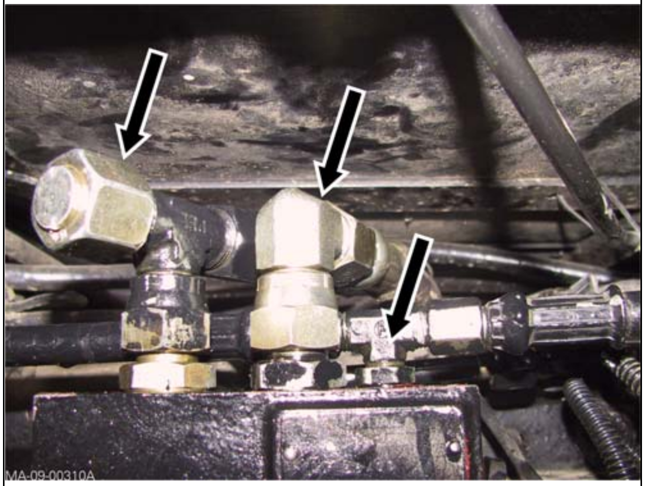


Fig. 31

30. If the tractor is fitted with a trailer braking system, fit the brake valve (18) and tighten the screws (19).

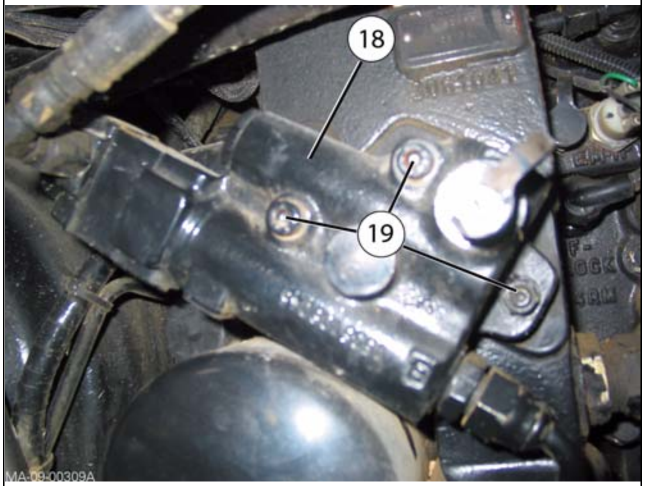


Fig. 32

31. Connect the hydraulic supply unions of the hydraulic spool valves.

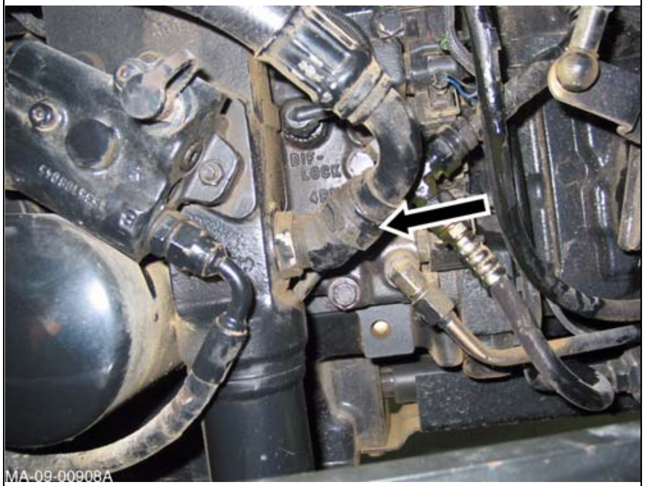


Fig. 33

32. Fit the 15 micron filter (14) and its base. Fit the clogging indicator harness.

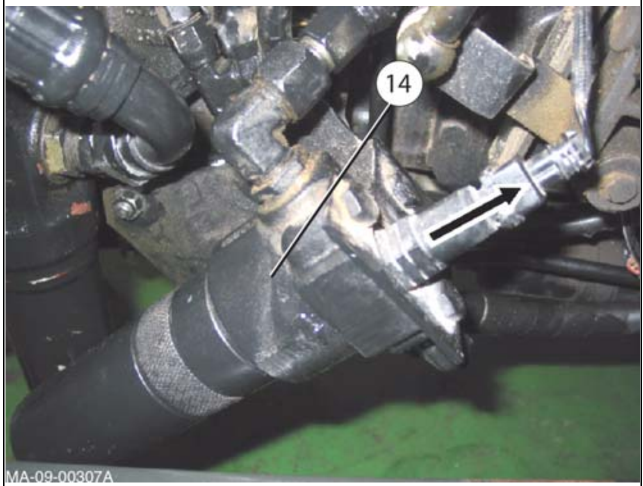


Fig. 34

33. Refit the wheel, then tighten the nuts to the torque stated below. Remove the axle stand, top up the oil level in the housing and check it using the gauge located to the rear of the centre housing.

34. Check the tightness of the mating faces and hydraulic unions.

Wheel tightening torque: 400-450 Nm

Special points

- The function of each solenoid valve is moulded on the outside face of the hydraulic cover casting.
- The cover is fitted with three different types of solenoid valves.
- Out of the four or five solenoid valves fitted (depending on version), the "Fluid Power System" solenoid valve (7) (Fig. 1) of the PTO clutch is of the proportional type.
- The "Parker" solenoid valve (8) (Fig. 1) of the PTO brake has a solenoid valve with a diode and is represented by the following symbol.
- The body of the "Parker" solenoid valve (11) (Fig. 1) must be fitted to the control circuit of the Hare / Tortoise mechanism. It features a machined end-piece on one of its ends.

35. Take out the screws (4) and remove the cover.

36. After removing the cover, if necessary remove from the housing the transfer pipe (25) (Fig. 35), ensuring hydraulic continuity with the pump manifold.

Refitting

37. Clean the mating faces of the housing and the cover.

38. Check for the presence of the two locating pins (1) and rivets at the ends of the channels on the cover (Fig. 7 and Fig. 36).

39. Fit new seals:
- on the Hare / Tortoise channels (2) (Fig. 36)
- on the power take-off clutch channel (3) (Fig. 36).

40. Fit and position the suction pipe (38) (Fig. 37), with its notch along the axis of the pin inserted in the housing. Put in place seal (39).

41. Screw two locally made guide pins into opposing holes on the housing (Fig. 37).

42. Refit the transfer pipe if it was previously removed.

43. Smear the mating faces of the cover with a sealing product (Loctite 510 or equivalent) taking care not to block the hydraulic ports of the Hare / Tortoise mechanism.

44. Refit the cover. Take out the guide pins. Fit and tighten the screws (4) (Fig. 24) to a torque of 72 -96 Nm.

45. Reconnect (according to the markings made):
- solenoid valves
- filtration switch
- low pressure switch
- engine speed sensor.

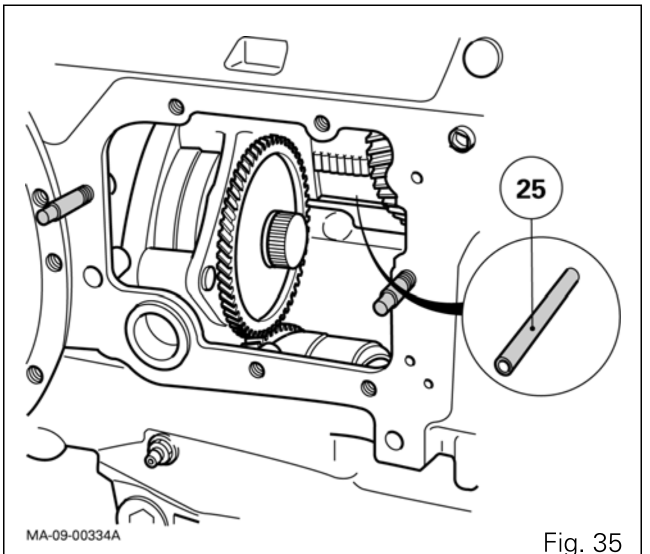


Fig. 35

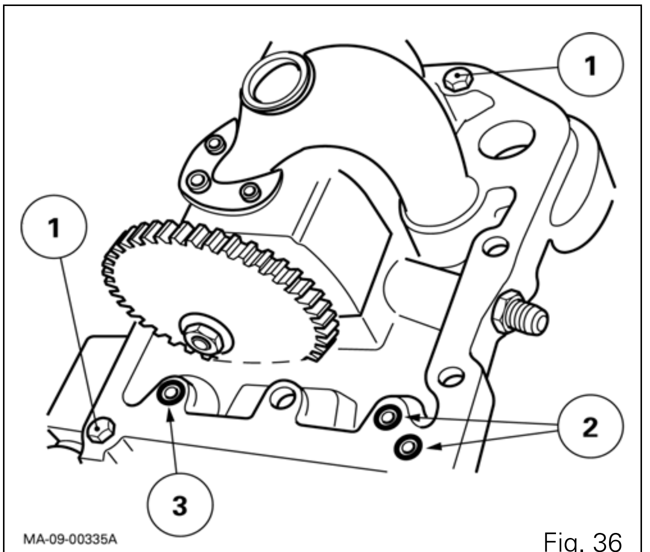


Fig. 36

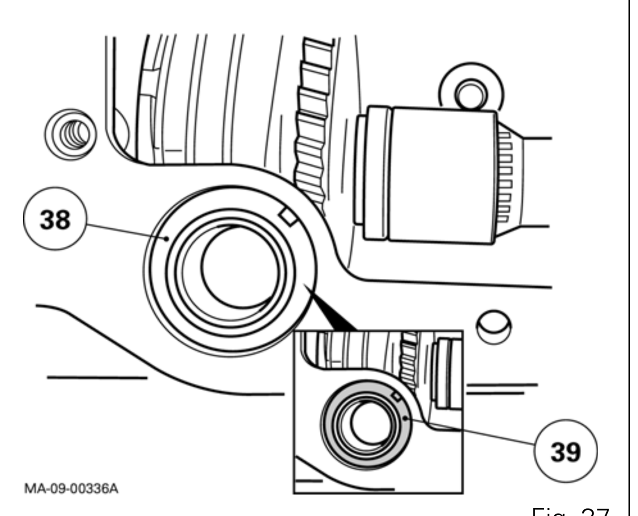


Fig. 37

46. Attach the electrical harnesses using a cable clip.
47. Reconnect the pipes and hose.
48. Refit the valve (6) (if fitted) (see chapter 9).
49. Check the condition of the strainer seal (18) and lubricate it. Refit the strainer and tighten it an additional quarter turn after it contacts with the cover.
50. Refit the 15 micron filter and its base. Reconnect the filter clogging indicator.
51. Lift the tractor. Refit the wheel.
Remove the axle stand and tighten the nuts to a torque of 400 - 450 Nm.
Remove the chocks.
52. Top up the transmission oil level of the rear axle and check it using the gauge located to the rear of the centre housing.
53. Check the operation of the electrical circuits, the low pressure switch, the solenoid valves, the filtration switch and the filter clogging indicator.
54. If the pump has been replaced, or if the disassembly of one or several hydraulic component(s) was necessary, check the hydraulic circuit by carrying out the relevant tests (voir section 9M01).
55. Check the tightness of the cover mating face, the strainer and the hydraulic unions.

D . Disassembling and reassembling the high pressure valve

Operation (Fig. 6)

If pressure "P" rises above 200 bar ± 5 bar, the spring (4) is compressed, opening the valve (7) to allow oil to pass into the housing via port R.

Preliminary operation

If necessary, take off the right-hand side rear wheel. Place an axle stand.

Disassembly (Fig. 38)

56. Unscrew the plug (1). Recover the shims (2) and take out the spring (4).
57. Remove the O'ring (5), extract the body (6) with the valve (7) and the washer (8) from the right-hand cover.
Note: The ball (9) is crimped in the body of the valve.

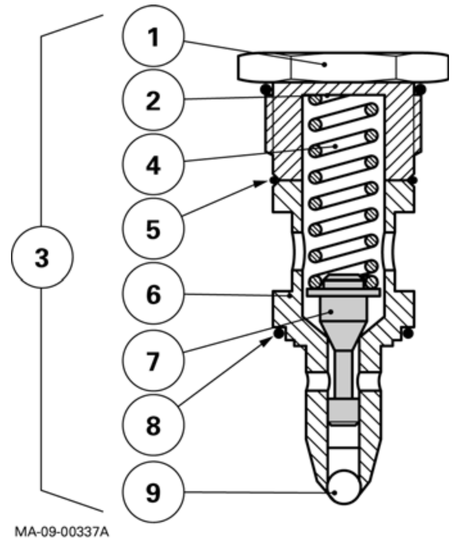


Fig. 38

Reassembly (Fig. 38)

58. Check that the valve (7) slides freely in the valve body (6).
59. Place the washer (8), fit the valve body (6) with the valve (7) into the cover. Position the O'ring (5).
60. Fit the spring (4), the shims (2) and tighten the plug (1) to a torque of 50 - 60 Nm.

Final operation

Refit the wheel (if removed). Tighten the wheel nuts to a torque of 400 - 450 Nm.

E . Disassembling and reassembling the cover

Disassembly

61. Take off the cover (see § C).

62. Place the cover (1) in a vice fitted with plastic jaws.

On the outside face (Fig. 1)

63. Mark the locations and types of solenoid valves (7) to (11) and remove them.

64. Mark the location of the switches (6) (19) and remove them.

65. Remove the engine speed sensor.

66. Remove the hydraulic unions and plugs, fitted according to the version.

67. Remove the diagnostics connectors.

Note: On tractors not fitted with trailer braking, if necessary, remove the cover plate (3) (see section 09B03).

68. Take off the high pressure valve (3).

On the inside face (Fig. 2)

69. Take out the screws (31) and remove the inlet manifold (40), seal (24) and pipe (42). Remove seals (41).

Removing the drive pinion

70. Unscrew nut (27). Take off washer (28), pinion (29) and key (30).

71. Take off the pump (see § F).

Reassembly

72. Clean the cover mating faces.

73. Check that no channels (low and high flow rate) are blocked. Check for the presence of the rivets ensuring oil tightness at the end of each channel.

On the inside face (Fig. 2)

74. Refit the pump (see § F).

Refitting the drive pinion

75. Position the key (30). Fit the pinion (29) on the shaft while ensuring that the key is correctly engaged. Fit washer (28).

76. Smear the nut (27) with Loctite 241 and tighten to a torque of 50 - 60 Nm.

77. Replace the O'rings (41) on the pipe (42).

78. Refit the seal (24), the pipe and the inlet manifold (40). Refit and moderately tighten the screws (31).

On the outside face (Fig. 1)

79. Refit the high pressure valve (3). See tightening torque in § D.

Note: On tractors not fitted with trailer braking, if removed, refit the cover plate (3) (see section 09B03).

80. Refit the diagnostics connectors.

81. Refit the plugs and hydraulic unions.

82. Refit and adjust the engine speed sensor (see § H).

83. Refit the switches (6) (19) in their respective locations, having lightly smeared the threads with Loctite 542.

84. Refit the solenoid valves according to the type and locations marked during disassembly.

Maximum tightening torque

- Solenoid valve body: 15 - 20 Nm
- Solenoid: 1.7 - 2.8 Nm.

85. Refit the cover (see § C).

F . Removing and refitting the pump

Removal (Fig. 39)

86. Remove and disassemble the cover (see § C and E).

87. Take out the screws (2) and disengage and remove the pump (32). Remove the O'rings (22) (23).

Note: The locating pins (21) are force fitted into the cover.

Refitting

88. Clean the components, replace any found to be defective. Check that none of the channels in the cover are obstructed.

89. Fit the locating pins (21) (if necessary) to the cover (Fig. 40).

90. On the cover, fit new O'rings (22) (23) in the recesses of the high and low flow rate channels (Fig. 40).

91. Inside the cover, apply a bead C of Loctite 574 around the four pump fixing screw holes (Fig. 40).

92. Refit the pump on the locating pins (Fig. 39).

93. Smear the screws (2) with Loctite 221 (Fig. 39) and tighten to a torque of 10 -12 Nm.

94. Reassemble and refit the cover (see § E and C).

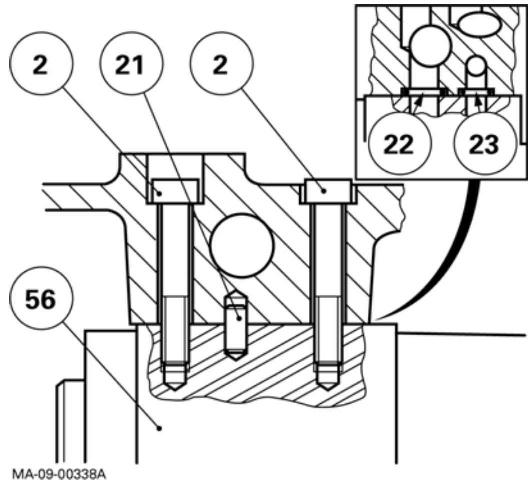


Fig. 39

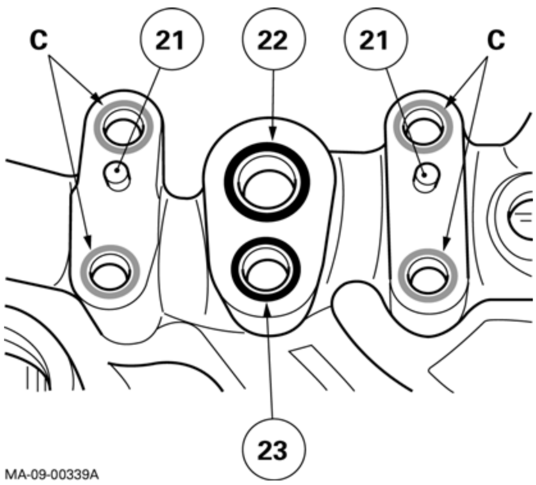


Fig. 40

Exploded view of the pump

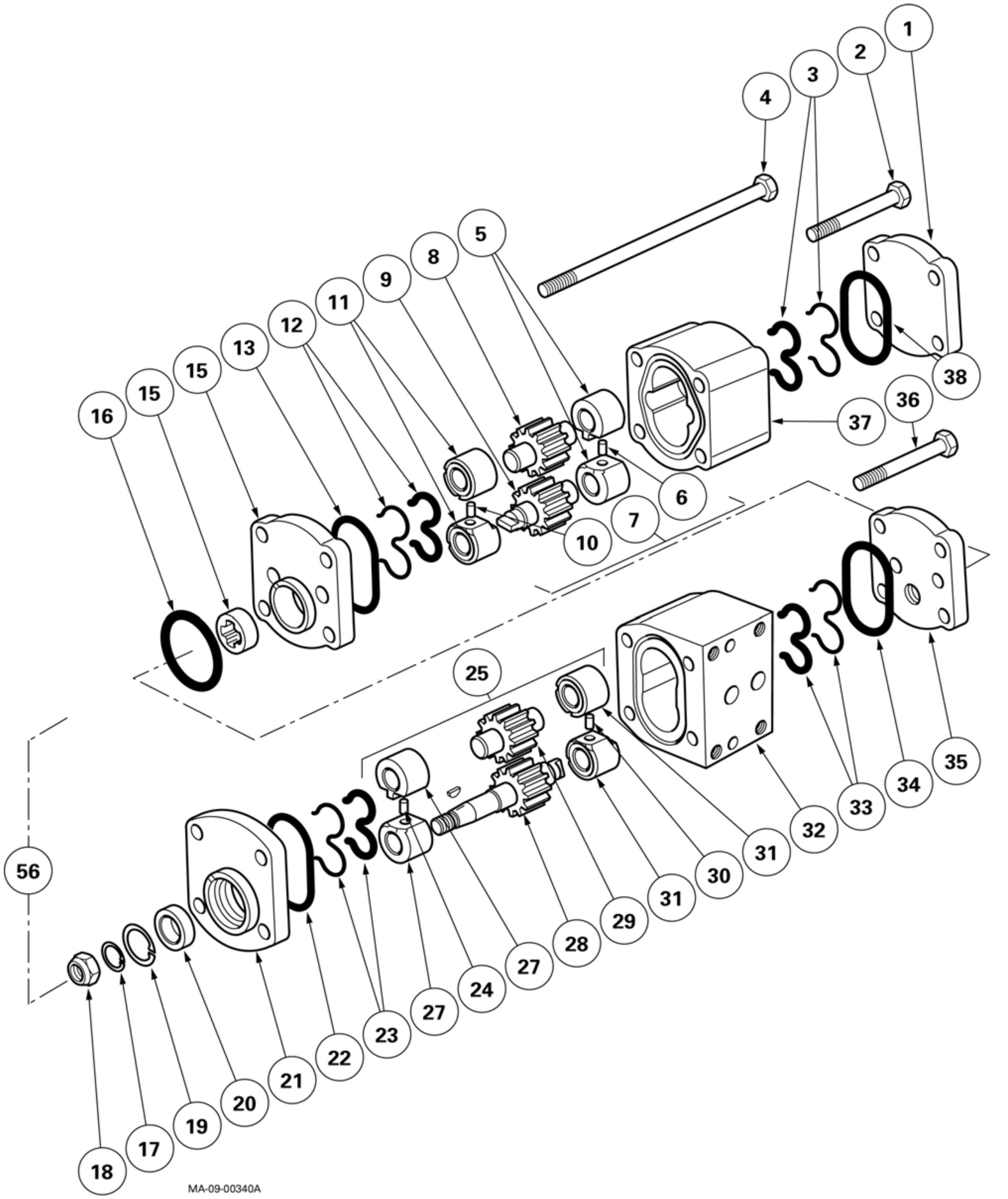


Fig. 41

G . Disassembling and reassembling the pump

95. Remove and disassemble the cover (see § C and E).

Disassembly (Fig. 41)

96. Clamp the pump in a vice (Fig. 42).

97. Using paint, mark the positioning of: pump stages, flange and plates.

98. Take out the screws (2) (4).

99. Remove the closing plate (1).

100. Remove the composite seal (3) and seal (38). Split the low flow rate stage (37) from the flange (14).

101. Take out the stage and the pinion / bearings assembly (7).

102. Remove the pinions (8) (9) from the bearing assemblies (5) (11).

Note: Pair the bearing assemblies. Each bearing is linked by a locating pin P (Fig. 43).

103. Remove the composite seal (12) and seal (13).

104. Take off the flange (14), catchdog (15) and seal (16).

105. Loosen and remove screws (36).

106. Take off the flange (35).

107. Remove the composite seal (33) and seal (34).

108. Split the high flow rate stage (32) from the flange (21).

109. Take out the bearing / pinion assembly.

110. Remove the pinions (28) (29) from the bearing assemblies (27) (31).

Note: Pair the bearing assemblies.

111. Remove the composite seal (23).

112. Remove seal (22).

113. Remove circlip (19) and drive out the bush (20).

Reassembly (Fig. 41)

114. Check and clean all components. Replace any defective parts.

Note: During reassembly, the bush (20) and the seals must be systematically replaced.

115. Insert the bush (20) in the flange (21) using a suitable fixture and fit and correctly position the circlip (19).

Remark

The pump comprises four bearing assemblies. The intermediary bearings (11) (31) possess a recess (E) (Fig. 44) to allow oil to pass to the low flow rate stage (37).

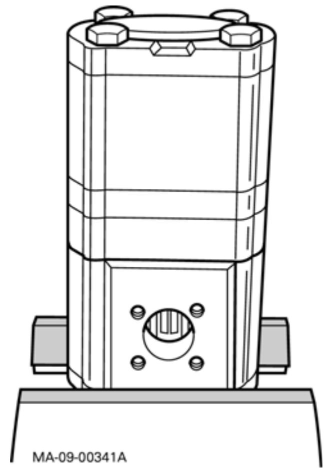


Fig. 42

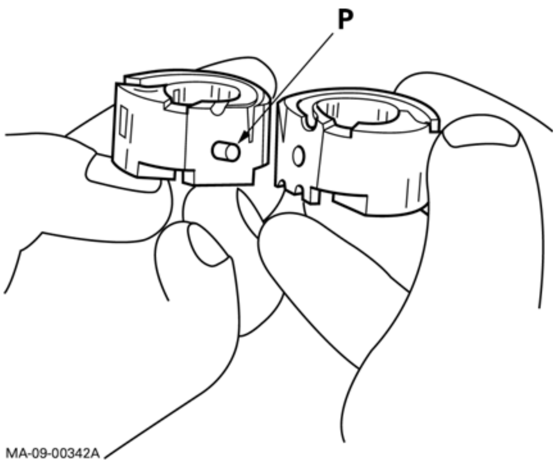


Fig. 43

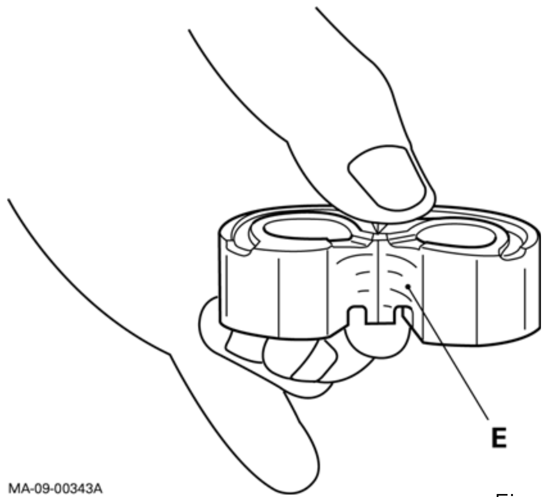


Fig. 44

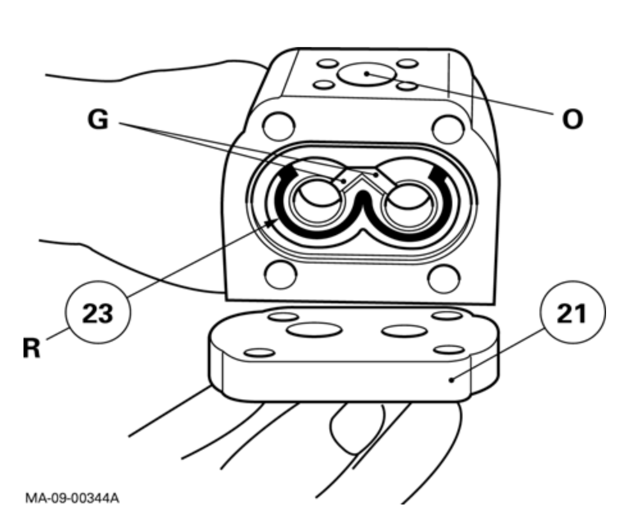


Fig. 45

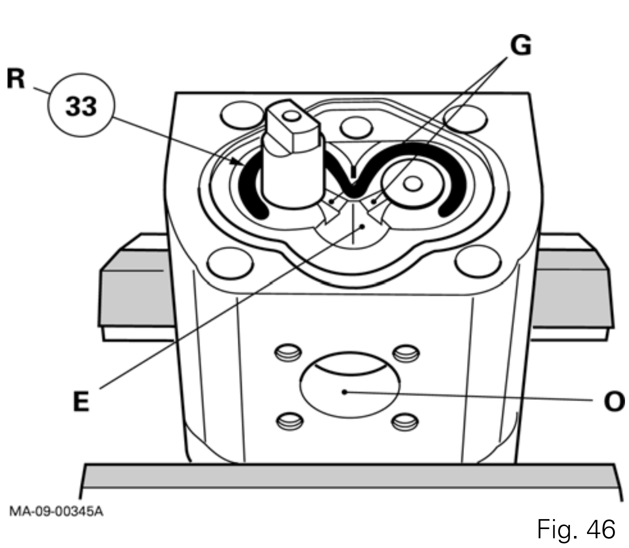


Fig. 46

116. Fit the bearing assembly (27) (without recess), centred by the pin (24), in the high flow rate stage (32). Turn lubricating grooves G towards inlet port O and groove R of the composite seal (23) towards the flange (21) (Fig. 49).

117. Place pinions (28) (29) of the high flow rate stage in the bearing assembly (27).

Remark

The high flow rate pinions are larger.

118. Position the composite seal (23) and seal (22) (Fig. 47).

119. Assemble the high flow rate stage (32) on the flange (21) according to the marks made during disassembly.

120. Fit the bearing assembly (31) (with recess), centred by the pin (30), in the high flow rate stage (32). Turn lubricating grooves G and recess E towards inlet port O, and groove R of the composite seal (33) upwards (Fig. 46).

121. Position the composite seal (33) and seal (34). Assemble the flange (35) on the high flow rate stage (32) (Fig. 48) according to the marks made during disassembly.

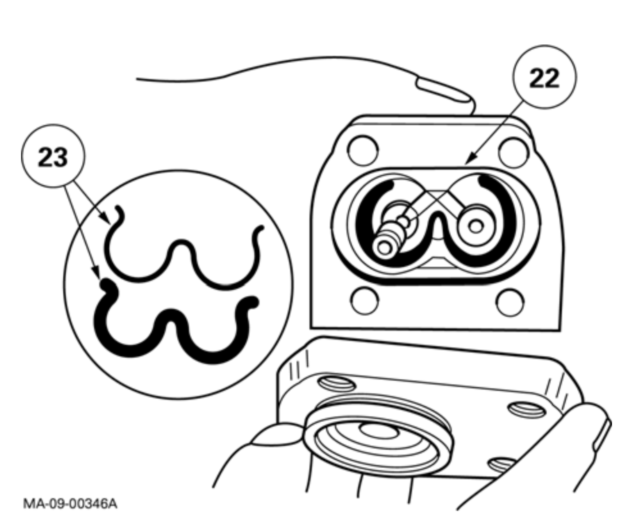


Fig. 47

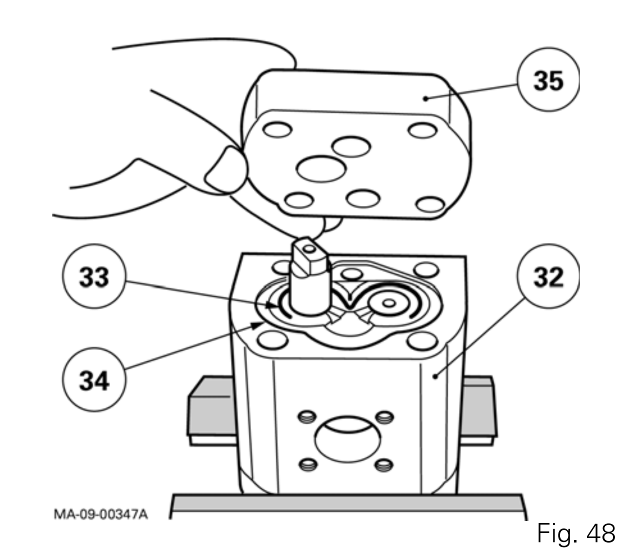


Fig. 48

122. Centre the flange (35). Tighten screws (36) to a torque of 40 - 47 Nm.

123. Refit the catchdog (15) on the flat of the driving pinion (28). Position the seal (16).

124. Assemble the flange (14) according to the marks made before disassembly.

125. Fit the bearing assembly (11) (with recess), centred by the pin (10), in the low flow rate stage (37). Turn lubricating grooves G and recess E towards inlet port O, and groove R of the composite seal (12) towards the flange (14) (Fig. 49).

126. Position the composite seal (12) and seal (13) (Fig. 49).

127. Assemble the low flow rate stage (37) on the flange (14) according to the marks made during disassembly.

128. Place the pinions (8) (9) in the low flow rate stage while ensuring that the flat of the drive pinion (9) is correctly positioned in the catchdog (15).

129. Fit the bearing assembly (5) (without recess), centred by the pin (6), in the low flow rate stage (37). Turn lubricating grooves G towards inlet port O and groove R of the composite seal (3) towards the closing plate (1) (Fig. 50).

130. Position the composite seal (3) and seal (38) (Fig. 51).

131. Centre the low flow rate stage (37) and assemble the closing plate (1) according to the marks made during disassembly.

132. Tighten screws (2) (4) to a torque of 40 - 47 Nm.

133. Manually check the rotation of the pump.

134. Reassemble and refit the cover (see § E and C).

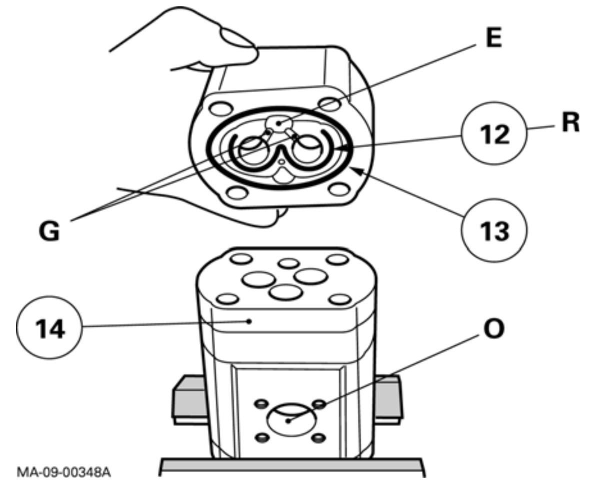


Fig. 49

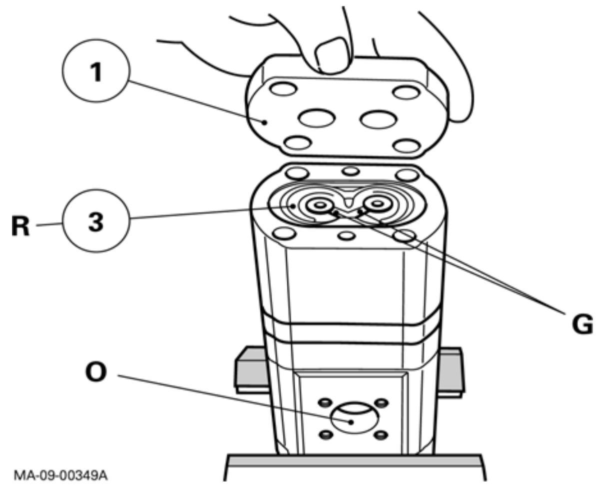


Fig. 50

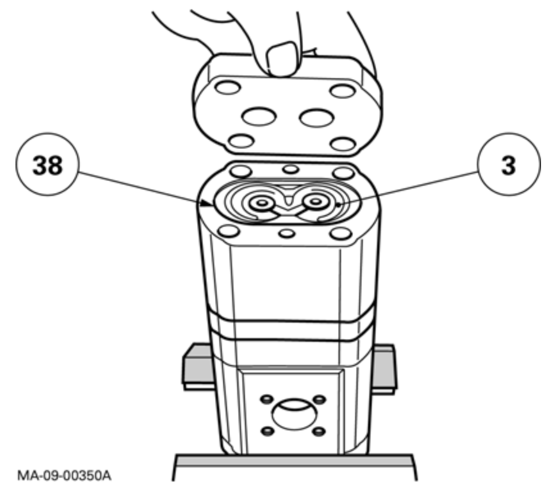


Fig. 51

H . Adjusting the engine speed sensor

135. Fit the engine speed sensor (16), having lightly smeared the threads with Loctite 542 or equivalent.

136. Screw the sensor fully home without forcing it until it makes contact with the pump pinion (29). Then unscrew it three quarters of a turn so as to obtain a gap of approximately 1mm between the sensor and the pump pinion.

Tighten the nut (1) to a torque of 5 - 7 Nm.

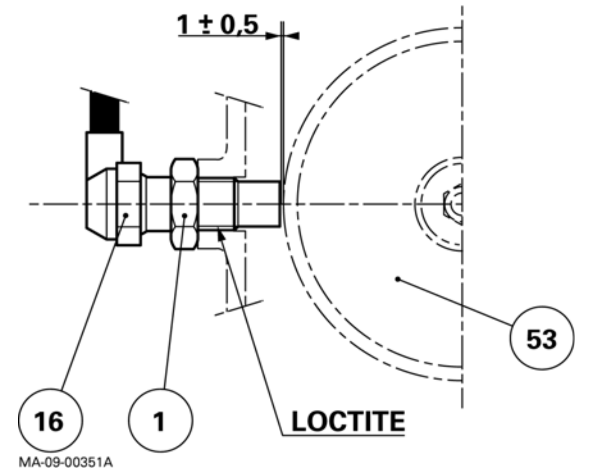


Fig. 52

9D10 - Left-hand cover - Open Centre

CONTENTS

A . General

The left-hand cover fitted to the centre housing acts as a support to the lift spool valve.

On its external face, the cover is fitted with various channels:
- low pressure to the right-hand cover
- cooler and lubrication, to the gearbox
- high pressure to lift control system.

On its internal face, a reducer (1) maintains a pressure of approximately 5 bar to lubricate the braking mechanism in the trumpet housings (Fig. 1).

A version without hydraulic lift is available. In this case, a plate replaces the lift spool valve.

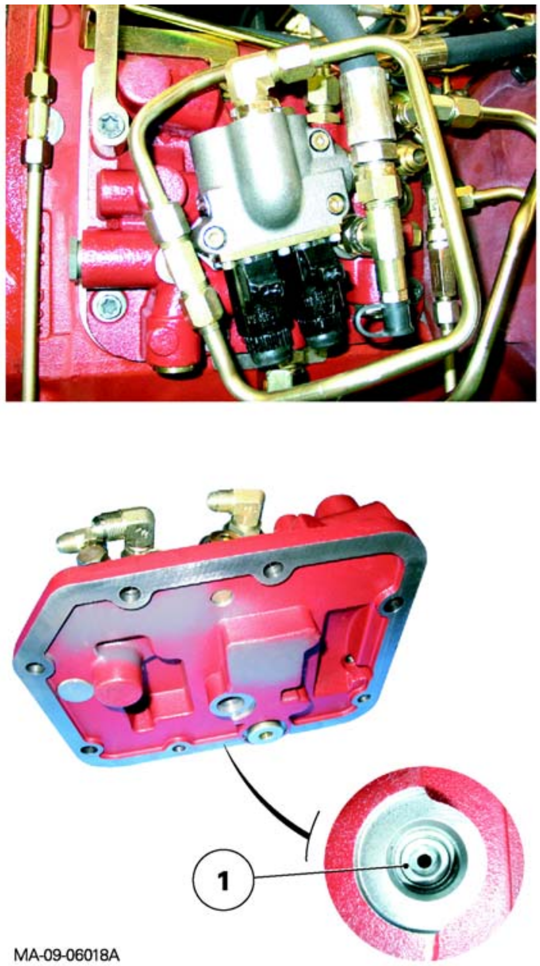


Fig. 1

B . Removing - Refitting

Preliminary operations

1. Immobilise the tractor. Chock the front wheels. Take off the rear wheel concerned. Position a safety stand.
2. Partially bleed the rear axle housing.
   Reminder
   Detach the fuel tank from the gearbox or, if necessary, remove it after draining.

Removal (Fig. 2)

3. Mark and disconnect the harnesses:
   - of the lift (1) and lower (2) solenoid valves,
   - of the low pressure switch (17 bar) (12),
   - of the temperature switch (7).
4. Mark, disconnect and block:
   - the hose (15) from the steering spool valve (Orbitrol),
   - the lubricating hose (14) to the cooler (hot oil),
   - the hose (3) from the lift spool valve,
   - the lift rams supply pipes (4),
   - the lubricating pipe (13) to the gearbox (cold oil),
   - the pipe (17 bar) (10) to the right-hand cover.
5. Disconnect the following controls:
   - handbrake,
   - GSPTO (8) (if fitted).
6. Disconnect the pipe (11) to the trumpet housing lubrication (all types). Take out the screws (5). Remove the support (6), support (9) (if mounted) (Fig. 3) and the cover.
7. If necessary, remove the transfer pipe (1) (Fig. 4).

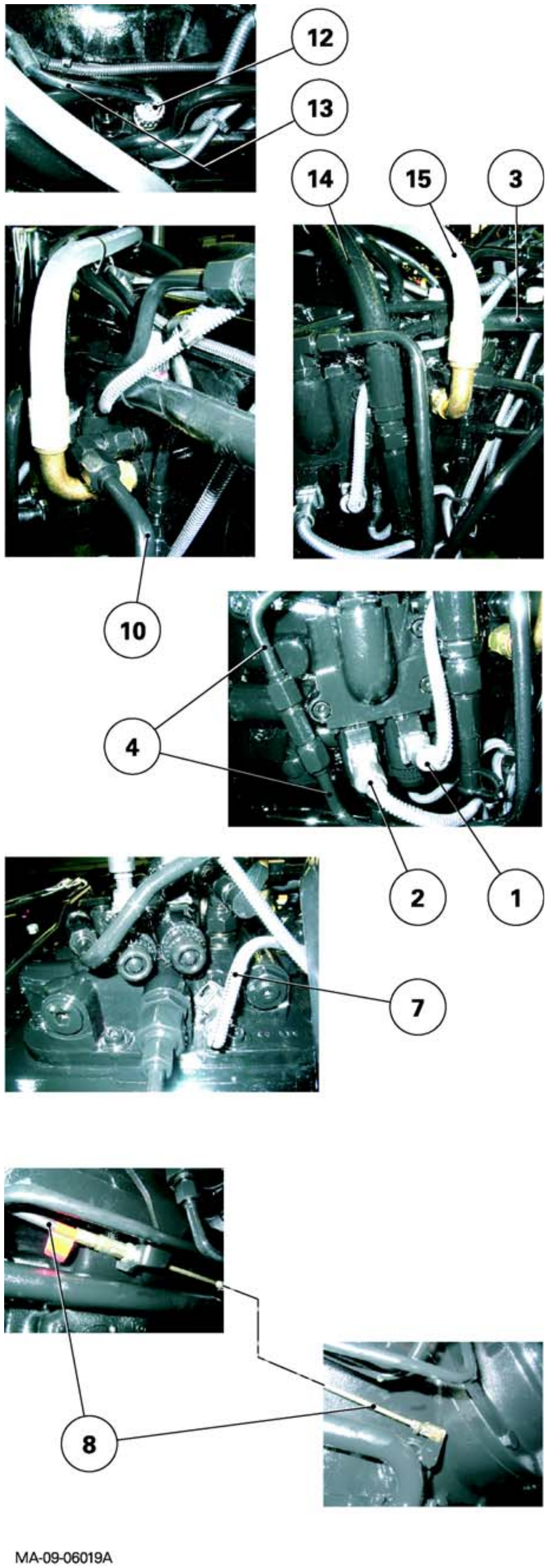


Fig. 2

Preparing for refitting

8. Clean the mating faces of the housing and the cover.

9. Check that the O'rings of the transfer pipe (11) are not damaged and refit it on the right-hand cover (Fig. 4).

10. Lightly smear the mating face of the housing with a sealing product (Loctite 510 or equivalent).

11. Screw two locally made guide studs "G" into opposing holes on the housing (Fig. 4).

Refitting

12. Refit the cover.

13. Fit the handbrake control support (6) and the proportional PTO support (9) (if fitted) (Fig. 3). Take out the guide studs. Fit and tighten the screws (5) to a torque of 72 - 96 Nm.

14. Reconnect the pipes, hoses and harnesses removed previously, according to their marks.

15. Attach the harnesses using one or more clip retainers.

Reminder

Check that they can move freely and easily.

16. Use cables to connect the controls.

17. Check the control setting for:
- handbrake,
- GSPTO (if fitted).

Final operations

18. Attach or refit the fuel tank (see operation 2).

19. Refit the wheel. Remove the axle stand and trolley jack. Tighten nuts (see chapter 6).

20. Top up the oil level in the rear axle and check it on the gauge located at the rear of the centre housing.

21. Start the engine.

22. Check the operation of the lifting system and the oil tightness of the mating face, cover and hydraulic unions.

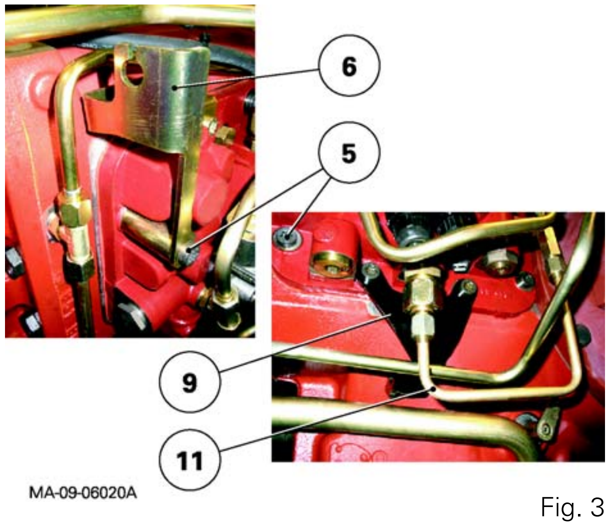


Fig. 3

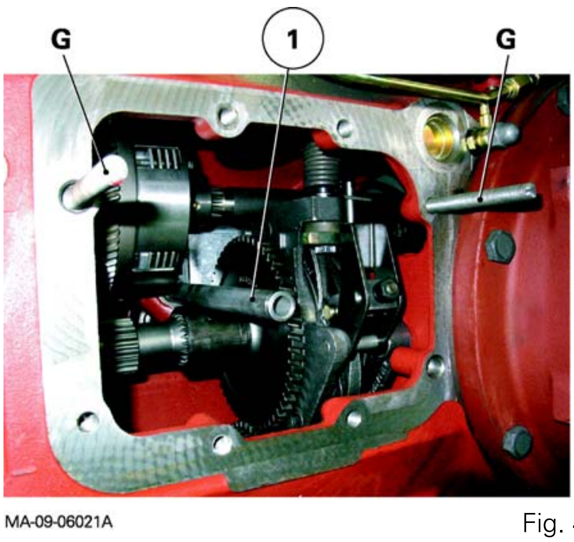


Fig. 4

9D20 - Left-hand LS cover plate

CONTENTS

A . General

With the exception of the profile of certain hydraulic components, the design and operation of the left-hand cover plate are virtually identical for tractors fitted with 110 l/min Load Sensing hydraulic equipment (GPA20, GPA30 or GPA40) or 150 l/min Load Sensing hydraulic equipment (GPA40).

Tractors fitted with a GPA20 or GPA40 rear axle

The left-hand cover plate (14) is fitted on the centre housing (Fig. 1).

It supports:

- on the **internal face** (Fig. 4):
  - the charge pump (2) with a capacity of 60 cm^3/revolution, 71 cm^3/revolution or 80 cm^3/revolution (according to specification) (GPA20 and GPA40) (110 l/min LS hydraulic system) or the charge pump (2) with a capacity of 100 cm^3/revolution (GPA40) (150 l/min LS hydraulic system)
  - the drive gear (12) fitted on the charge pump
  - the suction manifold (4);
- on the **external face** (Fig. 4):
  - the 150 micron suction strainer (6).

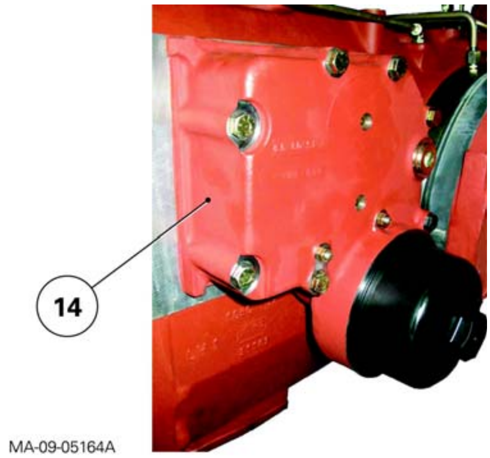


Fig. 1

Description

The engine movement transmitted to the gear (1) via the shaft (5) drives the gear (12) for the charge pump (2) (Fig. 2).

The oil is sucked in by the manifold (4). It is then directed to the strainer and the charge pump (2) via a channel moulded into the cover plate.

The oil delivered by the charge pump (2) is directed to the variable displacement pump (41) via the charge pipe (3) (Fig. 3).

***Note:** When the high pressure hydraulic slave devices (e.g. auxiliary spool valves) are not activated, the charge pump (2) is resupplied via the 5 bar safety valve (44) (Fig. 3).*

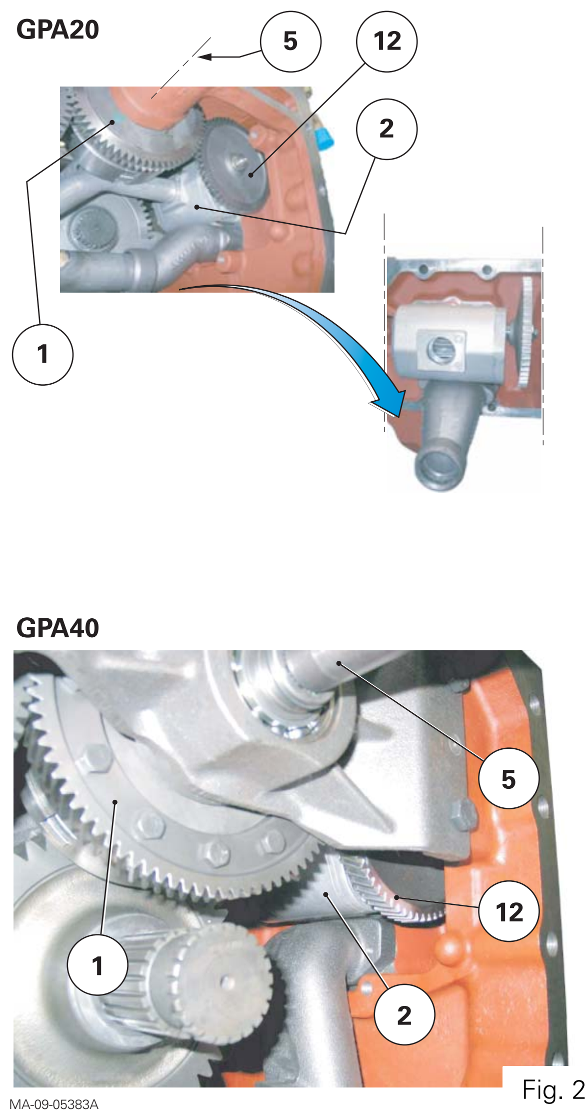


Fig. 2

Parts list (Fig. 3)

(1) Continuity pipe
(2) Charge pump
(3) Charge pipe
(4) Suction manifold (suction and resupply)
(41) Variable displacement pump
(44) 5 bar safety valve

Legend

A Inlet port

Movement of the fluid

(solid red arrow) Suction from the charge pump (2) and delivery to the variable displacement pump (slave devices used).

(dashed red line) Re-supply to variable displacement pump (slave devices not used).

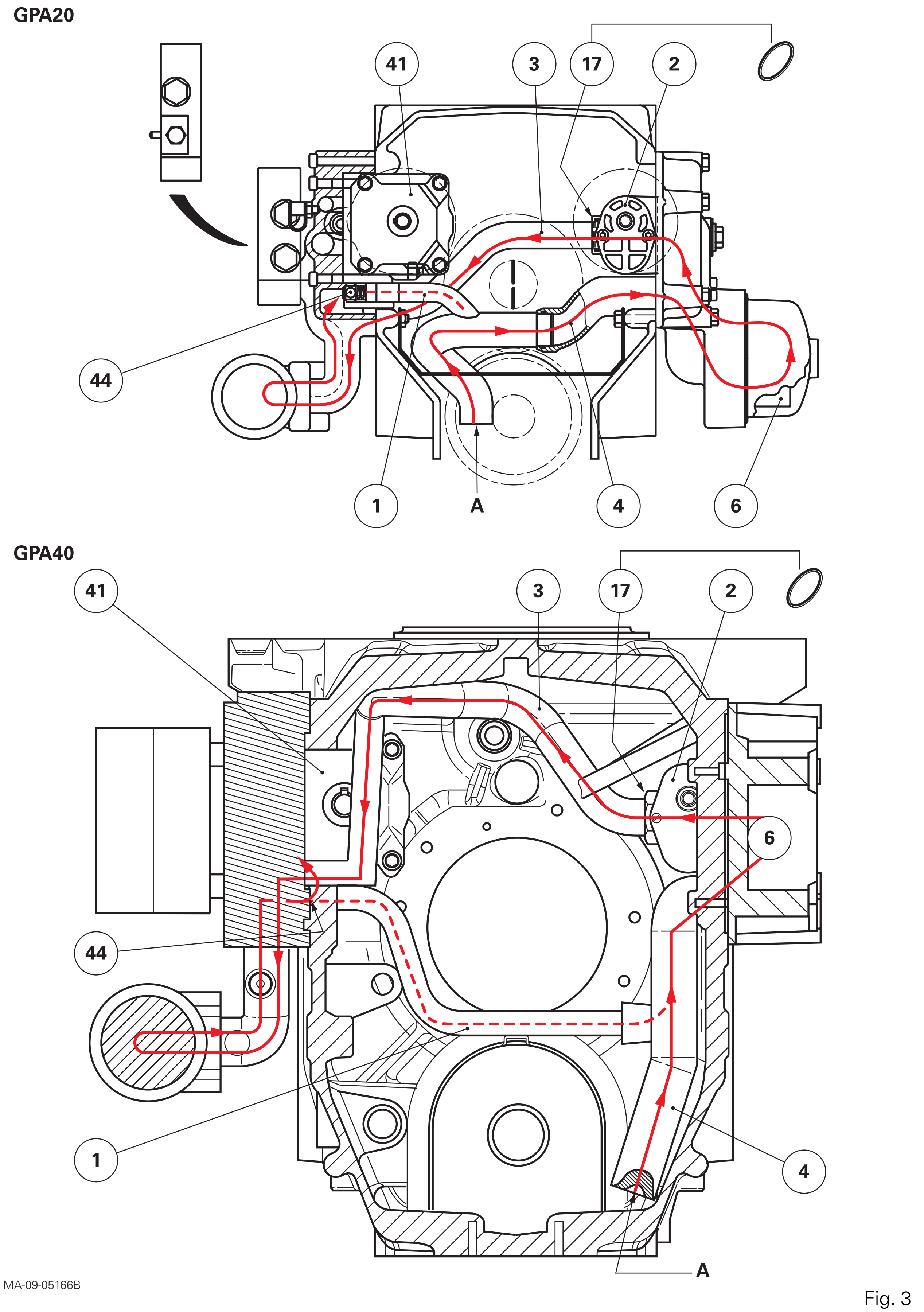


Fig. 3

Left-hand LS cover plate

Parts list (Fig. 4)

(1) Continuity pipe
(2) Charge pump
(3) Charge pipe
(4) Suction manifold (suction and resupply)
(5) "O" ring
(6) 150 µ suction strainer
(7) Studs
(8) Plug
(9) Seal
(10) Screw
(11) Washer
(12) Gear
(13) Key
(14) Left-hand cover plate
(15) Nut
(16) Locating pins
(17) "O" ring
(18) Flat seal
(19) Screw
(20) Strainer bowl
(21) "O" ring
(22) Screw
(23) "O" ring
(24) Dowels
(26) "O" ring
(27) Suction pipe
(28) Nuts

View of the assembly

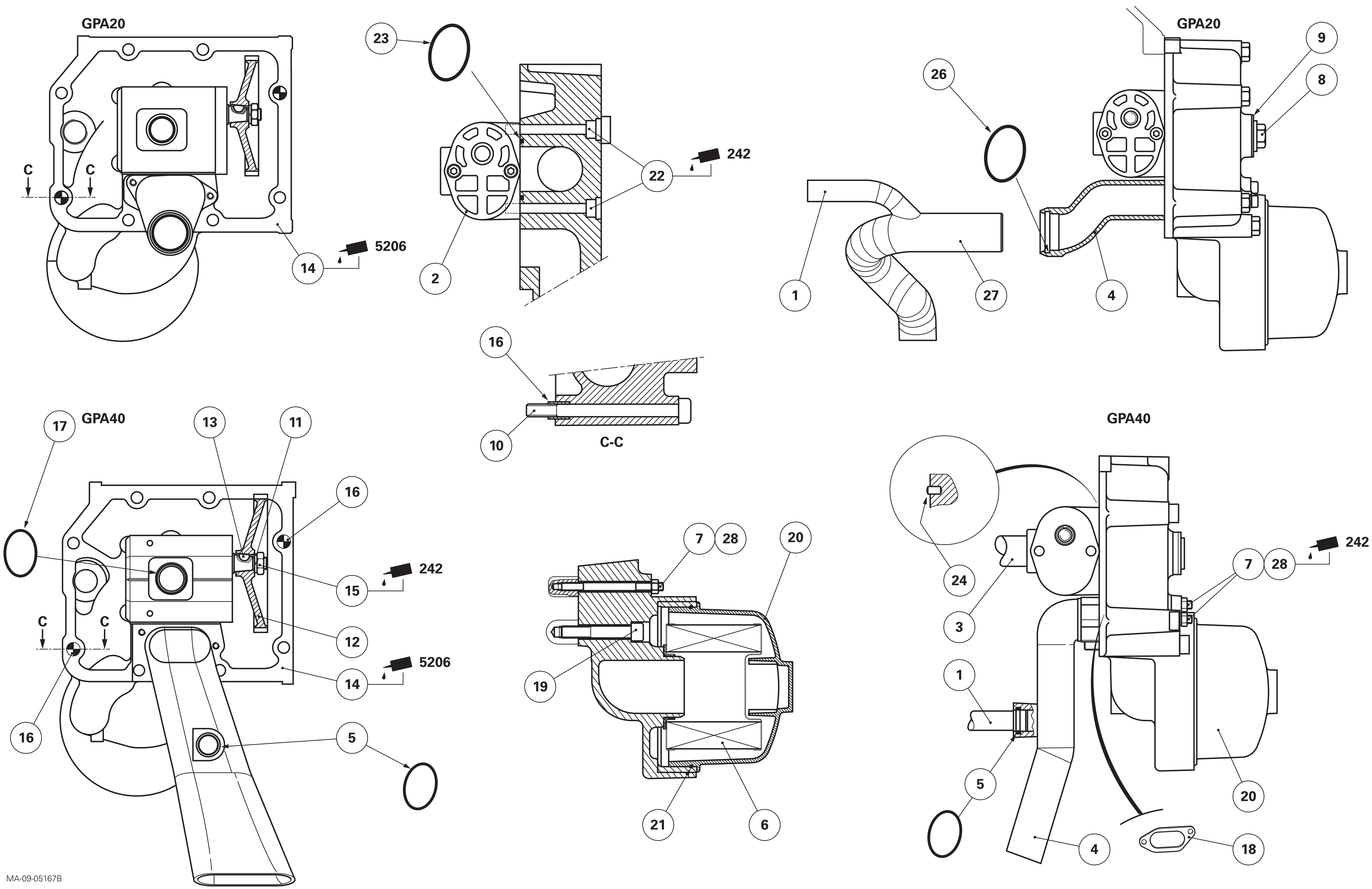
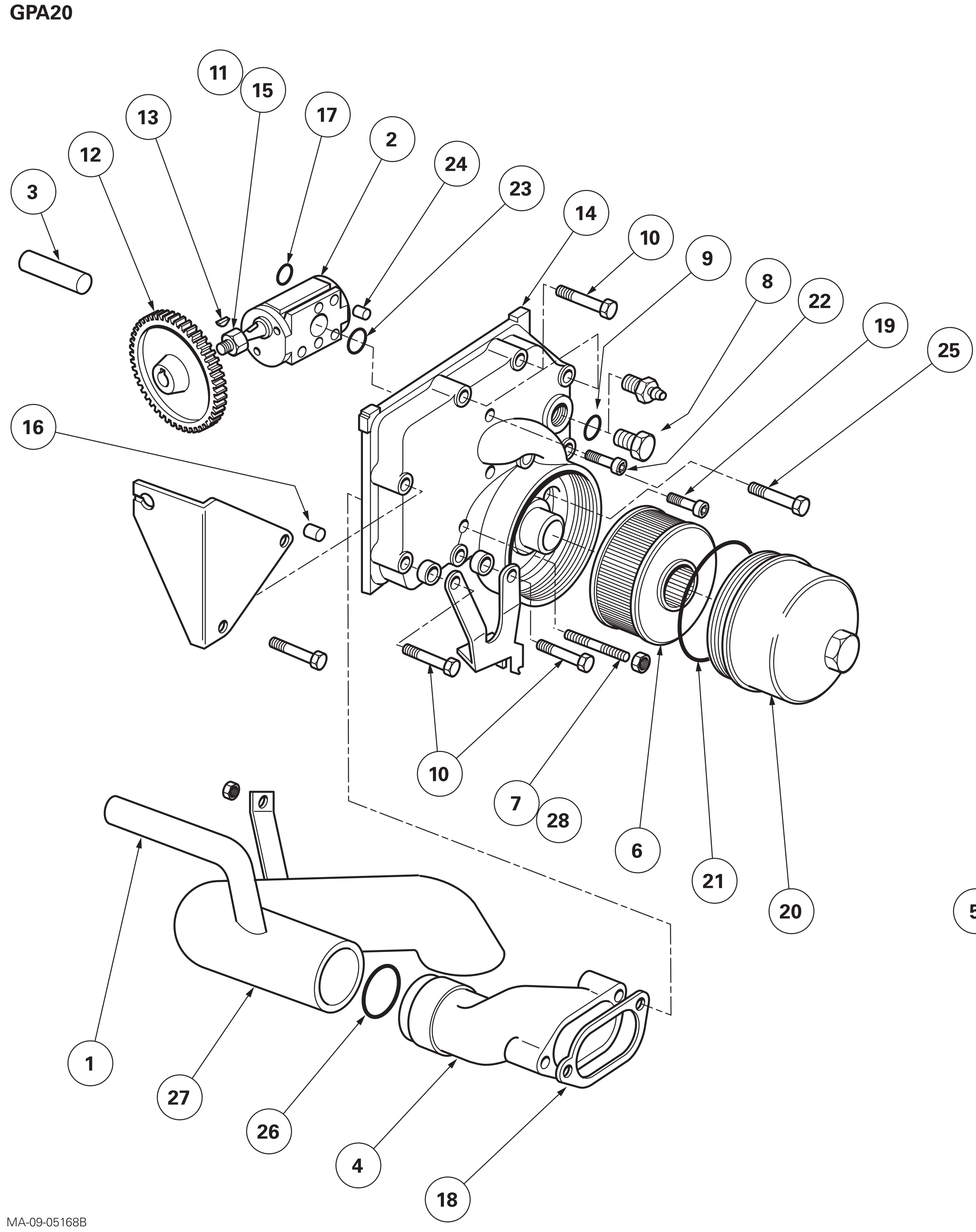


Fig. 4

Parts list (Fig. 5)

(1) Continuity pipe
(2) Charge pump
(3) Charge pipe
(4) Suction manifold (suction and resupply)
(5) "O" ring
(6) 150 µ suction strainer
(7) Studs
(8) Plug
(9) Seal
(10) Screw
(11) Washer
(12) Gear
(13) Key
(14) Left-hand cover plate
(15) Nut
(16) Locating pins
(17) "O" ring
(18) Flat seal
(19) Screw
(20) Strainer bowl
(21) "O" ring
(22) Screw
(23) "O" ring
(24) Dowels
(26) "O" ring
(27) Suction pipe
(28) Nuts

Blown-up view



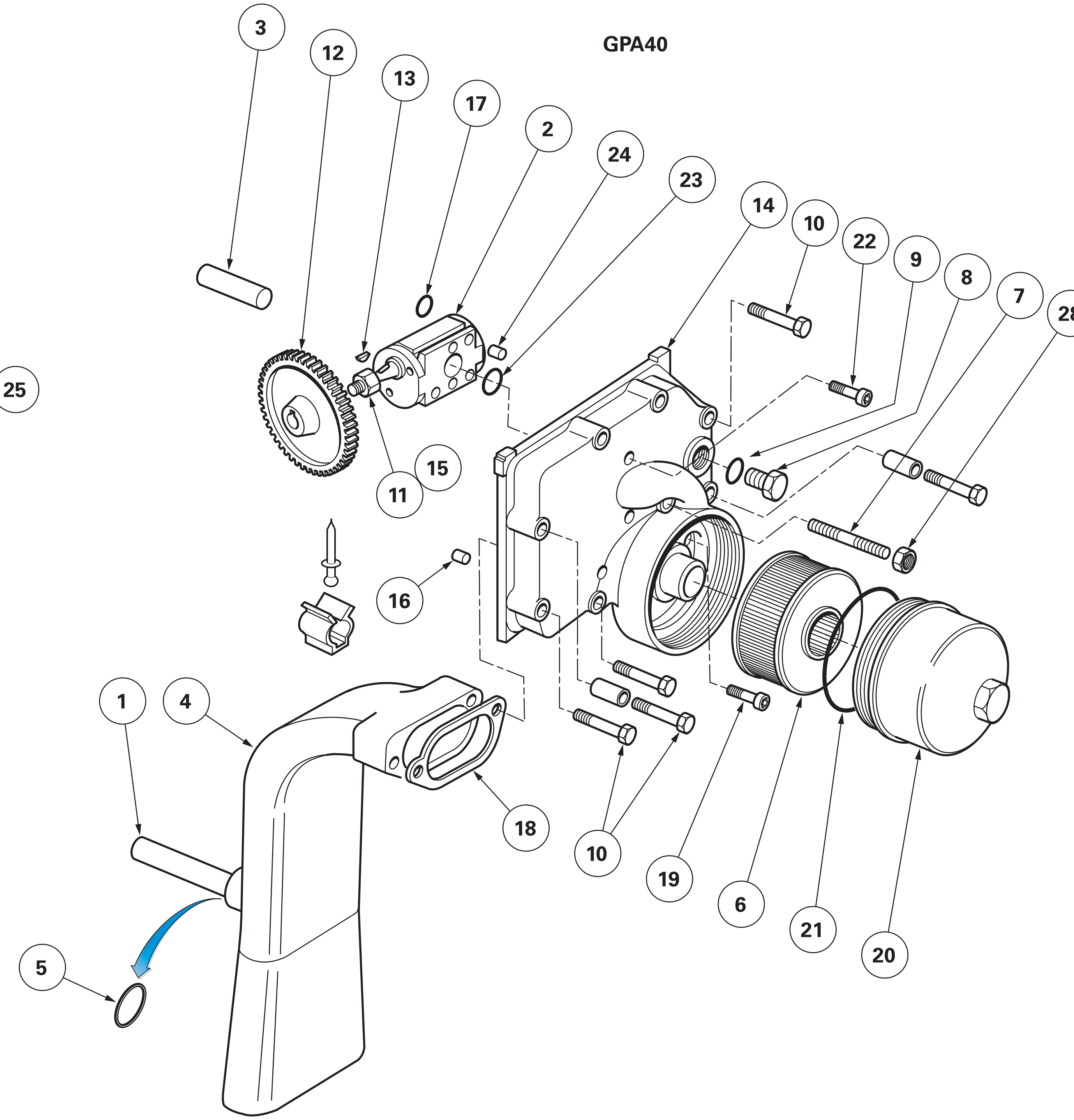


Fig. 5

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Tractors fitted with a GPA30 rear axle

The left-hand cover plate (14) is fitted on the intermediate housing (Fig. 6).

It supports:

- on the **internal face** (Fig. 7):
  - the charge pump (2) with a capacity of 60 cm^3/revolution (GPA30)
  - the drive gear (12) fitted on the charge pump
  - the suction manifold (4);
- on the **external face** (Fig. 6):
  - the 150 micron suction strainer (6).

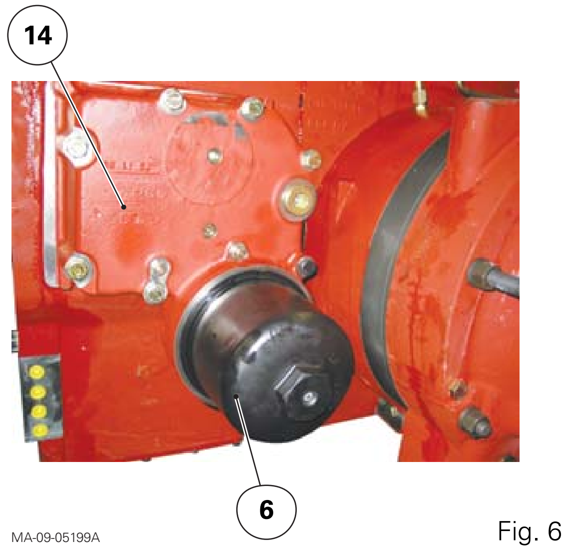


Fig. 6

Description (Fig. 7)

The engine movement transmitted to the gear (1) via the shaft (5) drives the gear (12) for the charge pump (2).

The oil is sucked in by the manifold (4). It is then directed to the strainer (6) (Fig. 6) and the charge pump (2) via a channel moulded into the cover plate.

The oil delivered by the charge pump (2) is directed to the variable displacement pump (41) via the charge pipes (3) and (54) (Fig. 8).

Note: *When the high pressure hydraulic slave devices (e.g. auxiliary spool valves) are not activated, the charge pump (2) is re-supplied via the 5 bar safety valve (44), the pipe (55) and the manifold (4) (Fig. 8).*

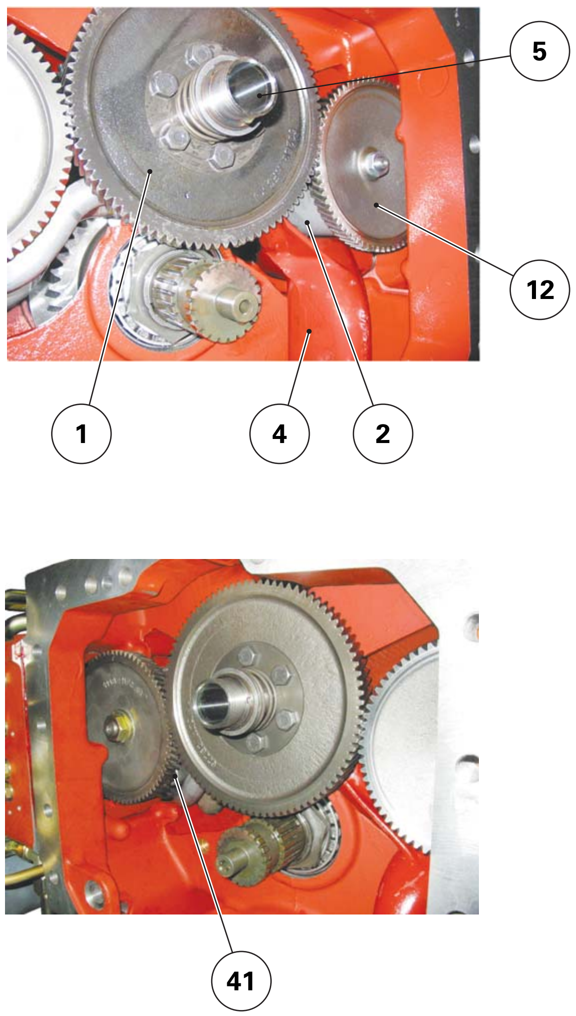


Fig. 7

Left-hand LS cover plate

Parts list (Fig. 8)

(2) Charge pump
(3) Charge pipe
(4) Suction manifold (suction and resupply)
(5) "O" ring
(6) 150 µ suction strainer
(17) "O" ring
(25) "O" ring
(26) Mecanindus pin
(44) Safety valve
(54) Charge pipe
(55) Continuity pipe from 5 bar safety valve

Legend

C Partition integral to the intermediate housing

Movement of the fluid

Suction from the charge pump (2) and delivery to the variable displacement pump (slave devices used).

Re-supply to variable displacement pump (slave devices not used).

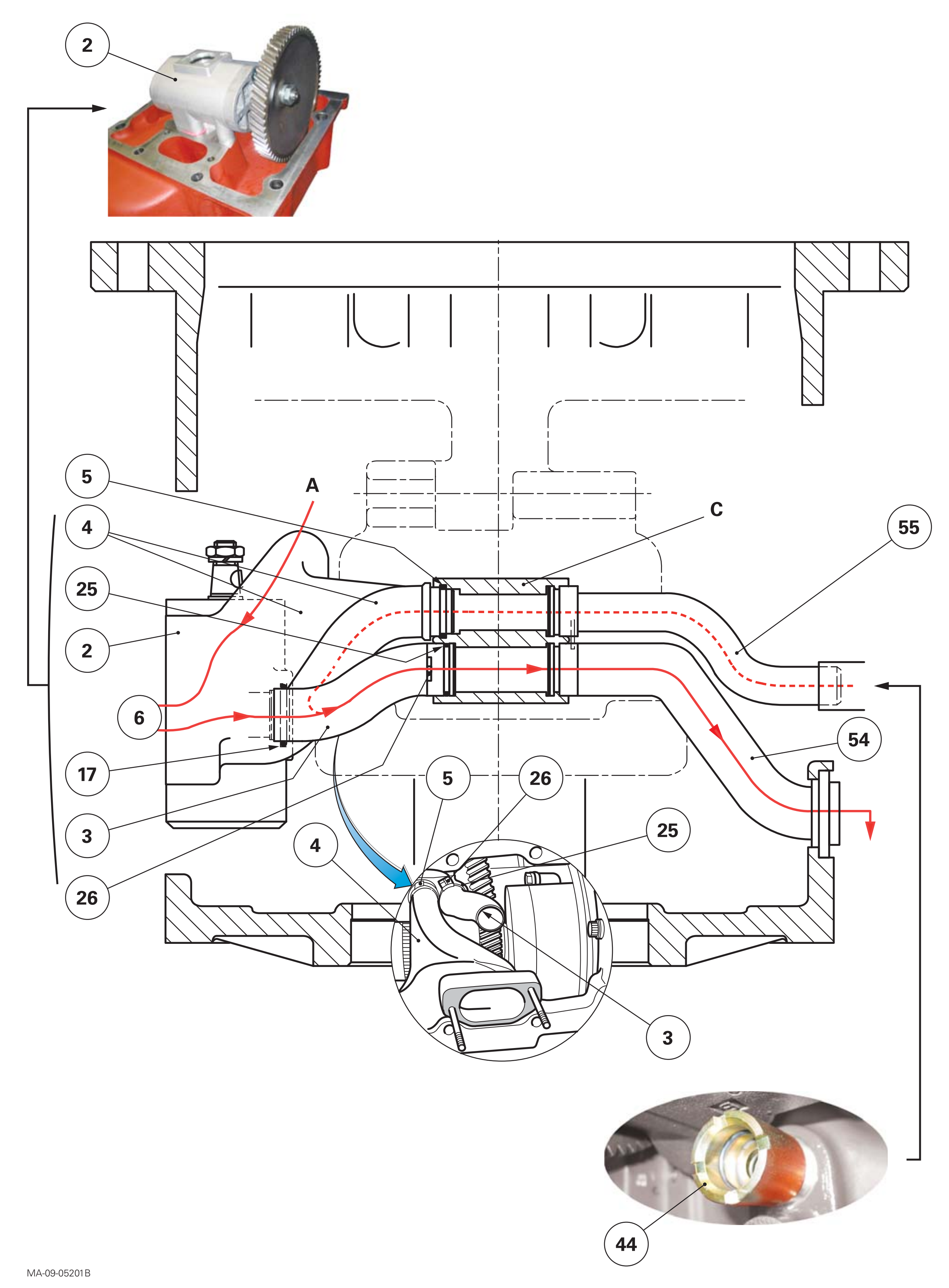


Fig. 8

Left-hand LS cover plate

Parts list (Fig. 9)

(2) Charge pump
(3) Charge pipe
(4) Suction manifold (suction and resupply)
(5) "O" ring
(6) 150 µ suction strainer
(7) Studs
(8) Plug
(9) Seal
(10) Screw
(11) Washer
(12) Gear
(13) Key
(14) Left-hand cover plate
(15) Nut
(16) Locating pins
(17) "O" ring
(18) Flat seal
(19) Screw
(20) 150 µ strainer bowl
(21) "O" ring
(22) Screw
(23) "O" ring
(24) Dowels
(28) Nuts

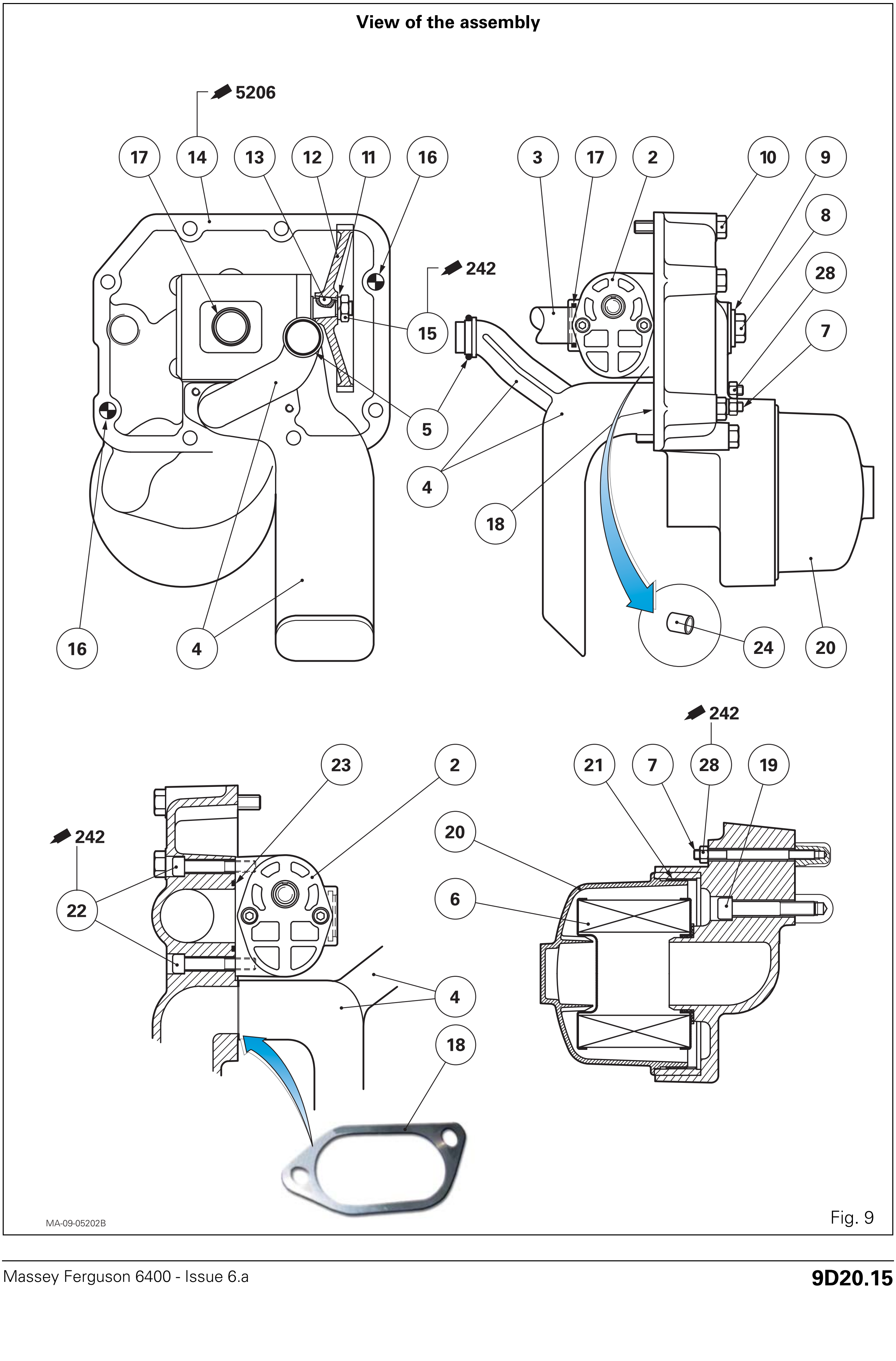

View of the assembly
5206
17
14
13
12
11
16
3
17
2
10
9
8
242
28
15
7
5
4
18
16
4
24
20
242
23
2
21
7
28
19
242
20
22
6
4
18
MA-09-05202B

Fig. 9

Left-hand LS cover plate

Parts list (Fig. 10)

(2) Charge pump
(3) Charge pipe
(4) Suction manifold (suction and resupply)
(5) "O" ring
(6) 150 µ suction strainer
(7) Studs
(8) Plug
(9) Seal
(10) Screw
(11) Washer
(12) Gear
(13) Key
(14) Left-hand cover plate
(15) Nut
(16) Locating pins
(17) "O" ring
(18) Flat seal
(19) Screw
(20) 150 µ strainer bowl
(21) "O" ring
(22) Screw
(23) "O" ring
(24) Dowels
(28) Nuts

Blown-up view

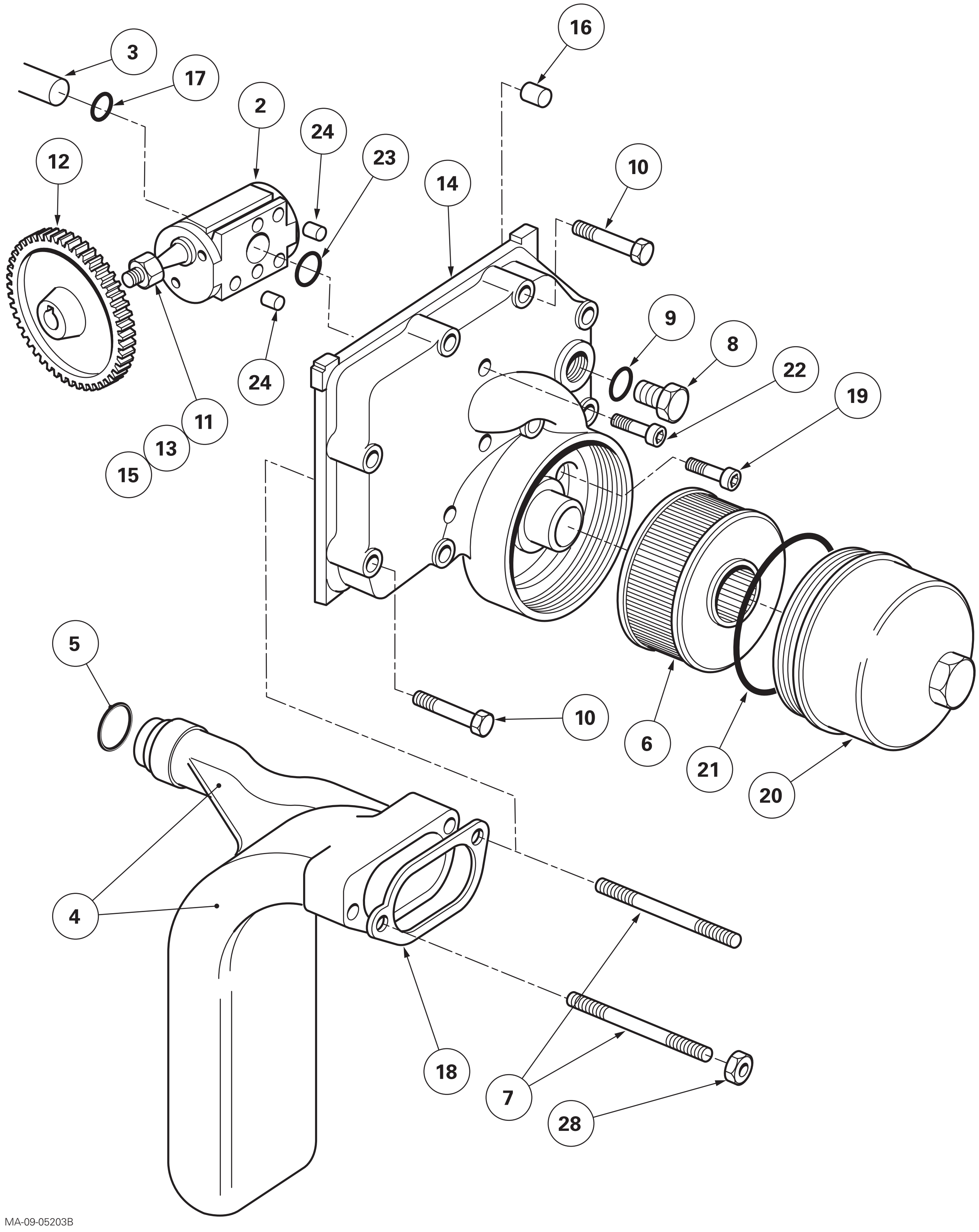


Fig. 10

B . Identification of channels and ports…

...on the cover plate (Fig. 11, Fig. 12, Fig. 13, Fig. 14)

A Suction port [oil from manifold (4) and continuity pipe (1) or (55) (Fig. 3 or Fig. 8 depending on assembly)]
C 150 µ suction strainer
G Charge port [oil directed to variable displacement pump via the charge pipe (3) (Fig. 3) or the charge pipes (3) and (54) (Fig. 8) depending on assembly]

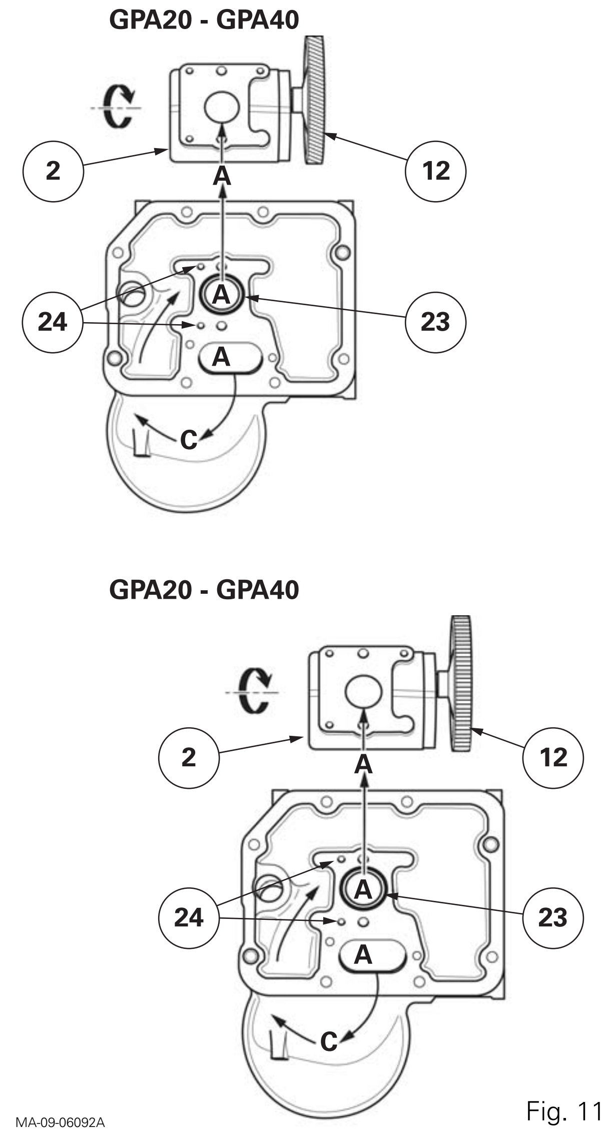


Fig. 11

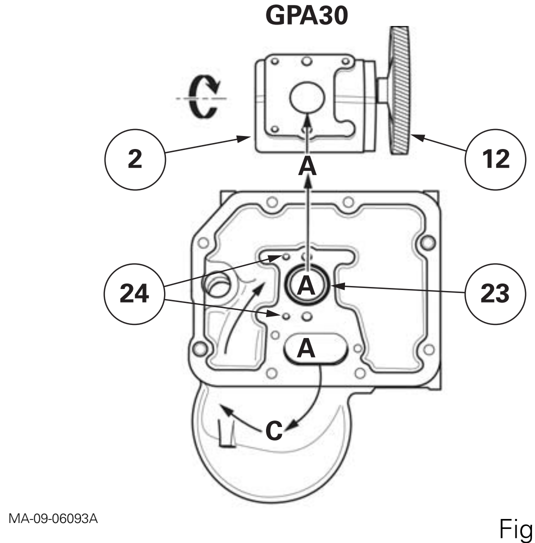


Fig. 12

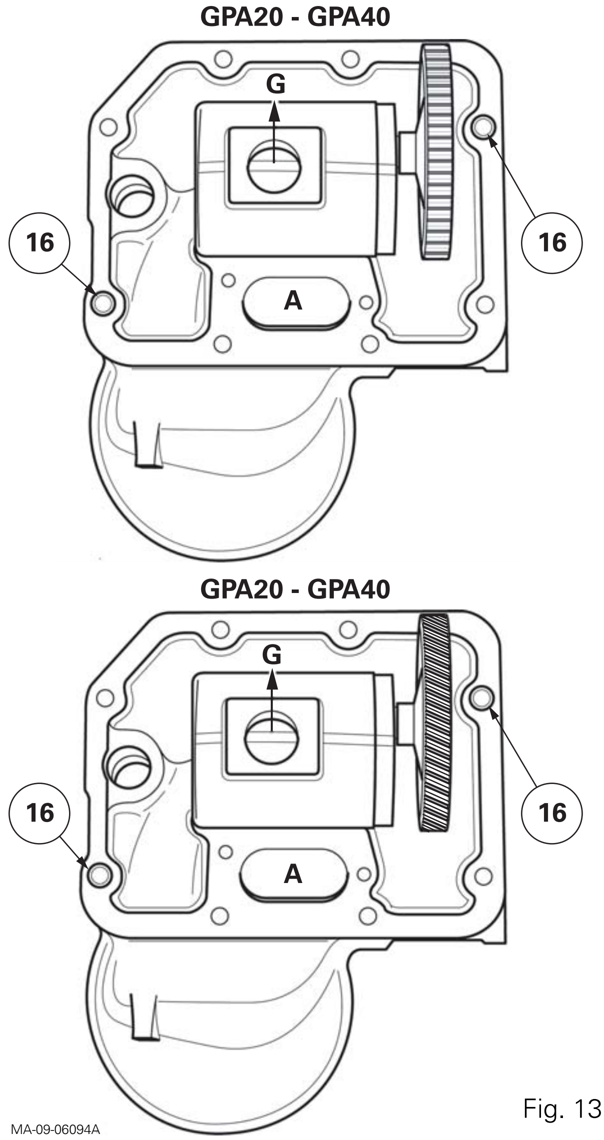

GPA20 - GPA40
G
16
16
A
GPA20 - GPA40
G
16
16
A
MA-09-06094A

Fig. 13

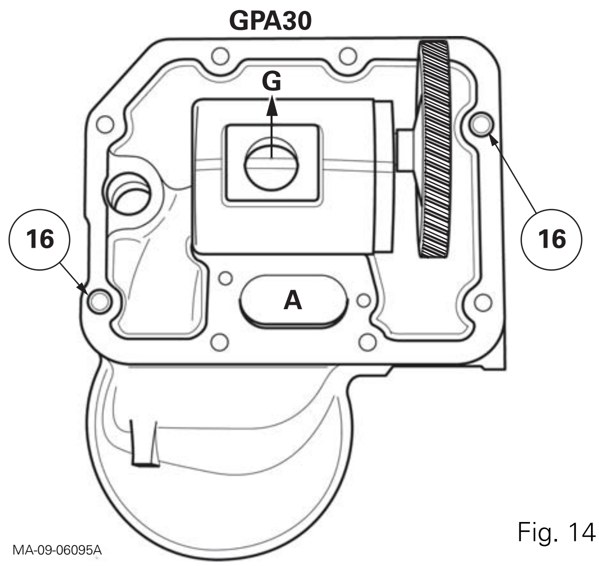

GPA30
G
16
16
A
MA-09-06095A

Fig. 14

C . Removing and refitting the cover plate

Removal (Fig. 15)

1. Immobilise the tractor.
Chock the right-hand rear wheel.

2. Chock between the frame and the front axle (optional).

3. Partially drain the housings.

4. Remove:
- the rear left-hand wheel and fit a safety stand underneath the trumpet housing
- the fuel tank, having partially drained it beforehand.

5. Unscrew the strainer bowl (20).
Remove the strainer (6).

6. Remove:
- screws (10) and (19);
- the nuts (28).

7. Release and remove the cover plate.

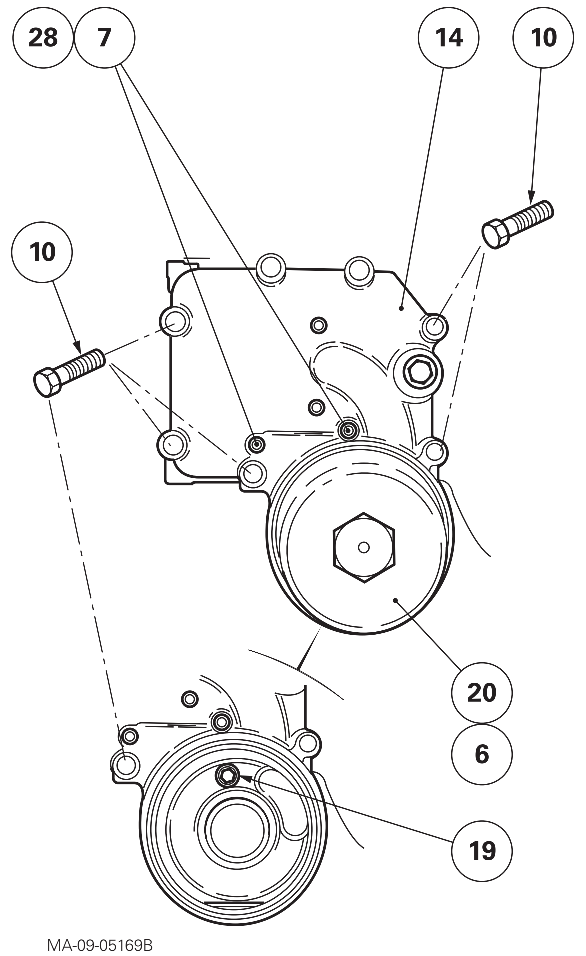


Fig. 15

Refitting

8. Clean the mating faces of the housing and cover plate.

9. Smear the mating face of the cover plate on the housing with Loctite 5206 or equivalent.

10. Replace the "O" ring (17) providing the seal between the charge pump (2) and charge pipe (3) (Fig. 3, Fig. 8).

11. Fix the adhesive face of the flat seal (18) to the suction manifold (Fig. 16).

__Note:__ Fig. 16 shows a flat seal (18) adhered to a suction manifold for a GPA40 rear axle.

12. Check:

- that the two locating pins (16) are on the cover plate (Fig. 13, Fig. 14);
- that the GPA40 charge pipe (3) is correctly positioned (Fig. 17).

__Note:__ The charge pipe (3) is fixed to the inside of the centre housing by a clip (1) (Fig. 17).

13. Screw two locally obtained guide studs into opposing holes on the centre housing or the intermediate housing (depending on assembly).

14. Slide the cover plate (14) onto the two studs mentioned above, aligning the studs (7) (Fig. 16) with the relevant ports on the cover plate. When the end of the studs (7) protrudes beyond the external face of the cover plate, gradually and partially screw on the nuts (28 (Fig. 15).

15. Using a plastic hammer, strike the cover plate to move it towards the housing.

16. Remove the locally obtained guide studs.

Use the screws (10) and (19) to definitively attach the cover plate to the housing.

17. Tighten opposing screws (10) and (19) to a torque of 90 - 120 Nm.

18. Unscrew the nuts (28). Lightly smear their thread with Loctite 242 or equivalent. Lock them definitively at 15 - 20 Nm.

19. If necessary, replace the "O" ring (21) on the strainer bowl (20).

Position the strainer (6).

Tighten the bowl to a torque of 15 - 20 Nm.

20. Refit the fuel tank and pour any drained fuel back in.

Refit the wheel and tighten the screws or wheel nuts to the correct torque depending on the version (see chapter 6).

21. Top up the oil level in the housings.

Check it:

- for GPA20, using the gauge located to the right of the PTO housing;
- for GPA30, on the sight glass on the left-hand side of the centre housing;
- for GPA40, using the sight glass located to the left of the PTO housing;

22. Carry out a road test.

23. Check the tightness of the mating face of the cover plate and strainer bowl (20).

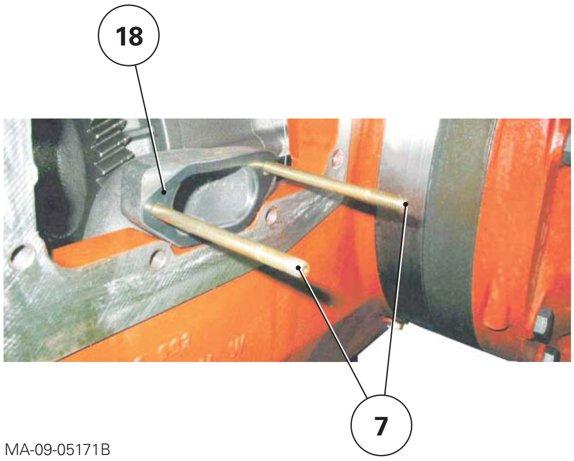


Fig. 16

GPA40

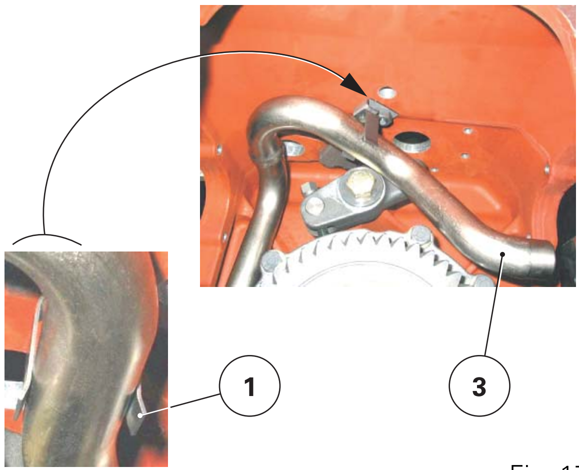


Fig. 17

D . Removing and refitting the charge pump

Preliminary step

24. Take off the cover plate (see § C).

Removal

25. If the gear (12) is also to be removed, immobilise the gear and unscrew the nut (15) while the charge pump is on the cover plate (Fig. 18).

26. Using a puller, release the gear (if required).

Unscrew the screws (22) and remove the charge pump (2) (Fig. 18).

Refitting

27. Clean the mating faces of the charge pump and cover plate.

28. Check the presence of the dowels (24) (Fig. 18).

29. Inside the cover plate, apply a bead C of Loctite 574 or equivalent around the two charge pump screw holes (Fig. 18).

IMPORTANT: *The diameter of the bead should be small so as to not touch the groove of seal (23).*

Fit a new seal (23).

30. Fit the key (13) and the gear (12) (if removed) onto the charge pump shaft.

Fit the charge pump onto the locating pins.

31. Lightly smear the thread of the screws (22) with Loctite 242 or equivalent. Tighten these screws to a torque of 40-50 Nm.

32. If the gear (12) was removed, lightly smear the thread of the nut (15) with Loctite 242 or equivalent. Tighten this nut to a torque of 50 - 60 Nm.

33. Manually check the rotation of the charge pump.

Final step

34. Refit the cover plate (see § C).

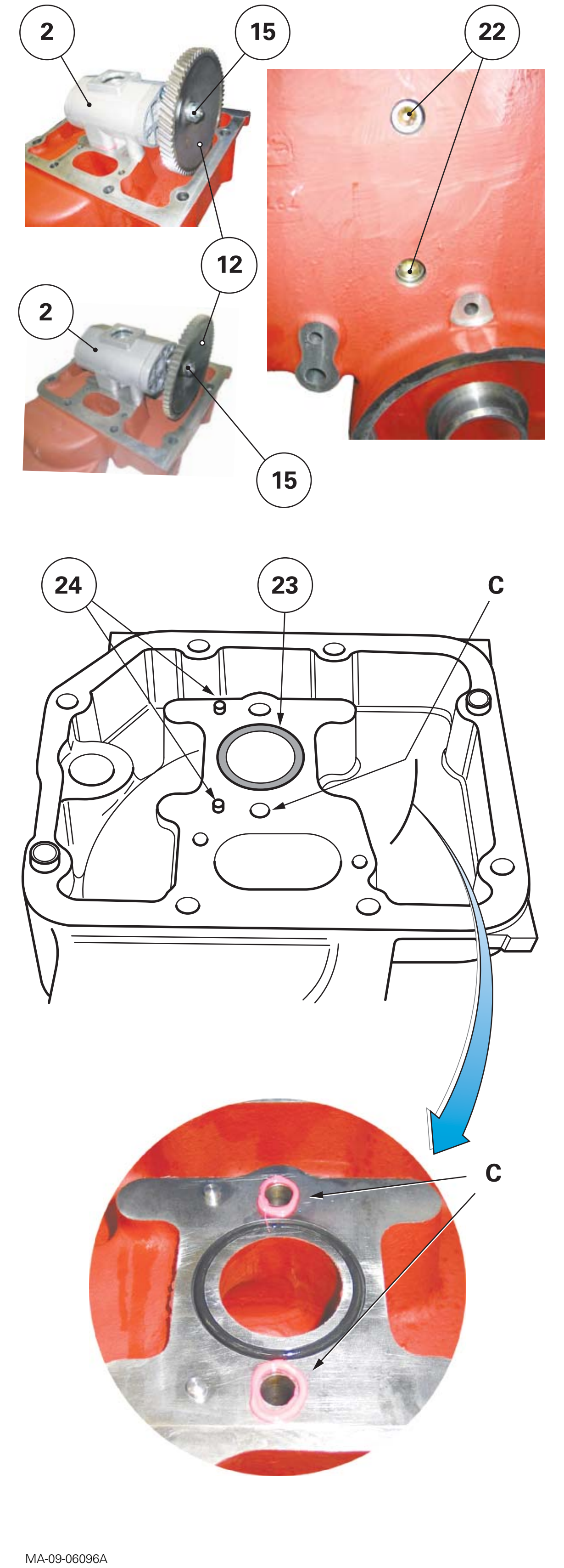


Fig. 18

E . Replacing the charge pump seals

Preliminary step

35. Remove the cover plate (see § C) and the charge pump (see § D).

Disassembly

Removal of the charge pump is identical irrespective of the type of rear axle (GPA20, GPA30 or GPA40).

36. Moderately secure the charge pump in a vice fitted with protective jaws.

37. Unscrew the screws (1) and remove the cover plate (7) (Fig. 19).

38. Remove (Fig. 20, Fig. 21):
- the circlip (3);
- the seal (4);
- the "O" rings (5) (6) on the cover plate (7).

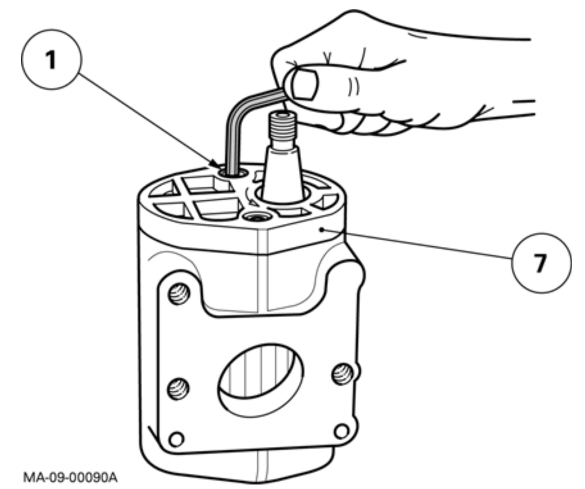


Fig. 19

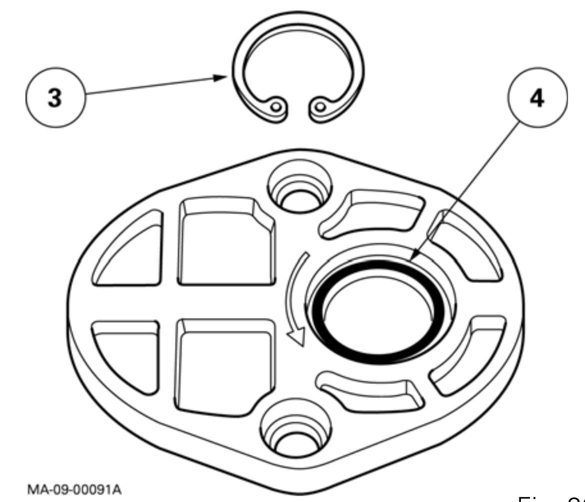


Fig. 20

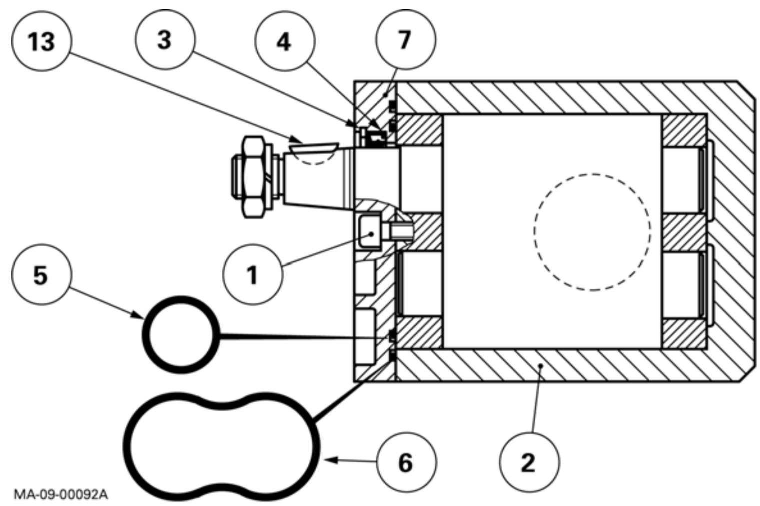


Fig. 21

Left-hand LS cover plate

Reassembly

39. Carefully fit the seal (4) (Fig. 20) using a suitable fixture. Lubricate its lip (with miscible grease).
Fig. 20Fit the circlip (3).

40. Lightly smear the "O" rings (5) and (6) with miscible grease.
Position these seals in the grooves of the cover plate (7) (Fig. 22).

41. Correctly position the cover plate above the charge pump and then refit the cover plate (Fig. 23).
Tighten the screws (1) (Fig. 19) to a torque of 30 - 40 Nm.

42. Manually check the rotation of the charge pump.

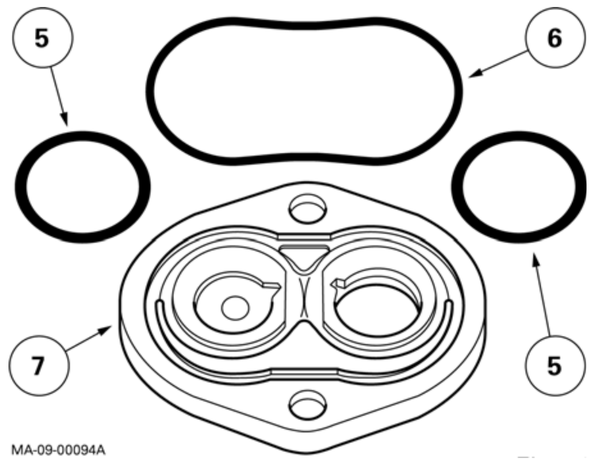


Fig. 22

Final step

43. Refit the charge pump (see § D) and the left-hand cover plate (see § C).

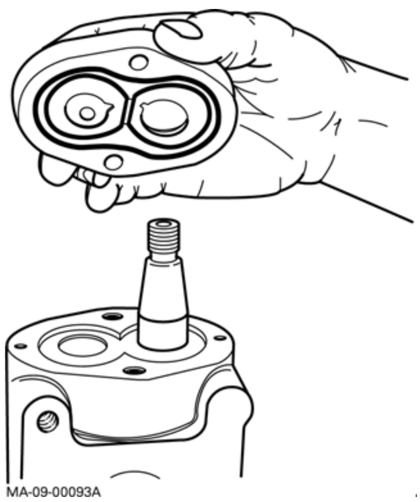


Fig. 23

9D30 - Twin flow load sensing left-hand cover

CONTENTS

A . General

The left-hand side cover, fitted to the centre housing, houses the following components:

On the inside face (Fig. 2)
- the 14cc pump (2) and its drive pinion (3)
- the suction manifold (4)

On the outside face (Fig. 1)
- 15 micron filter A
- 17 bar valve B
- hydraulic unions.

Description (Fig. 2)

The oil is sucked by the transfer pipe (1) or the manifold (4). It is then directed to the steering circuit via a 15 micron filter.

Remark

When the high pressure hydraulic slave devices are not activated, the 14 cc pump (2) is supplied by the tank.

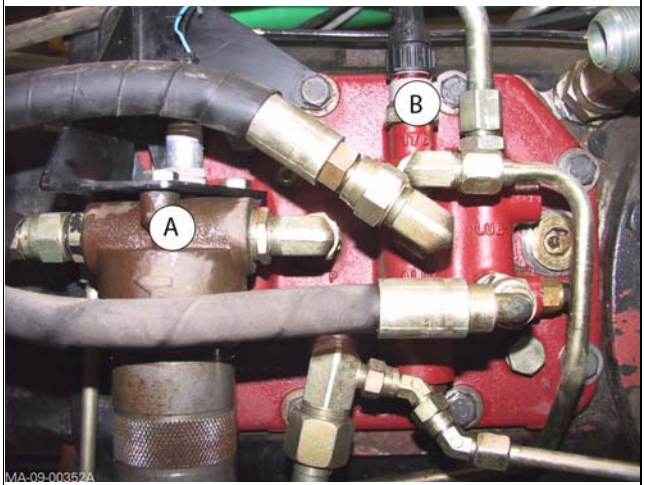


Fig. 1

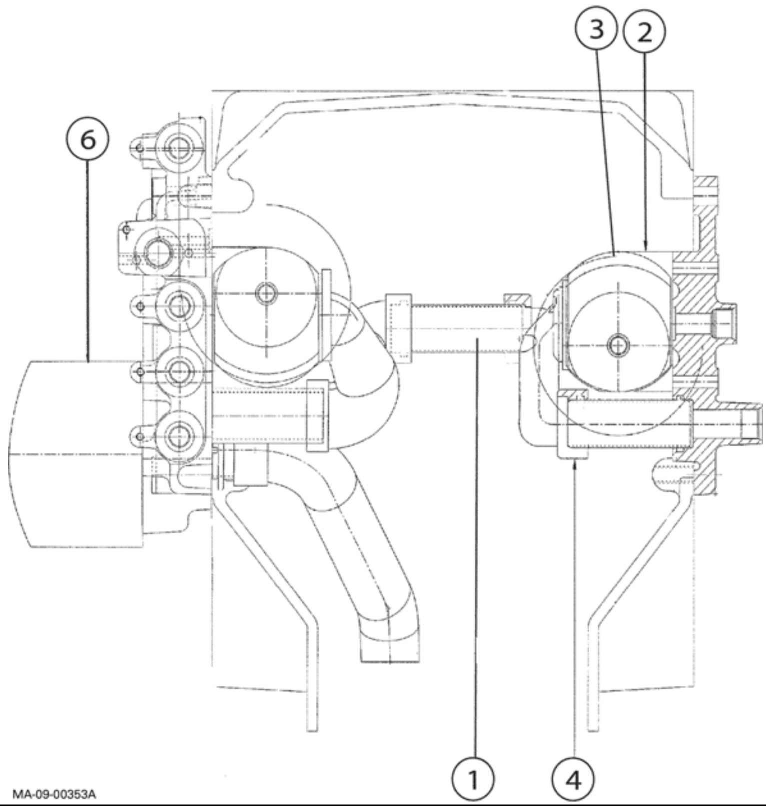


Fig. 2

Parts list

(1) Suction pipe
(2) 14cc pump
(3) Transfer pipe
(4) Suction manifold
(5) O'ring
(6) Screw
(7) Plug
(8) Seal
(9) Washer
(10) Screw
(11) Pinion
(12) Key
(13) Cover
(14) Nut
(15) Locating pins
(16) O'ring
(17) Screw
(18) Locating pins
(19) O'ring

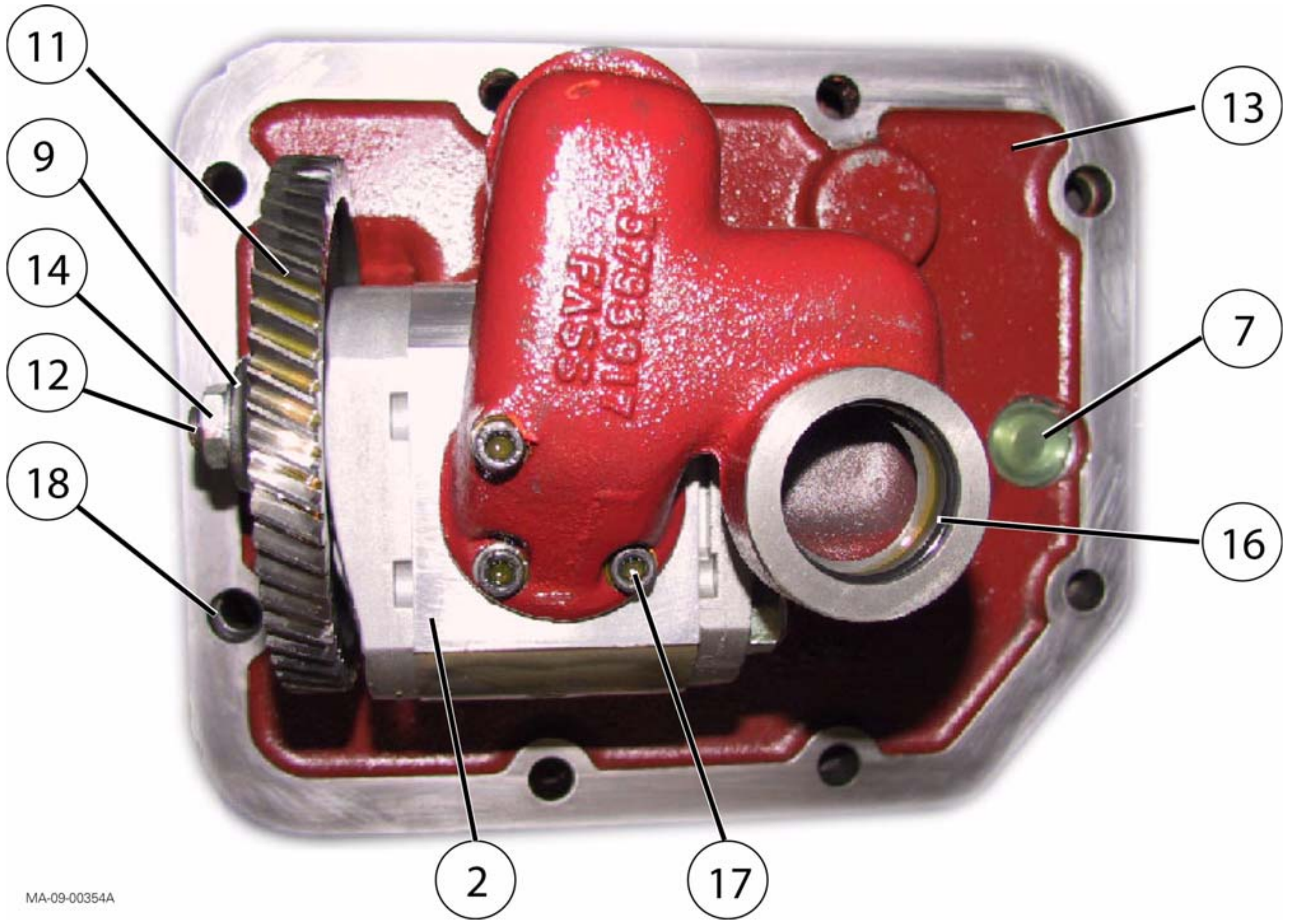


Fig. 3

Overall view

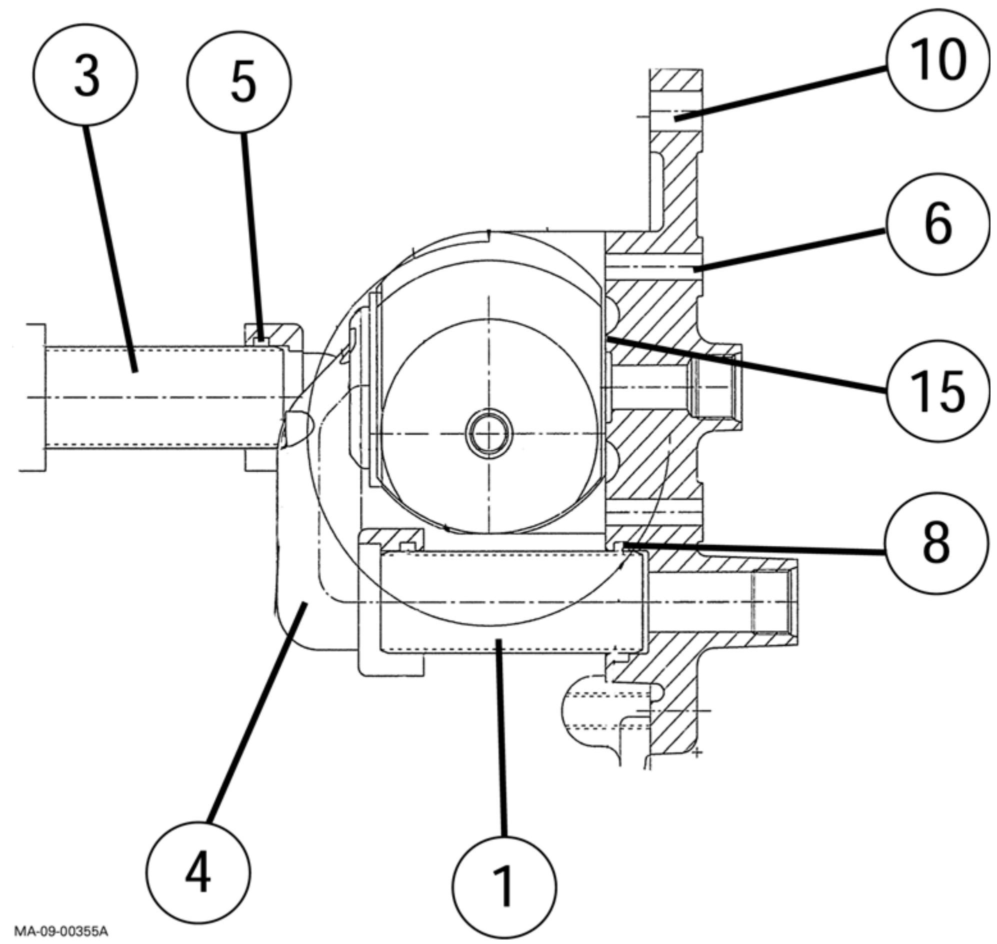


Fig. 4

Exploded view

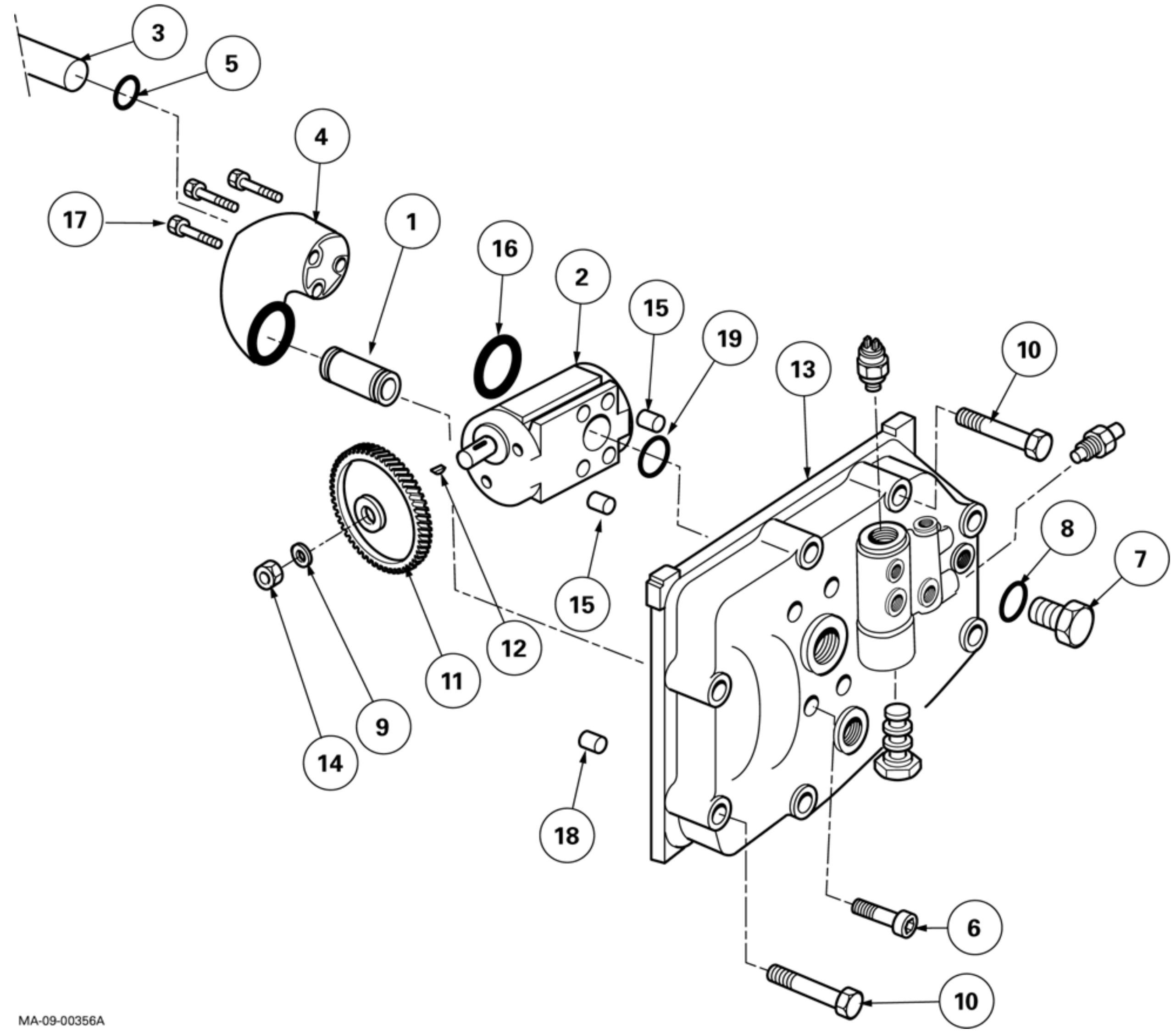
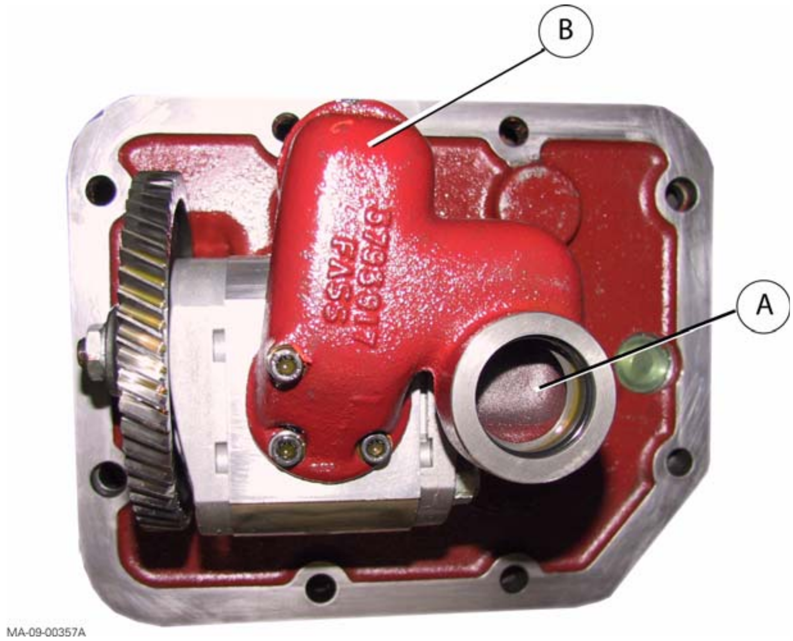


Fig. 5

Identification of channels and ports



A : Suction from transfer pipe
B : Suction from housing

Fig. 6

REF	GPA 20	GPA 40
A	To gearbox lubricating circuit	Plug
B	17 bar to filter	17 bar to filter
C	Steering circuit return	Steering circuit return
D	To cooler	To cooler
E	To right-hand cover	To right-hand cover
F	To steering circuit	To steering circuit

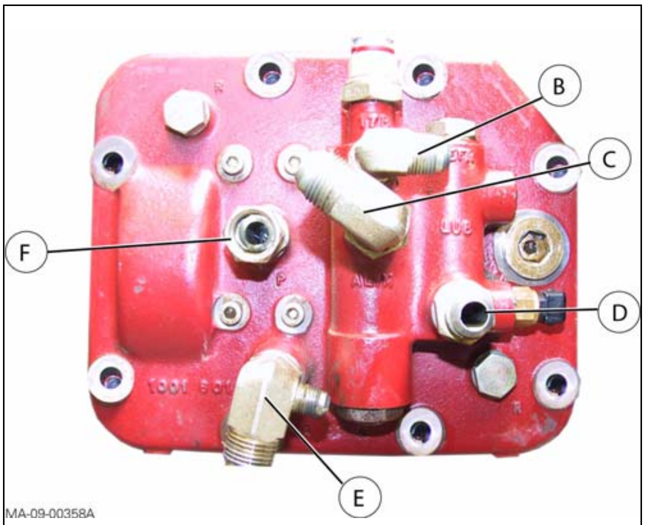


Fig. 7

B . Removing and refitting the cover

Removal

1. Take off the wheel on the side concerned. Position an axle stand.
2. Bleed the centre housing.
3. Mark and disconnect the electrical connectors (A), and disconnect and block off the hydraulic unions (B) (Fig. 8).

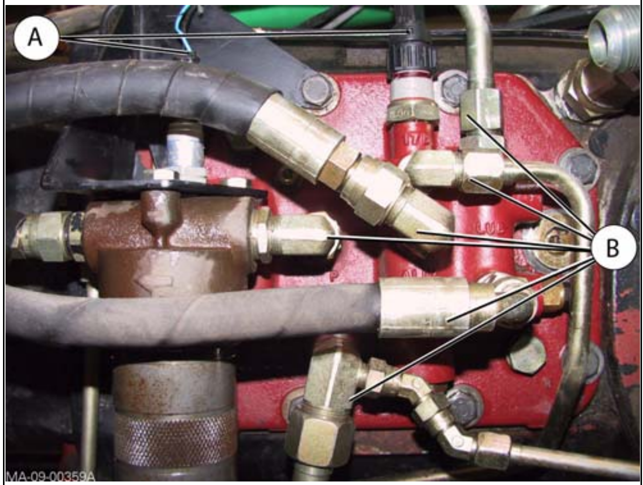


Fig. 8

4. Take out screws (7) and remove the handbrake control support and 15 micron filter (Fig. 9)

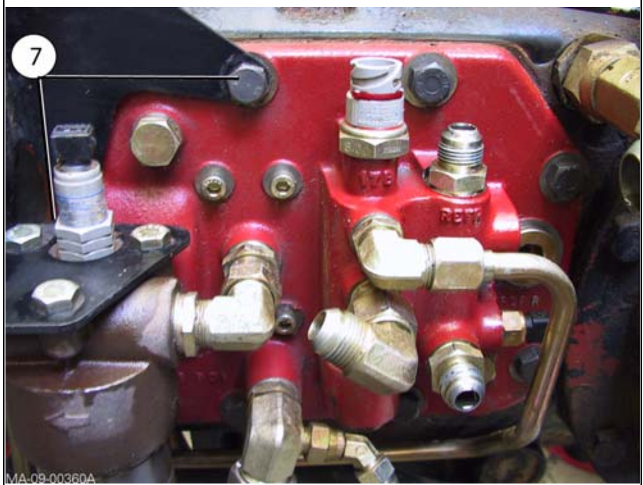


Fig. 9

5. Take out the screws (10) (Fig. 10).

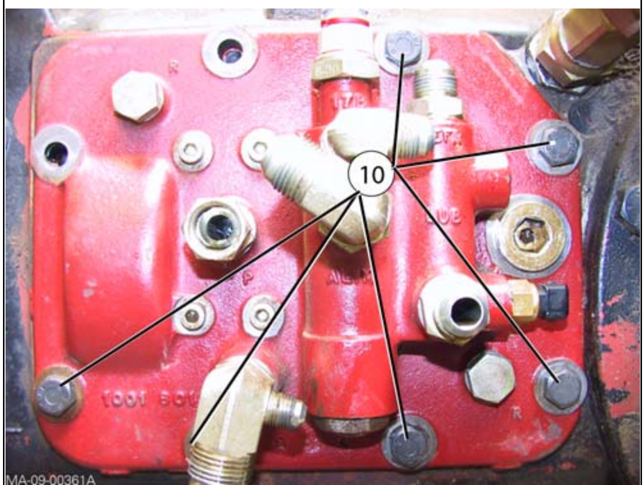


Fig. 10

6. Fit a guide stud (G1) to prevent the cover from falling off.

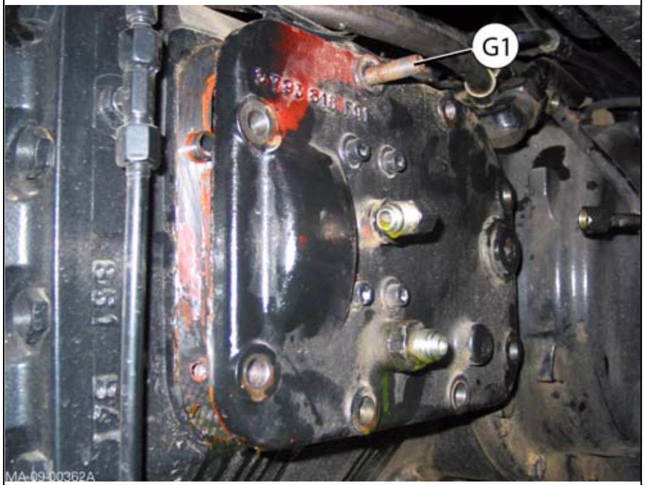


Fig. 11

7. Remove the cover and recover the transfer pipe (4).

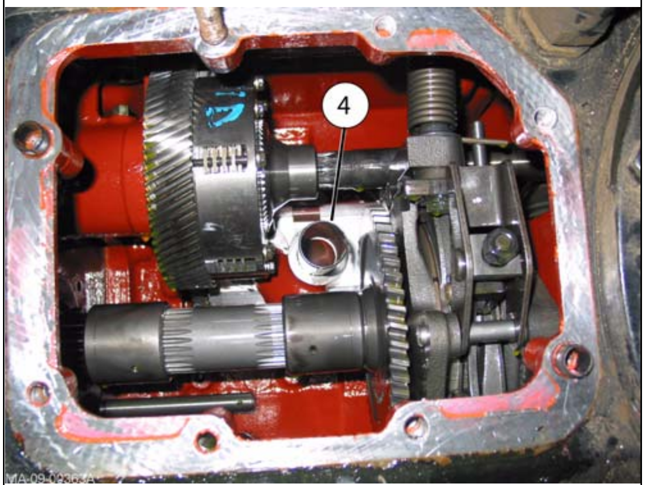


Fig. 12

Refitting

8. Clean the housing mating face and fit two diametrically opposed guide studs (G1).

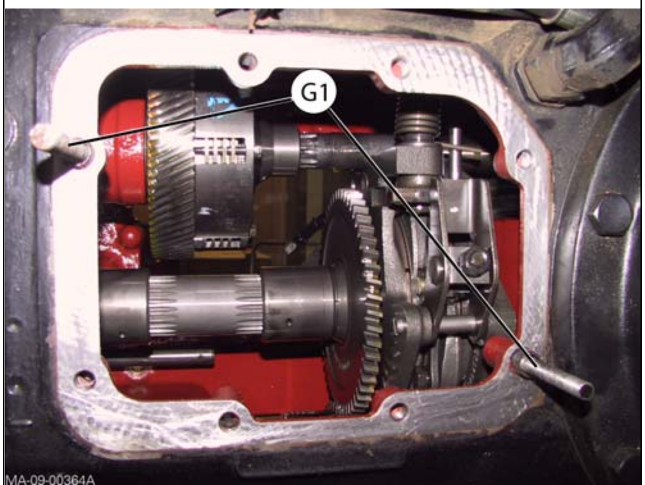


Fig. 13

9. Clean the cover mating face and fit a new O'ring (17).

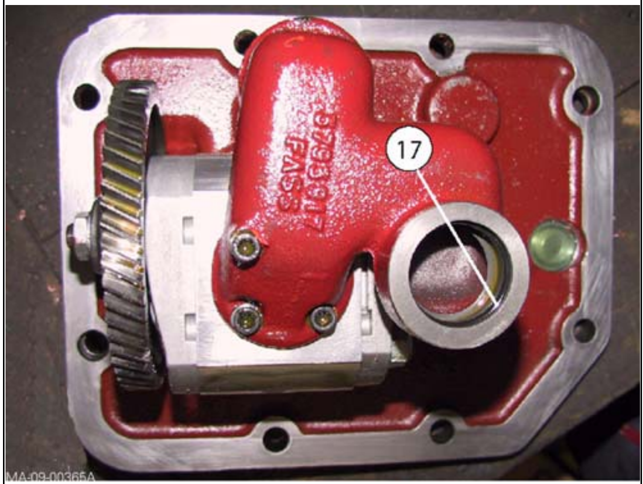


Fig. 14

10. Smear the cover mating face with Loctite 510 or equivalent.

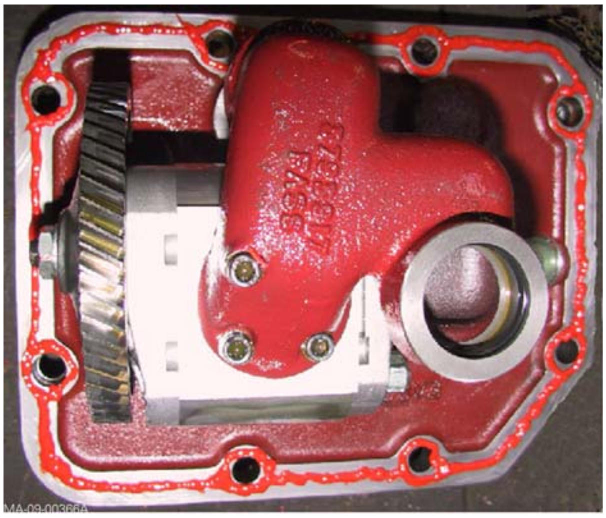


Fig. 15

11. Fit the cover on the guide studs (G1).

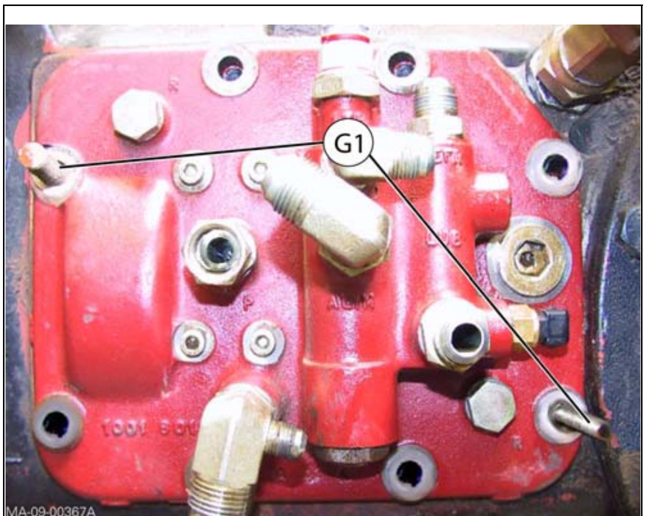


Fig. 16

12. Place the cover on the housing, fit 2 diametrically opposed screws, remove the guide studs (G1), and fit all the screws (10) to a torque of 90 - 120 Nm.

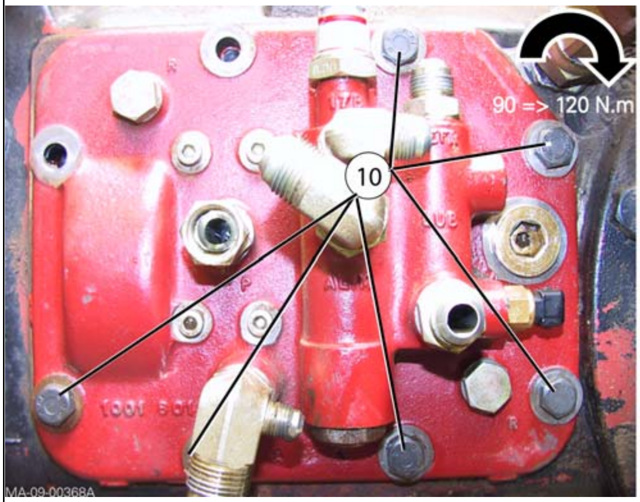


Fig. 17

13. Fit the handbrake cable support and 15 micron filter.
    Do not forget the spacers located behind the support. (Fig. 18).

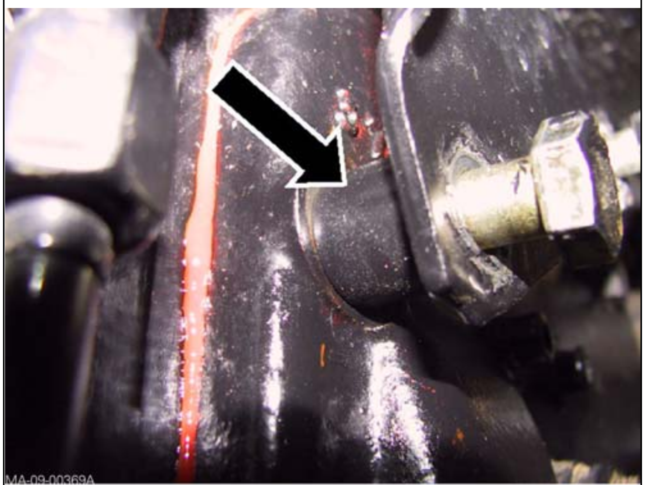


Fig. 18

14. Fit and tighten screws (7) (Fig. 19) to a torque of 15 - 20 Nm (Loctite 241).

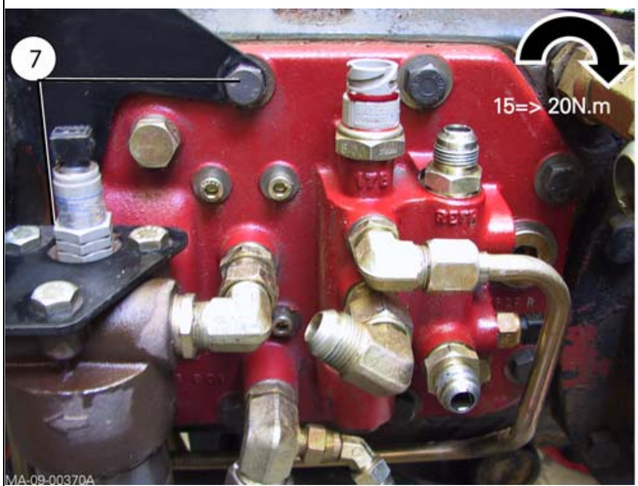


Fig. 19

15. Attach handbrake cable to its holder (Fig. 20).

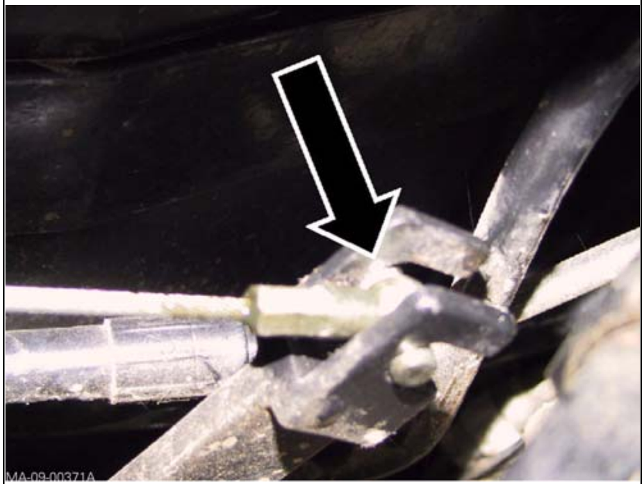


Fig. 20

16. Connect the hydraulic unions according to the markings made at disassembly (Fig. 21).

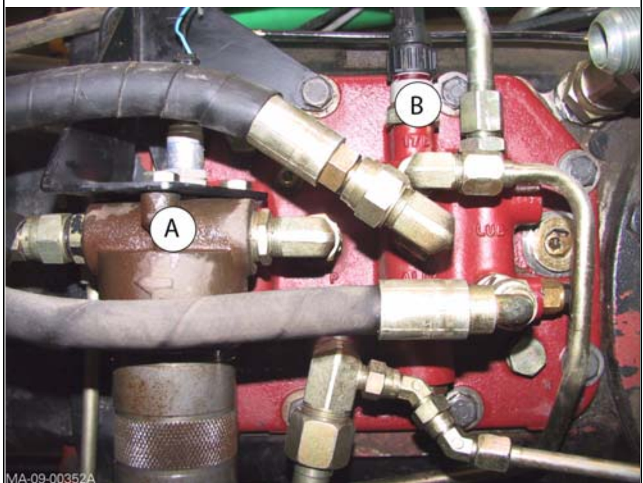


Fig. 21

17. Refit the wheel, then tighten the nuts to the torque stated below. Remove the axle stand, top up the oil level in the housing and check it using the gauge located to the rear of the centre housing.
18. Check the tightness of the mating faces and hydraulic unions.

Wheel tightening torque: 400 - 450 Nm.

C . Removing and refitting the booster pump

Preliminary operation

19. Take off the cover (see § B).

Removal

20. Take out the screws (22) and the pump (2) (Fig. 4).
Note: The pinion (12) can be taken off without removing the pump. Recover key (13).

Refitting

21. Clean the mating faces of the pump and cover.
22. Check for the presence of the locating pins (24) (Fig. 22).
23. Inside the cover, apply a bead C of Loctite 574 or equivalent around the two pump fixing screw holes (Fig. 22). The diameter of the bead should be small in section so as to not touch the groove of seal (23). Fit a new seal.
24. Position the pump on the locating pins.
25. Fit screws (22) smeared with Loctite 241 or its equivalent and tighten to a torque of 40 - 50 Nm.
26. Manually check for the free rotation of the pump.

D . Replacing the pump seals

Preliminary operation

27. Remove the left-hand side cover (see § B) and the booster pump (see § C).

Tightening torques

- Nut (15): 50 - 60 Nm (Loctite 241)
- Screw (22): 40 - 50 Nm (Loctite 241)

Final operation

28. Refit the cover (see § B).

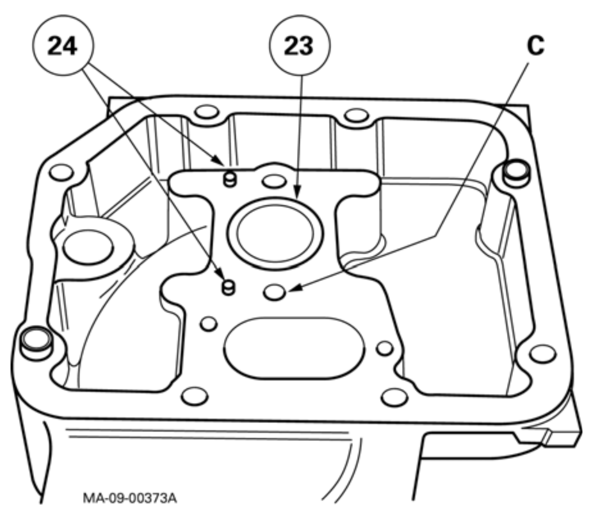


Fig. 22

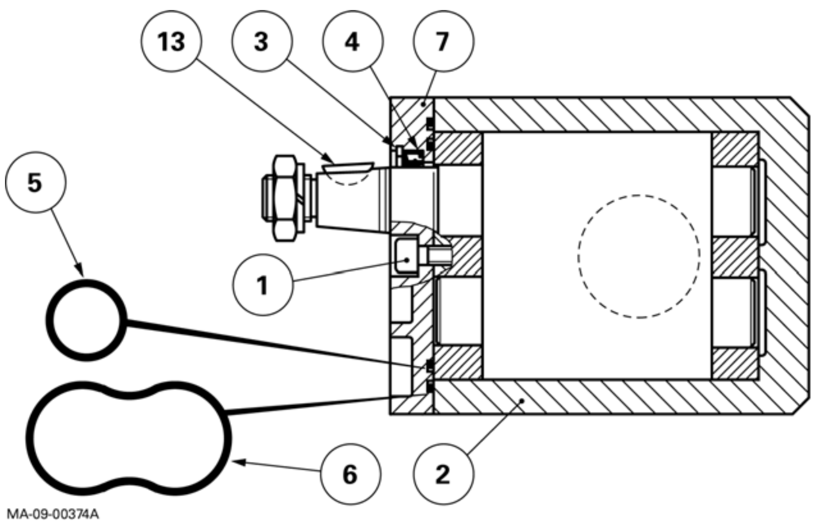


Fig. 23

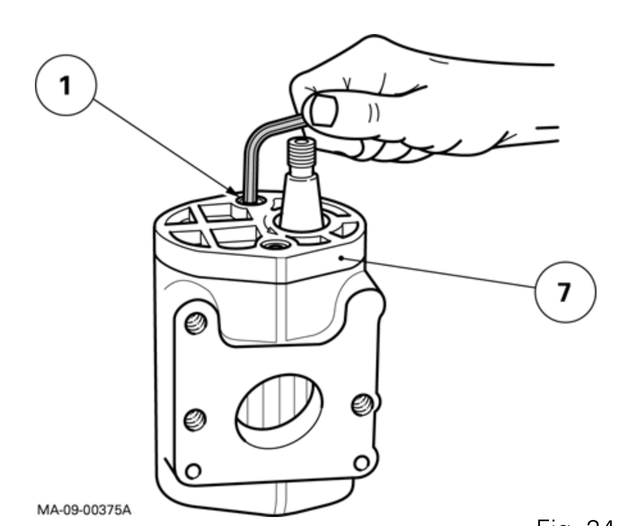


Fig. 24

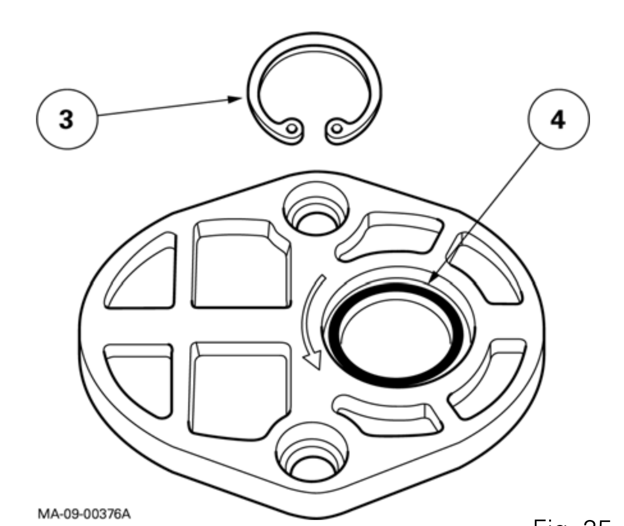


Fig. 25

Disassembly

29. Moderately tighten the pump in a vice fitted with plastic protective jaws.

30. Remove the screws (1) and the cover (7) (Fig. 24).

31. Take off circlip (3), seal (4) (Fig. 25) and O'rings (5) (6) on the cover (7) (Fig. 27).

Reassembly

32. Lubricate seal (4) and insert it using a suitable fixture. Place circlip (3).

33. Lightly smear the O'rings (5) (6) with miscible grease and position them on the cover (7) (Fig. 27).

34. Position the cover (Fig. 26). Fit and tighten the screws (1) (Fig. 24) to a torque of 30 - 40 Nm.

35. Manually check for the free rotation of the pump.

Final operation

36. Refit the booster pump (see § C) and the left-hand cover (see § B).

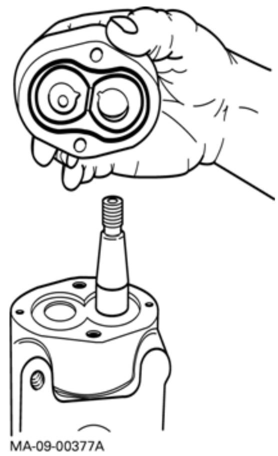


Fig. 26

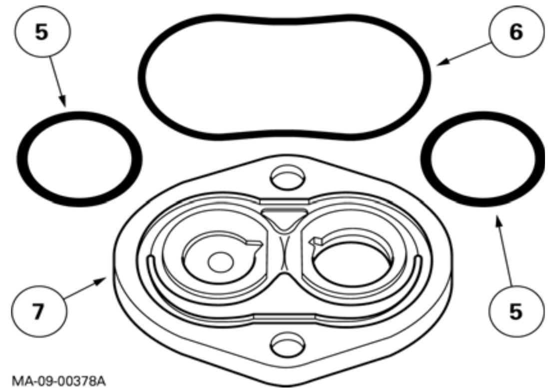


Fig. 27

9E11 - Assisted brake master cylinders

CONTENTS

A . General

The MERITOR brake master cylinders are attached to the pedal console and are housed to the right of the cab front bulkhead (Fig. 1).

They act on the tractor main brake located in the centre housing.

Depending on user requirements, the master cylinders can be activated separately or together in locked mode via a pedal latch (1) (Fig. 2).

The master cylinder specifications are similar whether the requested option includes trailer brake or not. However, if the trailer brake option has been selected, an FTE valve (14) is added to the system to perform this function (Fig. 1). This valve controls a second valve located in the external priority block of the hydraulic unit with two priority blocks (see chapter 9).

A quick coupling at the rear of the tractor provides the hydraulic link between the tractor and the trailer.

Legend (Fig. 1)

A	Master cylinders without oil tank
B	Master cylinders with oil tank

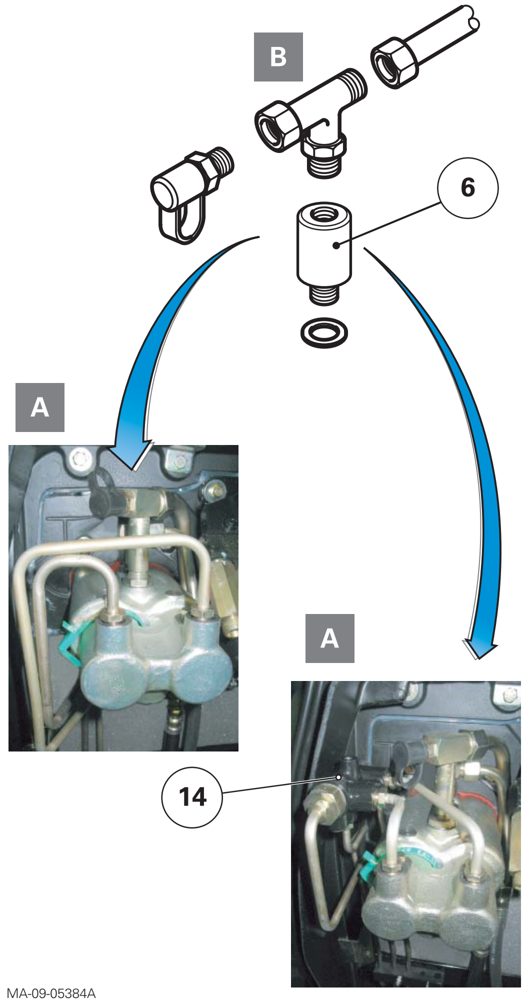


Fig. 1

Fig. 2

Assisted brake master cylinders

The accumulator (1) fitted upstream of the brake master cylinders (5) (Fig. 3 and Fig. 4) is supplied by the low pressure system (17 or 21 bar).

It quickens the response of the brake assistance mechanism.

It also maintains the pressure in the brake master cylinders via the non-return valve (2) through the line (4) when the engine has been stopped (Fig. 3).

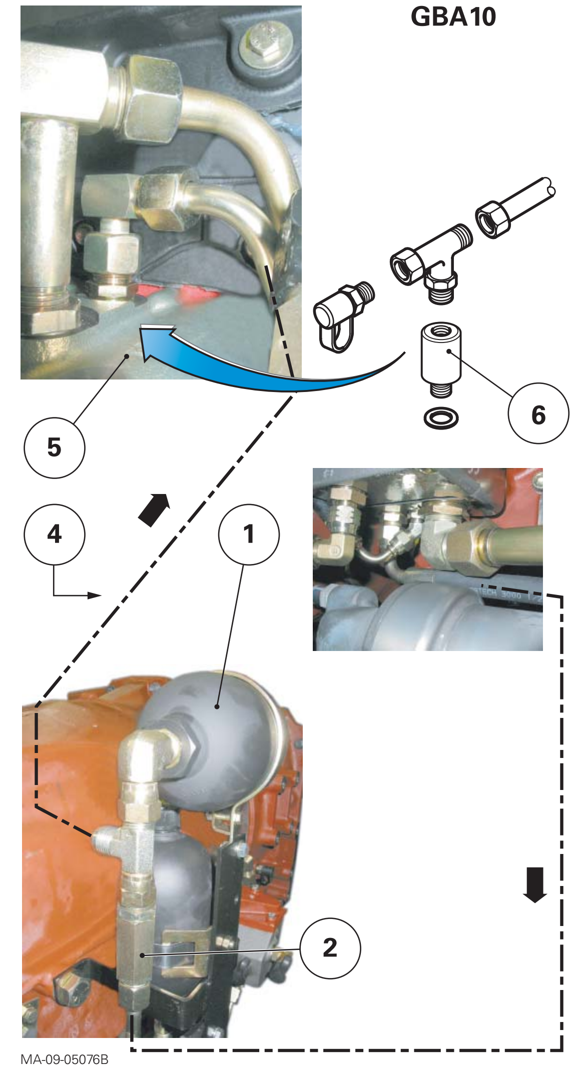


Fig. 3

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B . Layout of hydraulic lines

Specifications (Fig. 4)

(1) Braking assistance accumulator
- Brand............................... Olaer
- Type 1/20
- Capacity .... 1 l
- Gas.................................. Nitrogen
- Tyre pressure .... 9 ± 1 bar

IMPORTANT: *The pressure should be checked every 6 months, with the engine stopped.*

(2) Non-return valve
- Brand............................... Parker

NOTE: *When refitting the non-return valve, turn the arrow engraved on its body so that it points in the direction of fluid flow.*

(3) Main accumulator for:
- the Dynashift (GBA10)
- the Powershift (GBA15 and GBA25)
- ranges 1 to 4 of gearboxes GBA15 and GBA25

(4) To brake hydraulic assistance

Legend

17 or 21 bar low pressure

Gas

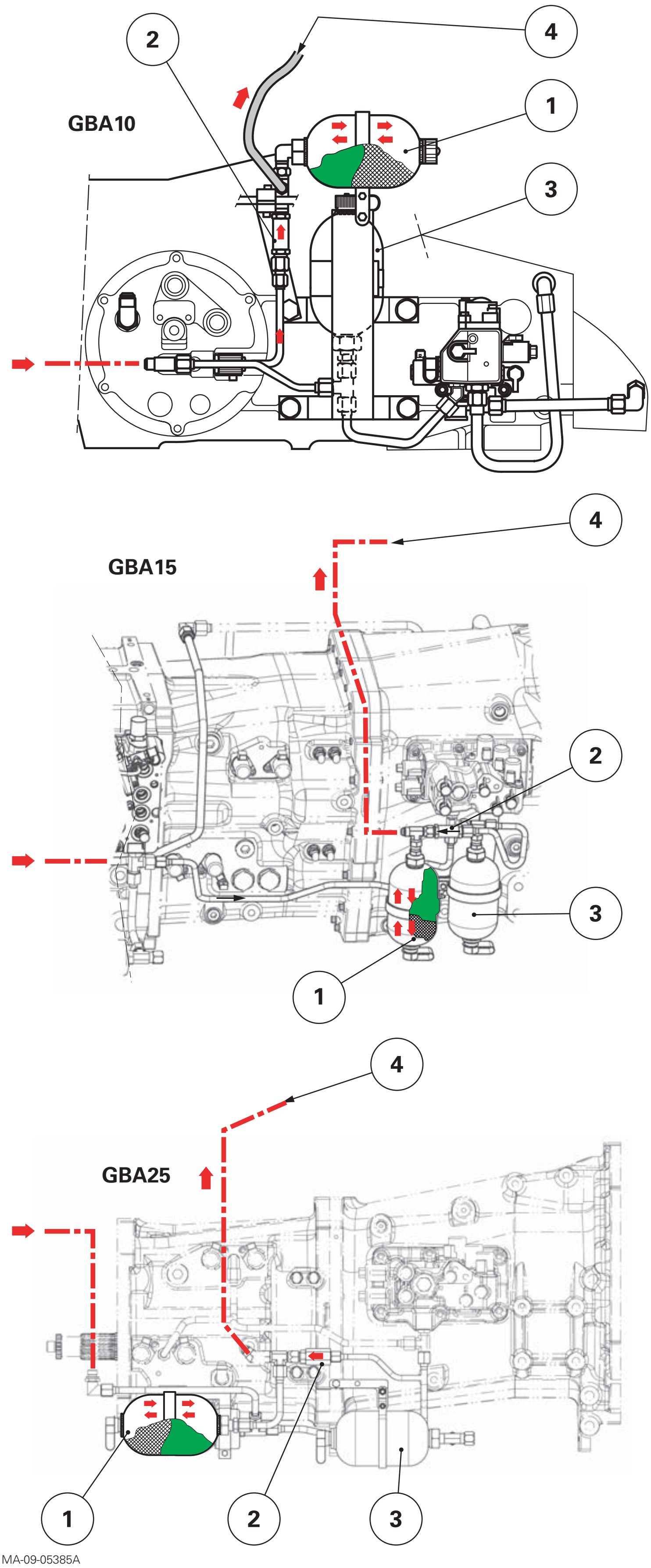

Fig. 4

GPA20, GPA30 and GPA40 development and assemblies

Fig. 7: GPA40 with old generation centre housing
Fig. 8: GPA40 with new generation centre housing

Parts list (Fig. 5, Fig. 6, Fig. 7, Fig. 8)

(1) Bleed screw
(3) Main brake supply lines (right and left)
(5) Brake master cylinders
(10) Connection to assist bleeding under pressure
(13) 17/21 bar low pressure supply line

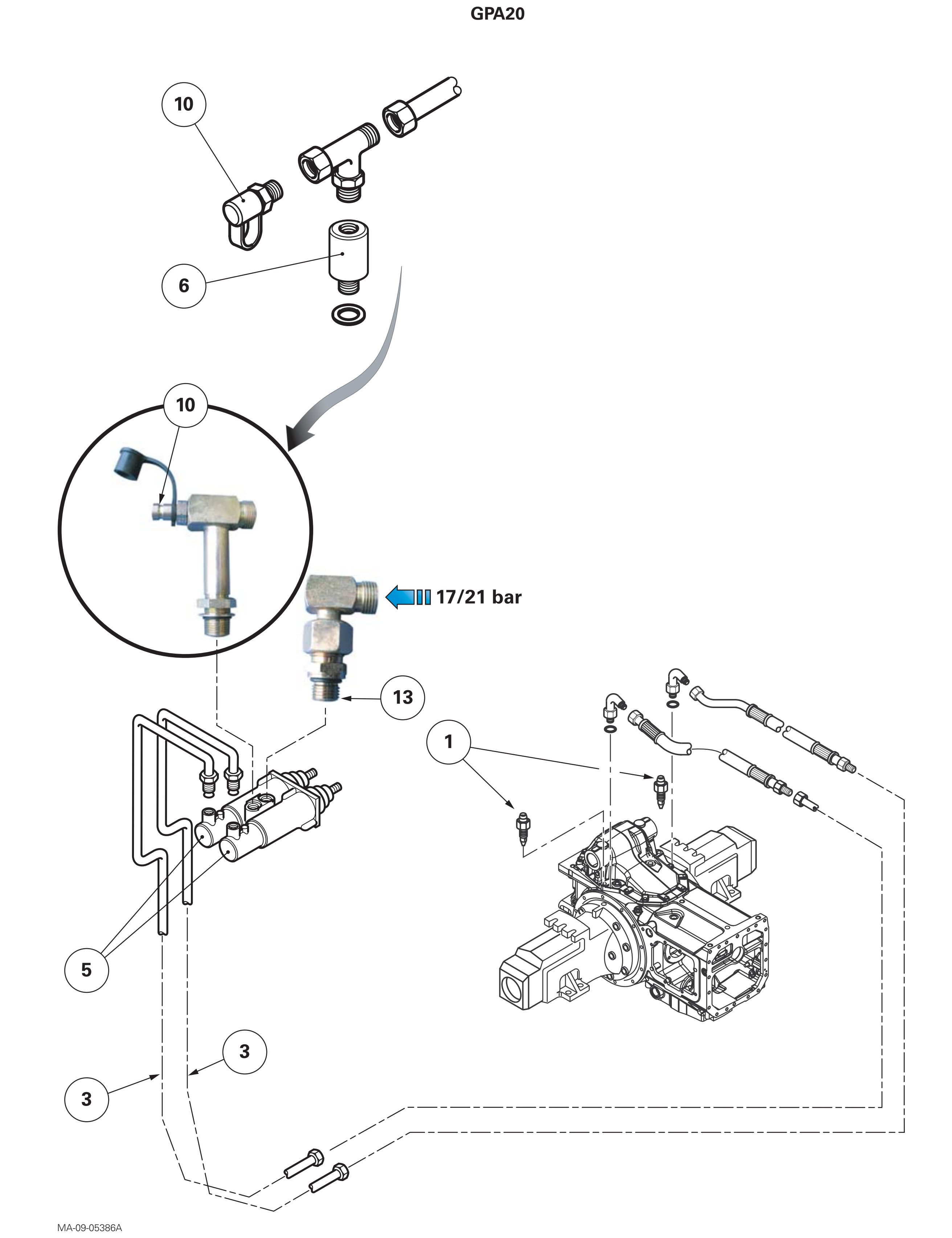

Fig. 5

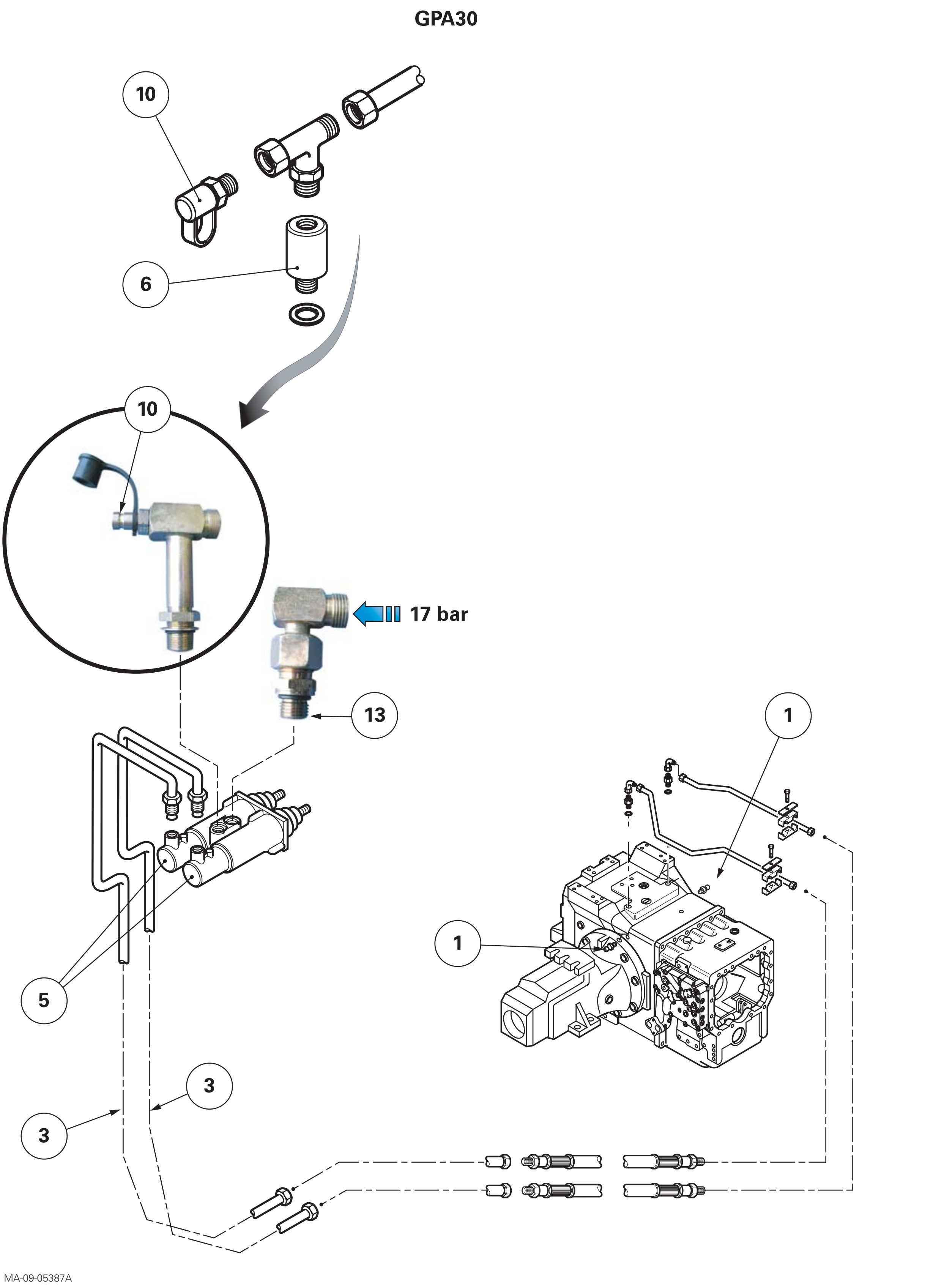

Fig. 6

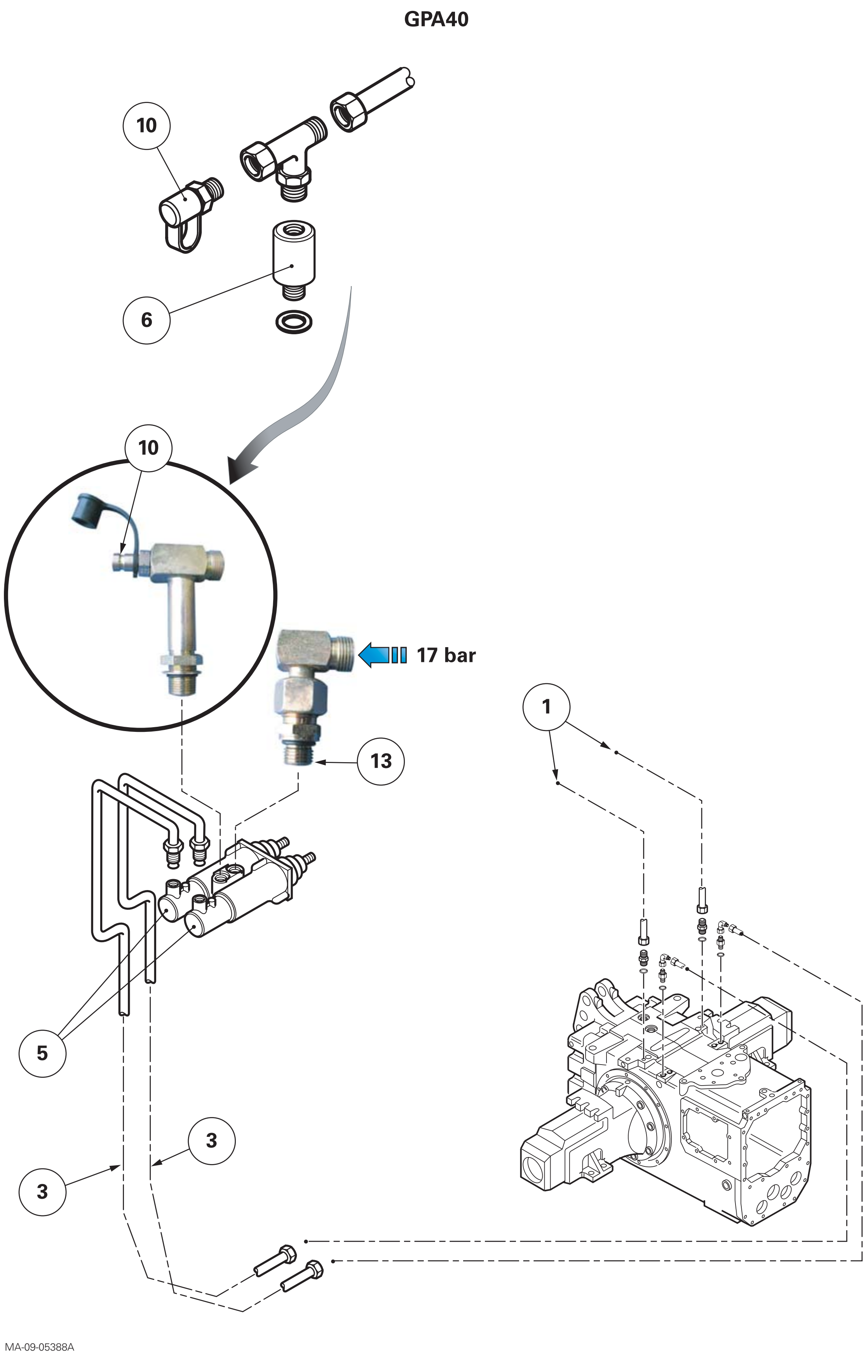

Fig. 7

Assisted brake master cylinders

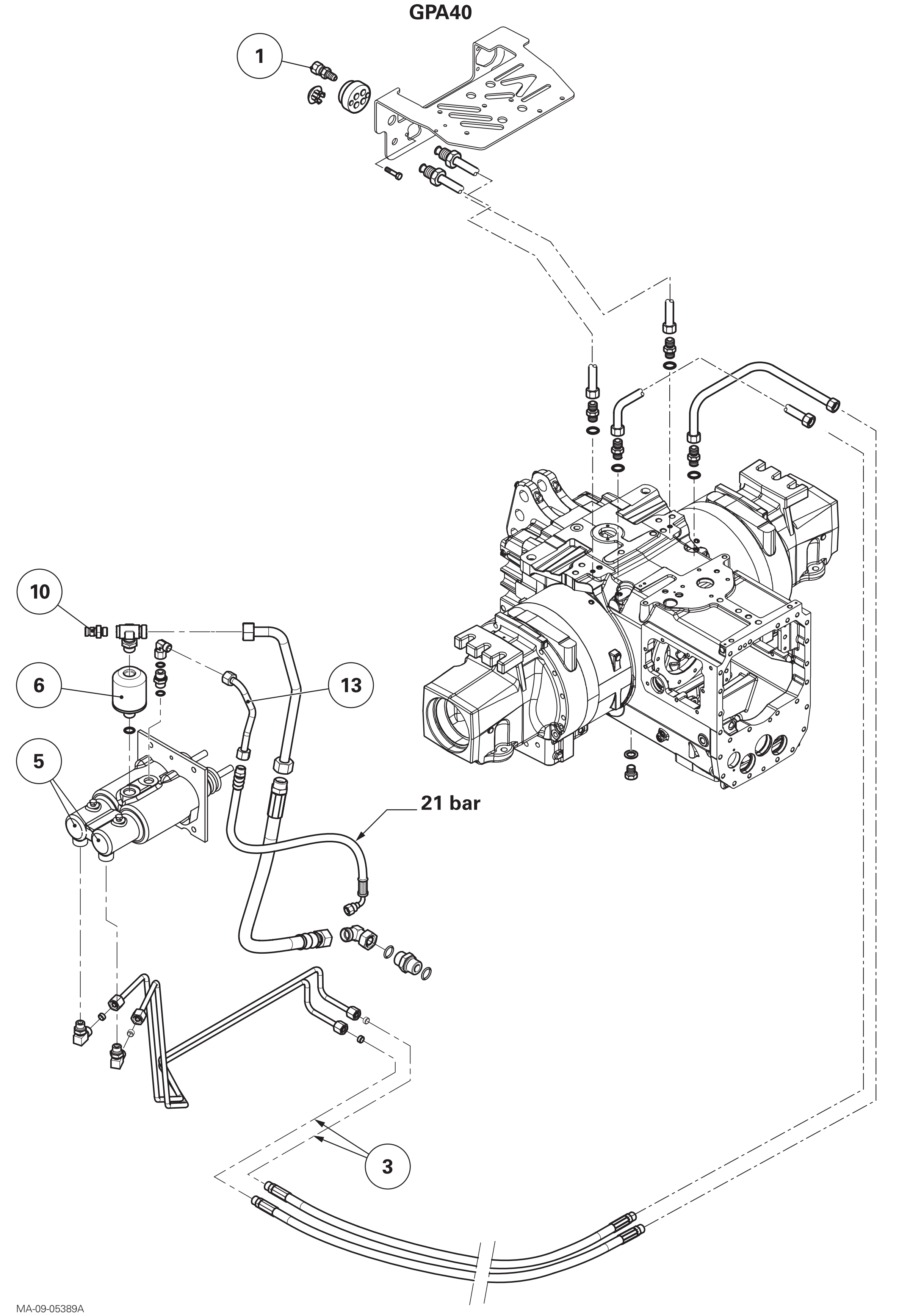

Fig. 8

GPA20, GPA30 and GPA40 development and assemblies

Fig. 11: GPA40 with old generation centre housing

Fig. 12: GPA40 with new generation centre housing

Parts list (Fig. 9, Fig. 10, Fig. 11, Fig. 12)

(1) Bleed screw
(3) Main brake supply lines (right and left)
(5) Brake master cylinders
(6) Oil reserve
(7) Trailer brake quick coupling
(10) Connection to assist bleeding under pressure
(13) 17/21 bar low pressure supply line
(14) FTE valve (trailer brake)
(15) Trailer brake control line
(16) Priority blocks with trailer brake (hydraulic unit with two priority blocks)

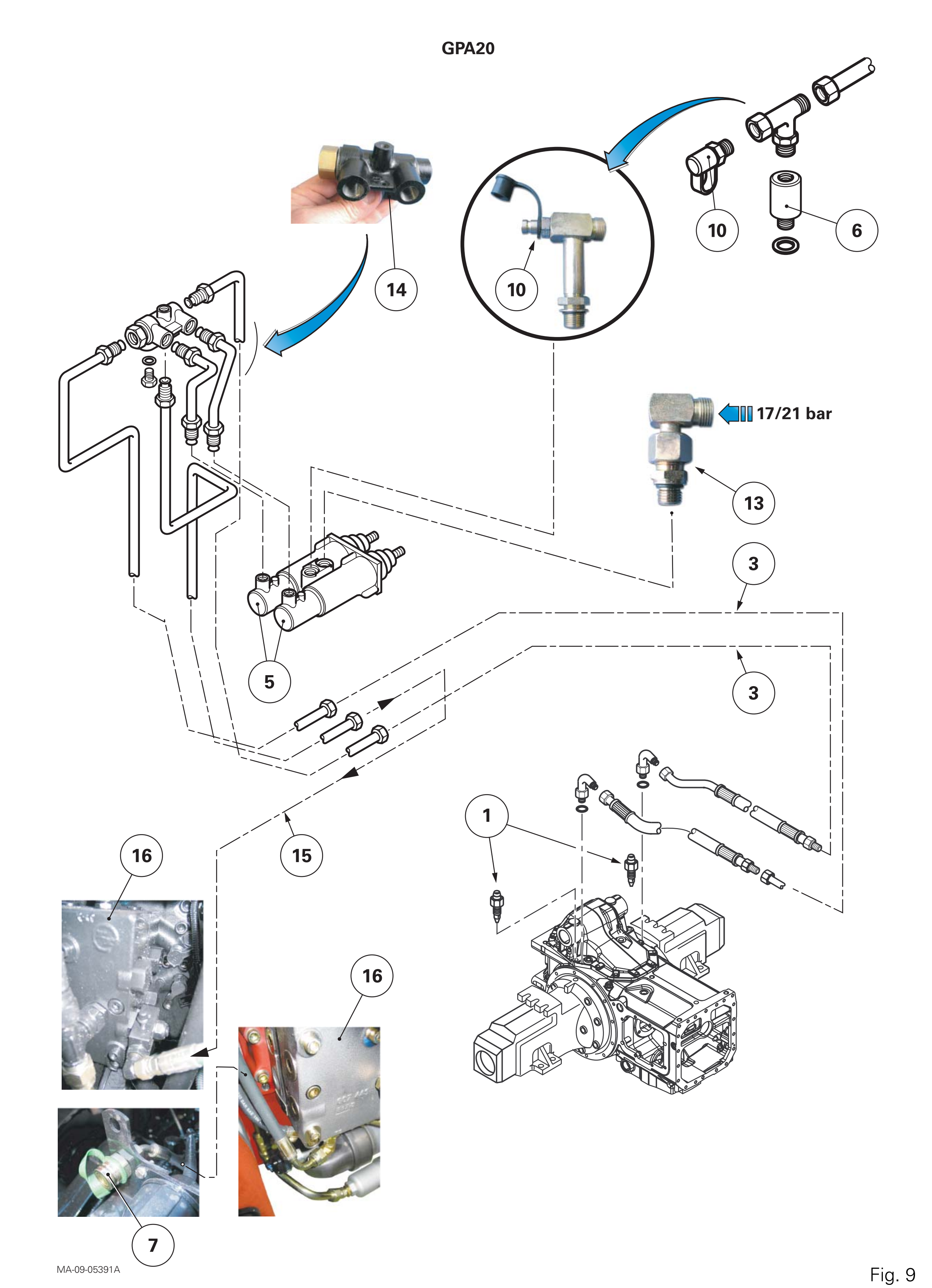

Fig. 9

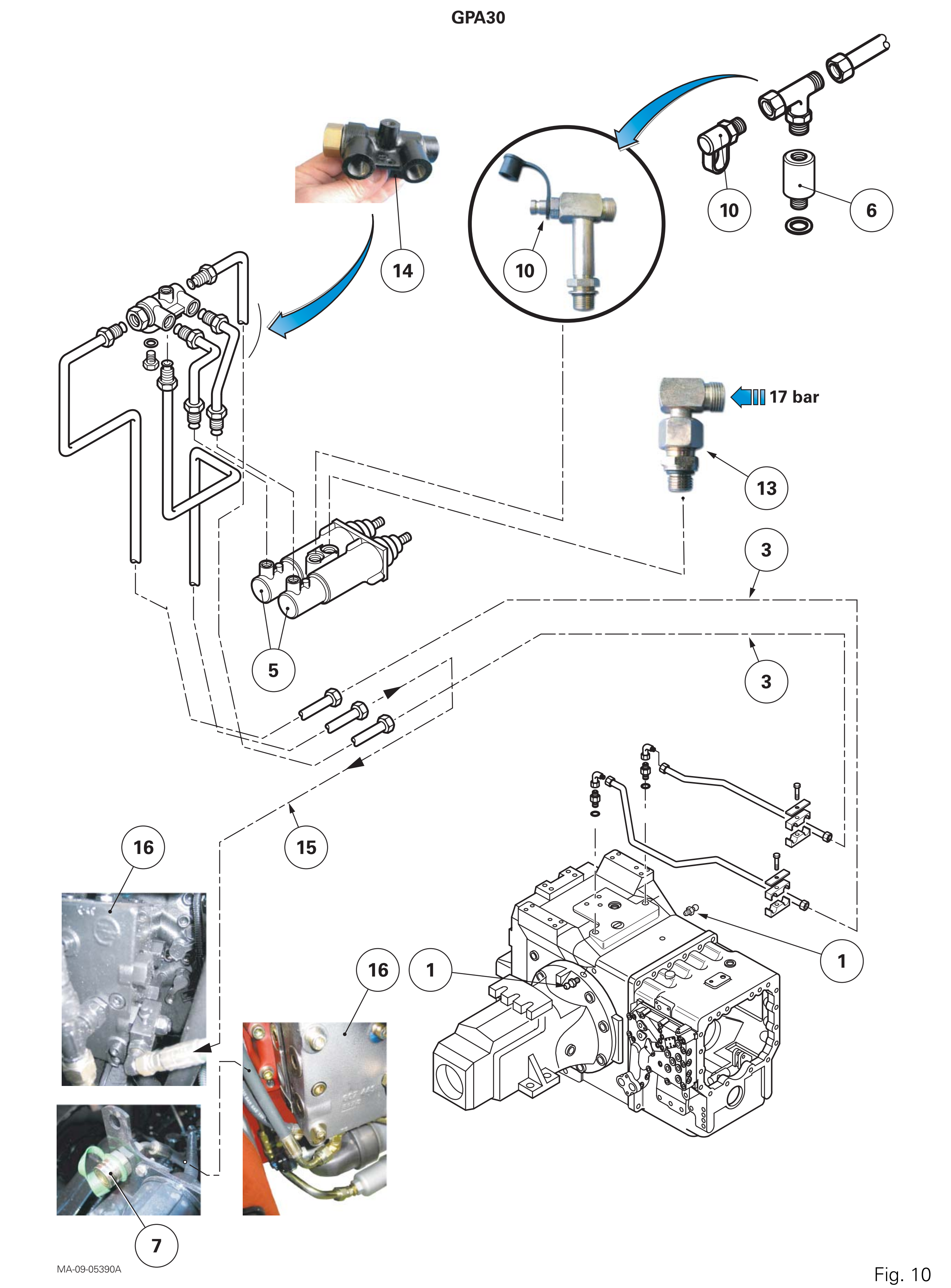

Fig. 10

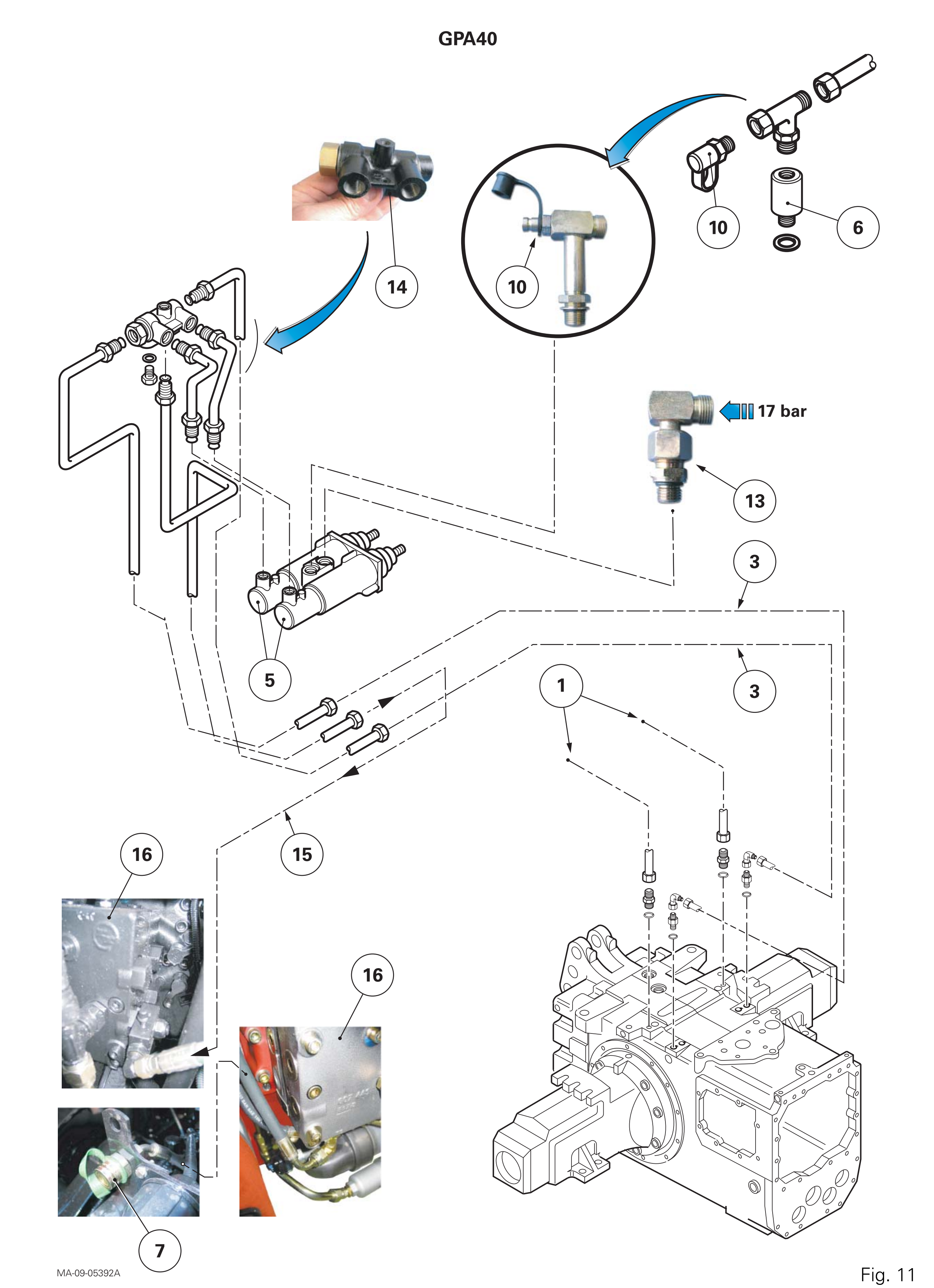

Fig. 11

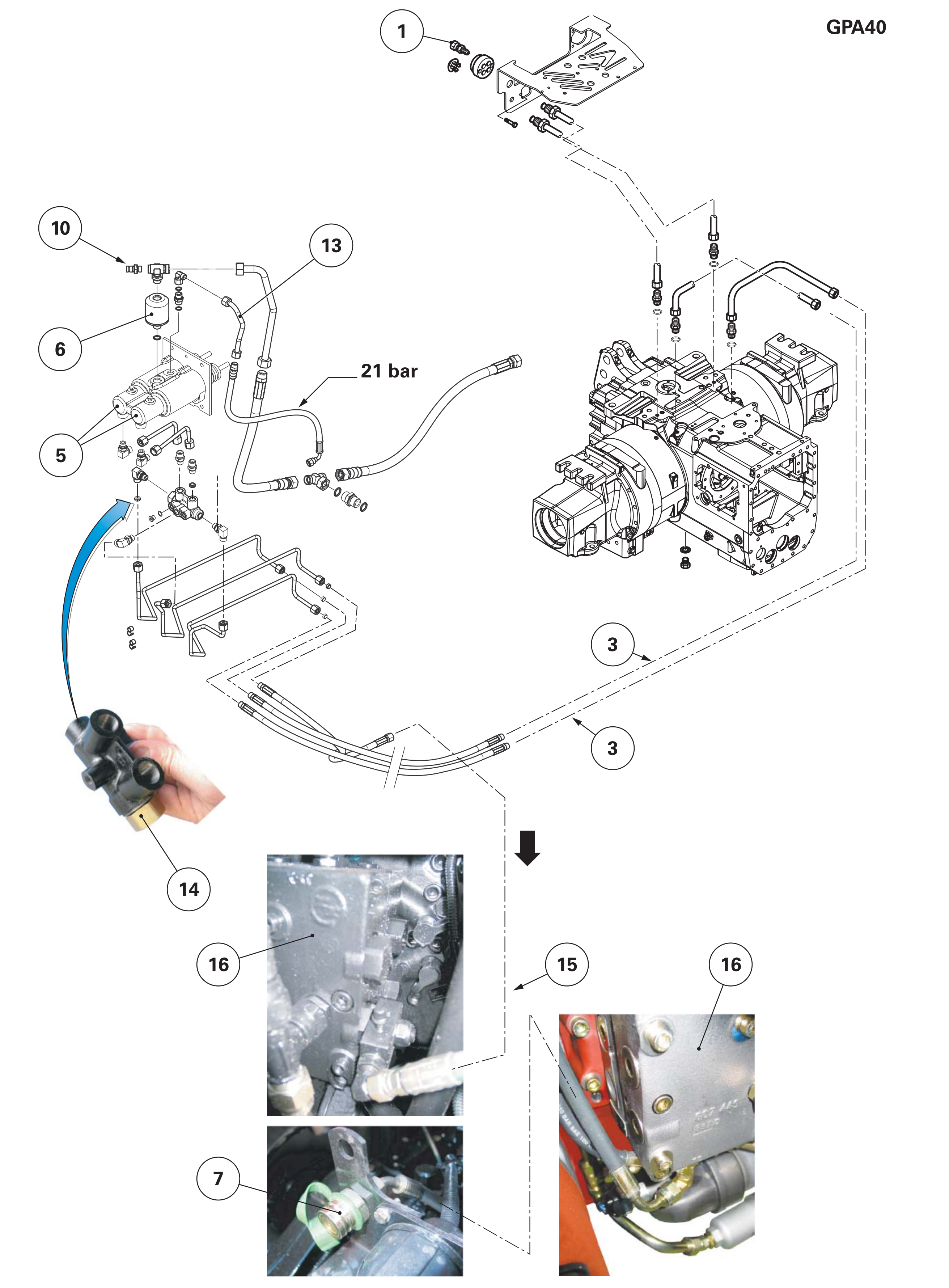

Fig. 12

C . Practical maintenance advice

The spare parts catalogue does not include any separate parts to repair MERITOR brake master cylinders or the FTE valve. In case of incorrect operation systematically replace the faulty assembly or assemblies.

After replacing the brake master cylinders and/or FTE valve:
- Bleed the main brake system (see § G) and trailer brake system (if fitted) (see § H).
- If necessary, check for slight operating clearance between the brake pedal control rods and their respective brake master cylinder.
- Also check the operation of the locking latch (see § F).

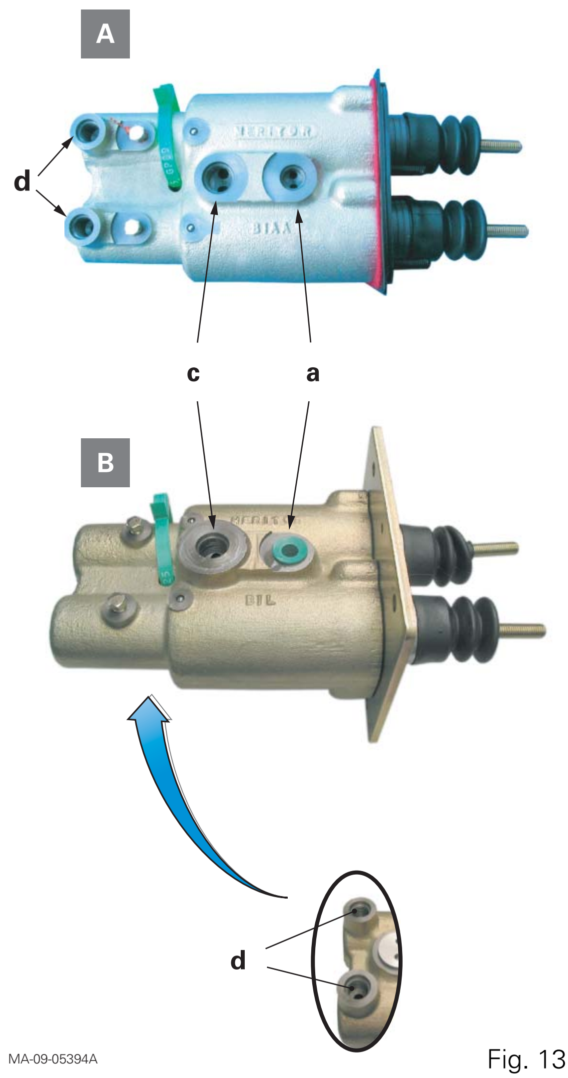

Fig. 13

D . Brake master cylinders

Operation (Fig. 13 and Fig. 14)

The force applied to the brake pedal is transmitted by the control rod (2) and moves the spool (3) in the bore of the piston (4).

The oil under pressure coming from the port (a) enters the holes (10) and the groove (12).

The piston (4) is then pushed to the left, compressing the oil in the hydraulic chamber (8) of the brake master cylinder, then directing it to the port (d) and the main brake piston via the FTE valve (if fitted).

The screw (7) guides the piston (4) along its movement axis.

***Important:** Under no circumstances should this screw (7) be removed.*

When the brake pedal is released, the spool (3) returns to its initial position. The piston (4) is no longer under pressure. It therefore returns to its resting position.

The valve (6) allows the pressure between the brake master cylinder hydraulic chamber (8) and the oil reserve (5) to be balanced only once the piston has returned.

The port (9) allows oil flow in order to maintain a constant level in the brake master cylinder chamber (8).

The oil under pressure (17 or 21 bar) in chamber (b) also fills reserve (5), passing through the bore (11).

Port (c) removes any excess oil and directs it to the return.

Parts list (Fig. 14)

(1) Master cylinder assembly
(2) Rod
(3) Spool
(4) Piston
(5) Brake system supply reserve
(6) Pressure balance valve
(7) Piston guide screw
(8) Master cylinder hydraulic chamber
(9) Port
(10) Port
(11) Bore
(12) Groove

Legend

(a) Supply (17 or 21 bar)
(b) Piston (4) chamber
(c) To the return
(d) To the main right and/or left-hand brake via the FTE valve (if fitted)

A Old generation master cylinders

B New generation master cylinders

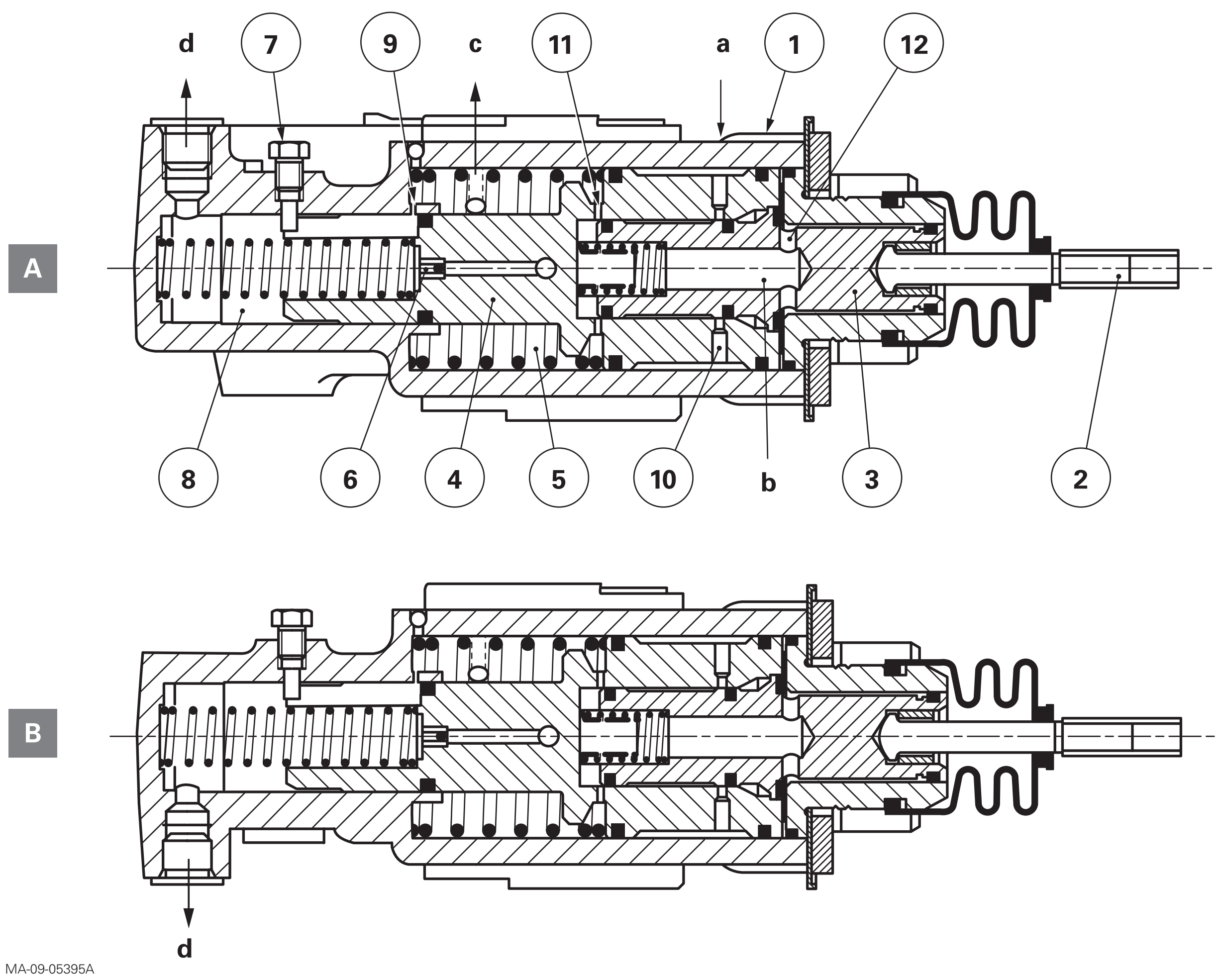

Fig. 14

E . FTE valve

Parts list (Fig. 15)

(1) Spool
(2) Ball bearing
(3) Plunger
(4) Spring

Legend

(A) To trailer brake valve
(B) From right-hand brake master cylinder
(C) From left-hand brake master cylinder
(D) To right-hand tractor brake
(E) To left-hand tractor brake

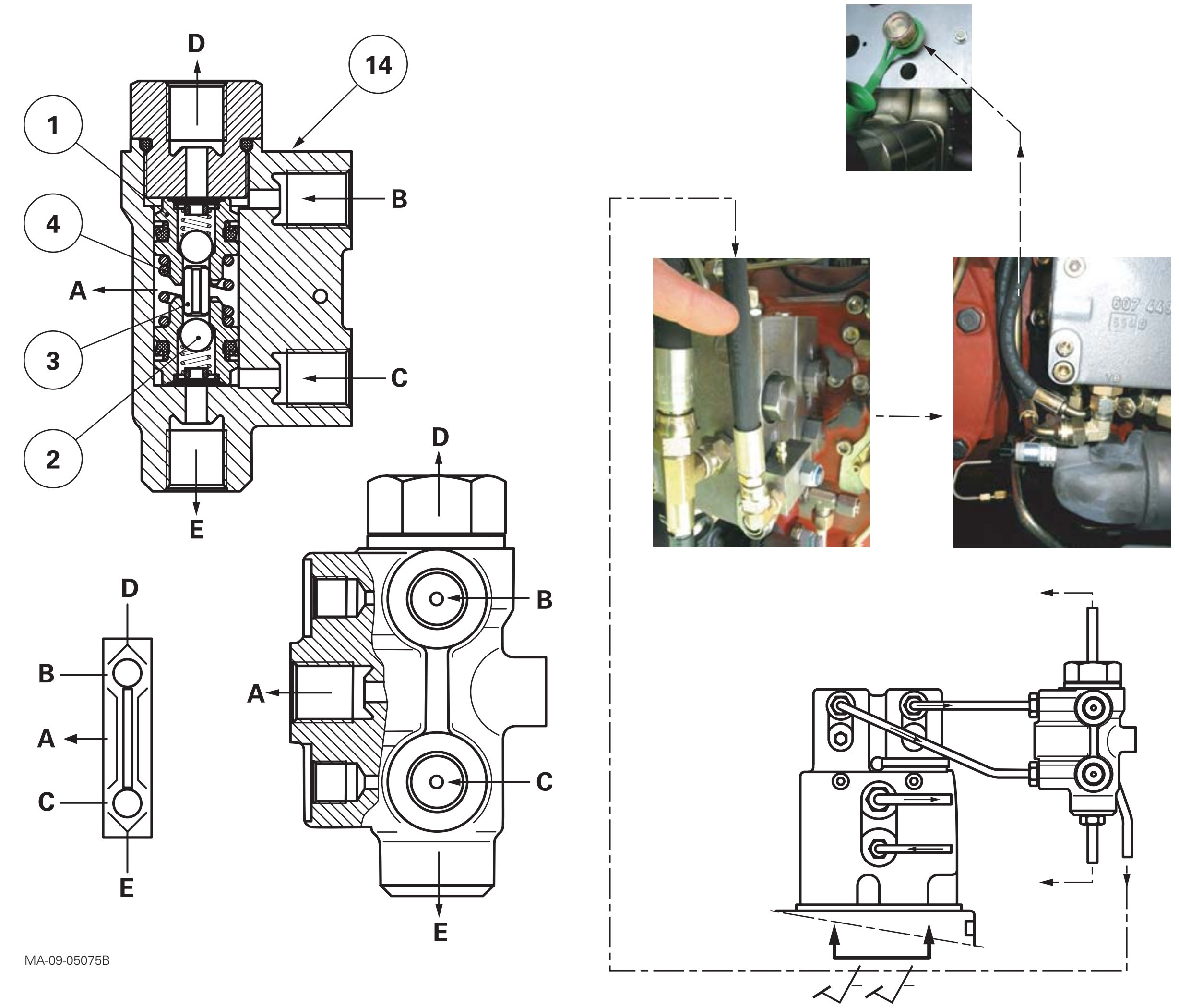

Fig. 15

Operation

The FTE valve (14) (Fig. 15) is an essential component of the trailer brake system.

It performs a logical "AND" function, i.e. it allows oil to flow to the brake valve only when both brake pedals are activated at the same time.

If only one brake pedal is pressed, the brake valve is not activated.

Note: *The FTE valve cannot be adjusted.*

Pedals uncoupled (Fig. 16)

When force is applied to only one brake pedal, the oil under pressure coming from the brake master cylinder and going to the port (B) moves the spool (1) and presses the ball bearing (2) against the spool to block the connection (D) and (A). Therefore, there is only one possible way for oil to flow from (B) to (D).

Pedals coupled (Fig. 17)

When force is applied to both pedals simultaneously, the spools (1) are thrust against each other and compress spring (4). The plunger (3) then forces the ball bearings (2) apart, lifting them from their seats in the spool. In this way all the ports are directly connected, i.e. there is a braking pressure supplied to tractor brakes (D) and (E) and to the brake valve (A).

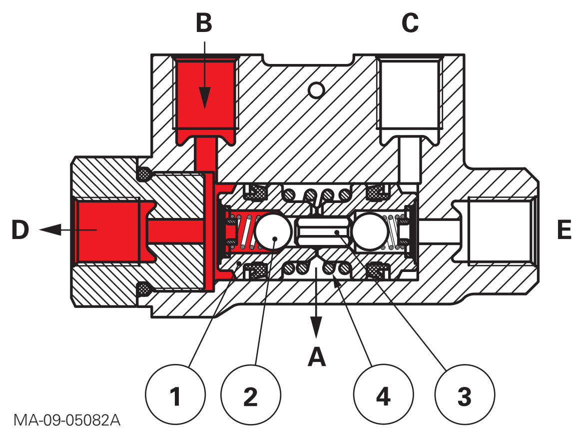

Fig. 16

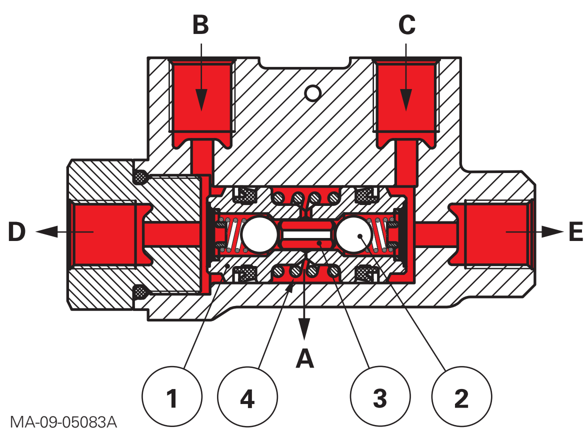

Fig. 17

F . Adjusting brake pedals

Preparing for adjusting (Fig. 18)

1. If the pins (5) and (6) are removed, smear them lightly with molybdenum disulphide or AS767 grease or equivalent.
2. Screw the counter-nut (8) and clevis (1) onto the rod (2).
3. Fit the return spring (3).

Settings

4. Adjust clevis (1) to obtain dimension **X = 135 ± 0.5 mm** (Fig. 18) between the support (4) and clevis attachment pin.

   Lock the counter-nut.
5. Carry out the same procedure on the second clevis and ensure that the locking latch (1) (Fig. 19) operates smoothly.
6. Check pedals for correct operation. Ensure they are at the same height when not activated and that they return freely to their initial position.

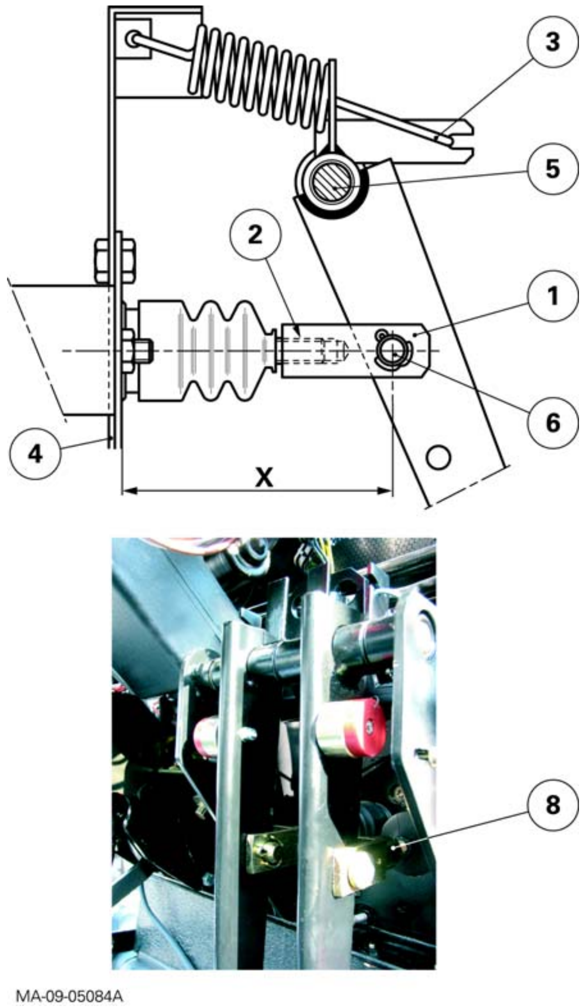

Fig. 18

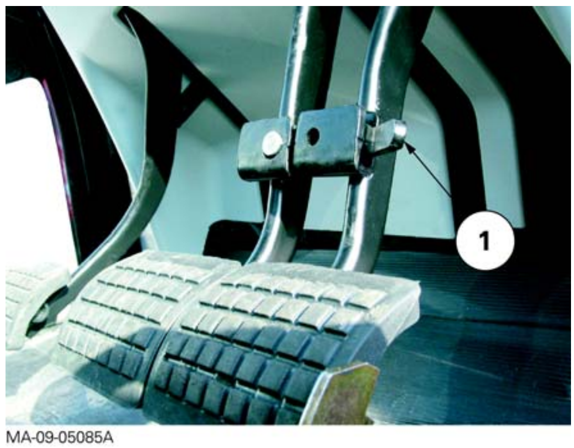

Fig. 19

G . Bleeding the main brake system

Important: *A male connector (3) fitted as standard on the charge and lubrication line (5 bar) of the right-hand hydraulic cover plate and the male connector (10) fitted as standard on the brake master cylinders with oil tank (B) or without oil tank (A) (Fig. 20) must be used to facilitate the bleeding under pressure of the brake system.*

7. Make a hose (2) (Fig. 24) for couplers whereby:
- one end is fitted with a female connector suitable for attachment to the male connector (10) (bleed assistance) of the brake master cylinders (Fig. 20)
- the other end is fitted with a female connector suitable for attachment to the male connector (3) (5 bar lubrication and charge) of the right-hand hydraulic cover plate (Fig. 20).

8. Connect a transparent pipe (T) to each bleed screw (1) (right and left) of the centre housing (Fig. 21, Fig. 22, Fig. 23).

9. Dip the ends of the two pipes into the oil filling pipe of the housings, without immersing them too deeply.

10. Conveniently locate the brake master cylinder return hose (1). Using a clamp fitted with protective jaws, pinch this hose without flattening it excessively (Fig. 25).

Important: *If the structure of the pipe/hose assembly is too rigid, disconnect it by unscrewing just the pipe (t) connected to the connector (10) via the T connector (Fig. 20). Temporarily screw a locally obtained plug onto each disconnected section.*

11. Start the engine. Stabilise its speed at approximately 1300 rpm. Bring the oil to operating temperature.

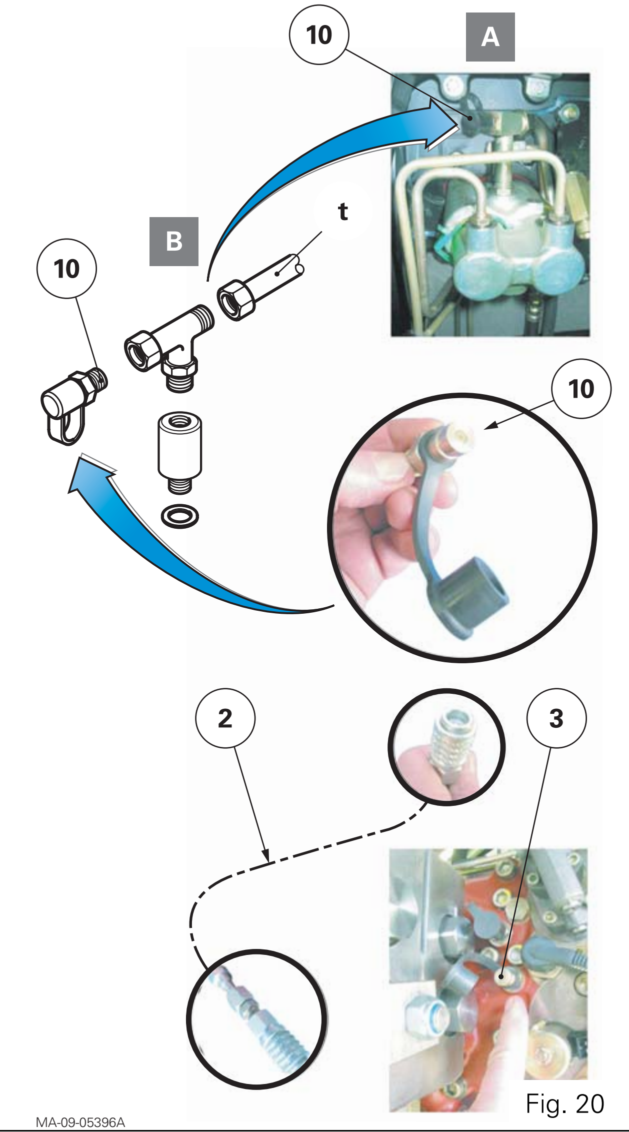

Fig. 20

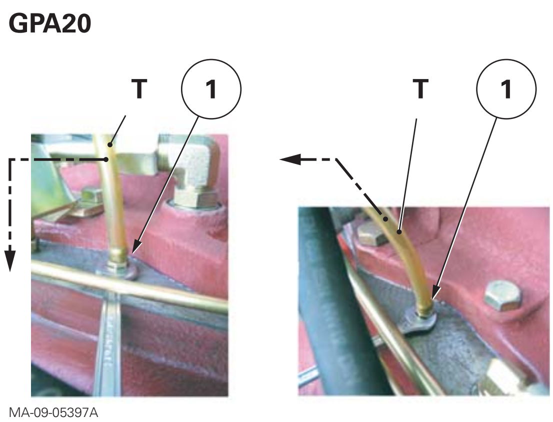

Fig. 21

12. Open the two bleed screws by approximately one turn. Wait approximately 5 minutes.
- **Pedals coupled**
  Fully press down and slowly release the pedals about 8 times until the oil flows free of air bubbles.
- **Pedals uncoupled**
  Fully press down and slowly release each pedal about 8 times until the oil flows free of air bubbles.
- **Pedals coupled**
  Fully press down and slowly release the pedals about 5 times until the oil flows free of air bubbles.

13. First close the left-hand bleed screw which is the furthest away from the brake master cylinders. Then close the right-hand bleed screw.

14. Press very hard (approximately 60 to 80 kg) on each pedal to correctly position the brake pistons.

15. Check the hardness under force of each pedal. Coupled pedals should not travel more than 120 mm for the force stated above.

16. If an operating problem emerges, carry out the bleed sequence a second time.
If the problem remains, switch off the engine and check the sealing of:
- the system;
- the master cylinders;
- the brake piston seals.

17. Remove:
- the local hose (2) for couplers (Fig. 24)
- the clamp fitted to the pipe/hose assembly (1) (Fig. 25). If a clamp has not been used, unscrew the locally obtained plugs. Reconnect the pipe (t) to the T connector of the connector (10) (see step 10).

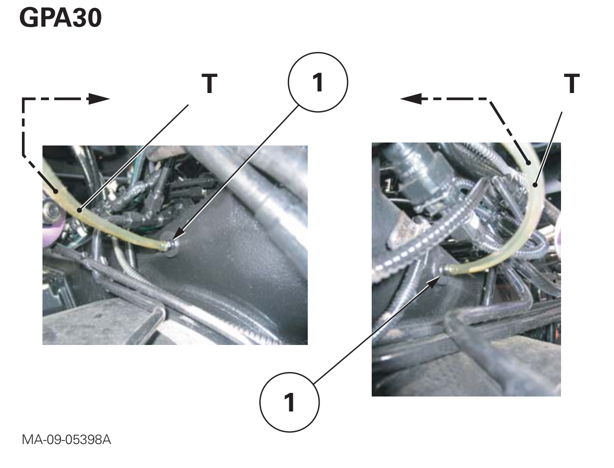

Fig. 22

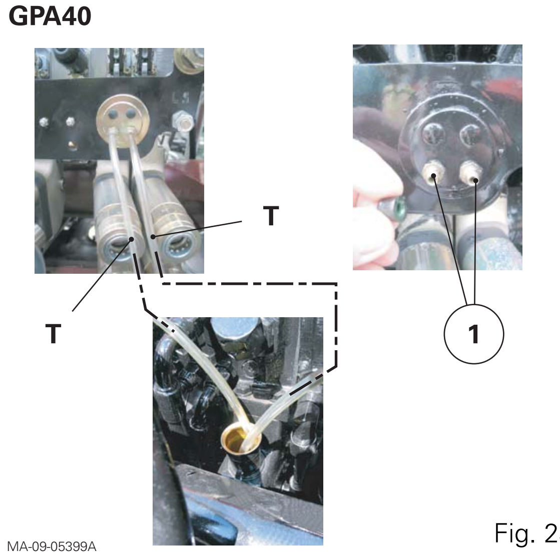

Fig. 23

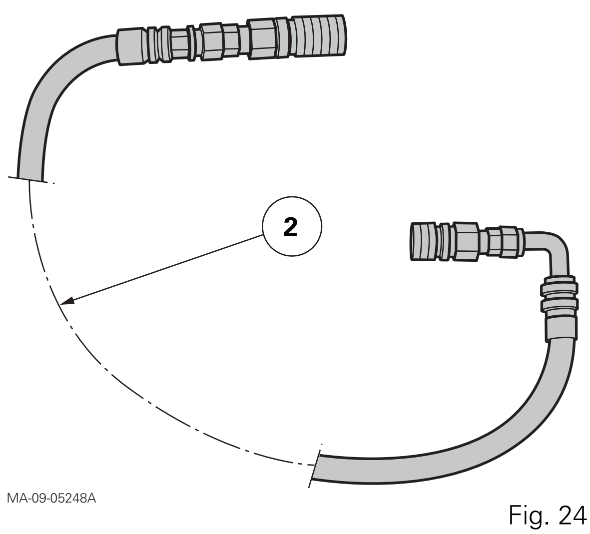

Fig. 24

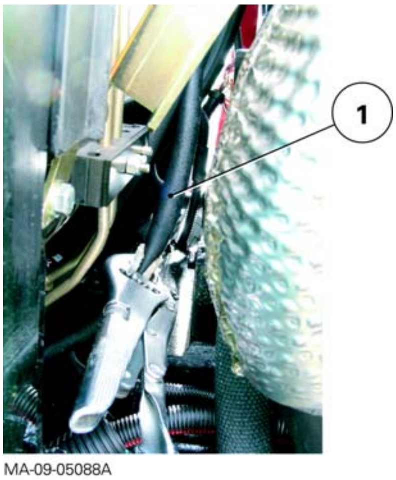

Fig. 25

H . Bleeding the trailer brake system

If the tractor is fitted with a trailer brake mechanism (FTE valve (14) (Fig. 26) and priority block (16) (Fig. 27, Fig. 28), it is strongly recommended to bleed the main brake and trailer brake systems simultaneously.

To carry out this bleeding procedure, use the same equipment and method as described in section G, following these additional points.

- Open (Fig. 27, Fig. 28):
  - the two screws (1) of the main brakes;
  - the trailer brake screw (2).
- When the bleeding is complete, tighten in the following order (Fig. 27, Fig. 28):
  - the left-hand bleed screw (1)
  - the right-hand bleed screw (1)
  - the trailer brake bleed screw (2)
- Check the trailer brake pressure on the quick coupling located at the rear of the tractor (see chapter 9).

  If this pressure is not correct, eliminate any air entering in the system. Repeat the bleeding procedure.
- Carry out a road test.

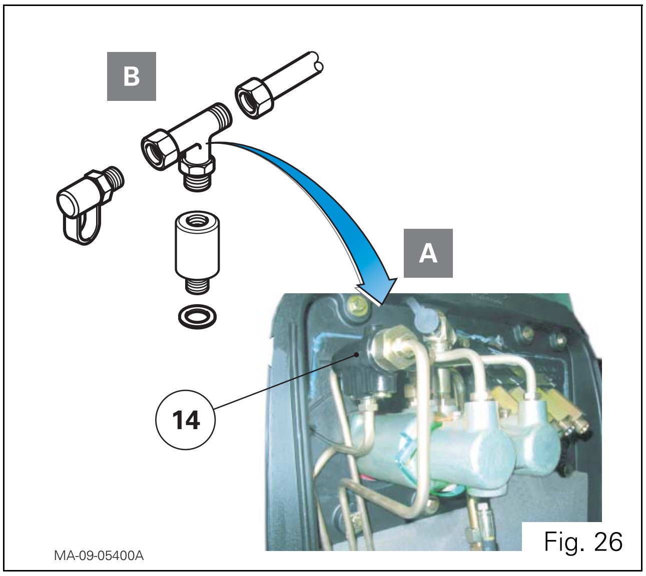

Fig. 26

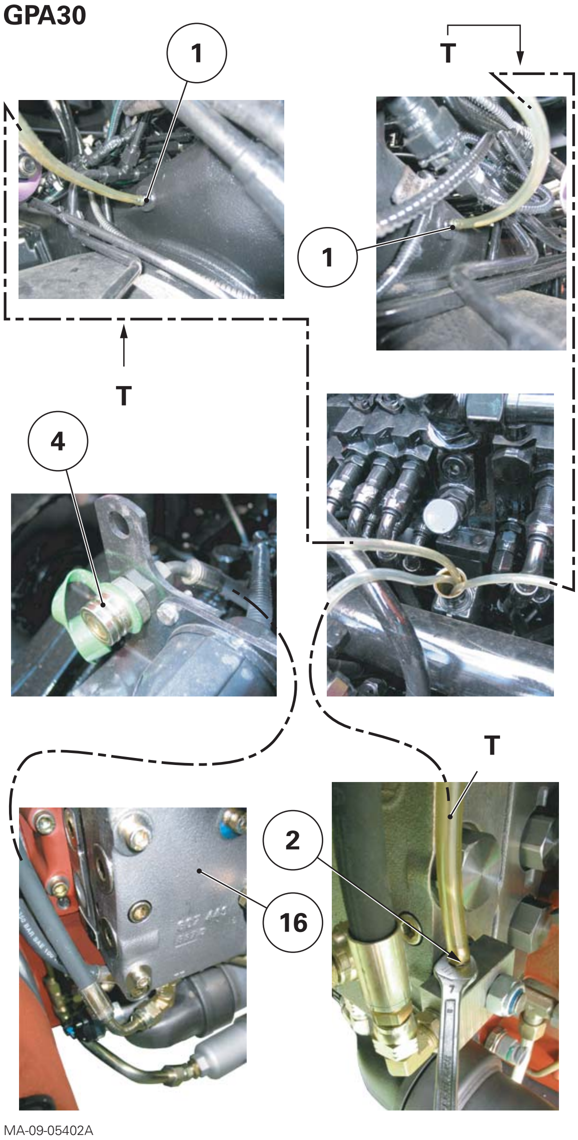
GPA30
1
T
1
T
4
T
2
16
MA-09-05402A

Fig. 27

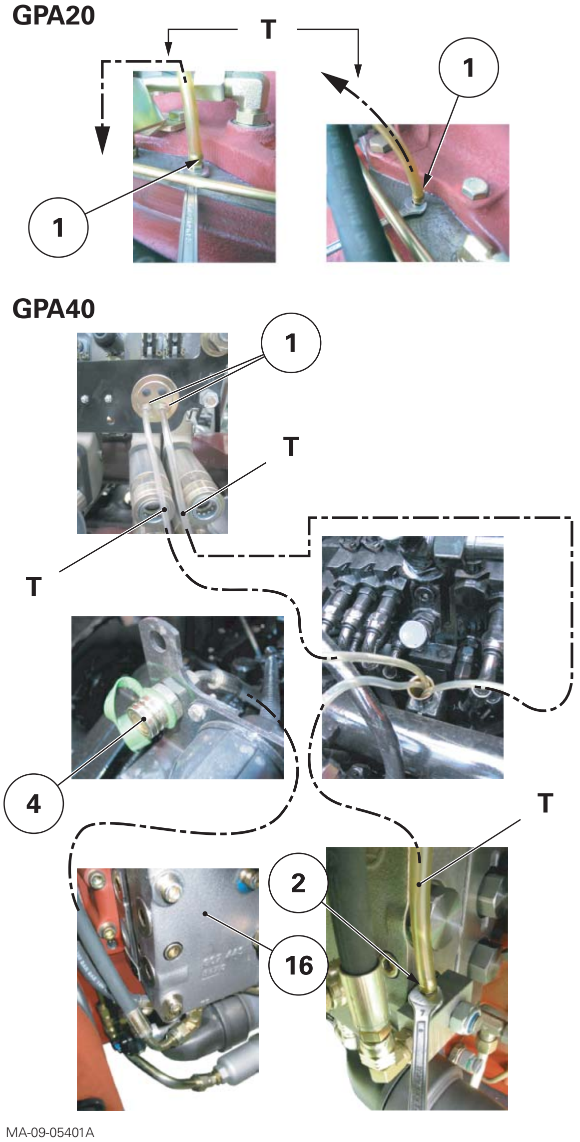
GPA20
T
1
1
GPA40
1
T
T
4
T
2
16
MA-09-05401A

Fig. 28

9E20 - High-pressure brakes - General

CONTENTS

A . General

The high-pressure braking unit is fitted to tractors equipped with a GTA1540 or GTA2520 transmission:

- as standard on 50 kph tractors
- as an option on 40 kph tractors

This system is an additional unit located on the right-hand side of the gearbox (Fig. 1). It is controlled by the transmission's Autotronic 5 controller and supplied hydraulically by the CCLS system.

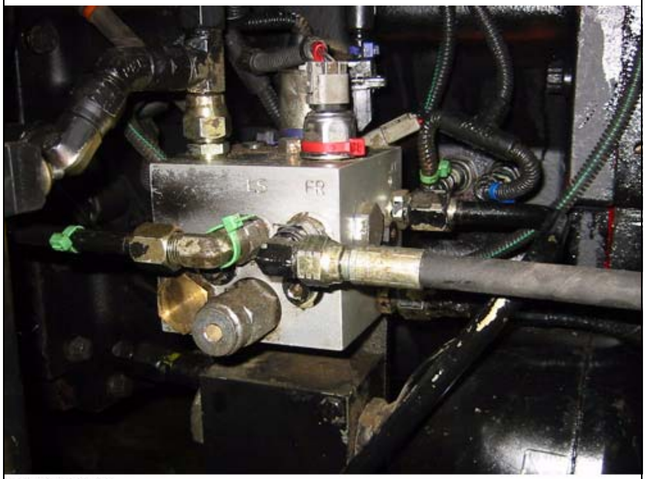

Fig. 1

B . Operation

The high-pressure braking system is based on the "regulator breaker" principle. Along with the Autotronic 5 controller, this operating principle ensures that the system remains in the right pressure range at all times. (between 80 and 95 bar).

Operating principle of the system (Fig. 2):

Supply: The pump for the hydraulic system directs flow into the unit depending on the XLS signal it receives from the system.

Regulation: The valve that controls the supply is the "normally open" type. It controls the supply pressure thanks to the pressure sensor indicating the instantaneous pressure in the unit.

Safety: The accumulator ensures independent braking in the event of a problem. (It guarantees up to 5 braking operations). The unit also has a safety valve that limits the pressure to 100 bar. A 25-micron filter protects the system at the braking unit inlet. A non-return valve maintains the pressure within the system during braking. When carrying out maintenance on the unit, an internal bleed screw enables the accumulator pressure to be eliminated to prevent accidents.

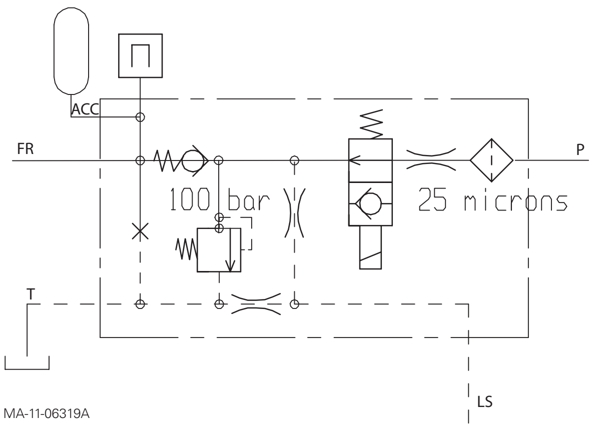

Fig. 2

Legend (Fig. 3)

1- Pressure from the pump
2- XLS signal
3- 25 μ filter
4- 100 bar relief valve
5- Accumulator
6- Return to tank
7- Pressure to braking system
8- Internal bleed screw
9- Pressure sensor
10- Solenoid valve

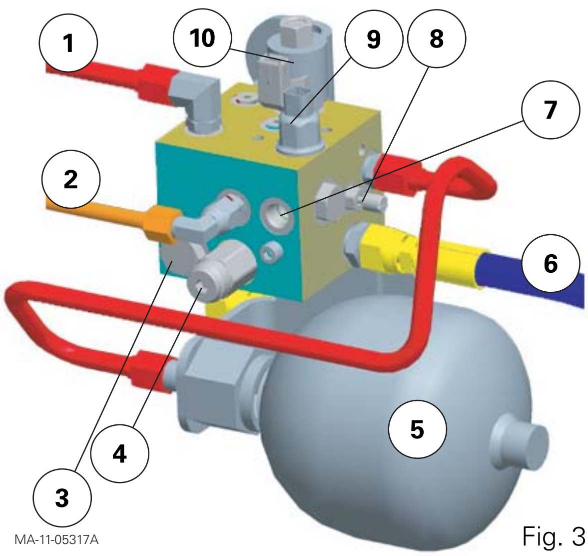

Fig. 3

C . Composition of the system

Hydraulic (Fig. 4 and Fig. 5).

- "Hydraforce" hydraulic unit: This unit has a spool valve, a non-return valve, a 25 µ filter and an internal bleed screw. It returns the regulated hydraulic pressure to the braking system.
- Pressure sensor (**TR44**): The pressure sensor is fitted to the braking unit. It measures the instantaneous pressure in the system and sends an analogue signal to Autotronic 5 no. 1. It is supplied with 5 V via the voltage converter.
- Solenoid valve (**L8**): The normally closed solenoid valve is fitted to the braking unit. Depending on the supply voltage to the solenoid valve terminals (0 or 12 V), Autotronic 5 enables the braking system pressure to be adjusted (accumulator inflation).
- Accumulator: This reserves a sufficient quantity of hydraulic pressure to enable 5 braking cycles as required.

Electronic (Fig. 4 and Fig. 5).

- Autotronic 5 no. 1 (**CAB151**): Located on the right-hand side inside the cab with a violet disc to identify it. It enables the pressure within the system to be controlled via the voltage converter, pressure sensor and solenoid valve. In the event of a system fault, an error code is displayed on the DCC2 DOT MATRIX screen.
- Voltage converter (**CAB171**). The voltage converter is fitted inside the cab, in the floor to the right of the operator's seat, and is connected to the transmission harness. It is connected to Autotronic 5 no. 1 in order to convert a voltage of 9.5 V at the controller output to a voltage of 5 V to supply the pressure sensor.

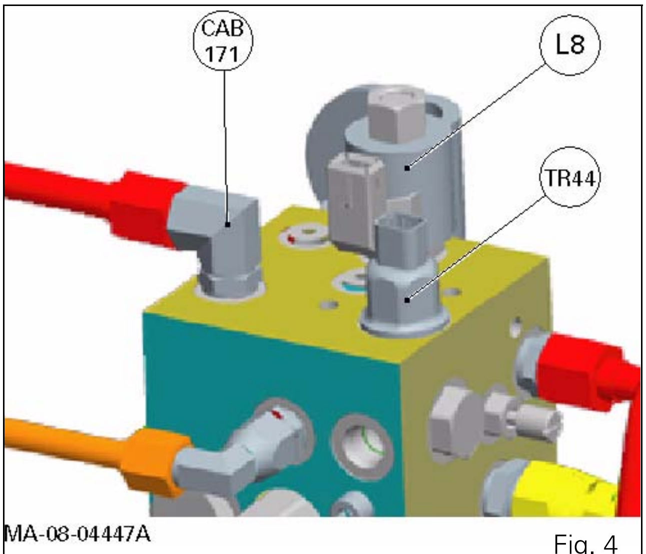

Fig. 4

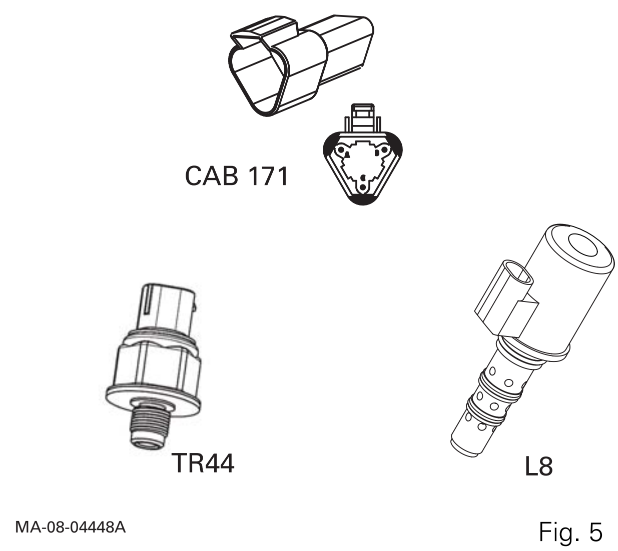

Fig. 5

9E21 - High-pressure braking - high-pressure braking unit

CONTENTS

A . General

The high-pressure braking unit is fitted to tractors equipped with a GTA1540 or GTA2520 transmission:
- as standard on 50 kph tractors
- as an option on 40 kph tractors

The high-pressure braking unit (1) mainly comprises (Fig. 1, Fig. 2):

- **Hydraulic part**
  - a 25 µ filter (3)
  - a pressure relief valve set to 102 bar (4)
  - an accumulator (5)
  - a non-return valve (7)
  - a drain screw (8)
- **Electronic part**
  - a pressure sensor (9)
  - a solenoid valve (10)

  ***Note:** In this section, only the electronic part in the main lines is described. A more detailed description is contained in a specific section (see chapter 11).*

The high-pressure braking unit is connected to the block/valve assembly (13) which is fixed onto the front bulkhead of the cab (Fig. 2) and forward of the brake pedals (see chapter 9, section dedicated to the block/valve assembly).

The high-pressure braking system may be fitted with a trailer brake mechanism.

The high-pressure braking unit and block/valve assembly (13) are managed by the tractor's electronic system.

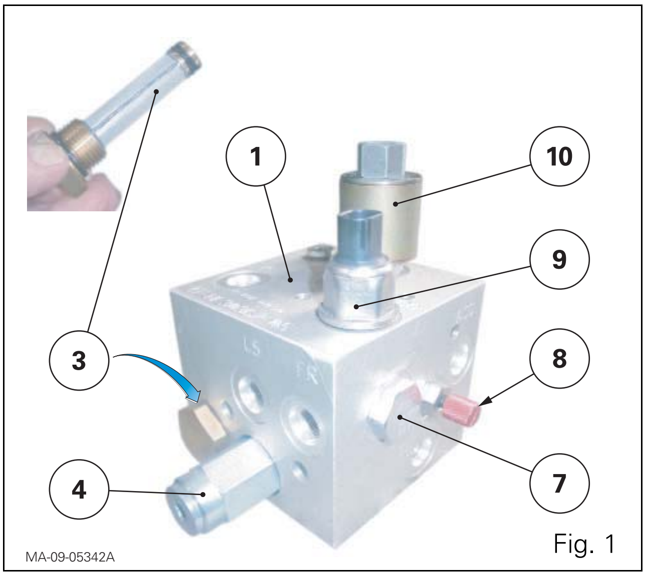

Fig. 1

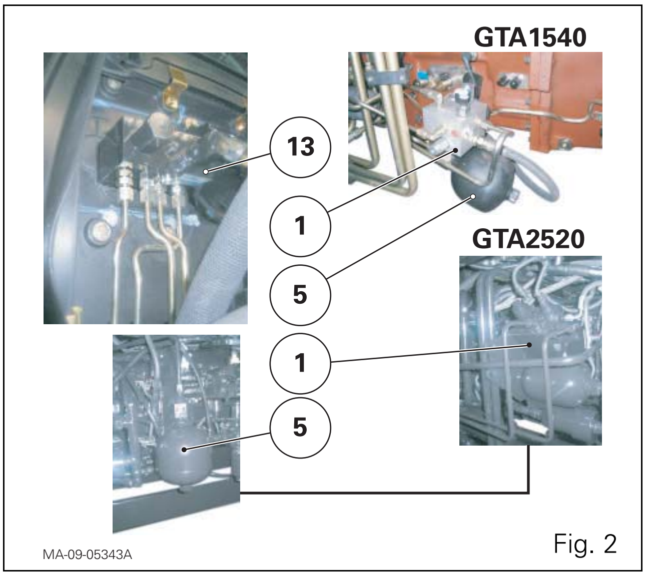

Fig. 2

Operation

The tractor's electronic system controls the high-pressure braking system via information received from the pressure sensor (9) (Fig. 3).

Normal operation (Fig. 2)

The hydraulic operating principle of the high-pressure braking unit (1) is to maintain a permanent pressure of between 80 and 95 bar inside the system and the block/valve assembly (13). To do this, the high-pressure braking unit is must comply with two separate operating phases: the connection and disconnection phases.

Connection phase (Fig. 4)

If the hydraulic pressure inside the high-pressure braking system (1) drops to between 70 and 80 bar, the tractor's electronic system shuts off the electrical supply to the solenoid valve (10) via the pressure sensor (9) (Fig. 3). The solenoid valve spool then moves down to the opening position under the action of the spring (6). The oil under pressure flowing from the variable displacement pump through the line (P) via the 25 µ filter (3) forces the non-return valve (7) to open, by compressing the spring (2). The oil under pressure is then permitted to pass through the line (FR) to the block/valve assembly (13) (Fig. 2) and through the line (ACC) to the accumulator (5).

***NOTE:** If there is a fault in the supply from the hydraulic line coming from the variable displacement pump, the non-return valve (7) closes so that the pressure stored inside the accumulator (5) keeps the hydraulic lines (FR) and (ACC) charged and therefore provides the tractor with independent braking.*

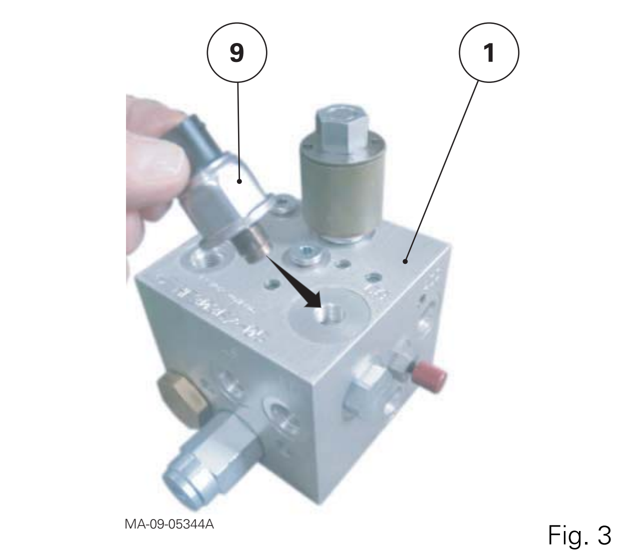

Fig. 3

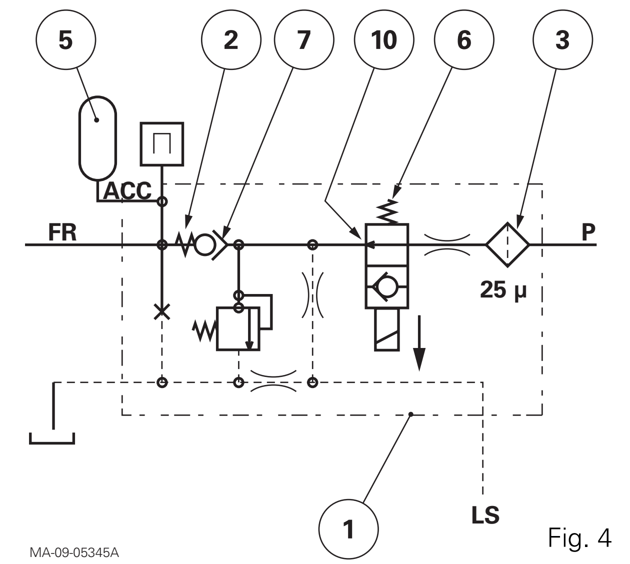

Fig. 4

Disconnected phase (Fig. 5)

If the hydraulic pressure inside the high-pressure braking system (1) reaches 95 bar, the tractor's electronic system activates the solenoid valve (10) (12 V) via the pressure sensor (9) (Fig. 3). The solenoid valve spool then moves upwards to the closed position, forcing the pressurised flow of oil from the variable displacement pump via the line (P) and via the 25 µ filter (3) to be reduced or interrupted.

***Note:** If the pressure of the hydraulic line (P) is equal to or higher than 102 bar, the pressure relief valve (4) opens gradually and the excess pressure is directed towards the return (T) (Fig. 6).*

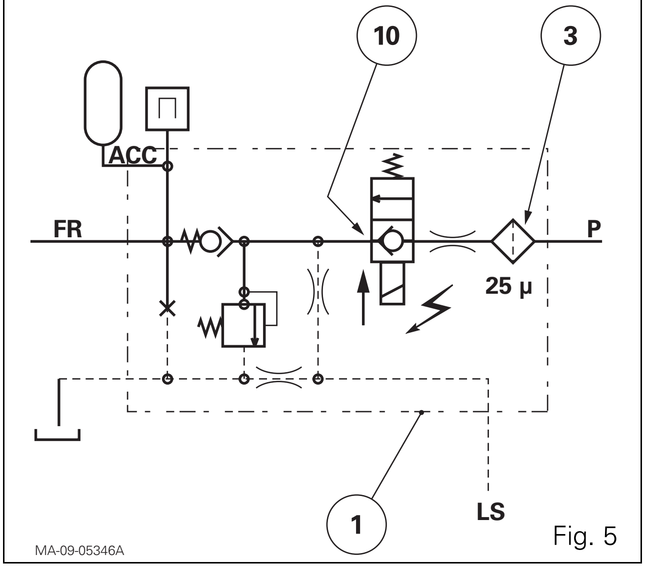

Fig. 5

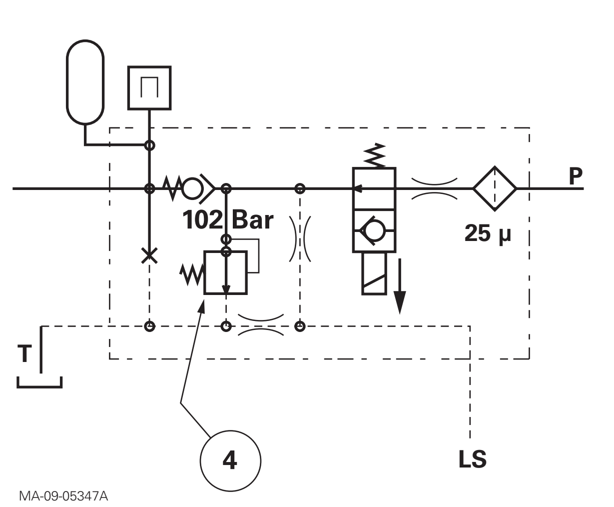

Fig. 6

Degraded operation

If the pressure in the high-pressure braking system and the block/valve assembly drops below 70 bar, the tractor's electronic system is informed of the fault and locks the braking system in degraded mode. In this case, the tractor's forward speed is systematically restricted. A connection time of 16 seconds is then assigned to the braking system for each action on the brake pedals. During this connection time, the accumulator (5) fills to make the hydraulic lines (FR) and (ACC) safe (Fig. 4) (for more details, see chapter 11).

B . Layout of components and identification of hydraulic ports

Components (Fig. 7 to Fig. 9)

(1) High-pressure braking unit

(3) Filter (25 µ)

(4) Pressure relief valve set to 102 bar

(5) 1.4 l accumulator

***Important:** The pressure should be checked every six months, with the engine stopped.*

(7) Non-return valve

(8) Drain screw

***Note:** This drain screw is used to drop the pressure inside the accumulator (5) and the block/valve assembly system prior to carrying out any operations on the hydraulic system.*

(9) Pressure sensor

***Note:** The pressure sensor is used to record the high-pressure braking unit pressure in order to manage the connection and disconnection phases.*

(10) Solenoid valve (0/12 volts)

Hydraulic ports (Fig. 7)

ACC Port to accumulator

FR Port to block/valve assembly (13) (Fig. 2)

LS Load Sensing signal port to the hydraulic unit with two priority blocks

P High-pressure port from the variable displacement pump via the hydraulic unit with two priority blocks

T Return port

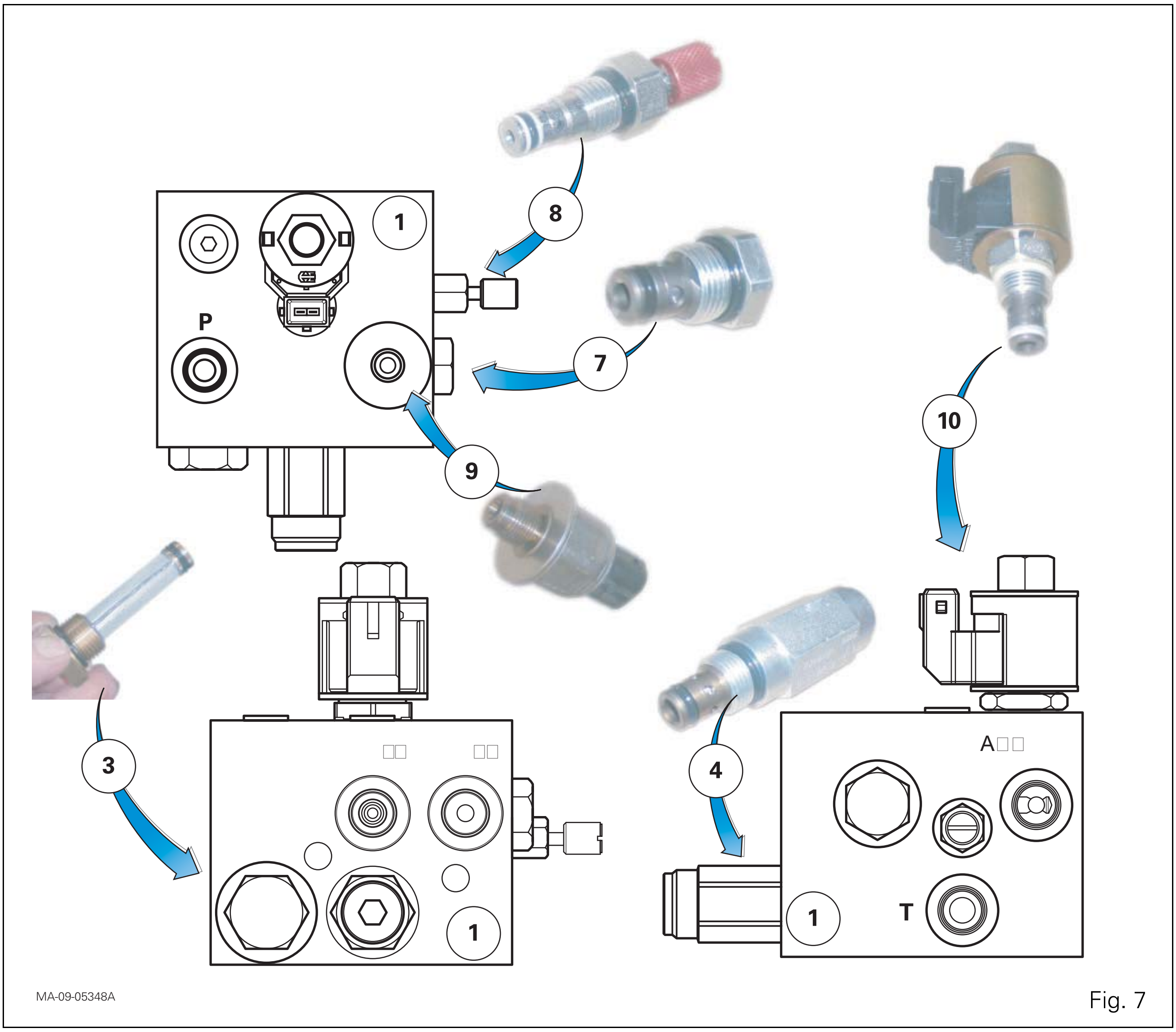

Fig. 7

High-pressure braking - high-pressure braking unit

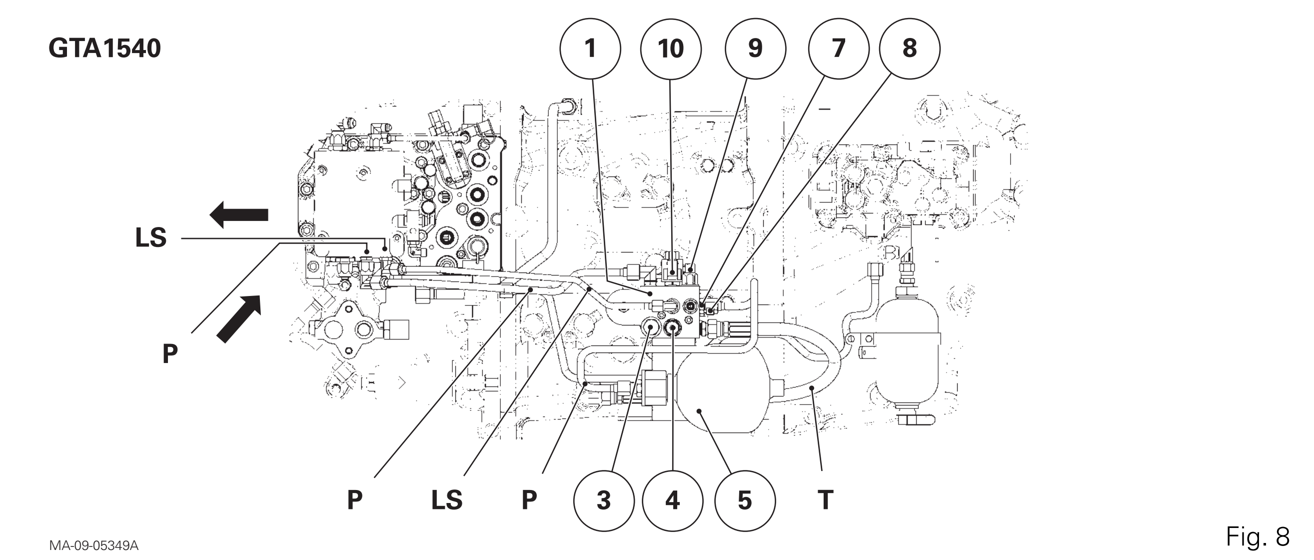

Fig. 8

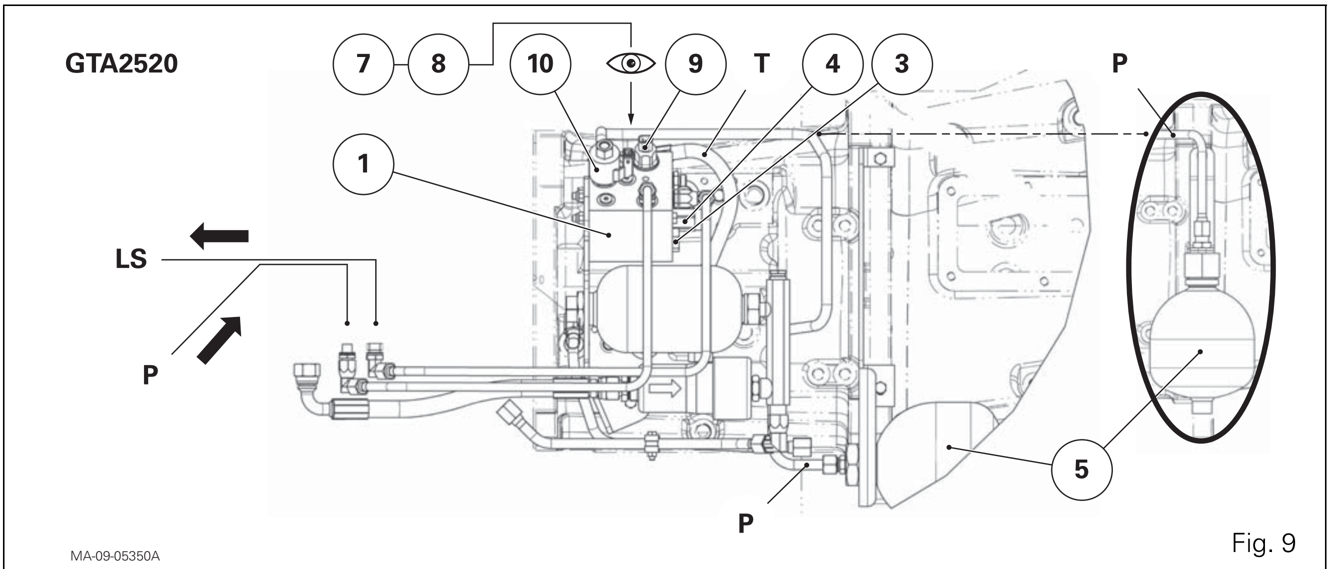

Fig. 9

C . Removing and refitting the high-pressure braking unit

Preliminary steps

1. Immobilise the tractor.
If the tractor is not fitted with a ParkLock device, engage the hand brake.
Chock between the frame and the front axle.

2. Remove the rear right-hand wheel.
Place a safety stand under the trumpet housing.

Removal

3. Disconnect the following from the high-pressure braking unit (Fig. 10):
- the harness (TR44) connected to the pressure sensor
- the harness (L8) connected to the solenoid valve

4. Disconnect the hydraulic pipes from the high-pressure braking unit.

***DANGER:* Certain hydraulic connections for the high-pressure braking unit are under high pressure, even when the tractor's engine is stopped. As a result, before disconnecting one or more of these hydraulic connections, first release the pressure stored inside the accumulator. To do this, gradually unscrew the knurled section of the drain screw (8) (Fig. 10) (maximum slackening is approximately four turns) in order to release the high pressure stored inside the accumulator and the high-pressure braking unit.**

***NOTE:* On GTA2520 transmissions, the drain screw (8) can be accessed via the face (F) of the high-pressure braking unit. This face (F) is facing towards the GBA25 gearbox housing.**

5. Release the return hose (at the high-pressure braking unit end) without unscrewing it fully.

6. Remove the surrounding components which may hinder access to the high-pressure braking unit.

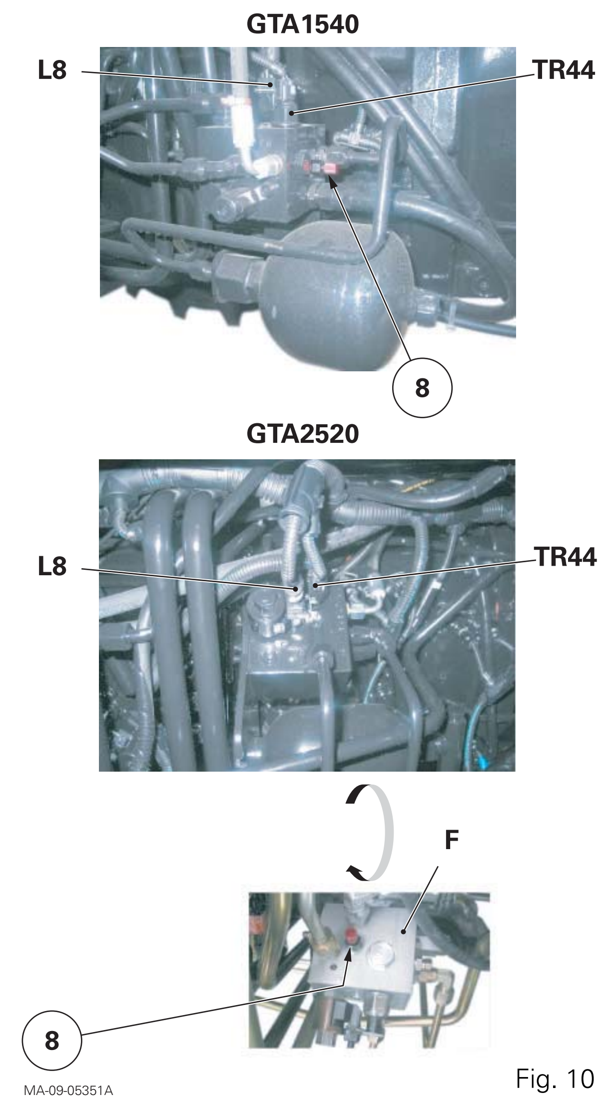

Fig. 10

7. To prevent transmission oil draining out when disconnecting the return hose from the high-pressure braking unit, proceed as follows:
   - Separate the high-pressure braking unit and its return hose from the support.
   - While vertically supporting the high-pressure braking unit and its return hose in the top position, finish disconnecting the hose by unscrewing it fully from the high-pressure braking unit.
   - As soon as the hose is disconnected, plug its upper end with a sealing plug.

     NOTE: *The second end of this hose, which is not to be disconnected, is connected to the bottom section of the gearbox and underneath the oil level.*
8. Remove the high-pressure braking unit from the tractor.
9. If necessary, place the high-pressure braking unit on a clean workbench.
10. If necessary, unscrew the following from the high-pressure braking unit:
    - the electrohydraulic components
    - the hydraulic unions

    NOTE: *When carrying out any operations, always ensure that each electrohydraulic component is kept clean.*

Refitting

11. If necessary, screw the electrohydraulic components back onto the new or re-used high-pressure braking unit according to the procedure described in § D.

    NOTE: *As for removal, refitting must be carried out in a clean environment.*
12. Refit the high-pressure braking unit to the tractor by carrying out steps 3 to 7 in reverse order.
13. Screw on the knurled section of the drain screw (8) up to its stop, in order to eliminate any atmospheric connections with the internal lines of the high-pressure braking unit.

Final steps

14. Refit the wheel.

    Remove the axle stand.

    Tighten the screws and nuts to their indicated torque, depending on the version (see chapter 6).
15. Start the tractor engine. With the engine at idle, wait several moments until the hydraulic and electronic functions have re-stabilised. Check that there are no system faults displayed on the instrument panel.
16. Move the tractor several metres at slow speed. Apply and release each brake pedal to carry out an initial operating test of the high-pressure braking unit.
17. Check the sealing of the high-pressure braking unit and check the sealing of the hydraulic unions.
18. Check the pressure of the trailer brake (if fitted) on the quick coupler located at the rear of the tractor (see chapter 9).
19. Carry out a road test on the brake system.

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D . Electrohydraulic components and accumulator fitting procedure

20. Check that there is no dirt at the inlet of each of the hydraulic ports on the high-pressure braking unit and its accumulator.

21. Check for the presence and check the condition of the seals on the components (3) (4) (7) (8) (10) (Fig. 11).

22. Screw on and tighten the components according to the table below.

Component (Fig. 11)	Tightening torque	Assembly instructions
(3)	60-70 Nm	Prior to assembly, check that the 25 µ filter strainer is clean.
(4)	26-27 Nm	
(5)	150-170 Nm	Sealing of the accumulator (5) is obtained by a copper seal. In addition to the sealing provided by this seal, the thread of the accumulator should also be lightly smeared with Loctite 577 or equivalent.
(7)	26-27 Nm	
(8)	15-16 Nm	The knurled section of the drain screw (8) must be tightened by hand without using a tool.
(9)	33-36 Nm	Sealing of the pressure sensor is obtained by a copper seal.
(11)	6.3-6.8 Nm	
(12)	26-27 Nm	

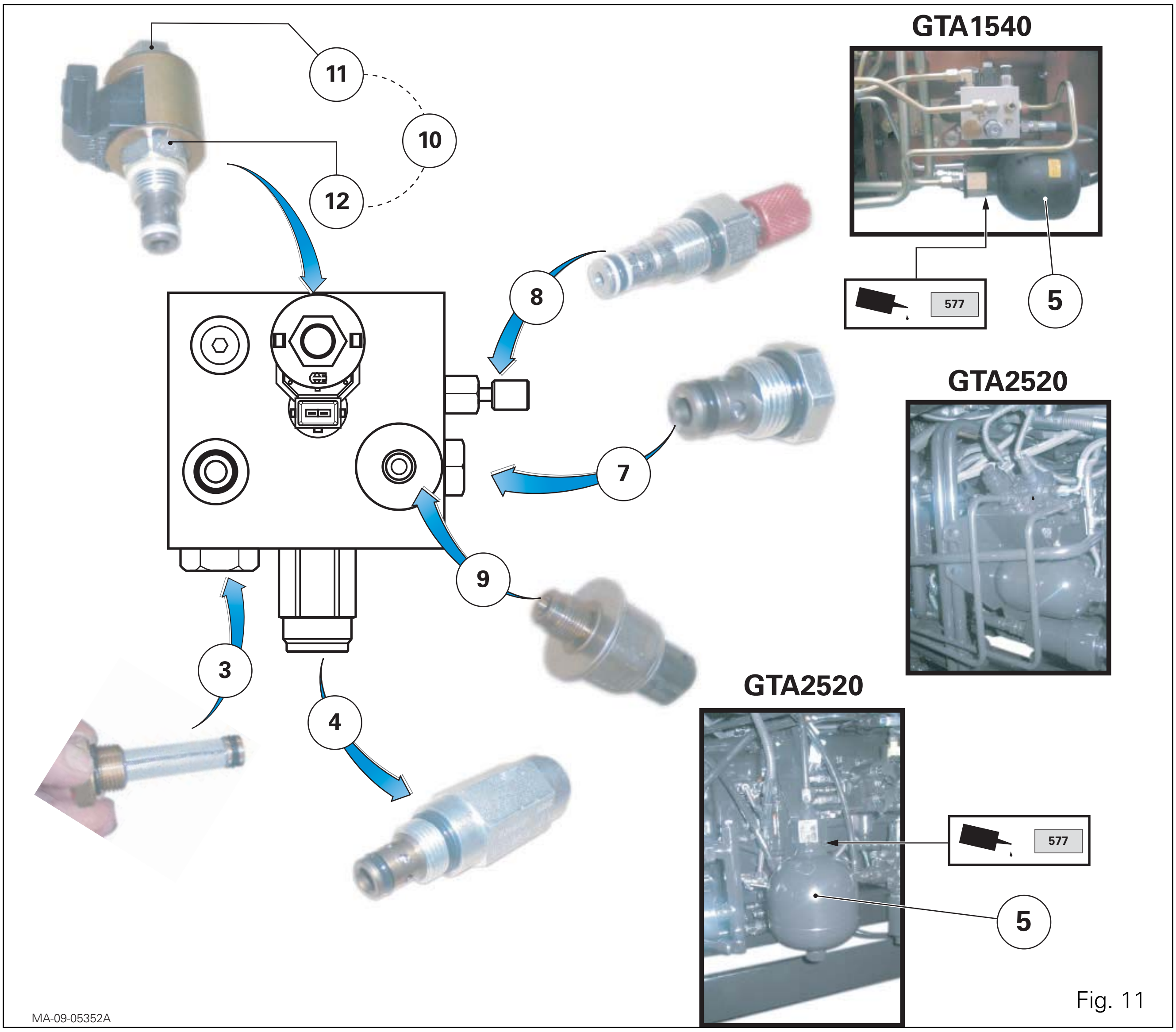

GTA1540
GTA2520
GTA2520
577
577
11
10
12
8
7
9
3
4
5
5
MA-09-05352A

Fig. 11

9E22 - High-pressure braking - block/valve assembly

CONTENTS

A . General

The block/valve assembly (13) is fitted to tractors equipped with a GTA1540 or GTA2520 transmission:

- as standard on 50 kph tractors
- as an option on 40 kph tractors

It is fixed onto a support (S) (Fig. 1), which is fixed to the front right-hand side of the cab.

The block/valve assembly (13) is hydraulically linked to the high-pressure braking unit (see section on the high-pressure braking unit, chapter 9). It manages the high pressure that it receives from the high-pressure braking unit (1) (Fig. 6) via the brake pedals (P) and the two sets of straight bearings (r) (Fig. 2). The output pressure is then directed to the main brake mechanism (right and/or left-hand brake) located inside the GPA20 or GPA40 rear axle housing and inside the trumpet housings.

***Note:** The brake pedals may be uncoupled or coupled together using the latch (1) (Fig. 3).*

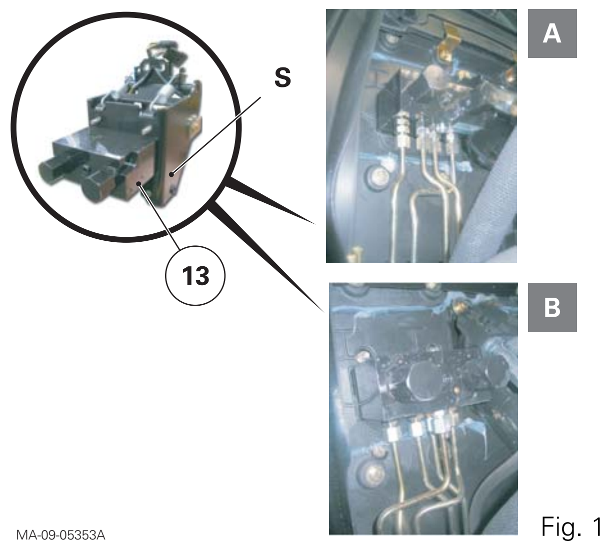


Fig. 1

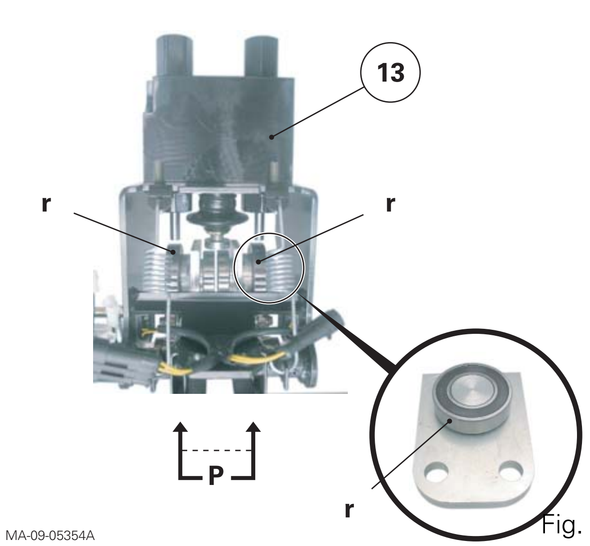


Fig. 2

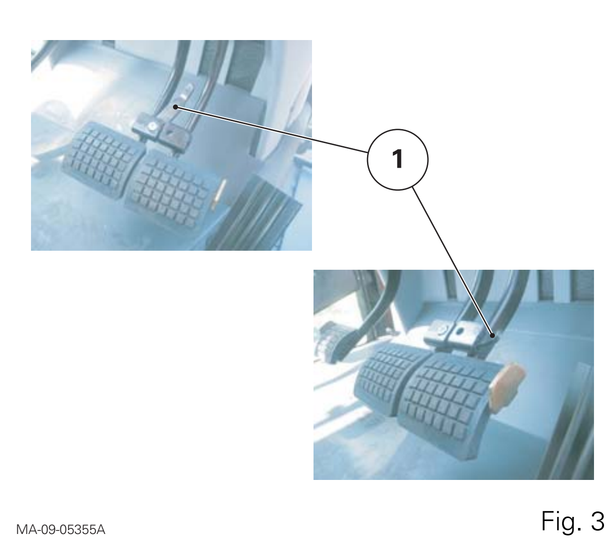


Fig. 3

B . Identification of ports and main components

A Block/valve assembly without trailer braking (Fig. 1, Fig. 5)

B Block/valve assembly with trailer braking (Fig. 1, Fig. 5, Fig. 6)

C Hydraulic unit with two priority blocks and closed centre (Fig. 6)

Identification of ports

The block/valve assembly (13) (Fig. 4) is one of the pressurised control components of the tractor's main brakes. It is identical whether the tractor is fitted with a trailer brake mechanism or not. If the tractor is not fitted with this mechanism, a threaded plug blanks off the tapped port designed for the hydraulic line (FR) (trailer brake) to the block/valve assembly.

The block/valve assembly is identified by its specifications, which are written on an adhesive plate (1) (Fig. 4).

The block/valve assembly has the following five hydraulic lines (Fig. 4):

(F1) Pressure delivered to the main left-hand brake

(F2) Pressure delivered to the main right-hand brake

(FR) Control pressure to the trailer brake valve

(P) High pressure from the high-pressure braking unit

(T) Return

Note: *These hydraulic ports are identified by the letters and numbers engraved on the body of the block/valve assembly.*

Legend (Fig. 5)

- High pressure
- Braking pressure
- Return
- Control

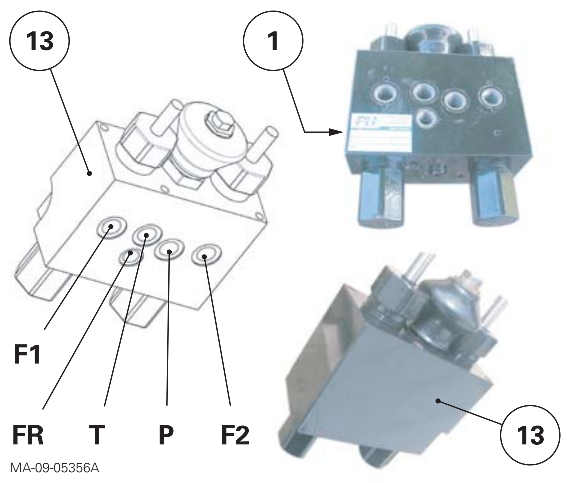
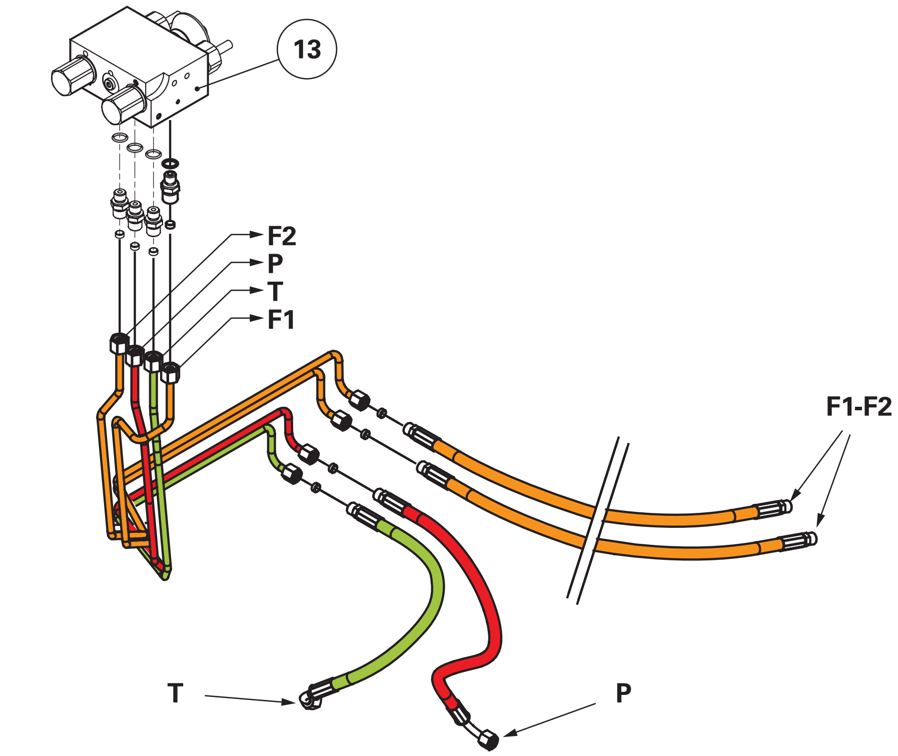


Fig. 4

A



B

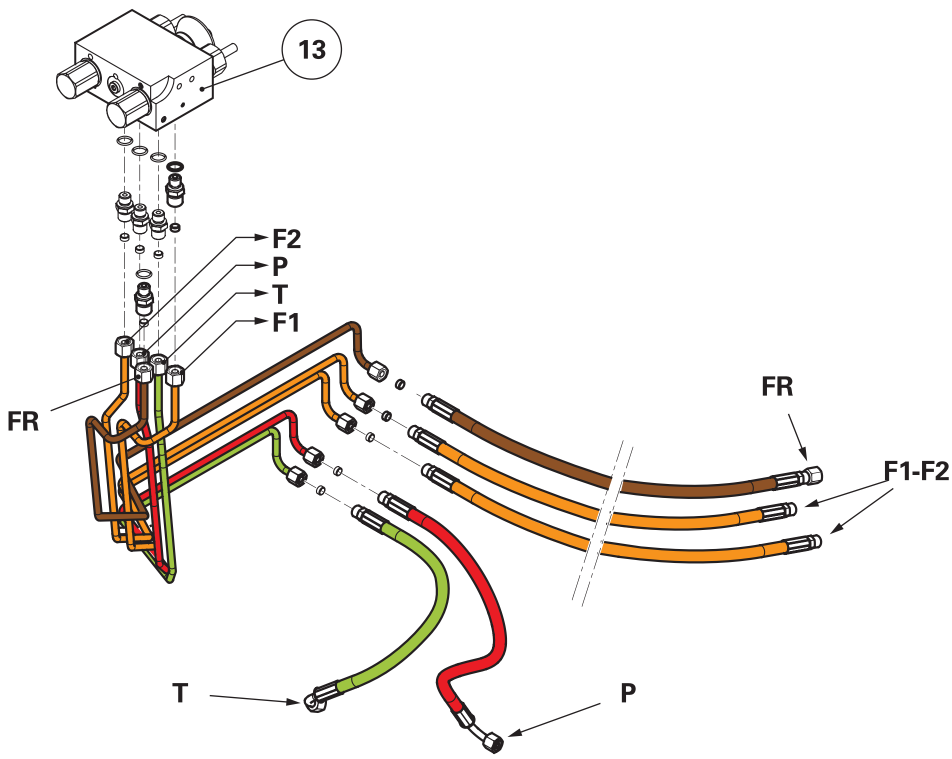


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Fig. 5

High-pressure braking - block/valve assembly

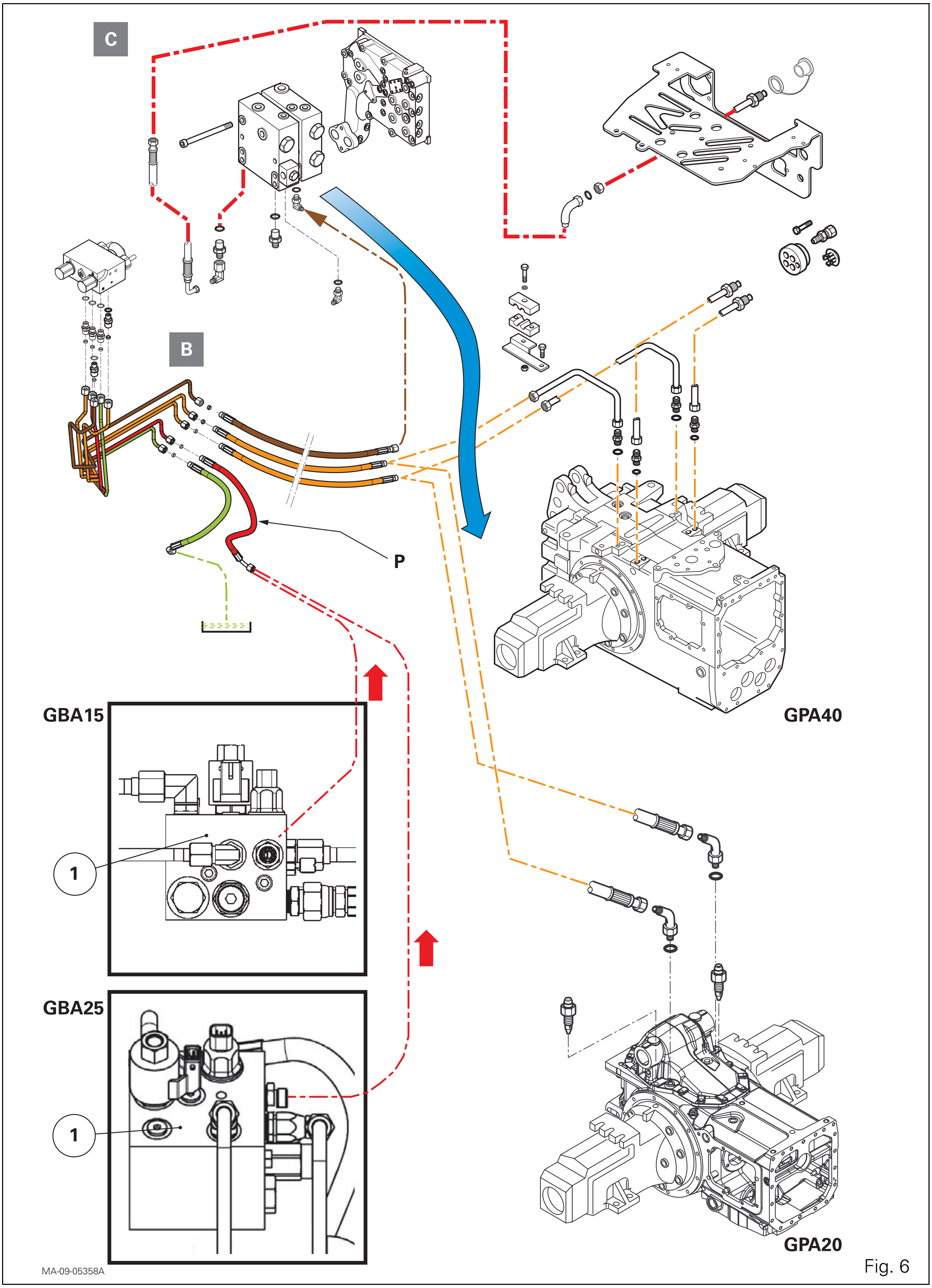


Fig. 6

Identification of the main components

The block/valve assembly (13) comprises the following main components (Fig. 7, Fig. 8, Fig. 9):

(b) Spool spring and plug
(c) Block/valve assembly body
(c1) Valve
(p) Guard
(pp) Main piston and head
(t1) Spool
(t2) Spool

Important: *The spare parts catalogue does not include replacements for main hydraulic components. Only the seals currently have a part number reference and can be replaced. If a serious hydraulic fault occurs on the block/valve assembly (13), replace the worn block/valve assembly with a new block/valve assembly of the same specification.*

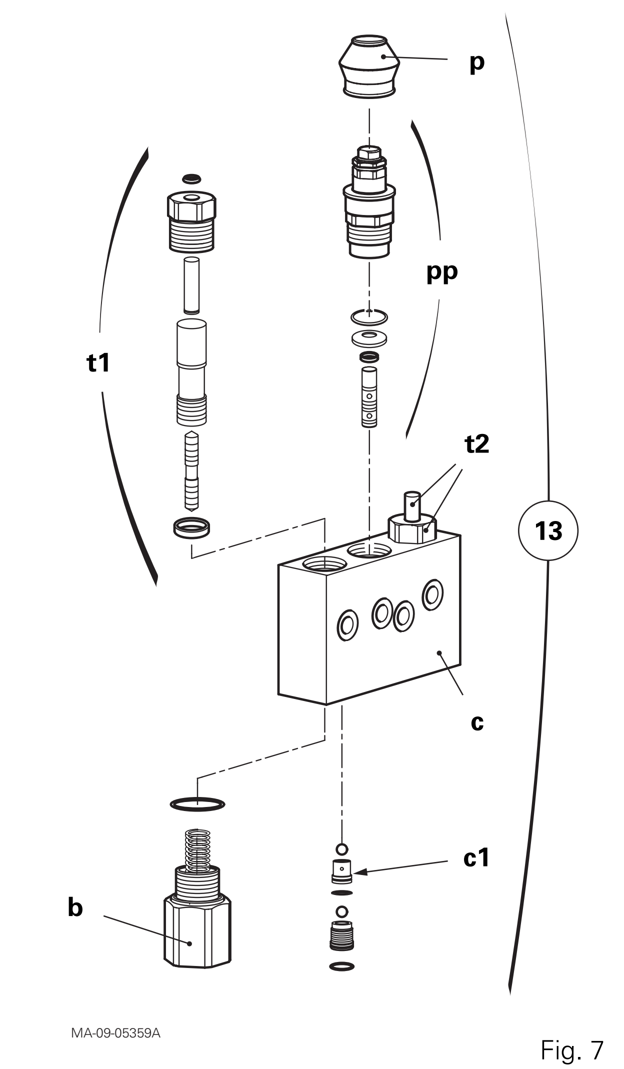


Fig. 7

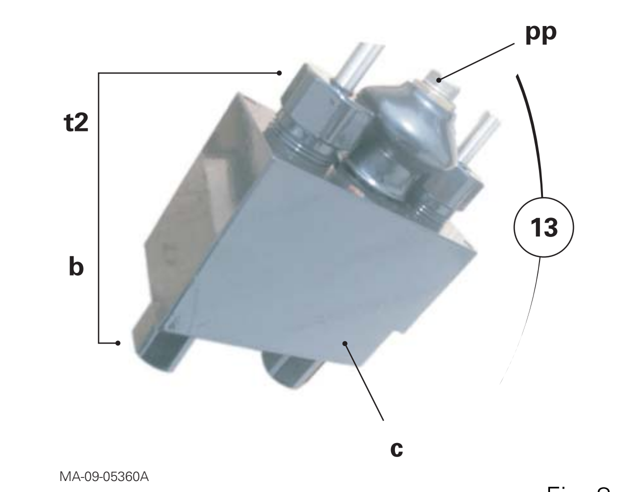


Fig. 8

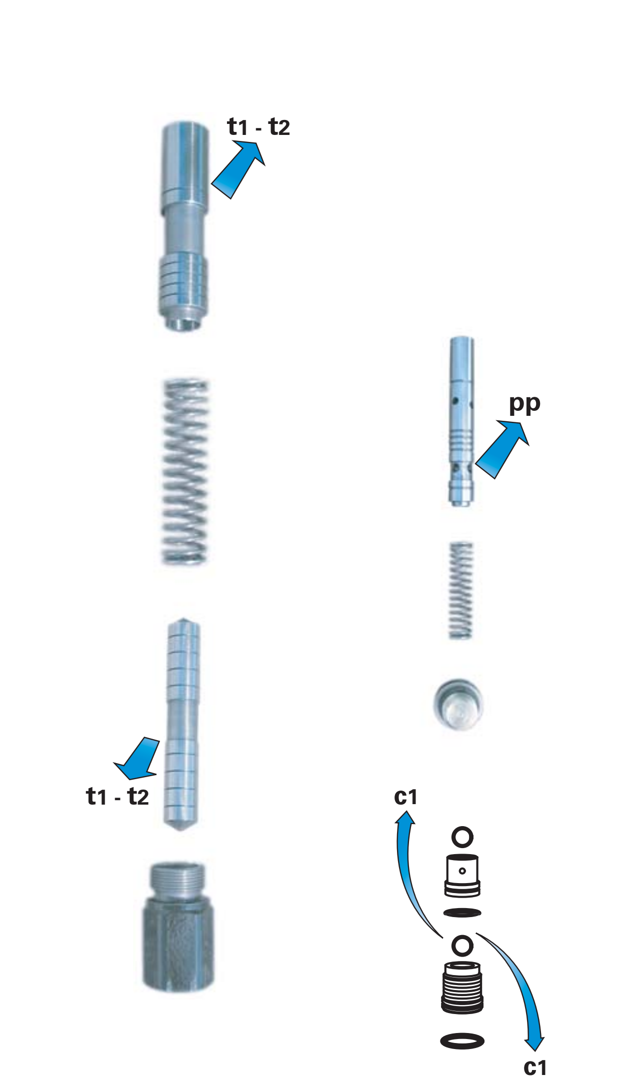


Fig. 9

C . Diagram

The diagram (Fig. 10) of the block/valve assembly (13) provides a symbolic representation of the hydraulic layout of the following main components:

- the valve (c1), which is systematically integral with the block/valve assembly whether the tractor is fitted with a trailer brake mechanism or not
- the main spool (pp), which receives the high pressure from the high-pressure braking unit
- the spool (t1) for the hydraulic line (F1)
- the spool (t2) for the hydraulic line (F2)

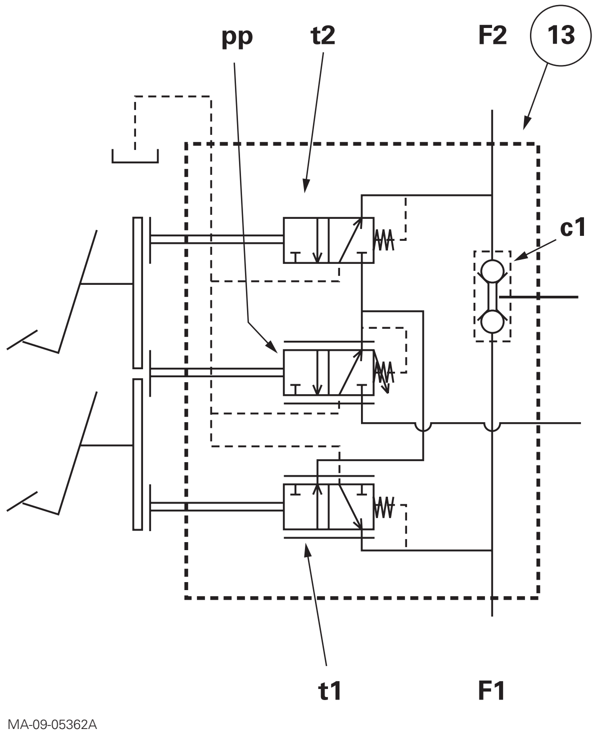


Fig. 10

D . Operation

The block/valve assembly's main piston (pp) and spools (t1) and (t2) are controlled:

- either in mode 1: pedals uncoupled (Fig. 11)
- or in mode 2: pedals coupled (Fig. 12)

NOTE: *Irrespective of the mode, the main piston (pp) is always controlled.*

Legend (Fig. 11, Fig. 12)

- High pressure
- Braking pressure
- Return
- Control

Mode 1: pedals uncoupled (Fig. 11)

When just one brake pedal is pressed, the main piston (pp) and the spool (t1) or (t2) (depending on which pedal is used) act simultaneously. The oil under high pressure from the high-pressure braking unit and the port (P) on the block/valve assembly passes via the main piston (pp) and is then directed to the spool (t1) or (t2). The high pressure is then directed to the relevant brake piston on the centre housing via the hydraulic line (F1) or (F2) (depending on which brake pedal is used) according to the force applied to the brake pedal.

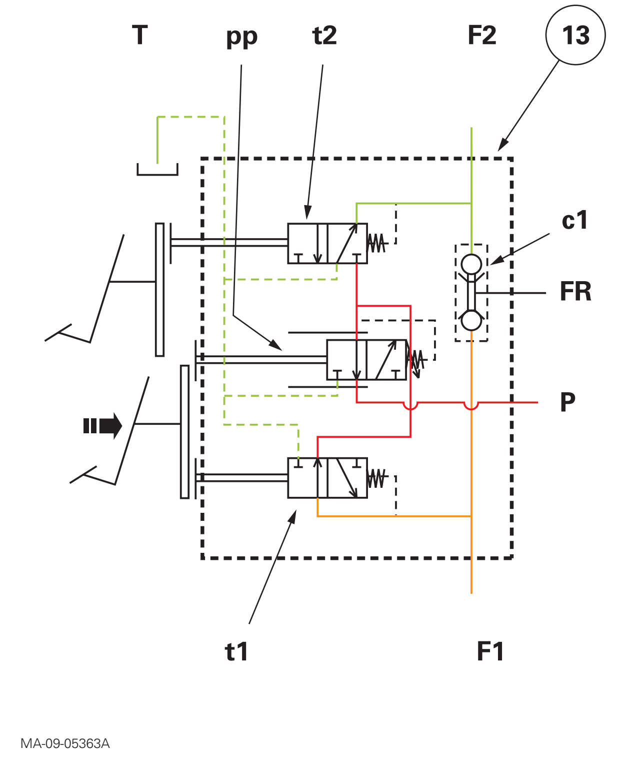
NOTE: *Fig. 11 shows line F1 under hydraulic activity.*

In mode 1, the valve (c1) simultaneously blocks the passage of oil to the hydraulic lines (F1) or (F2) (depending on which brake pedal is used) and (FR) (trailer brake, if fitted).

Mode 2: pedals coupled (Fig. 12)

When both brake pedals are pressed, the main piston (pp) and the two spools (t1) and (t2) act simultaneously. The oil under high pressure from the high-pressure braking unit and the port (P) on the block/valve assembly passes via the main piston (pp) and is then directed to the spools (t1) and (t2). Like in mode 1, when the brake pedals are uncoupled, the high pressure is then directed to the brake pistons on the centre housing via the hydraulic lines (F1) and (F2) according to the force applied to the two brake pedals.

In mode 2, the equal pressure exerted either side of the valve (c1) releases the flow of oil to the hydraulic lines (F1), (F2) and (FR) (trailer brake, if fitted).



T
pp
t2
F2
13
c1
FR
P
t1
F1
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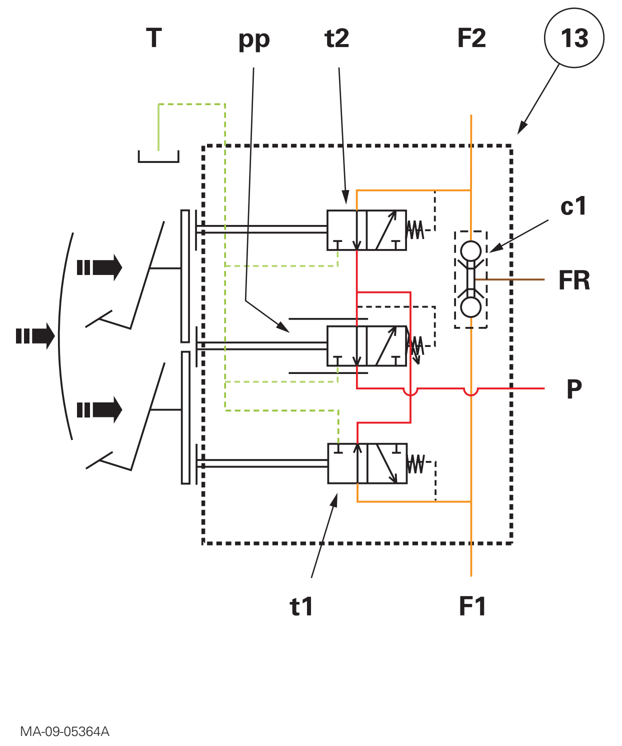
Fig. 11



T
pp
t2
F2
13
c1
FR
P
t1
F1
MA-09-05364A

Fig. 12

E . Bleeding the main brake system

Bleeding the main brake system is carried out as normal. Therefore, simply open the two bleed screws slightly and keep the two coupled brake pedals constantly and moderately depressed. In this configuration, the oil drains from the bleed screws only and under pressure.

Preliminary steps (Fig. 13)

1. Remove the protective rubber caps (3) from the bleed screws (1) situated on the rear support of the auxiliary spool valves.

2. Force-fit the end of two locally obtained transparent pipes (T) onto each bleed screw to obtain a secure and efficient connection between the pipe and the bleed screw.

__Note:__ This fitting precaution prevents the transparent pipe from coming loose from the bleed screw when bleeding the main brake system.

Bleeding

3. Carry out the following operations with the assistance of an operator:
- Start the engine and stabilise the engine speed at approximately 1300 rpm.
- Bring the oil up to operating temperature (optional).
- Open the two bleed screws by approximately one turn.
- Moderately depress the two brake pedals (coupled beforehand).

  __Note:__ Moderately depressing the brake pedals generates a force of approximately 30 kg.
- Check that the oil under pressure is draining into each transparent pipe free of any air bubbles. When there are no longer any air bubbles, tighten the two bleed screws.

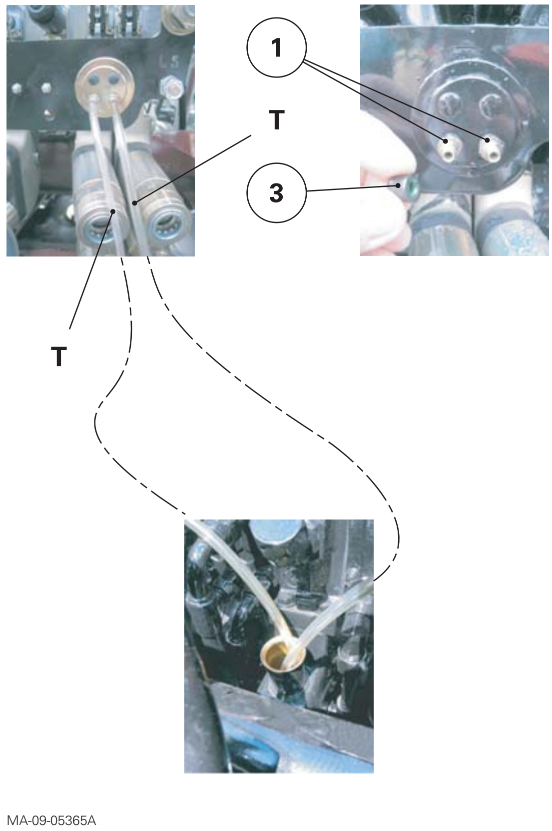


Fig. 13

Operating test

4. Check the hardness under force of the brake pedals when coupled and uncoupled.
5. Move the tractor several metres at slow speed. At the same time, apply and release each brake pedal to carry out an initial operating test of the main brake system. Repeat the test with the pedals coupled.

Final steps

6. Check the tightness of the bleed screws and the hydraulic unions.
7. Refit the protective rubber caps onto the bleed screws.
8. Carry out a road test on the main brake system.

   If an operating problem occurs, check the electronic functions of the high-pressure braking unit (see chapter 11) and remedy any faults.

   If the problem persists, carry out the bleed operation a second time. If the problem still persists, switch off the engine and check the sealing of:
   - the main brake system
   - the high-pressure braking unit
   - the high-pressure block/valves
   - the brake piston seals located inside the rear axle centre housing

F . Bleeding the trailer brake system

If the tractor is fitted with a trailer brake mechanism, it is strongly recommended to bleed the main brake and trailer brake systems simultaneously.

To bleed the trailer brake system, use the same equipment and the same method as described in § E, taking care to observe the following points (Fig. 14):

- Open:
  - the two bleed screws (1) of the main brakes;
  - the trailer brake bleed screw (2).

    Note: *This bleed screw is located on the outer priority block (16) of the hydraulic unit with two priority blocks (closed centre hydraulic system).*
- When the bleeding is complete, tighten in the following order (optional):
  - the left-hand brake bleed screw (1);
  - the right-hand brake bleed screw (1);
  - the trailer brake bleed screw (2).
- Check the trailer brake pressure on the quick coupling (4) located at the rear of the tractor (see chapter 9). If this pressure is not correct, eliminate any air entering in the system. Repeat the bleeding procedure.
- Carry out a road test.

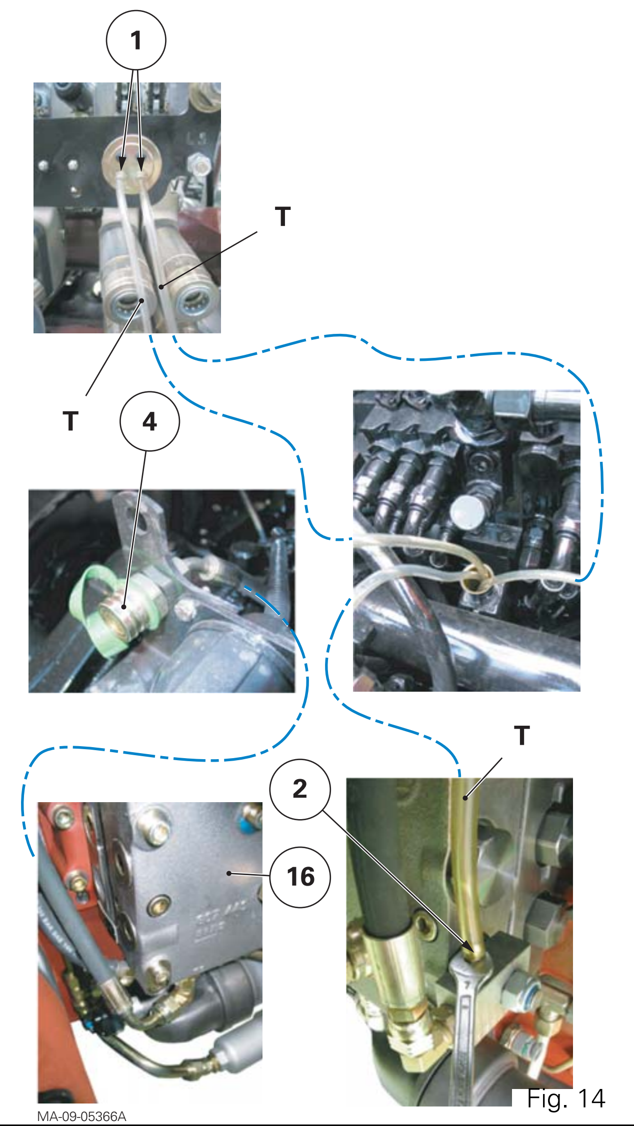


Fig. 14

9F20 - LS trailer braking

CONTENTS

A . General

The trailer brake mechanism comprises a hydraulic unit with two priority blocks. It is located on the right-hand hydraulic cover plate of the rear axle housing. The priority blocks are screwed together (Fig. 1).

The inner unit (7) (Fig. 1) ensures priority to the 17 or 21 bar system.

The outer unit (10) (Fig. 1) shares priority between the steering and trailer braking. Flow is then directed to the auxiliary spool valves and linkage spool valve (see chapter 9).

Note 1: *For the 40 kph version with trailer braking, the tractors are fitted with a hydraulic unit with two priority blocks. A trailer brake valve is integral with the outer priority block (10). It is supplied by the control pressure from the brake master cylinders when the brake pedals are locked together.*

Note 2: *For the version with high-pressure braking with or without a trailer brake, tractors are systematically fitted with a hydraulic unit with two priority blocks. These priority blocks can be distinguished from the priority blocks on the 40 kph version with trailer braking by a higher number of hydraulic ports. These additional hydraulic ports (M) and (N) (Fig. 2) are used by the high-pressure braking unit. A trailer brake valve is integral with the outer priority block (10). It is supplied by the control pressure from the block/valve assembly when the brake pedals are locked together.*

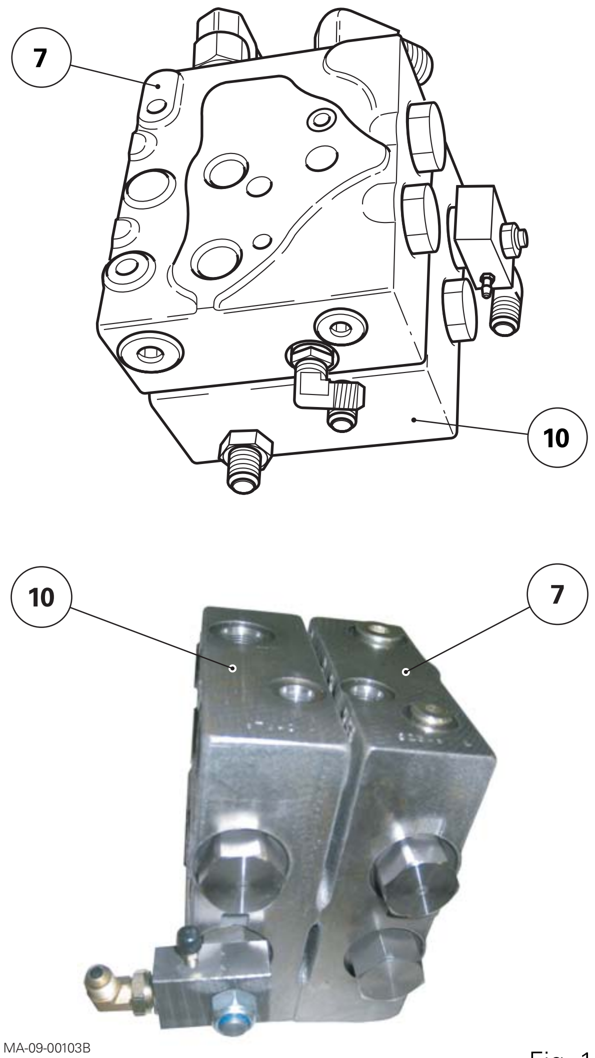


Fig. 1

B . Identification of 110 l/min Load Sensing ports

Parts list (Fig. 2 to Fig. 5)

(A)	Supply to steering spool valve (Orbitrol)
(B)	High-pressure supply from variable displacement pump
(C)	LS pilot flow to the variable displacement pump regulator
(D)	LS pilot flow from the steering spool valve (Orbitrol)
(E)	To trailer brake connector
(F)	Pressure to linkage valve and auxiliary spool valves
(G)	LS pilot flow from linkage valve and auxiliary spool valves
(I)	17 or 21 bar outlet
(J)	Plugs
(K)	Pilot flow from brake master cylinders (40 kph tractors) or block/valve assembly (tractors fitted with high-pressure braking)
(M)	High pressure internal channel to the braking unit (tractors fitted with high-pressure braking) (Fig. 2, Fig. 8)
(N)	LS pilot flow from the braking unit which is directed to the variable displacement pump regulator via a channel inside the priority block (10) (tractors fitted with high-pressure braking) (Fig. 2, Fig. 8)
(O)	Vent port (trailer brake line)

(P. dir)	Steering priority spool
(BP)	Low-pressure spool
(HP)	High-pressure spool

A	Hydraulic unit with two priority blocks for 40 kph tractors
B	Hydraulic unit with two priority blocks for tractors fitted with high-pressure braking

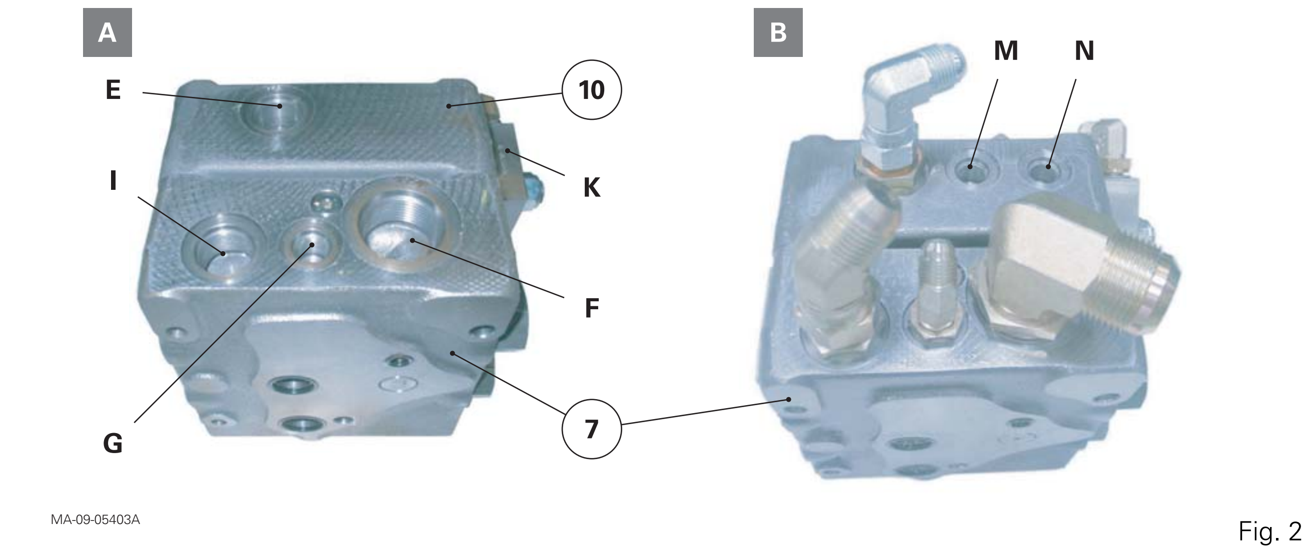


Fig. 2

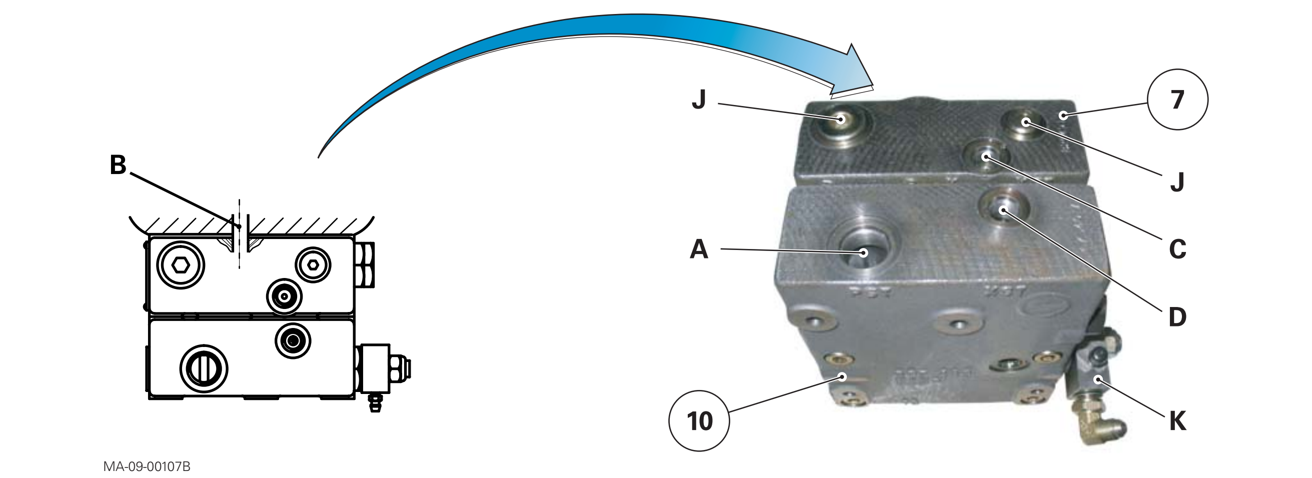


Fig. 3

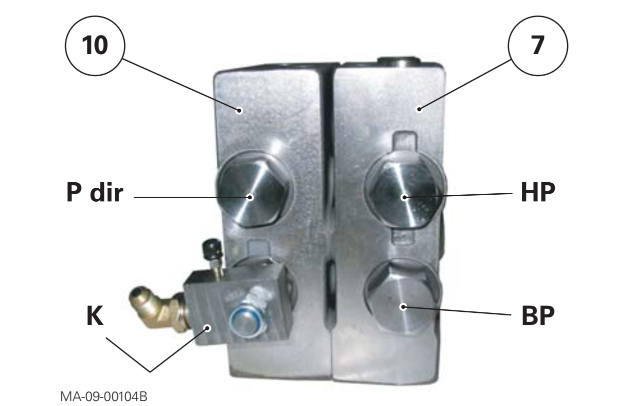


Fig. 4

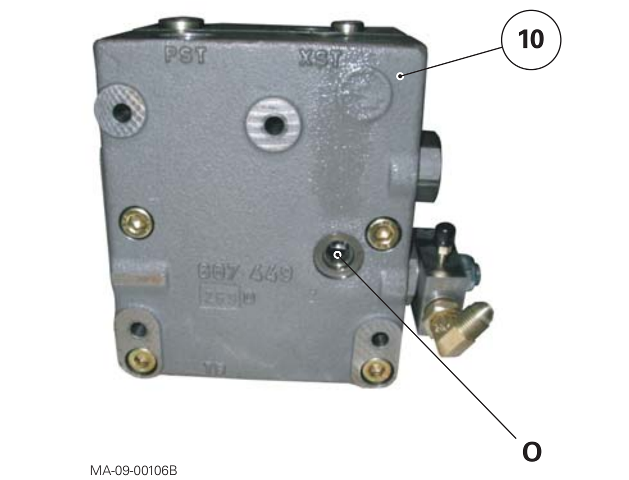


Fig. 5

Parts list (Fig. 6)

(A) Supply to steering spool valve (Orbitrol)

(C) LS pilot flow to the variable displacement pump regulator

(D) LS pilot flow from the steering spool valve (Orbitrol)

(E) To trailer brake connector

(F) Pressure to linkage valve and auxiliary spool valves

(G) LS pilot flow from linkage valve and auxiliary spool valves

(I) 17 or 21 bar outlet

(K) Pilot flow from brake master cylinders (40 kph tractors) or block/valve assembly (tractors fitted with high-pressure braking)

Note: *For tractors fitted with high-pressure braking without trailer braking, the hydraulic port (K) is blanked off with a threaded plug.*

(M) High pressure pipe to the braking unit (tractors fitted with high-pressure braking)

(N) LS signal pipe from the braking unit (tractors fitted with high-pressure braking)

(O) Vent port (trailer brake line)

B Hydraulic unit with two priority blocks for tractors fitted with high-pressure braking

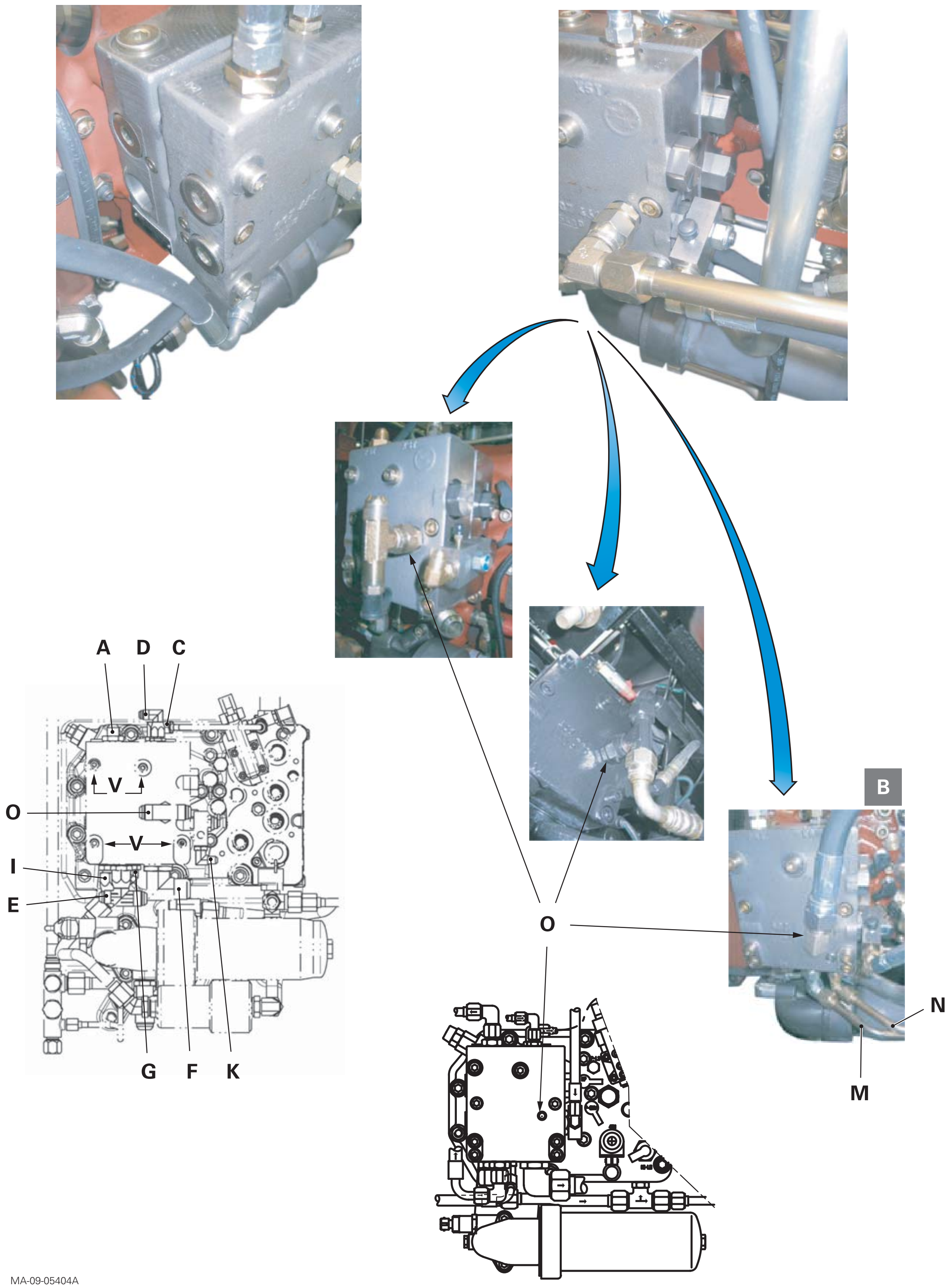


Fig. 6

C . Spool operation

A Priority block (10) GPA20, GPA30 and GPA40 for 40 kph tractors (Fig. 7)

B Priority block (10) GPA20 and GPA40 for tractors fitted with high-pressure braking (Fig. 8)

Note: *Tractors fitted with high-pressure braking have an outer block (10) which has two additional hydraulic ports (M) (pressure) and (N) (LS signal).*

Steering priority spool (2) (Fig. 7 to Fig. 11)

The spool moves to the left under the action of spring (5). The flow from the channel (B) is directed as a priority to the steering spool valve (Orbitrol) via the channel (A). With the steering in a neutral position, there is no flow in this channel. The increasing pressure forces the spool to move to the right and compress spring (5) thus allowing the flow to pass into channel J.

During operation, a pilot flow pressure from the steering spool valve (Orbitrol) arrives through channel (D) and pushes the spool back to the left, thus allowing the flow rate required by the steering to enter into channel (A).

The remaining flow is directed into channel J.

Trailer brake spool (6) (Fig. 7 to Fig. 11)

When the trailer brake is not activated, the pressure in channel K is zero and the spool allows communication between channels L and R.

As soon as the tractor brake is activated, the pressure existing in channel K moves piston (7), which pushes the spool to the left, allowing the flow to pass between channels J and L.

The increasing pressure in channel L acts on the end of the spool (6) and compresses the spring (8) to create a balance allowing the pressure in channel L to be maintained depending on the pressure in channel K.

This pressure is maintained by linking channel L either to channel J or port R.

Note: *As with the "no trailer braking" priority block, a flow rate of 0.5 l/min flows through channel A towards channel D (dynamic steering) via a hole and a restrictor in the spool (2).*

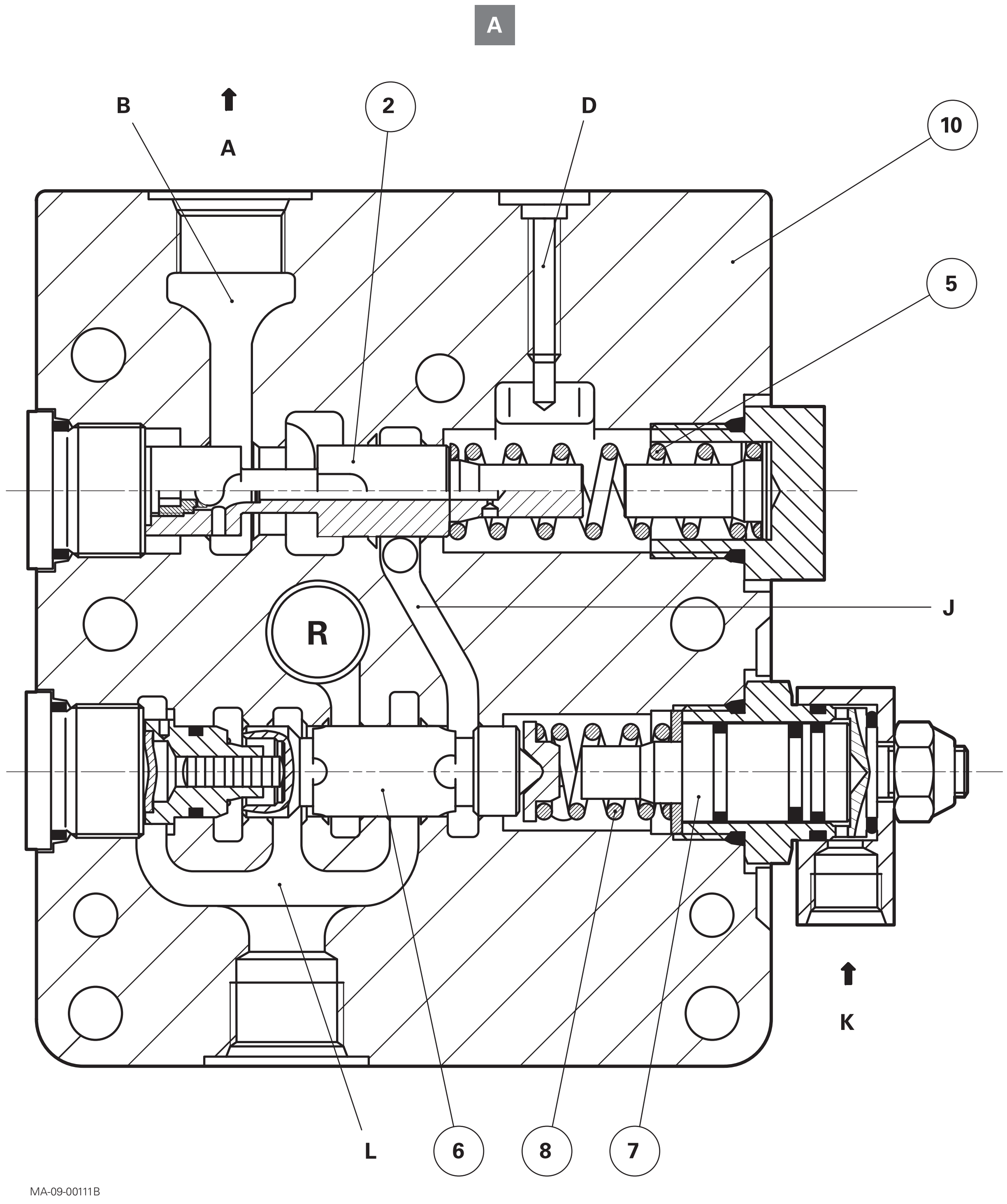


Fig. 7

GPA20 - GPA40

B

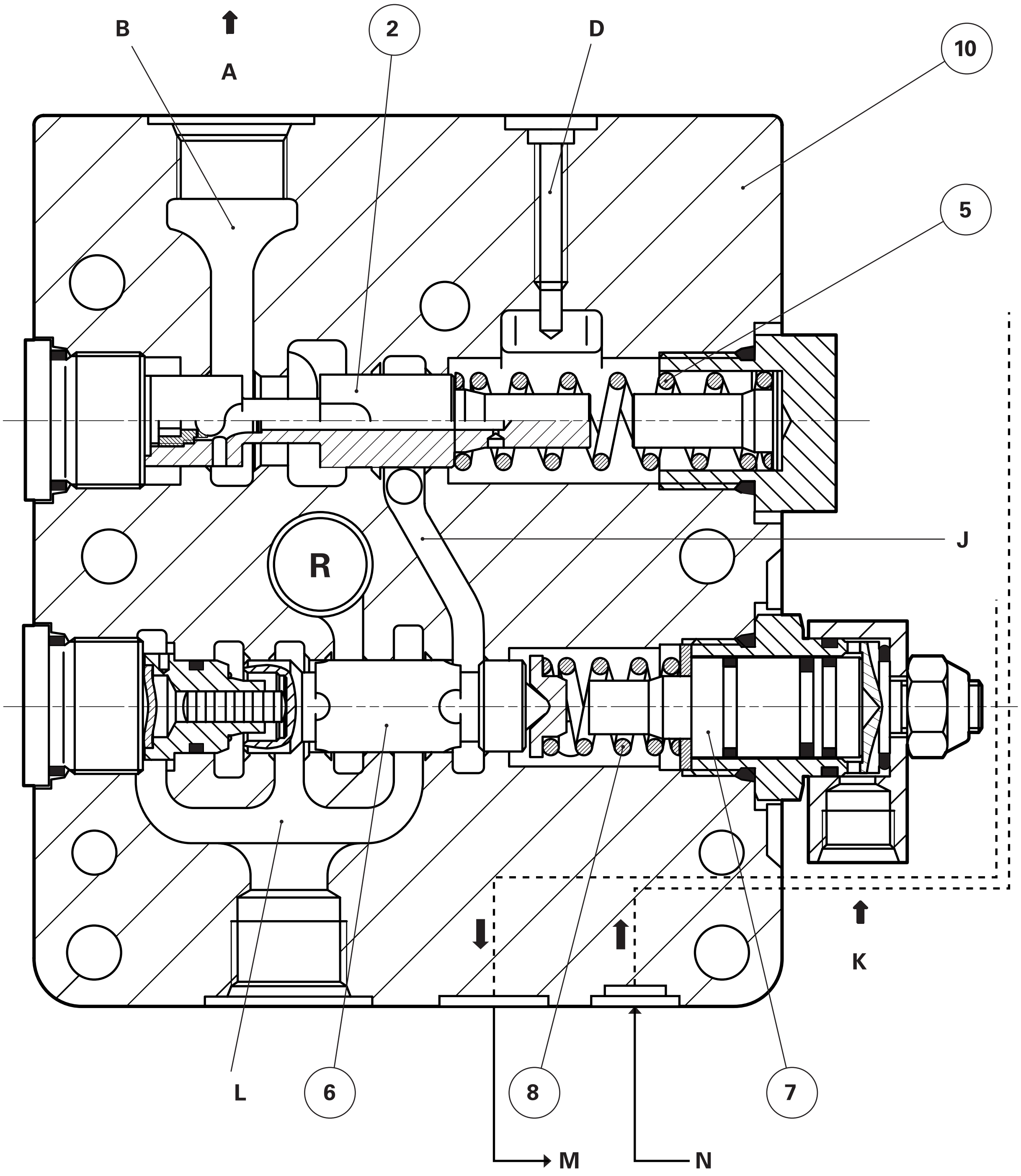


Fig. 8

Parts list (Fig. 9, Fig. 10, Fig. 11)

(P1) High pressure hydraulic line
(P2) Provision for high pressure connector
(R) Return below oil level
(LS) Signal to the variable displacement pump regulator via the hydraulic unit with two priority blocks

A Hydraulic unit with two priority blocks for 40 kph tractors

B Hydraulic unit with two priority blocks for tractors fitted with high-pressure braking

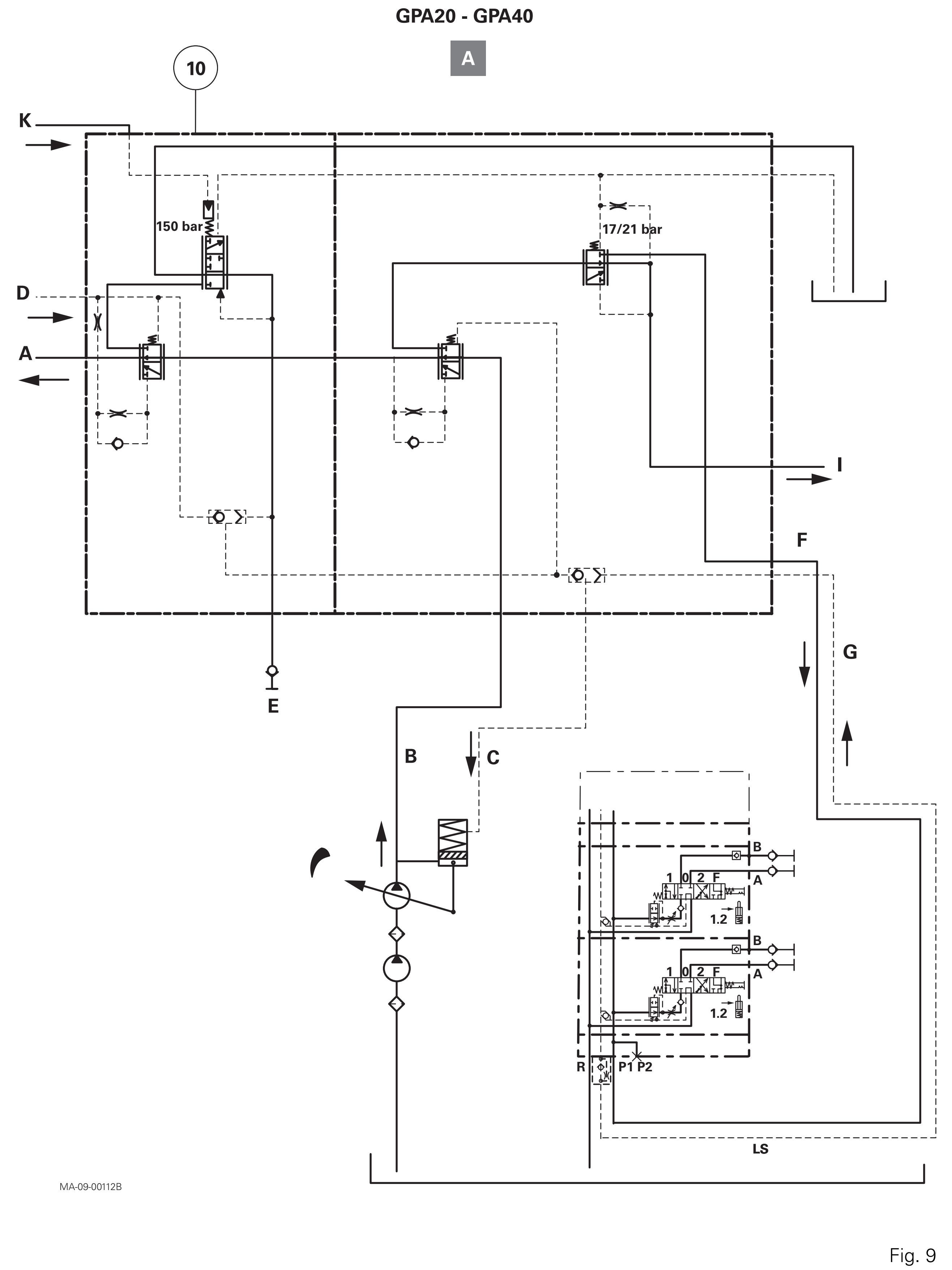

GPA20 - GPA40
A
10
K
D
A
150 bar
17/21 bar
I
F
G
E
B
C
B
1 0 2 F
A
1.2
B
1 0 2 F
A
1.2
R
P1 P2
LS
MA-09-00112B

Fig. 9

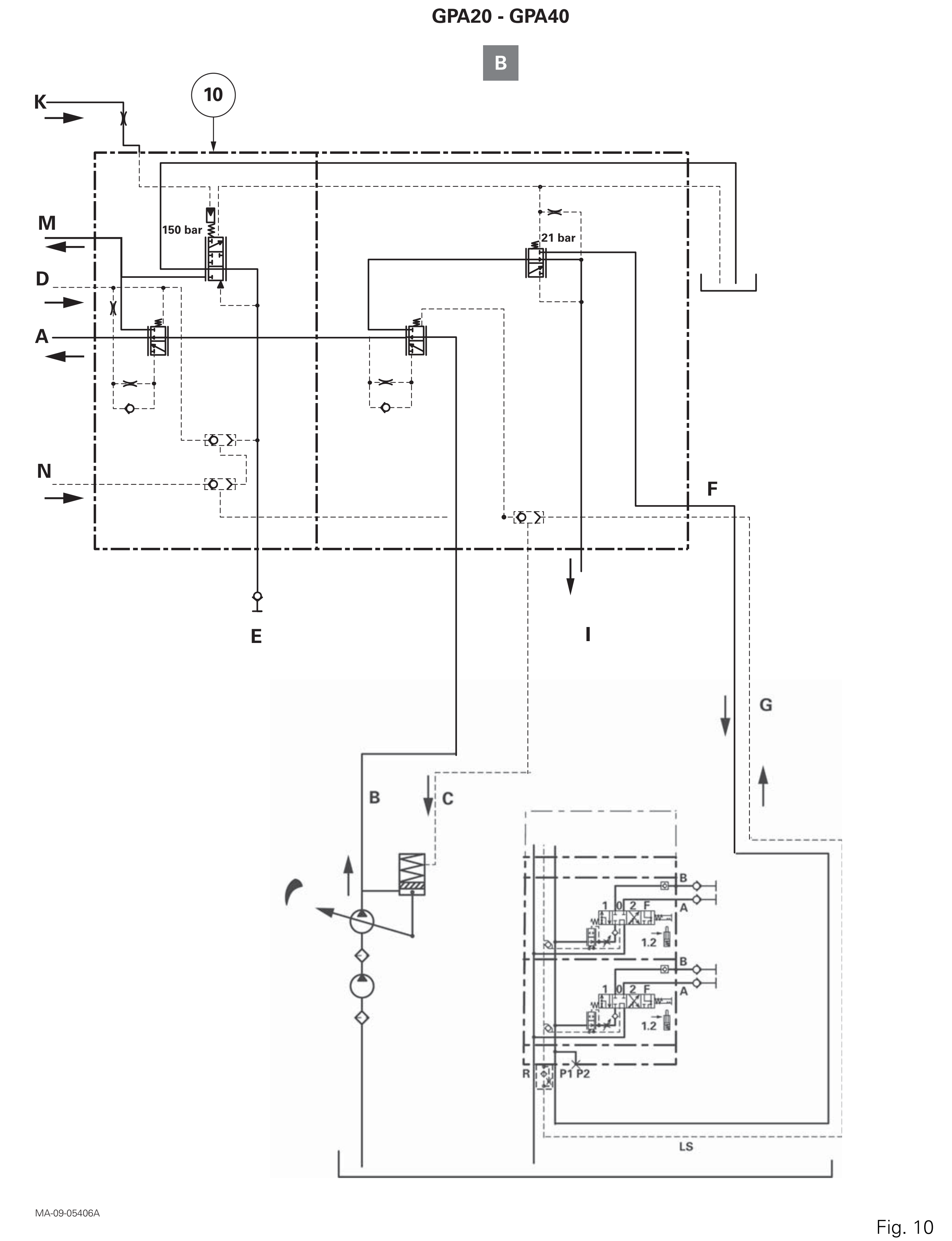

GPA20 - GPA40
B
10
K
M
D
A
N
150 bar
21 bar
F
E
I
G
B
C
1 0 2 F
B
A
1.2
R P1 P2
LS
MA-09-05406A

Fig. 10

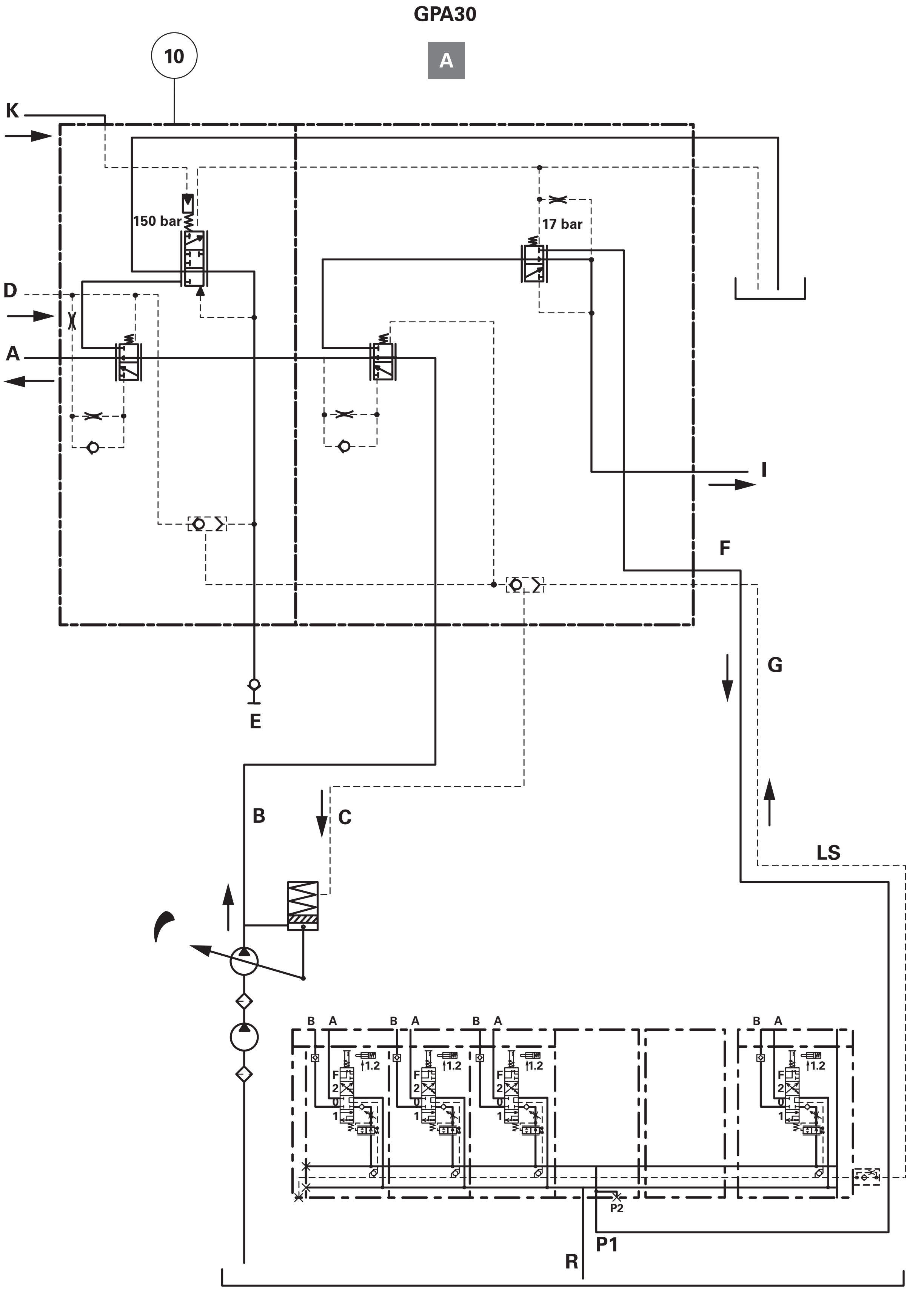


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Fig. 11

D . Removing and refitting the trailer braking unit

Preliminary steps

1. Immobilise the tractor. Chock the left rear wheel.
2. If the tractor is not fitted with a ParkLock device, engage the hand brake.
3. Chock between the frame and the front axle (optional).
4. Remove the rear right-hand wheel.
   Place a safety stand under the trumpet housing.

Removal

5. Remove the complete hydraulic unit comprising the priority blocks (7) and (10).
   Note: *Nothing specific regarding removal. However, if removal does not concern work on the braking unit, the hose for the hydraulic control line (mark (K), Fig. 3, Fig. 4 and Fig. 6 to Fig. 11) coming from the brake master cylinders (40 kph tractors) or from the block/valves (tractors fitted with high-pressure braking) should not be disconnected in order to avoid bleeding the hydraulic control line during the final phase.*

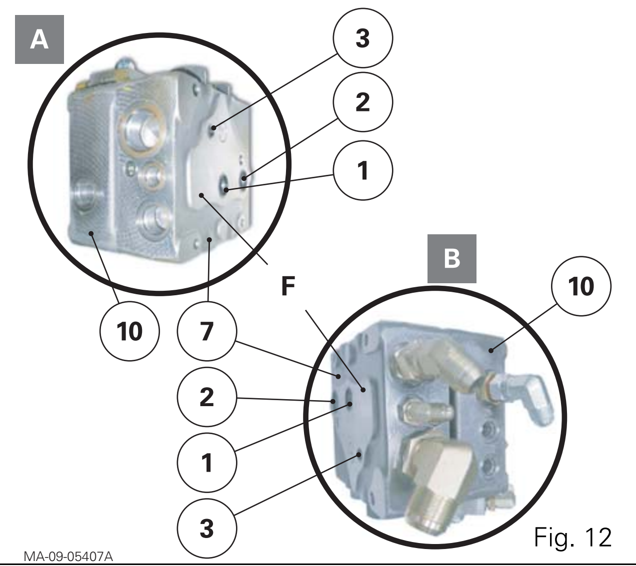

Fig. 12

Refitting

Legend (Fig. 12)

A Hydraulic unit with two priority blocks for 40 kph tractors - GPA20, GPA30 and GPA40

B Hydraulic unit with two priority blocks for tractors fitted with a high-pressure braking - GPA20 and GPA40

6. Check (Fig. 12):
   - that the mating face (F) of the block assembly (7) (10) and of the right-hand hydraulic cover plate are clean;
   - the "O" rings (1) to (3) are present.

7. Lightly smear the thread of screws V (Fig. 6) with Loctite 242 or equivalent. Tighten these screws to a torque of 25 - 35 Nm.
8. Connect the hydraulic pipes or hoses. For the pipe or hose (13) of the trailer braking unit (10) proceed as follows:
   - GPA20 rear axle (Fig. 13)
     - Fit and tighten the pipe or hose (13) onto the trailer braking unit (10). This return pipe or hose is connected to the GBA20 or GBA25 gearbox (Fig. 17).
   - GPA40 rear axle (old generation) (Fig. 14)
     - Position the hose (13) so that it is facing upwards. Tighten the hose. This return hose is connected to the GBA10 gearbox (Fig. 17).
     - Fill the hose via the quick connector (1), filling it with approximately 0.5 litres of clean transmission oil so as to form a column of approximately 100 mm of oil at the trailer braking unit end (10). This column of oil optimises the operation of the trailer braking system.
   - GPA40 rear axle (new generation) (Fig. 15)
     - Fit and tighten the hose (13) for the trailer braking unit (10). This return hose is connected to the GBA15 gearbox (Fig. 17).
   - GPA30 rear axle (Fig. 16)
     - Fit and tighten the hose (13) for the trailer braking unit (10). This return hose is connected to the GBA10 gearbox (Fig. 17).
     - Fit the hose (50). This hose maintains a column of oil at the inlet of the trailer braking unit (10). This column of oil optimises the operation of the trailer braking system. The hose (50) is connected to the quick fill connector located above the brake master cylinders on 40 kph tractors.
     - Position the T connector (1) vertically. Tighten this union and the hoses (13) and (50).

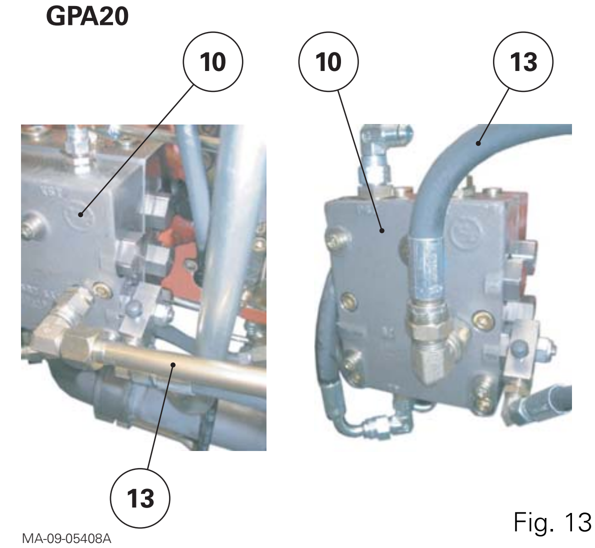

Fig. 13

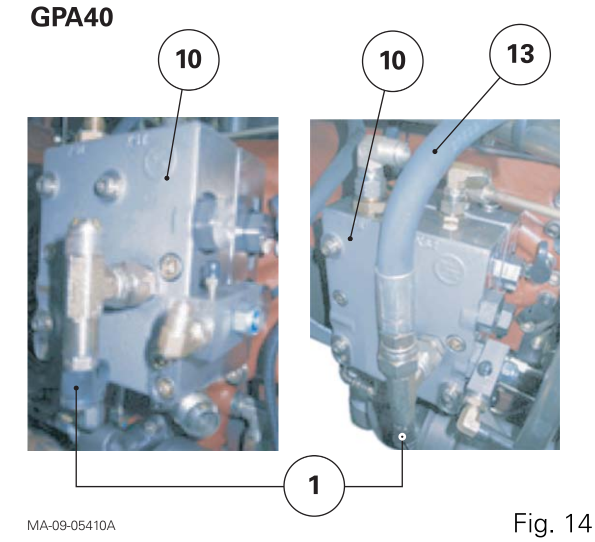

Fig. 14

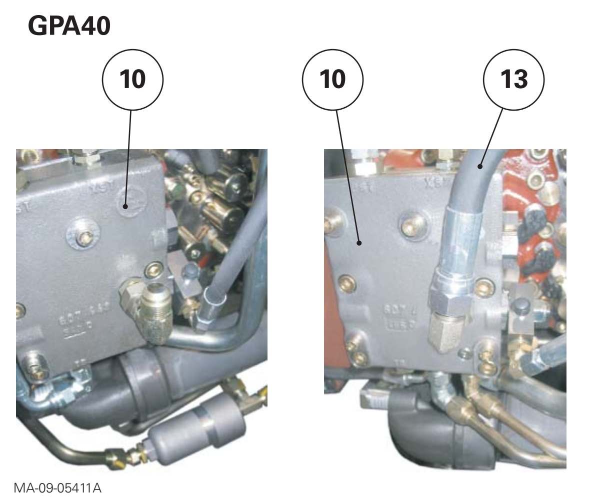

Fig. 15

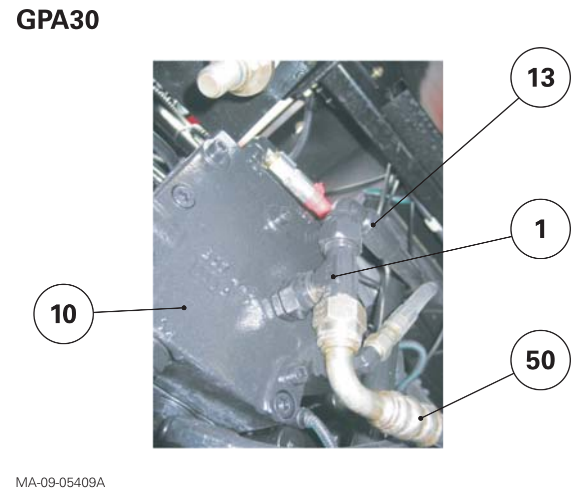
GPA30
13
1
10
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Fig. 16

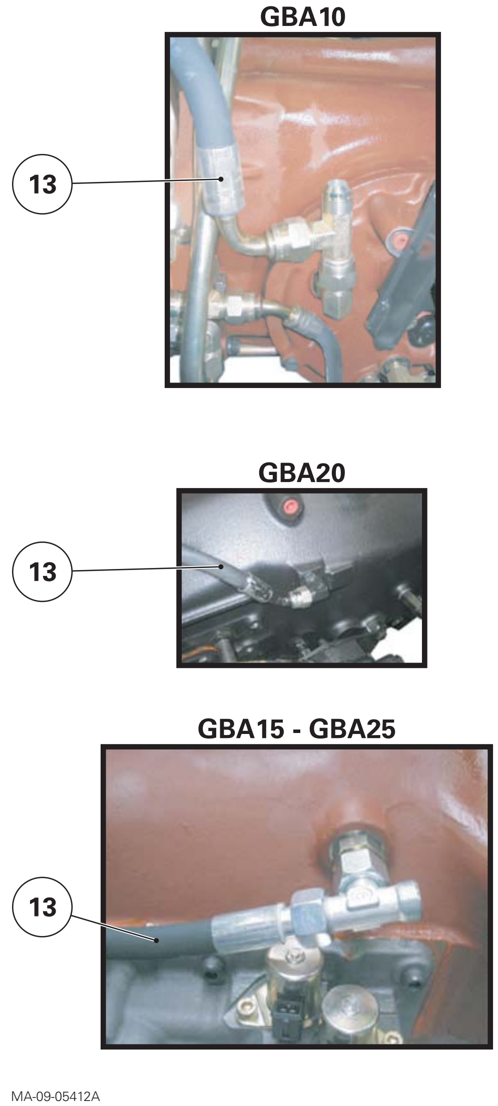

GBA10
13
GBA20
13
GBA15 - GBA25
13
MA-09-05412A

Fig. 17

Final steps

9. Lift the right-hand side of the tractor.
Refit the wheel.
Remove the axle stand.
Screw in the wheel screws or nuts depending on version (see chapter 6).

10. If it was necessary to replace or remove the block assembly (7) (10), carry out:
- bleeding of the trailer brake system (see chapter 9, section on the brake master cylinders (40 kph tractors) or the block/valves (tractors fitted with high-pressure braking)
- the hydraulic tests

11. Check the tightness of the unions and "O" rings between the two priority blocks and between the inner priority block and the right-hand hydraulic cover plate.

12. Carry out a road test.

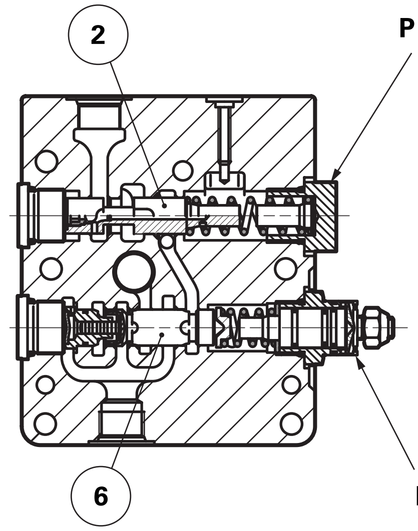


Fig. 18

E . Plug torques in the event of maintenance on the spools (2) (6)

If maintenance must be performed on spools (2) (steering pressure) and/or (6) (trailer brake), tighten the plugs to the torque shown in the following table.

Plugs (Fig. 18)	Tightening torque
P dir (2)	70 Nm
Fr (6)	70 Nm

9F30 - Twin flow load sensing trailer braking

CONTENTS

A . General

The tractors may be fitted with a trailer braking unit comprising:

- a valve unit (41) (Fig. 1) (spool valve) fitted to the balance block of the right-hand hydraulic cover
- a pipe linking the spool valve to a connector (47) (Fig. 1) located at the rear of the tractor
- a pilot flow pipe connected to the master cylinders.

The valve receives its priority supply from the high pressure circuit. The oil not used for braking the trailer is directed to the spool valves (auxiliary and lift control spool valves).

The valve regulates the flowrate and pressure to the trailer brakes. It is controlled by the tractor braking circuit pressure, generated by the master cylinders, so as to obtain progressive tractor / trailer braking that is proportional to the effort applied to the pedal. The trailer brake only operates if the two brake pedals are latched.

Identification of ports (Fig. 1)

B : Supply to the trailer brake connector

N : Continuity to spool valves (auxiliary and lift control spool valves)

P : Pressure

R : Return to housing

Y : Pilot flow from tractor braking unit

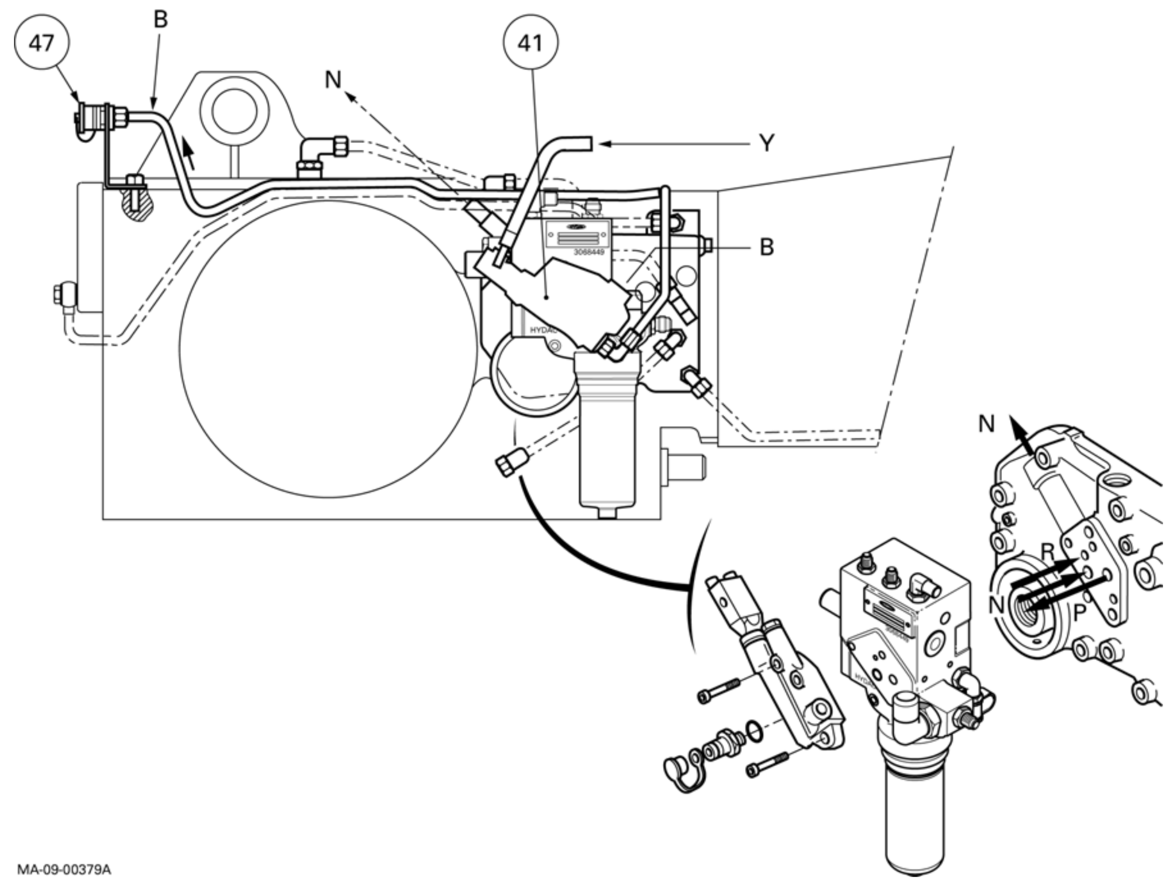


Fig. 1

Twin flow load sensing trailer braking

Description of the braking valve (Fig. 2)

Flow control valve (1) ensures control of the Qx flowrate and adjusts the hydraulic flow, transmitting the pressure to the trailer brakes (Fig. 5 - Fig. 6 - Fig. 8 and Fig. 9).

Control spool assembly (2) ensures the control of the flow control valve and adjusts the pressure in the trailer brakes.

Non-return valve (3) stops the return of oil from brake pipe B to port N (Fig. 5 to Fig. 7 and Fig. 8 to Fig. 10).

Pressure relief valve (4) with loaded spring (8), limits the braking pressure.

Pilot flow housing (5) with piston (6) and bleed screw (7), controls the trailer brake valve via the tractor braking system.

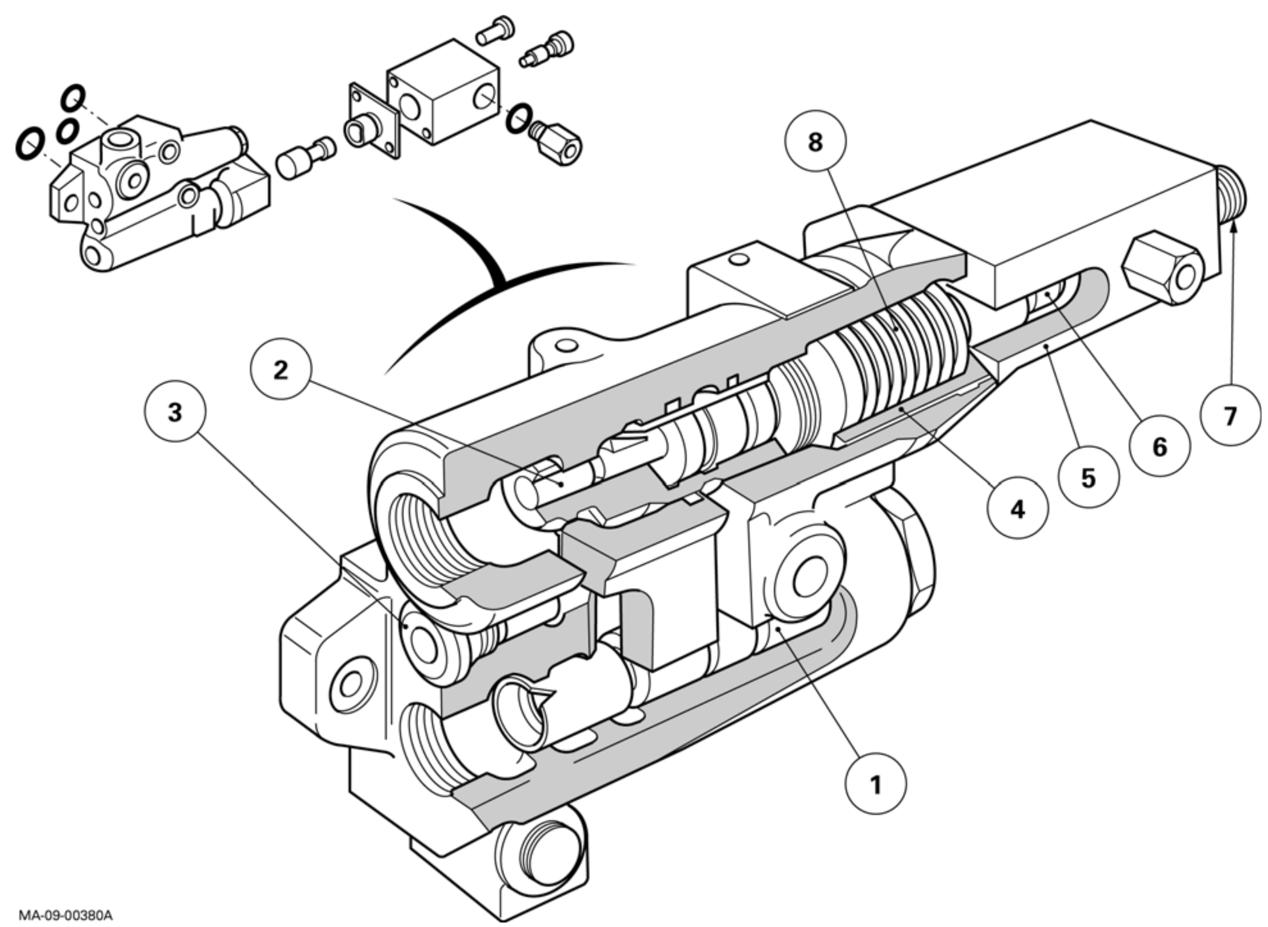


Fig. 2

B . Removing and refitting the braking valve

Remark

If the removal of the valve does not concern its replacement, do not disconnect the hose (B) (Fig. 3) from the master cylinders, in order to avoid draining the system.

Preliminary operation

1. Immobilise the tractor. Take off the wheel concerned. Position an axle stand.

Removal (Fig. 3)

2. **Disconnect and block off:**
- the hose pipe (B) of pilot flow housing (D) (if necessary, see previous remark)
- the feed hose (A) from the auxiliary spool valve and the pipe (C) from the trailer brake connector.

3. Take out the screws (19) and remove the valve (18).

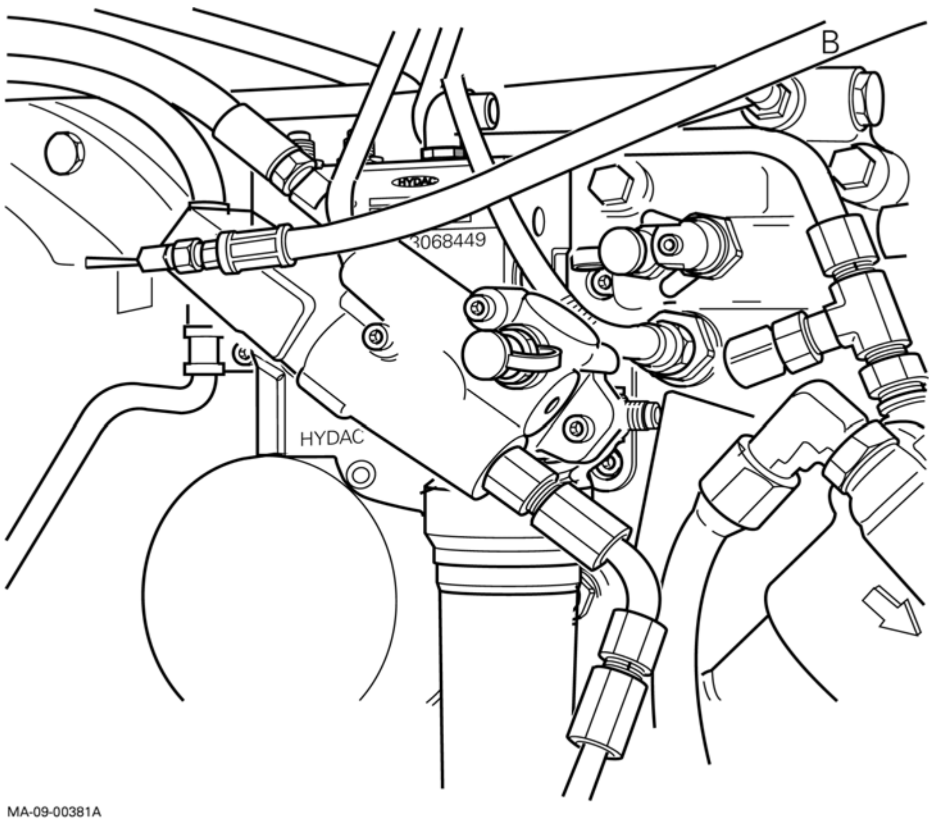


Fig. 3

Refitting

4. Clean the mating faces of the hydraulic cover and the valve.

5. Replace the O'rings (1) (2) (Fig. 4).

6. Refit the valve, place and tighten the screws (19) to a torque of 21 - 24 Nm.

7. **Reconnect:**

- the pipe (C) of the trailer brake connector and the feed hose (A) from the auxiliary spool valve
- the hose pipe (B) of the pilot flow housing.

8. If necessary, bleed the main brake and the trailer brake (see chapter 9). Check the pressure in the trailer brake system (see section 9M01).

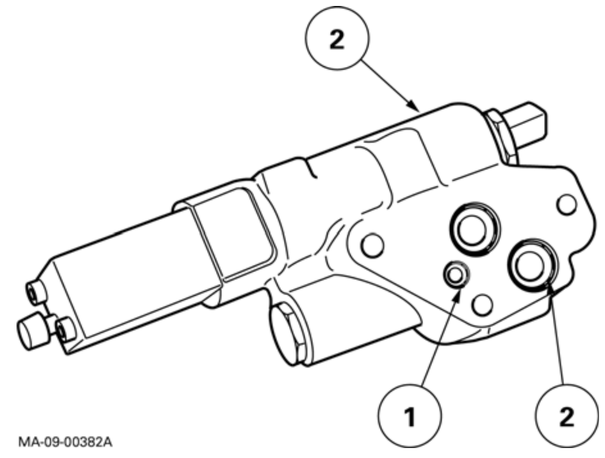
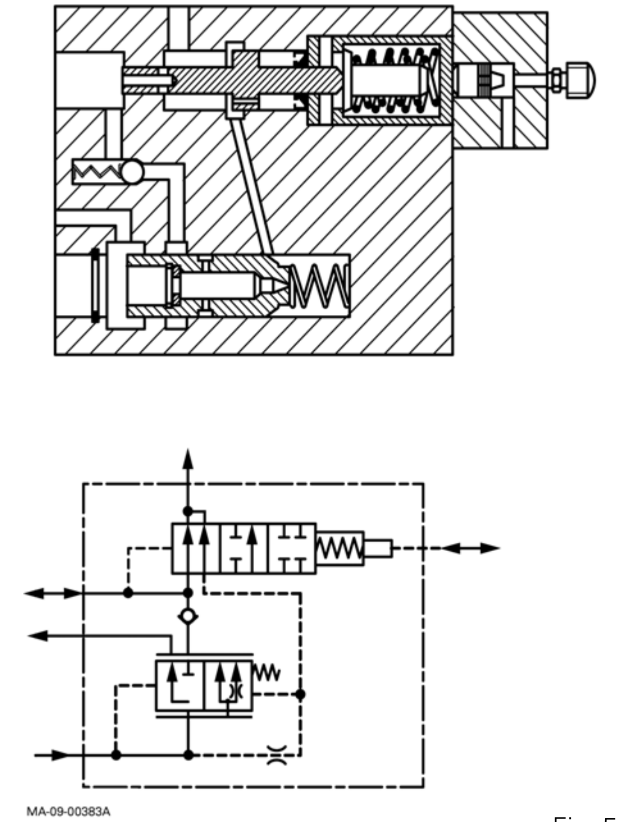


Fig. 4

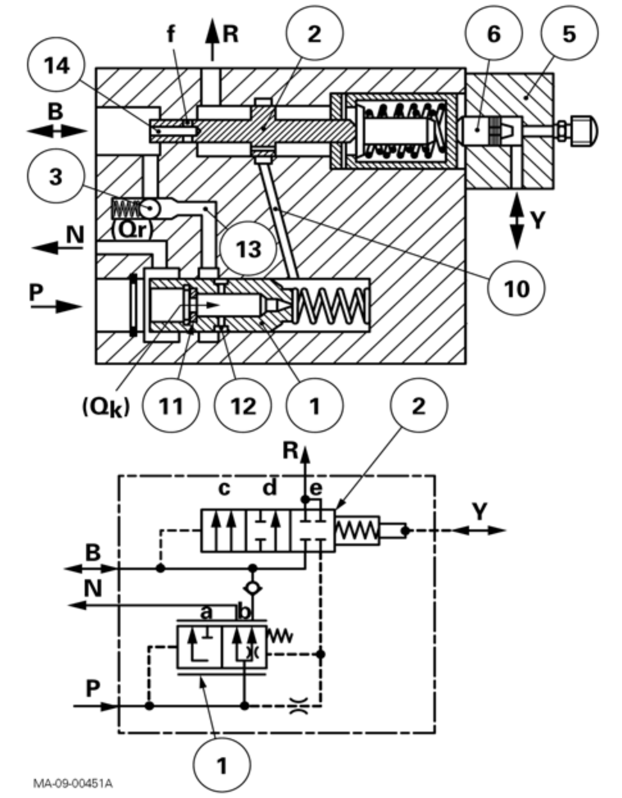
Final operation

9. Refit the wheel. Remove the axle stand. Tighten the wheel nuts to a torque of 400 - 450 Nm.



Trailer brakes released

Fig. 5



Partial trailer braking:
start of the braking process

Fig. 6

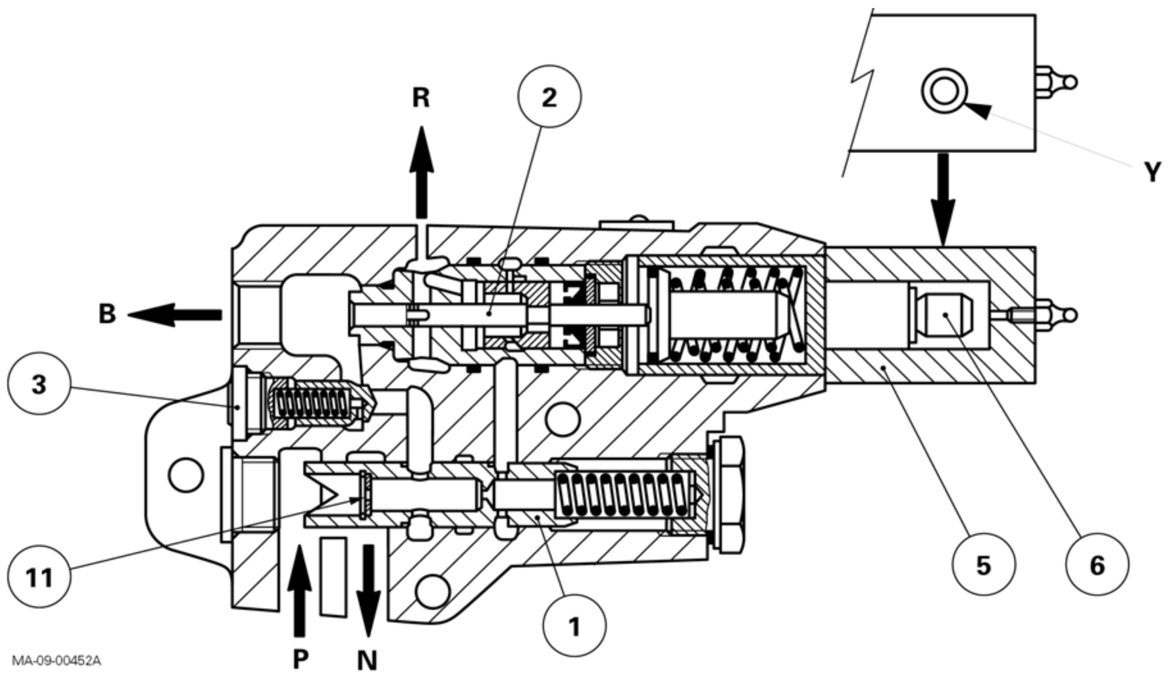


Fig. 7

C . Operation, trailer brakes released and partial braking

Trailer brakes released (Fig. 5)

The control channel Y is not under pressure (no action on brake pedals).

Port B (feed to the trailer brake connector) is linked to return channel R via the drilled hole f of the control spool (2).

Flow QP from the pump flows via port P to the flow control valve (1).

Flow QP - QX is directed towards port N (continuity towards auxiliary spool valve and lift control valve).

Partial flow QX (approximately 0.6 l/min) from port P is directed towards the diaphragm (11), the restrictor (9), the drilled hole (10) and the control spool (2) to join channel R.

Consequently, the pressure drop produced by the restrictor (9) maintains the flow control valve (1) in open position a, the position in which it does not assure a regulating function.

Partial trailer braking

Start of the braking process (Fig. 6)

The piston (6) of the pilot flow housing (5) is pressure fed by the tractor braking system (action on the brake pedals).

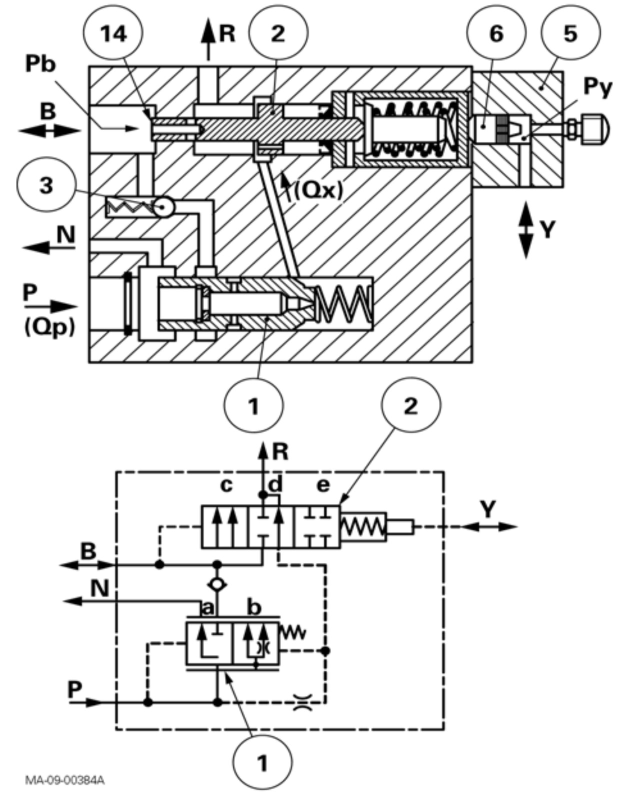
The pressure arrives via port Y, the control spool assembly (2) is then pushed to the left, obstructing the drilled hole f and cutting off the communication of port B (towards the trailer brake connector) with the return channel R, then the link with the drilled hole (10).

The control spool (2) moves from position c to position e. The QX control flow is cut and the flow control valve (1) moves to position b (regulating position).

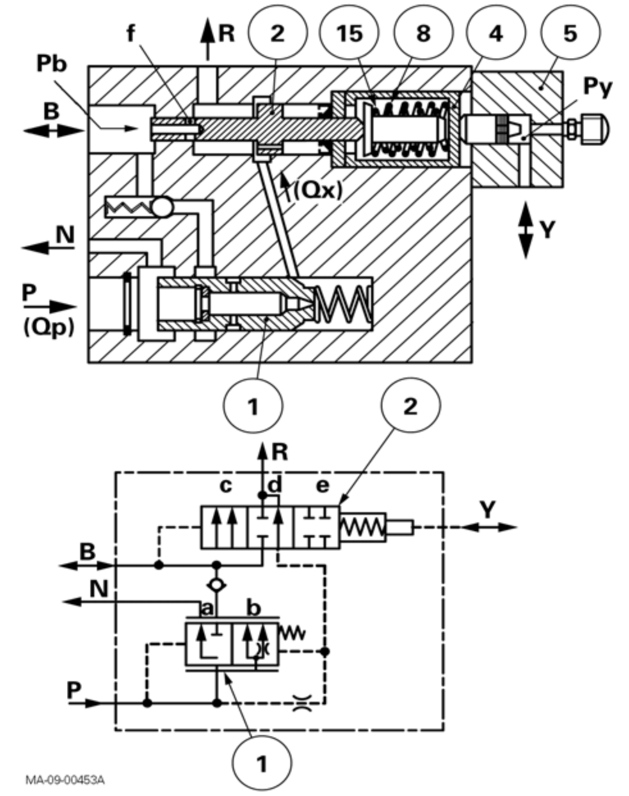
A constant flow QK flows from port P to port B (towards the trailer brake connector) via the diaphragm (11), the drilled hole (12), the channel (13) and the non-return valve (3). The diaphragm (11) has a surface area calculated in relation to the constant flow rate QK.

The residual flow QR flows via the flow control valve (1) and is directed to port N (continuity with the auxiliary spool valve and the lift control valve).

The channel of port B (towards the trailer brake connector) is placed under pressure and acts upon the surface (14) of the control spool (2) against the pressure on piston (6) by the tractor braking system.



Partial trailer braking Fig. 8



Maximum trailer braking:
limited brake pressure Fig. 9

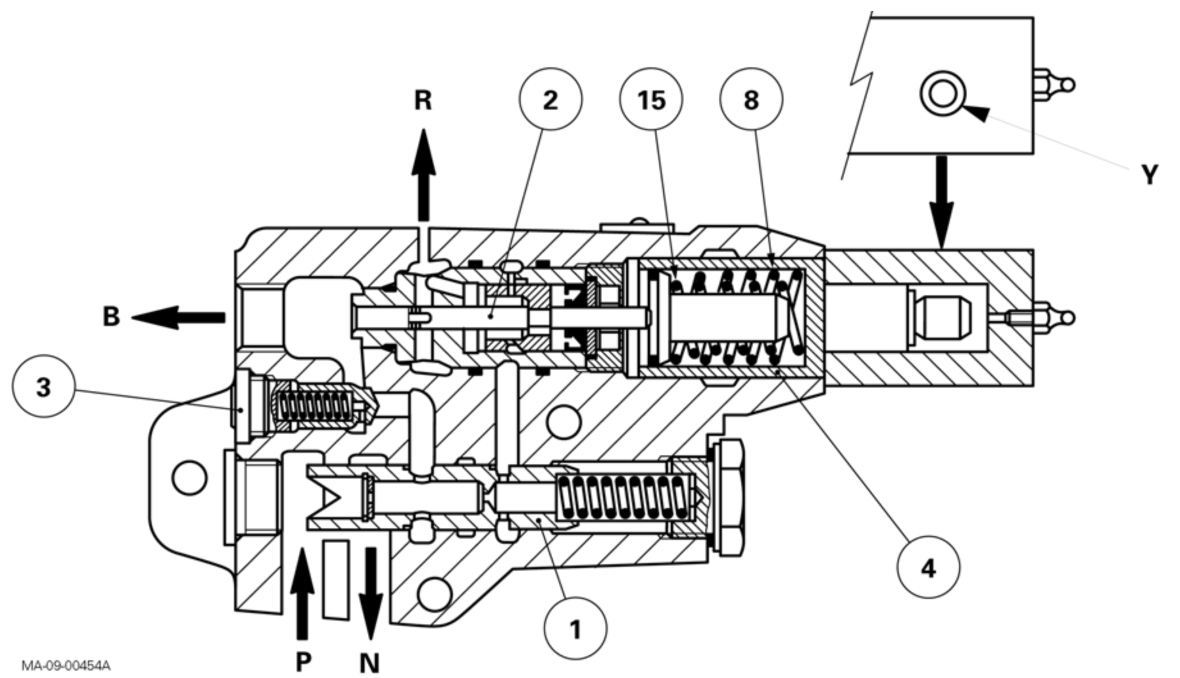


Fig. 10

D . Partial and maximum trailer braking

Partial trailer braking (Fig. 8)

The pressure Pb in the trailer braking line (pressure acting on the active surface (14) of control spool (2)) is in balance with pressure Py (coming from the tractor braking system) which acts upon piston (6) of the pilot flow housing (5).

The channel from port B (to the trailer brake connector) is cut off from the return port R. Consequently, the oil is trapped in the trailer braking unit. When the pressures are balanced, the control spool (2) is in position d.

The flow control valve (1) then moves to position a, an open position in which it does not ensure a regulating function.

As when the trailer brakes are released, the flow Qp - Qx is directed to port N (continuity with the auxiliary spool valve and the lift control valve) and the control flow Qx is directed to return channel R by the control spool (2).

Maximum trailer braking (Fig. 9)

Limited braking pressure

The flow control valve (1) and the control spool (2) are in the same switching positions (a and d) as for partial braking.

The flow rates Qp and Qx are the same as for partial braking. The maximum admissible braking pressure is reached (Pb = 150 bar). An increase in the trailer braking pressure cannot take place, even if the tractor braking pressure continues to increase.

The pressure relief valve (4) is then pushed to the left.

The springs (8) (15) pre-loaded with the maximum admissible braking pressure (Pb = 150 bar) for the trailer, are compressed.

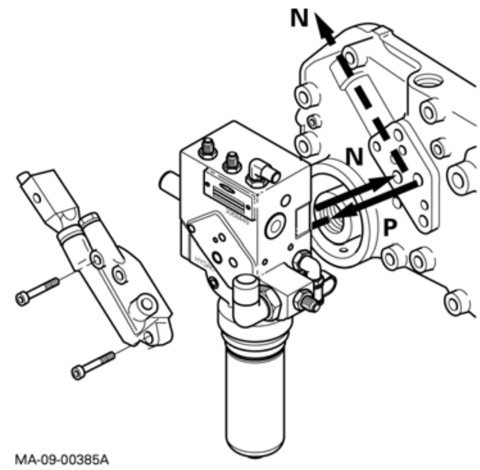


Fig. 11

If, due to external conditions, the trailer braking pressure Pb continues to rise, the control spool (2) momentarily opens the communication f between port B (supply to the trailer brake connector) and the return channel R.

In all operating positions of the trailer braking valve, the auxiliary spool valve and the lift control valve are used when required by port N (Fig. 11) without causing significant effect on the trailer brake system, which has priority on the high flowrate hydraulic circuit.

E . Version without trailer braking (Fig. 12)

- For this tractor version, the braking valve (spool valve) is replaced by a cover plate (3).
- As with the trailer braking version, the oil tightness between components is ensured by O’rings (1) (2).
- A test connector (4) also allows to check the high pressure of the pump.

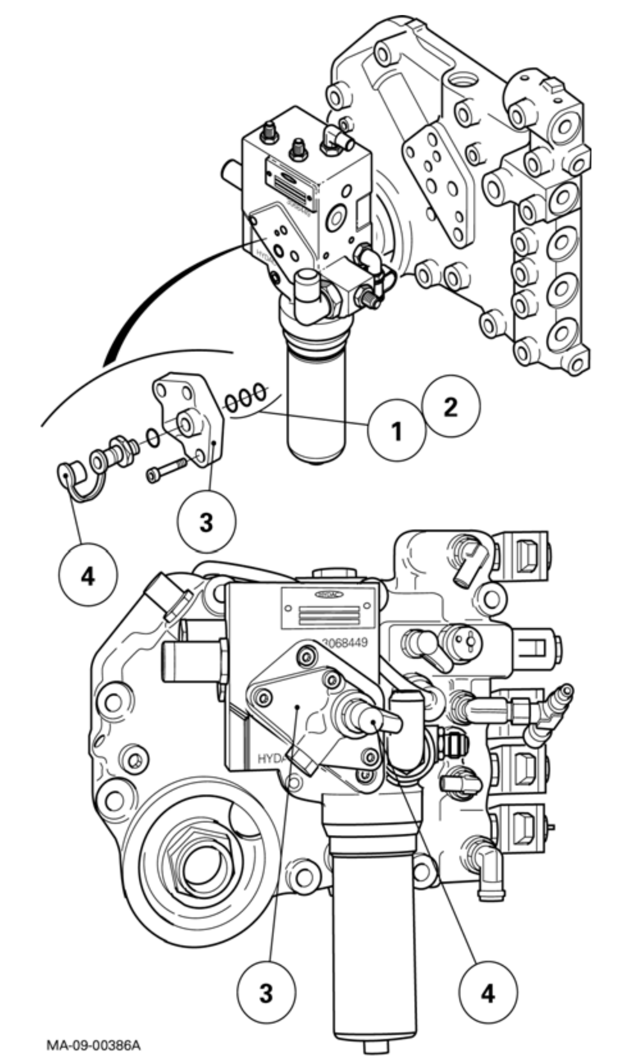


Fig. 12

9F40 - Pneumatic trailer braking

CONTENTS

A . General

The new range of MF6400tractors with the 6-cylinder Tier 3 Perkins engine may be fitted with a pneumatic trailer braking system as an option.

There are 3 types of system, depending on country:
- German fitting
- Italian fitting
- English fitting

The German fitting is of double line and single line type and comprises 3 couplers located at the rear of the tractor:
- A yellow coupler for the brake line
- A red coupler for the service brake (or emergency brake)
- A black coupler for the single line brake

The Italian and English fitting is of double line type. It has 2 couplers located at the rear of the tractor:
- A yellow coupler for the brake line
- A red coupler for the service brake (or emergency brake)

The brake system control is not completely identical for the English and Italian type fittings. This depends on the homologation applicable for each country.

The pneumatic brake systems are identical on tractors fitted with DYNA-6 and DYNA VT transmission. However, the location of the components is different depending on whether the hydraulic system is of the Load Sensing or Open Centre type.

B . Components

Compressor:

The compressor is connected to the engine lubrication system. Air sucked in by the compressor is filtered through the engine air filter. The compressor is permanently driven by the engine.

Regulation:

The pressure inside the air tanks is limited by the pressure regulator located on the right-hand side of the tractor. The air pressure is regulated between 6.5 bar and 8 bar. When the pressure is at maximum, the air directed by the compressor leaves the system via the regulator and is discharged into the open air via a silencer. This silencer is fitted on the pressure regulator.
The operating pressure is different depending on the country:
- Italy: 7.3 bar
- Germany and England: 8.1 bar

The safety valve opens at 12 bar.

Right-hand tank:

The right-hand tank has a capacity of 10 litres. A pressure sensor is fitted to this tank and indicates the pressure of the system.

Left-hand tank:

The left-hand tank has a capacity of 10 litres. This tank is directly connected to the system. The compressor directs the air inside the right-hand tank and then inside the left-hand tank.
An automatic bleed system is located underneath the tanks. This allows any water that may still be in the system to drain out.

Electro-pneumatic valve for the German and English type fitting:

The valve is controlled by the electrical section of the hydraulic brake system. When the brake pedal is not activated, the electro-pneumatic valve is not supplied and so no pressure is supplied to the pneumatic brake line. As soon as the brake pedal is applied, the valve is supplied (electrically) and pressure is supplied to the pneumatic brake line. The electro-pneumatic valve is supplied at the same time as the brake lights. The electro-pneumatic valve reduces the braking response time between the tractor and the trailer.

Main valve for the German and English type fitting:

This valve is controlled by three different functions:
- By the electro-pneumatic valve
- By the trailer brake oil pressure
- By the parking brake system

Main valve for the Italian type fitting:

This valve is controlled by three different functions:
- Tractor right-hand brake oil pressure
- Tractor left-hand brake oil pressure
- Parking brake action

Control valve:

This valve, located on the German type fitting, is used to control the single line B. It controls the pressure for the black coupler. When the brake is not applied, the pressure is between 4.8 and 5.6 bar, and reduces to 0 bar, reciprocally proportional to the pressure inside the main valve.

Pressure sensor:

The pressure sensor is mounted on the right-hand tank. This sensor measures the pressure of the system and the value is displayed on the DCC2 Dot Matrix screen. If the pressure is less than 4 bar, an indicator light illuminates on the DCC2.

Relief valve:

A relief valve is fitted on the left-hand tank, on the Italian type fitting only. It prevents pressures greater than 9 bar.

Couplers:

Yellow: This coupler connects the trailer's main service brake line.

Red: This line is permanently supplied with compressed air. This coupler must be connected after the yellow coupler and must be disconnected first.

Black: This coupler is only fitted to the German type fitting and is the single line.

The couplers are different, depending on country. They are designed in such a way as to prevent incorrect connection.

German system

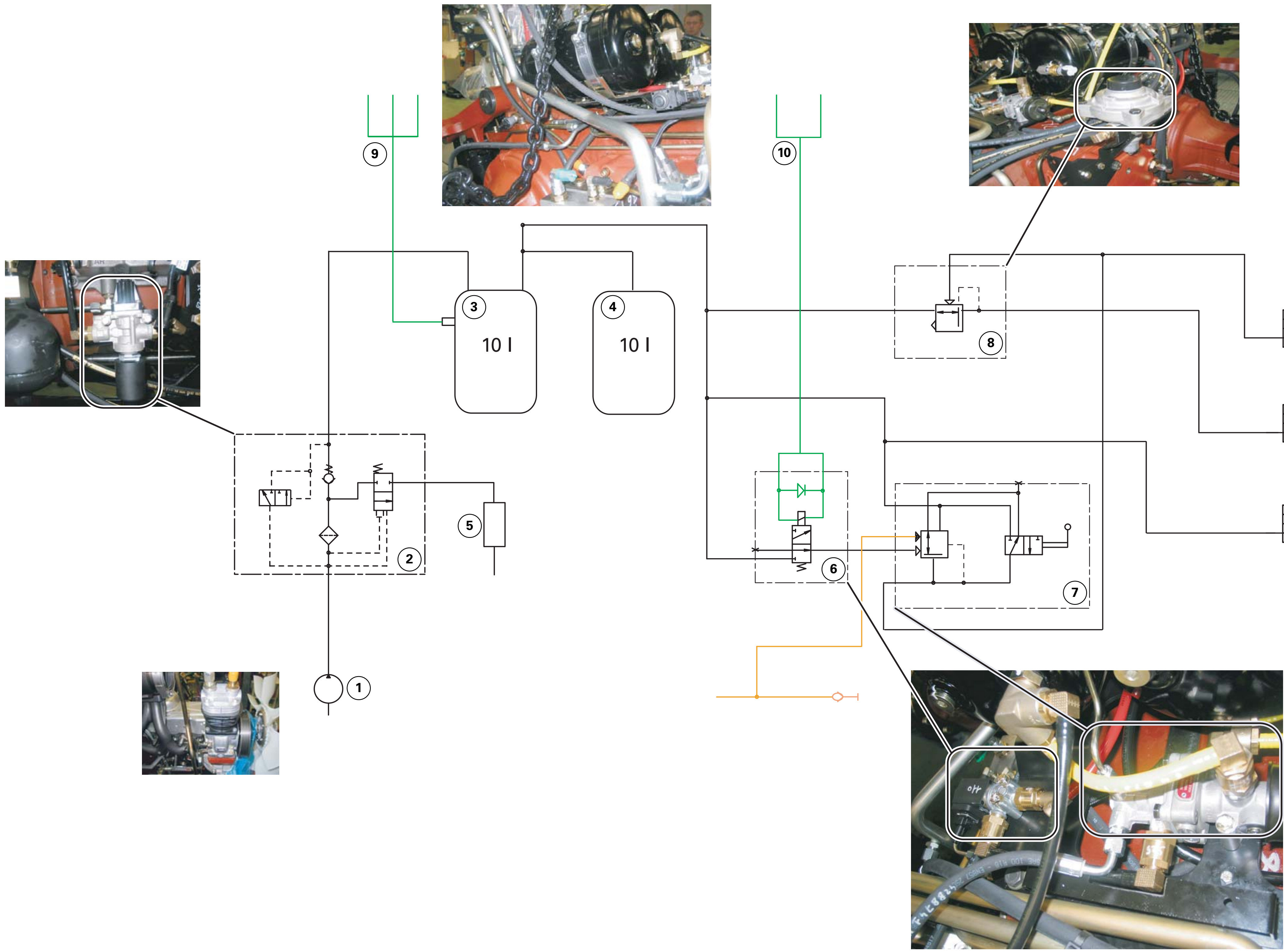


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Fig. 1

English system

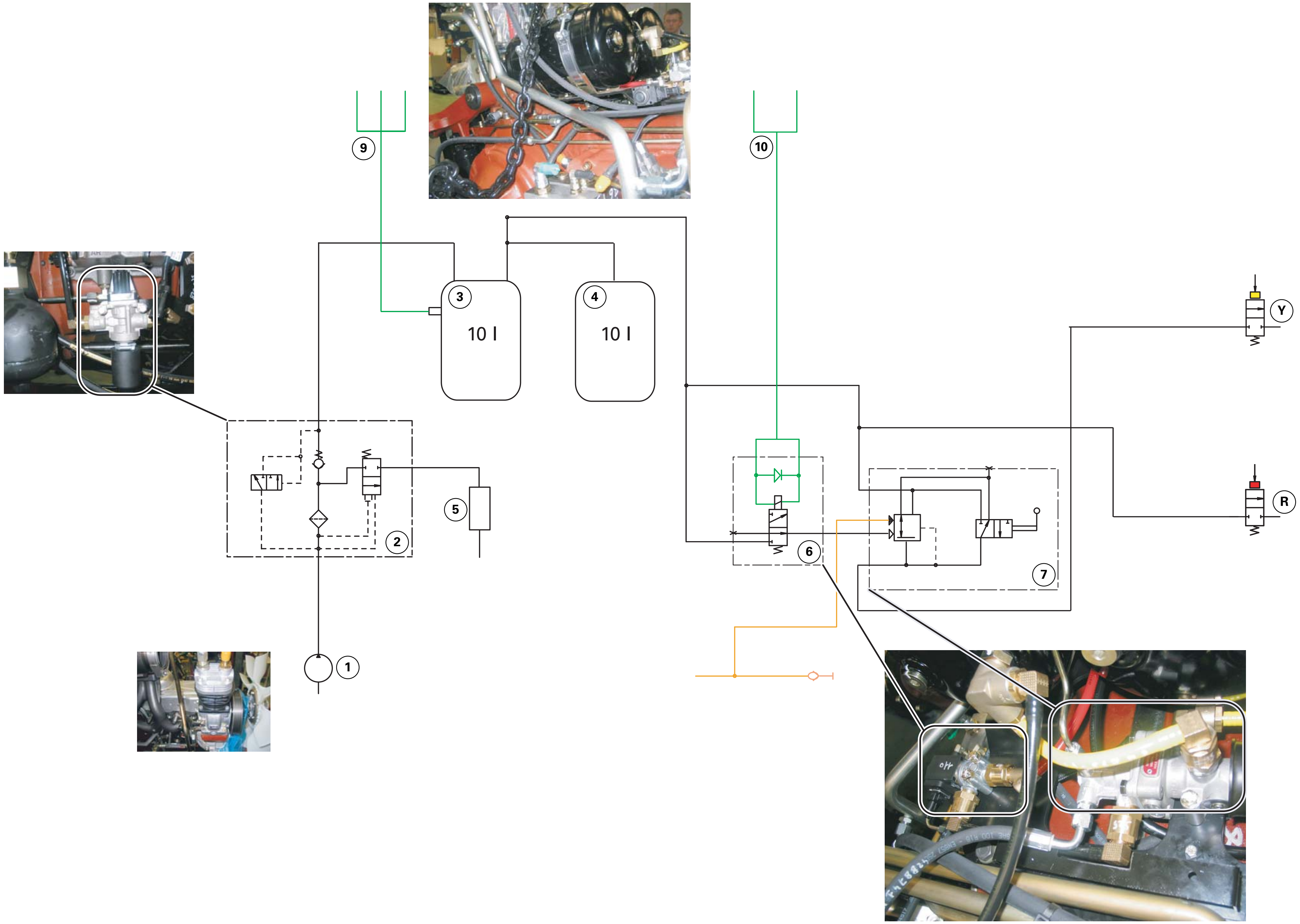

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Fig. 2

Italian system

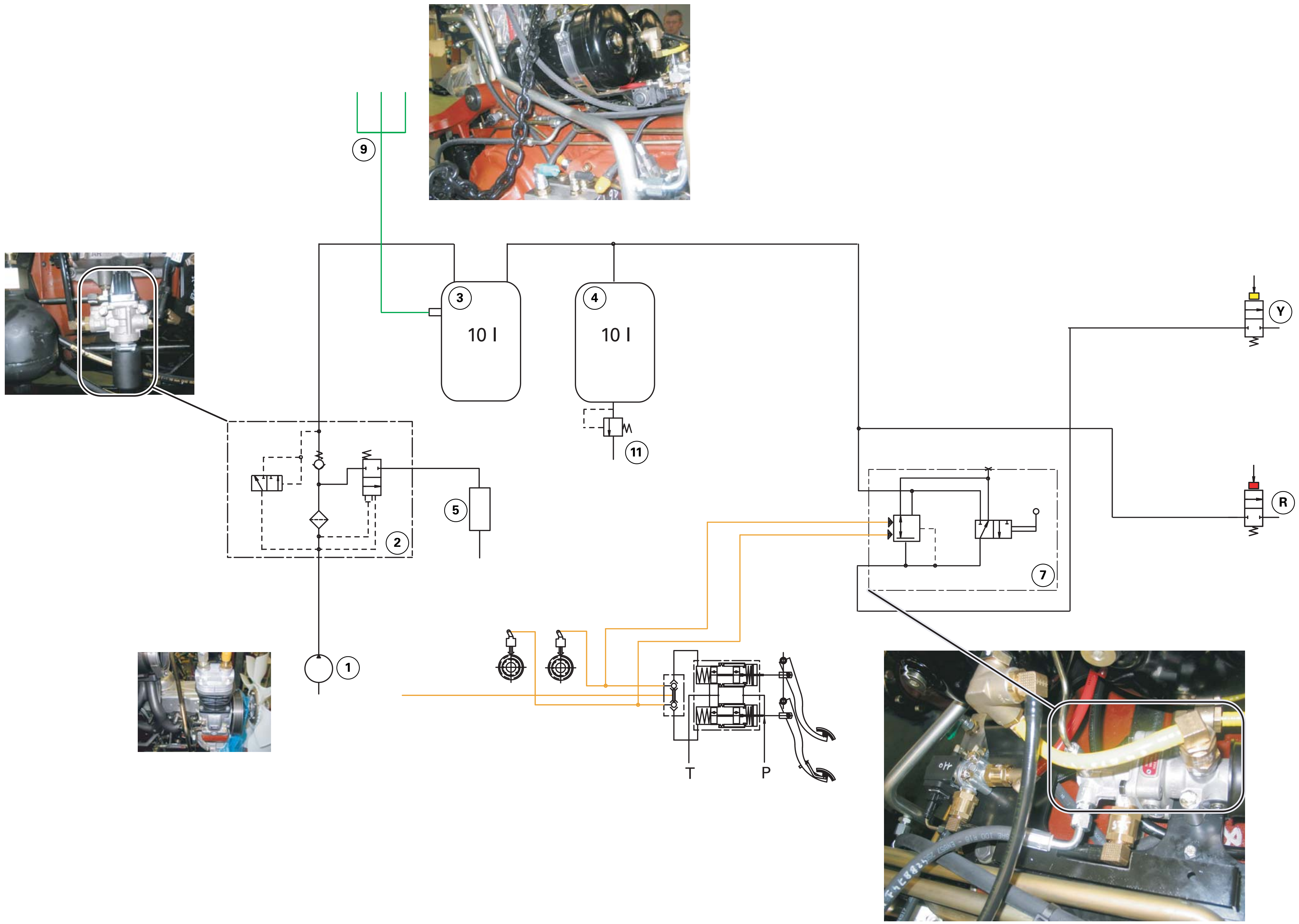

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Fig. 3

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C . Operation of the pneumatic system

German system

Engine running, brake not activated

Compressor (1): The air compressor sucks in the outside air to compress it. As soon as the engine operates, the compressor is active.

Pressure regulator (2): The pressure regulator maintains a pressure of 6.5 to 8 bar inside the system.

Solenoid valve (6): No action on the brake pedals. The solenoid valve is not supplied. V = 0 Volt. The system's air pressure is unable to control the main valve (7).

Main valve (7): The parking brake is not activated and therefore the air pressure is locked. The brake pedals are not applied, there is no hydraulic pressure over the trailer brake line and so the air pressure remains locked inside this line.

Control valve (8): This valve cannot be controlled while the air pressure remains locked inside the main valve. Therefore, there is no pressure inside the yellow coupler line, but there is air pressure inside the black coupler single line.

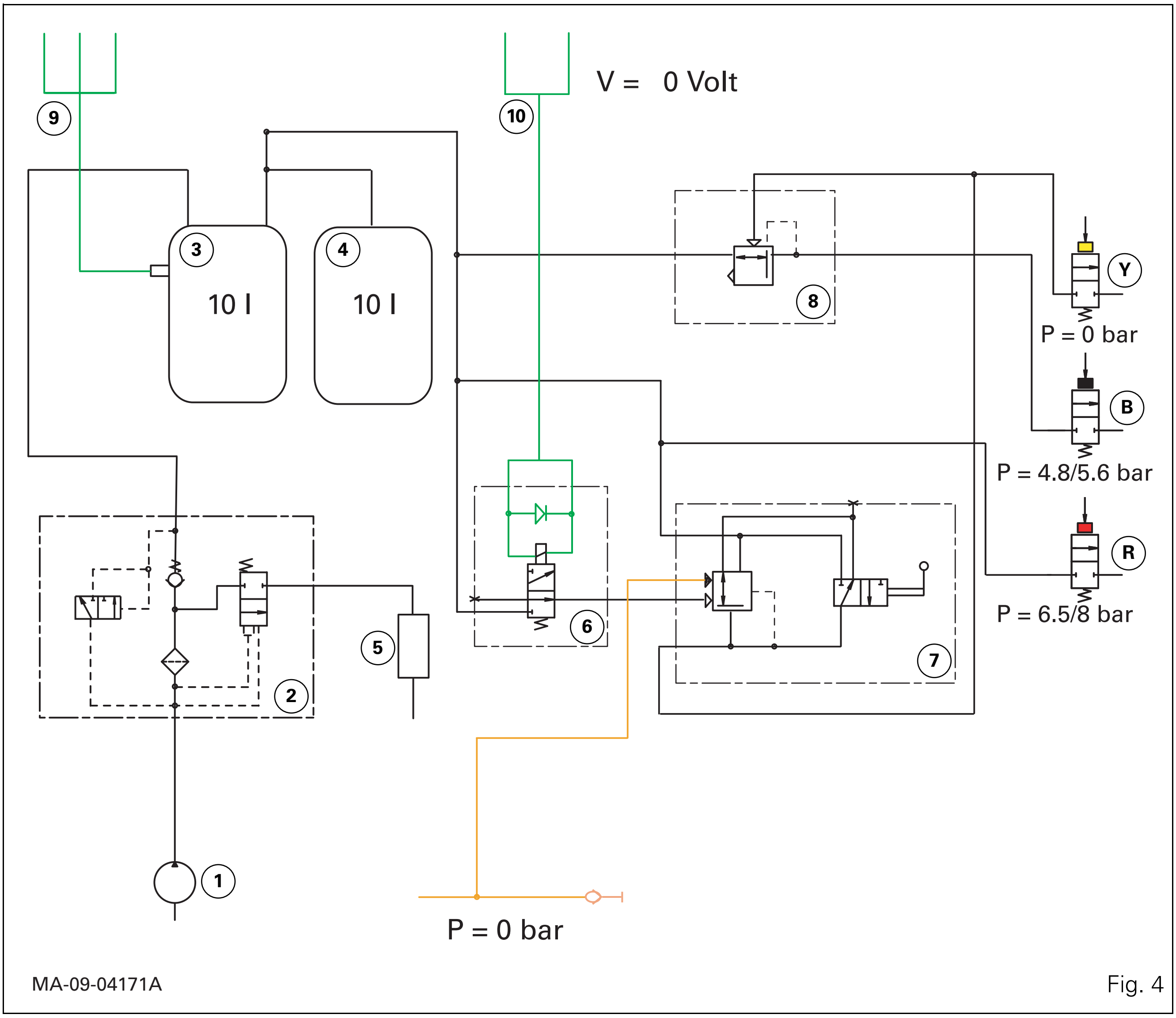


Fig. 4

Pneumatic trailer braking

Engine running, brake pedals applied

Solenoid valve (6): The brake pedals are fully applied. The solenoid valve is supplied. V = 12 Volt. The system air pressure controls the main valve (7).

Main valve (7): The parking brake is not activated and therefore the air pressure is locked. The brake pedals are applied, the hydraulic pressure over the trailer brake line and the air pressure inside the yellow line controls the control valve.

Control valve (8): The valve is controlled by the air pressure of the main valve. Therefore, there is pressure inside the yellow coupler line, but the air pressure is not available for the black coupler single line.

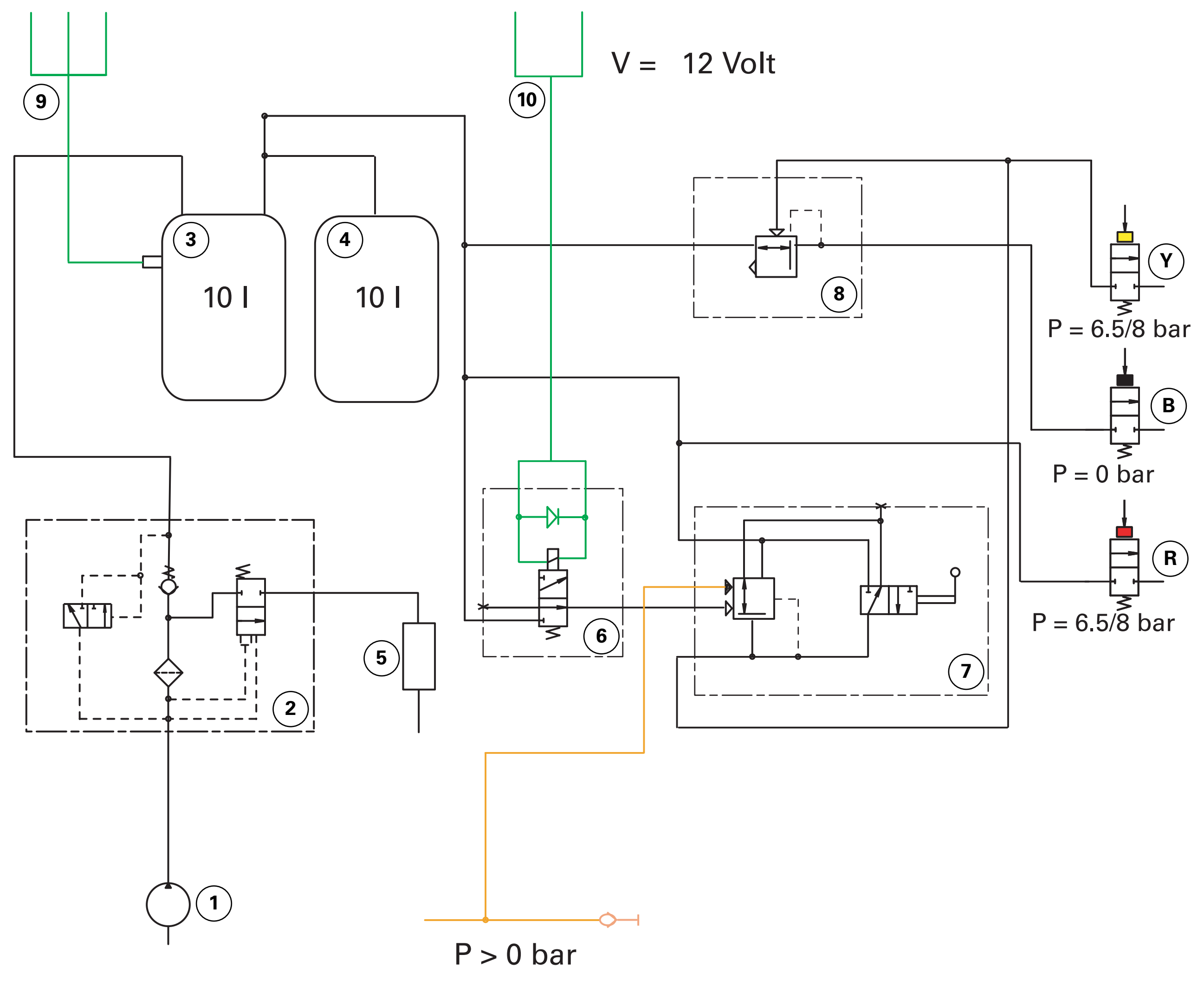


Fig. 5

Engine running, parking brake activated

Solenoid valve (6): The brake pedals are fully released. The solenoid valve is not supplied. V = 0 Volt. The system's air pressure does not control the main valve (7).

Main valve (7): The parking brake is activated. Therefore, the air pressure enters the yellow line and also enters the control valve (8). The brake pedals are fully released, the hydraulic pressure does not enter the trailer brake line and the air pressure remains locked inside this line.

Control valve (8): The valve is controlled by the air pressure of the main valve. Therefore, there is pressure inside the yellow coupler line, but the air pressure is not available for the black coupler single line.

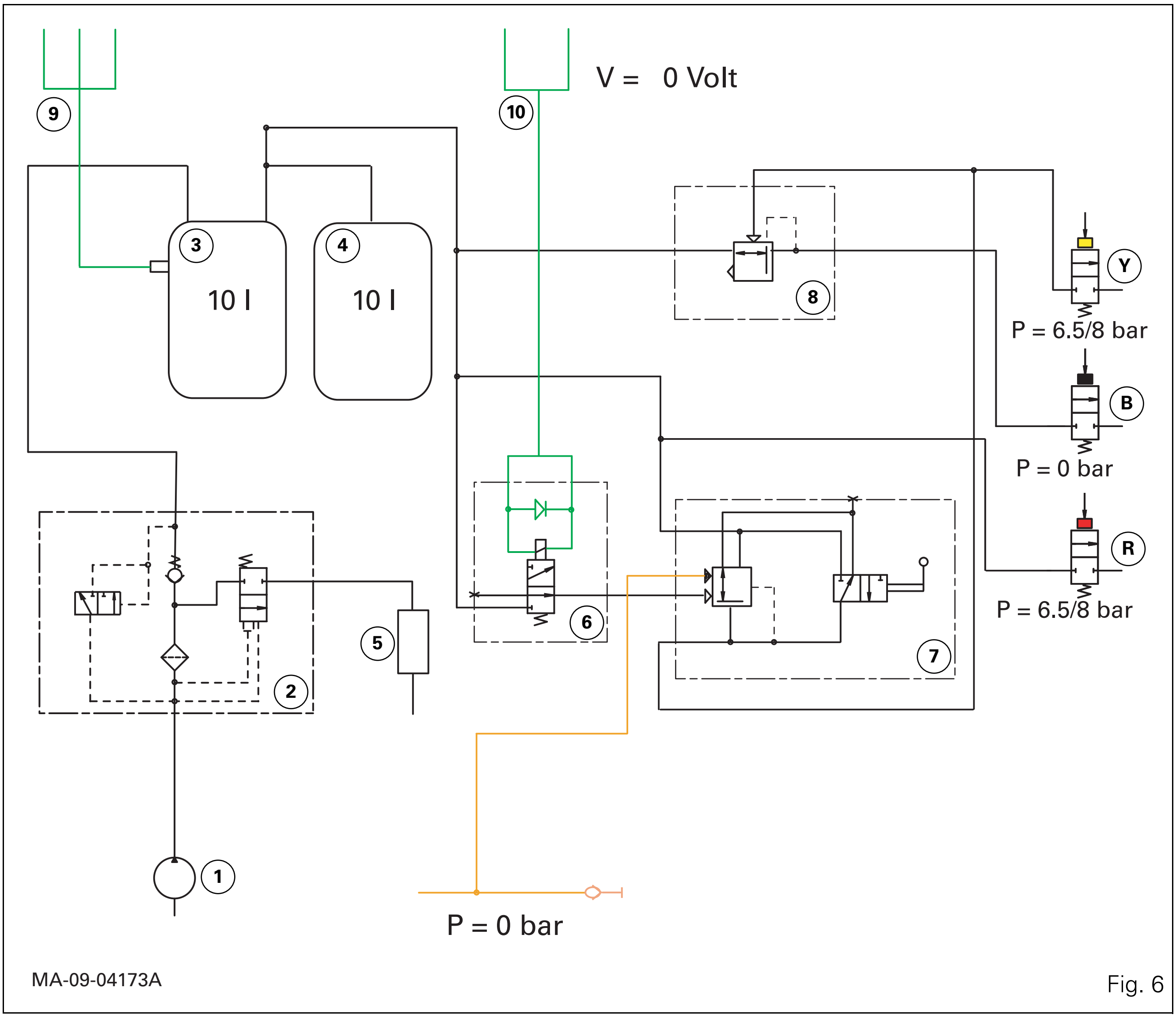


Fig. 6

Pneumatic trailer braking

English system

Engine running, brake not activated

Compressor (1): The air compressor sucks in the outside air to compress it. As soon as the engine operates, the compressor is active.

Pressure regulator (2): The pressure regulator maintains a pressure of 6.5 to 8 bar inside the system.

Solenoid valve (6): No action on the brake pedals. The solenoid valve is not supplied. V = 0 Volt. The system's air pressure is unable to control the main valve (7).

Main valve (7): The parking brake is not activated and therefore the air pressure is locked. The brake pedals are not applied, there is no hydraulic pressure over the trailer brake line and so the air pressure remains locked inside this line.

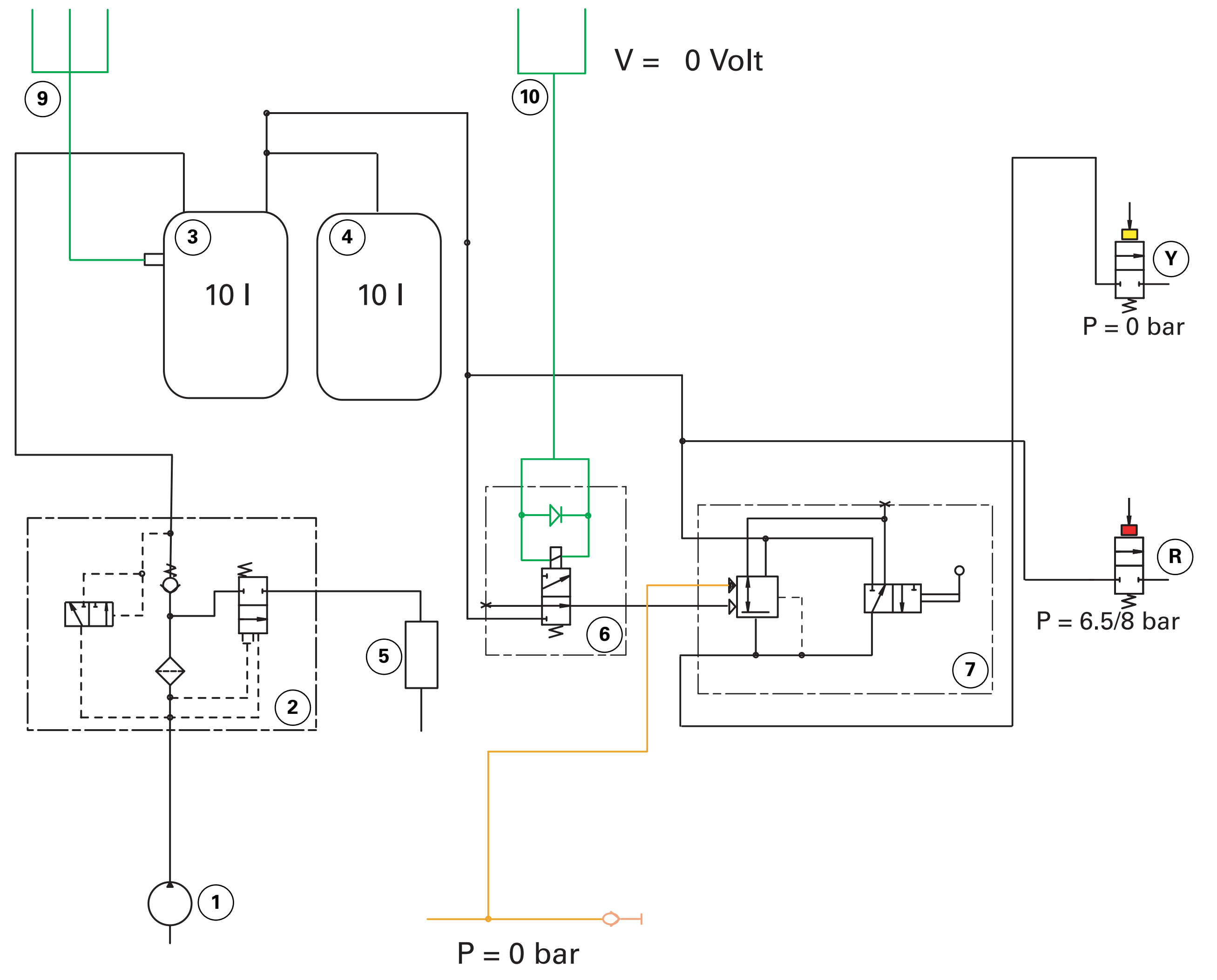


Fig. 7

Engine running, brake pedals applied

Solenoid valve (6): The brake pedals are fully applied. The solenoid valve is supplied. V = 12 Volt. The system air pressure controls the main valve (7).

Main valve (7): The parking brake is not activated and therefore the air pressure is locked. The brake pedals are applied, the hydraulic pressure over the trailer brake line and the air pressure inside the yellow line controls the control valve.

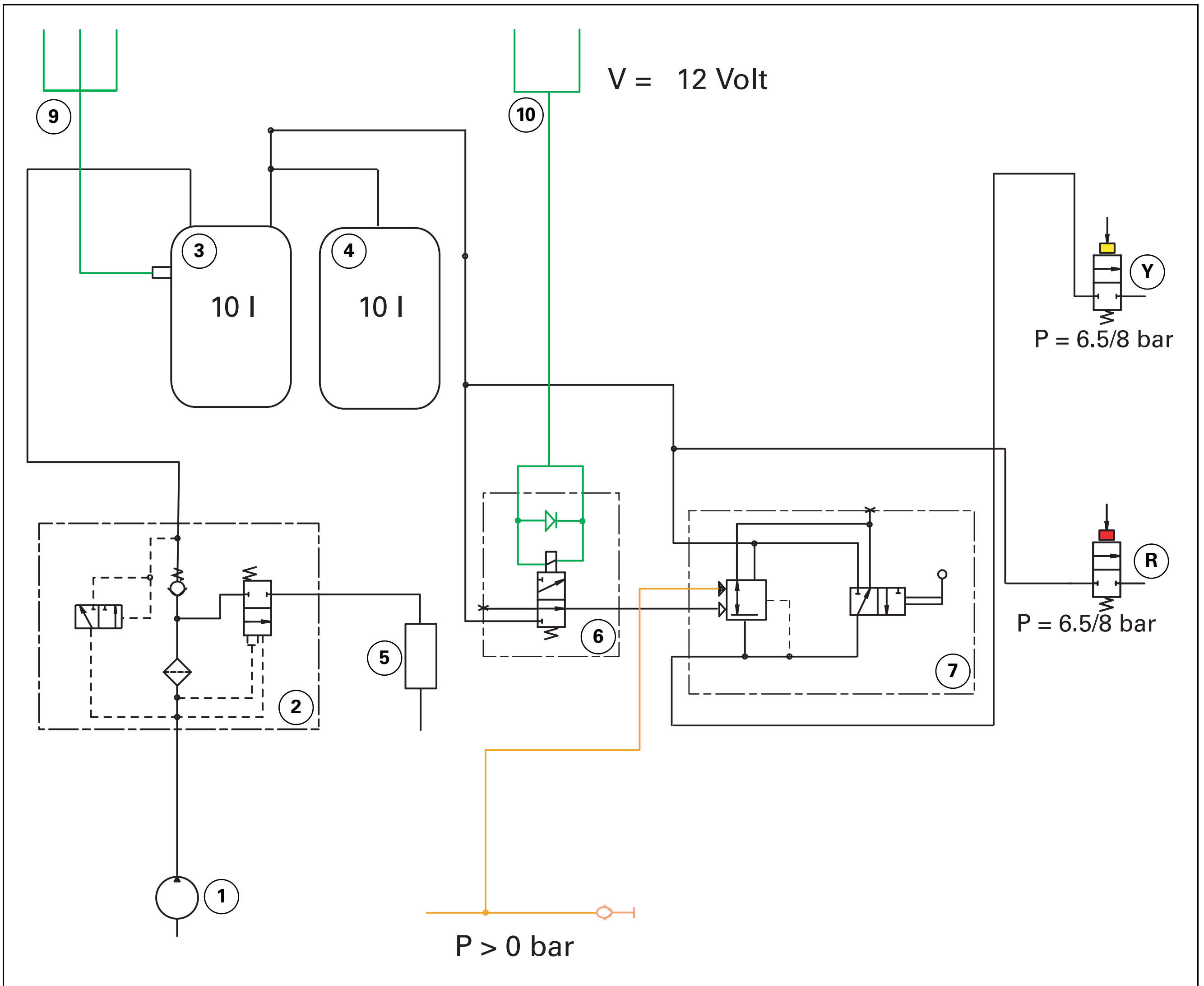


Fig. 8

Pneumatic trailer braking

Engine running, parking brake activated

Solenoid valve (6): The brake pedals are fully released. The solenoid valve is not supplied. V = 0 Volt. The system's air pressure does not control the main valve (7).

Main valve (7): The parking brake is activated. Therefore, the air pressure enters the yellow line and also enters the control valve (8). The brake pedals are fully released, the hydraulic pressure does not enter the trailer brake line and the air pressure remains locked inside this line.

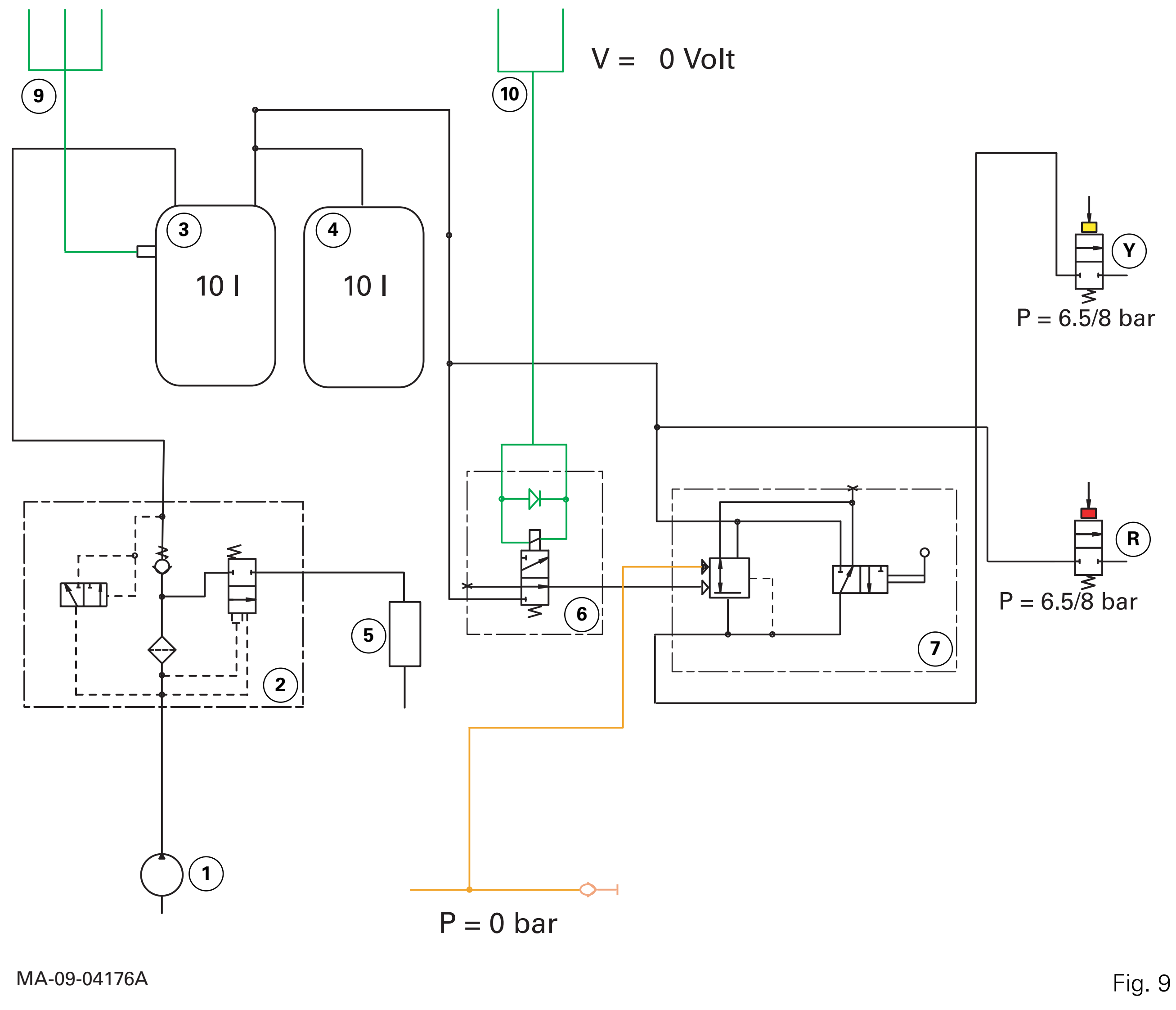


Fig. 9

Italian system

Engine running, brake not activated

Compressor (1): The air compressor sucks in the outside air to compress it. As soon as the engine operates, the compressor is active.

Pressure regulator (2): The pressure regulator maintains a pressure of 6.5 to 7.3 bar inside the system.

Main valve (7): The parking brake is not activated and therefore the air pressure is locked. The brake pedals are not applied, there is no hydraulic pressure over the brake line and so the air pressure remains locked inside this line.

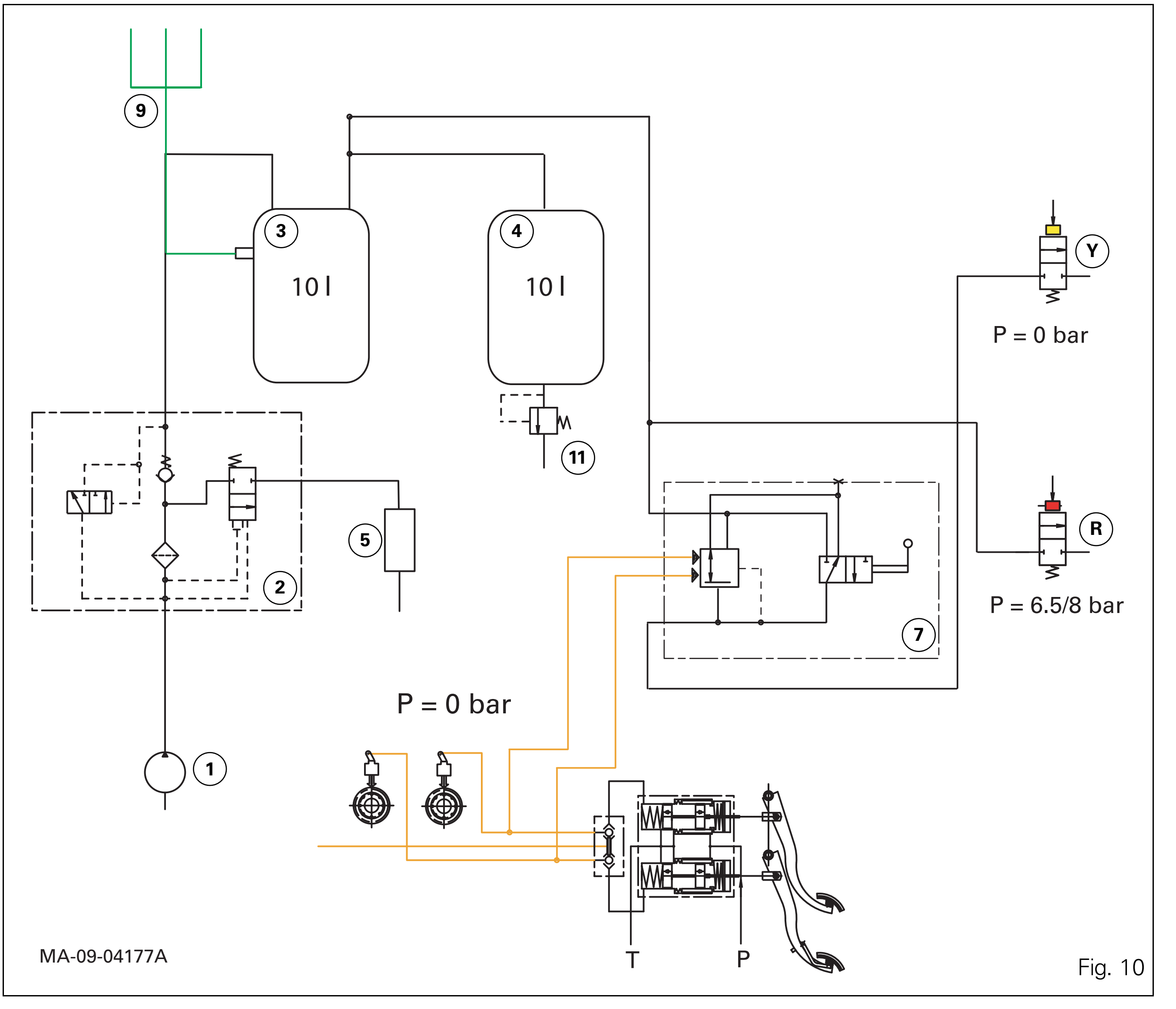


Fig. 10

Engine running, brake pedals applied

Main valve (7): The parking brake is not activated and therefore the air pressure is locked. The brake pedals are applied, the hydraulic pressure over the right and left-hand trailer brake lines controls the control valve (7) to supply the yellow line.

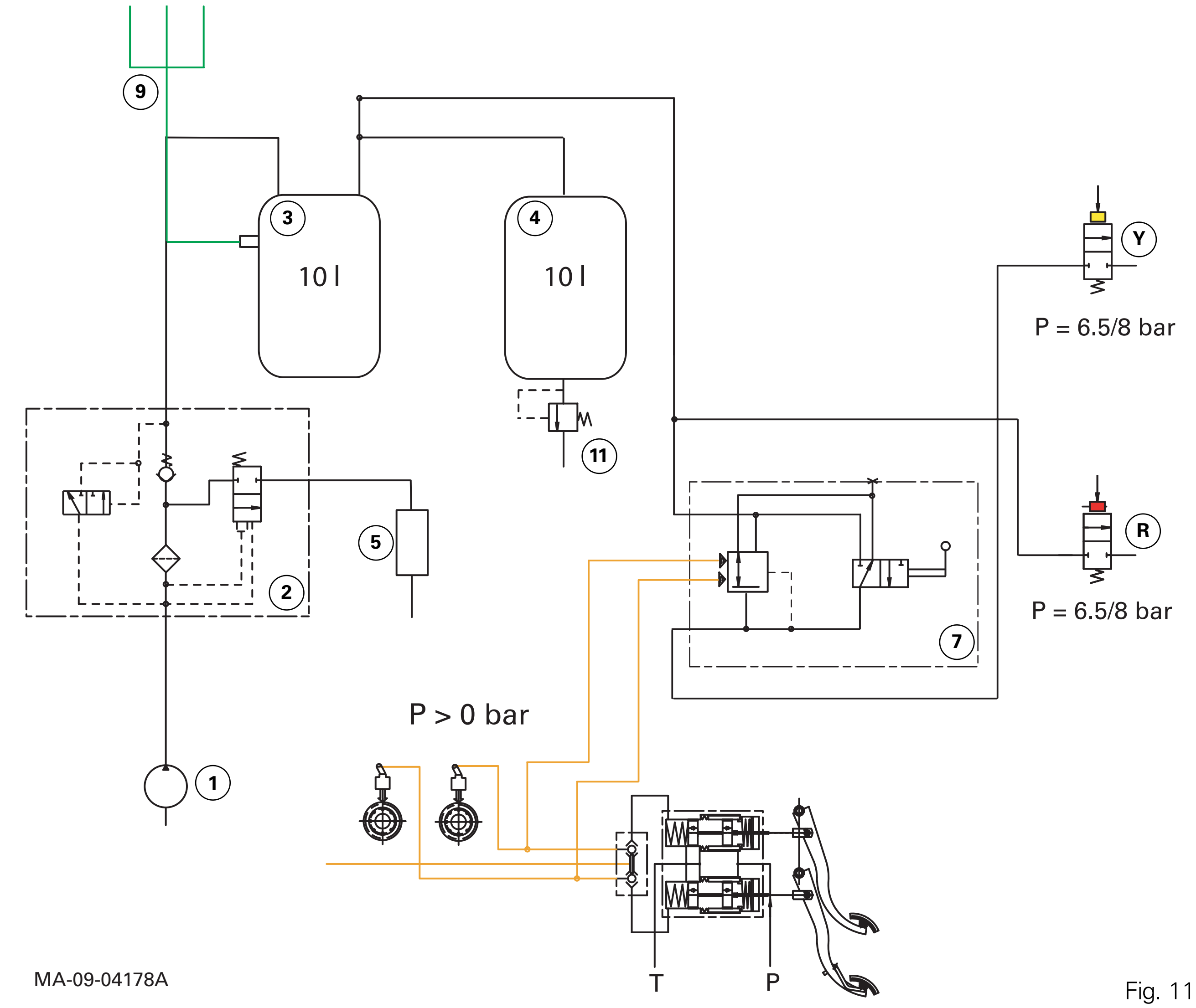


Fig. 11

Engine running, parking brake activated

Main valve (7): The parking brake is activated. Therefore, the air pressure enters the yellow line, passing via the control valve (8). The brake pedals are fully released. The hydraulic pressure does not enter the tractor brake lines and the air pressure remains locked inside this line.

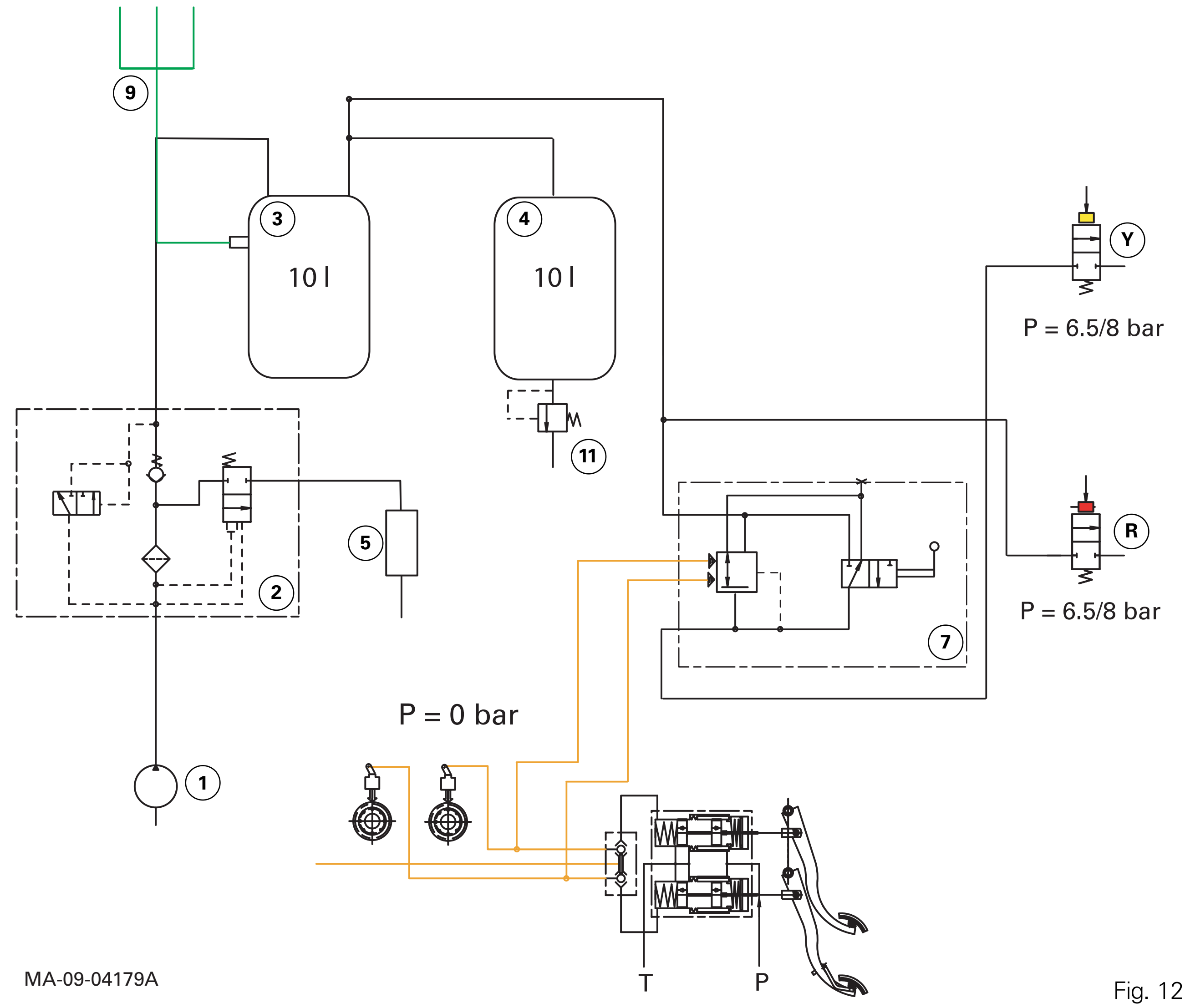


Fig. 12

D . Adjustments and tests

Connecting rod

The control valve is connected to the parking brake mechanical system via a connecting rod. This connecting rod must be adjusted for maximum efficiency.

Connecting rod setting value:
distance between A and B = 120 mm±1

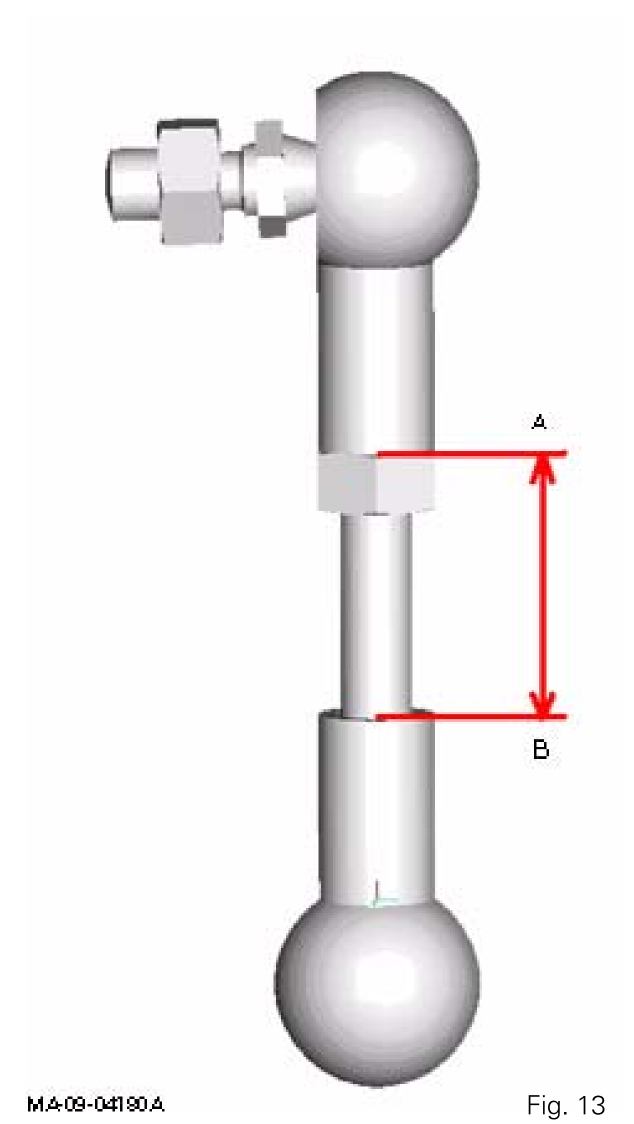


Fig. 13

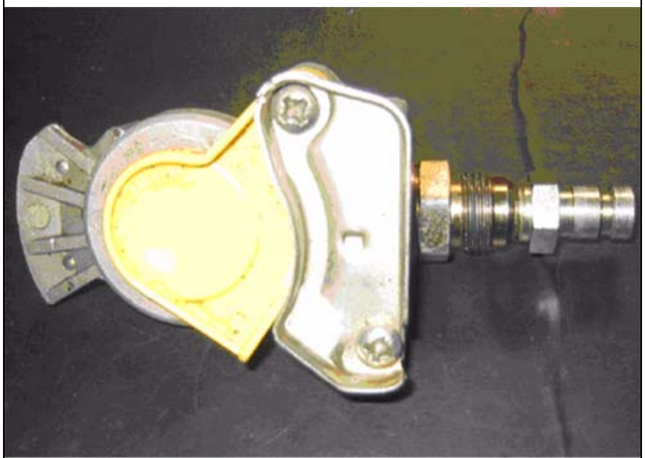
Air system test

These test values are used to check whether the pressure is correct and to detect any leakage in the system.

- For 10 minutes after stopping the engine, the pneumatic pressure should not drop below 0.15 bar.
- Check the operation of the automatic bleed.

System type	Pressure value (bar) when: Brake pedal or hand brake not in use	Pressure value (bar) when: Brake pedal or hand brake in use	Coupler colour
Ger/Eng	6.5-8	6.5-8	Red (Fig. 15)
Italian	6.5-7.3	6.5-7.3	Red (Fig. 15)
German	4.8-5.6	0	Black
Ger/Eng	0	6.5-8	Yellow (Fig. 16)
Italian	0	6.5-7.3	Yellow (Fig. 16)

Example of a coupling head for the pressure connector.



MA-09-04183A

Fig. 14

MA-09-04181A

Fig. 15

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Fig. 16

9G10 - ParkLock - GPA40

CONTENTS

A . General

The ParkLock is a parking brake mechanism located above the GPA40 rear axle (Fig. 1). It is designed to immobilise the tractor in complete safety.

The ParkLock is easily controlled via a pushbutton located to the left of and below the steering wheel (Fig. 2). This pushbutton enables the operator to select the ParkLock engaged position (A) or the disengaged position (B) while seated in the operator's seat.

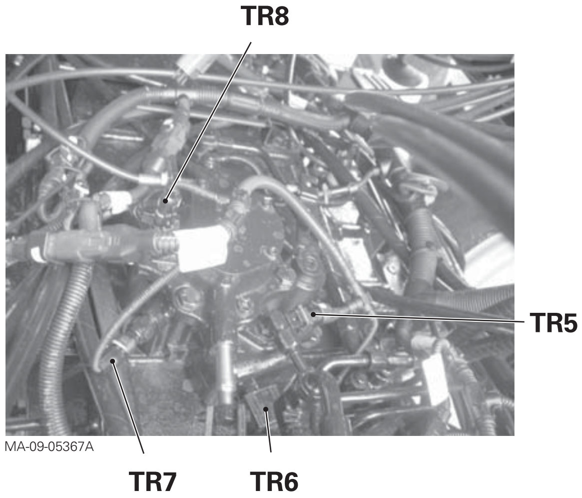

Fig. 1

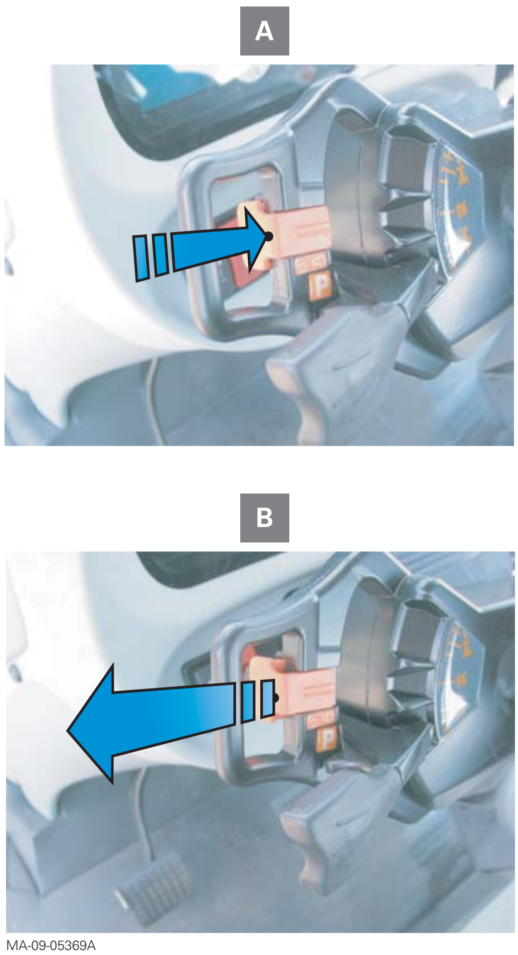

Fig. 2

The ParkLock mainly comprises three parts:

- **a hydraulic part**

  The hydraulic part is located above the rear axle inside the ParkLock unit (7)/cover plate (20) assembly. It comprises (Fig. 3):
  - two "O" rings (12) and (13)
  - a piston (2), which is returned by a set of eight Belleville washers (14). The effect of the load exerted on the piston (2) by the Belleville washers may be cancelled by fully screwing the special hexagonal head screw (5). Cancelling the load exerted by the Belleville washers is useful if:
    - it is necessary to disassemble the ParkLock
    - a hydraulic and/or electronic problem occurs, which hinders tractor mobility.

- **an electrical part**

  The electrical part comprises:
  - two solenoid valves (21) and (22)
  - two switches (18) and (19)

  The solenoid valves and switches are screwed onto the ParkLock unit (7) and the cover plate (20) respectively. They are managed by the tractor's electronic system and via the connectors (TR5), (TR6), (TR7) and (TR8) (Fig. 1).

  NOTE: *In this section, the electronic part is not described. A more detailed description is contained in a specific section (see chapter 11).*

- **a mechanical part**

  The mechanical part of the ParkLock uses the components and the operating principle which are an extension of the hand brake mechanism. Here is a reminder of the components used (if necessary, refer to the section on the GPA40 hand brake control unit, chapter 6):
  - Actuator lever
  - Discs
  - Intermediate plates
  - Mechanism

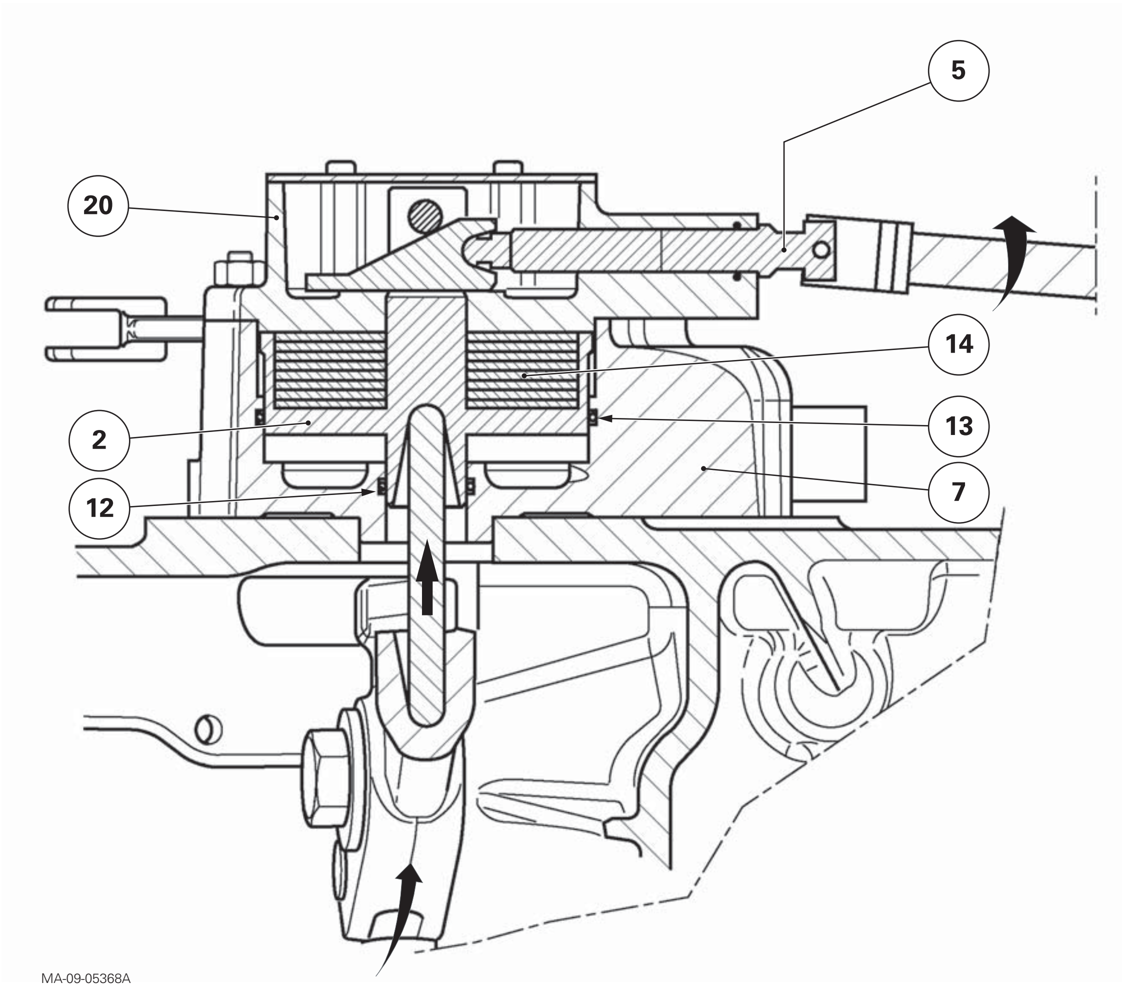

Fig. 3

Parts list (Fig. 4, Fig. 5)

(1) ParkLock
(2) Piston
(3) Pin
(4) Wedge
(5) Special screw (manual disengagement)
(6) "O" ring
(7) ParkLock unit
(8) Actuator lever
(9) Screw
(10) Push rod
(11) Pushrod
(12) "O" ring
(13) "O" ring
(14) Belleville washers
(15) Screw
(16) Cover plate
(17) Screw
(18) Switch
(19) Switch
(20) Cover plate
(21) Solenoid valve
(22) Solenoid valve
(23) 17 or 21 bar union
(24) Mecanindus pin
(25) Circlip
(26) Tie rod
(27) Screw
(28) Stud
(29) Washer/nut

Legend

(M) Hand brake mechanism

View of the assembly

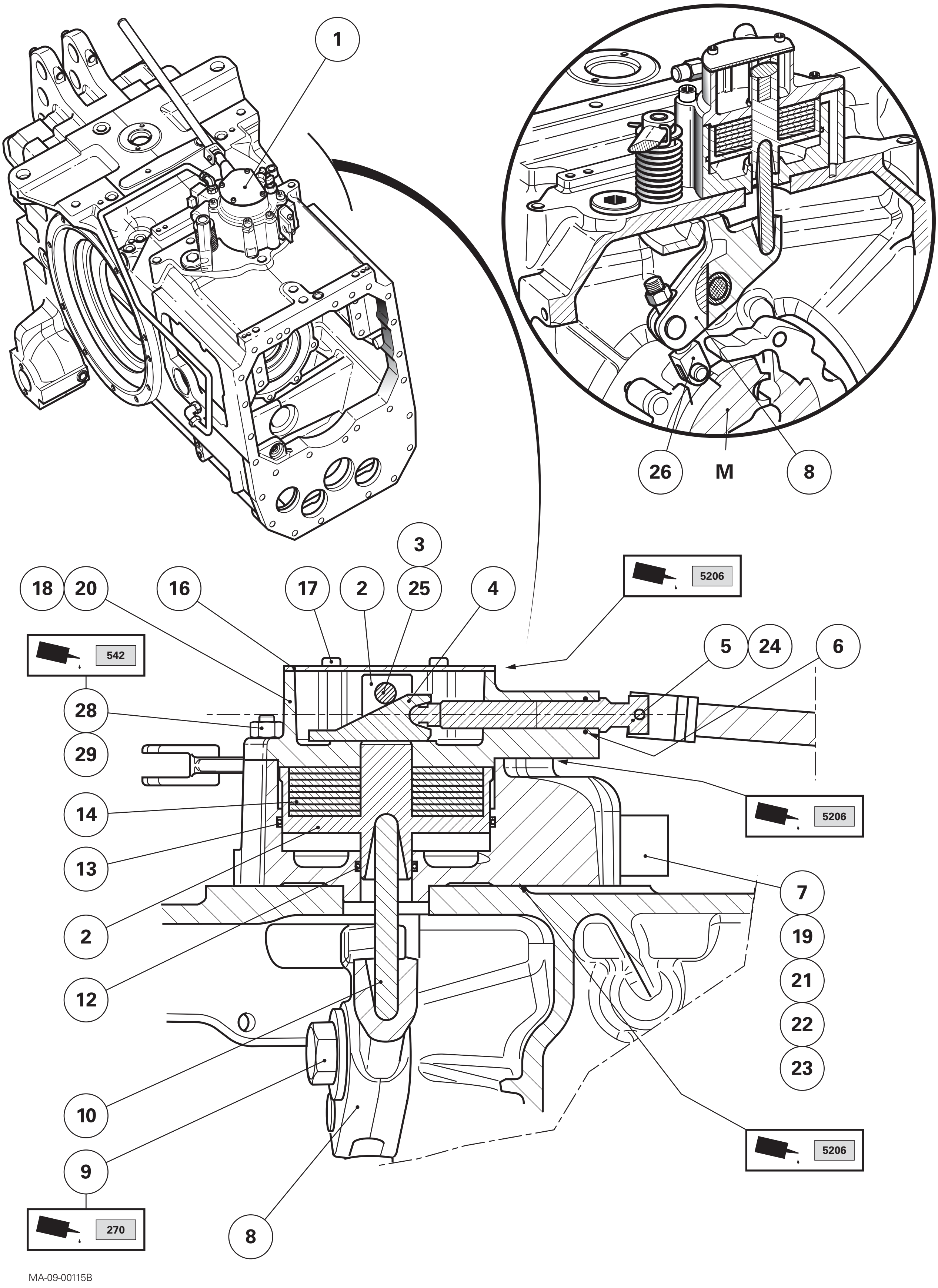

Fig. 4

Blown-up view

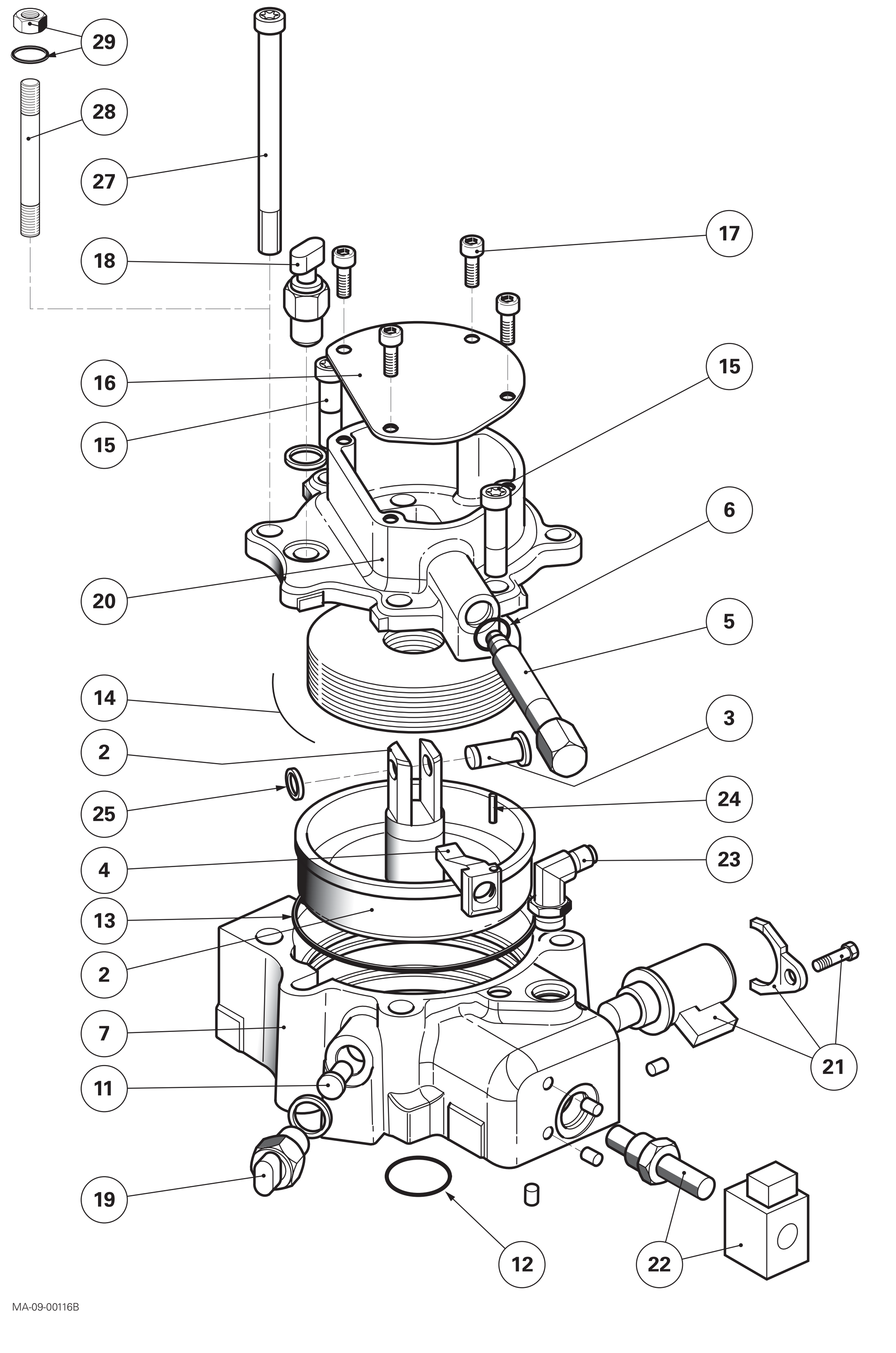

Fig. 5

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Operation

Engaged position: mechanical action (Fig. 6)

The movement of the piston (2) caused when the Belleville washers (14) are released forces the actuator lever (8) to tilt, compressing the hand brake discs splined in rotation with the pinion. The rear axle is then blocked and the tractor is immobilised.

Disengaged position: hydraulic action (Fig. 7)

In this configuration, the ParkLock mechanism receives a 17 or 21 bar oil supply via two different solenoid valves. The piston (2) then compresses the Belleville washers and releases the push rod (10), the mechanism (M) and the hand brake discs via the actuator lever (8) and the hand brake tie rod (26).

One of the two solenoid valves secures the ParkLock disengaged position in the event of a fault. The principle consists of maintaining the oil chamber of the piston (2) under pressure by shutting off its return line.

A switch screwed onto the cover plate (20) and a second switch located on the ParkLock unit (7) check the hand brake disc wear and operation of the ParkLock respectively via indicator lights.

Each electrical component is controlled by the tractor's electronic system.

Legend (Fig. 7)

17/21 bar

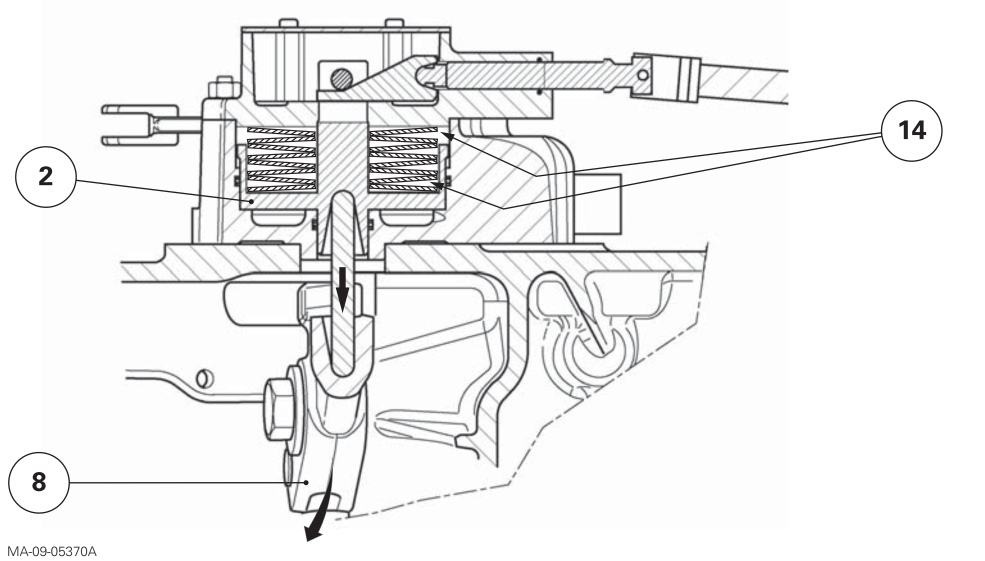

Fig. 6

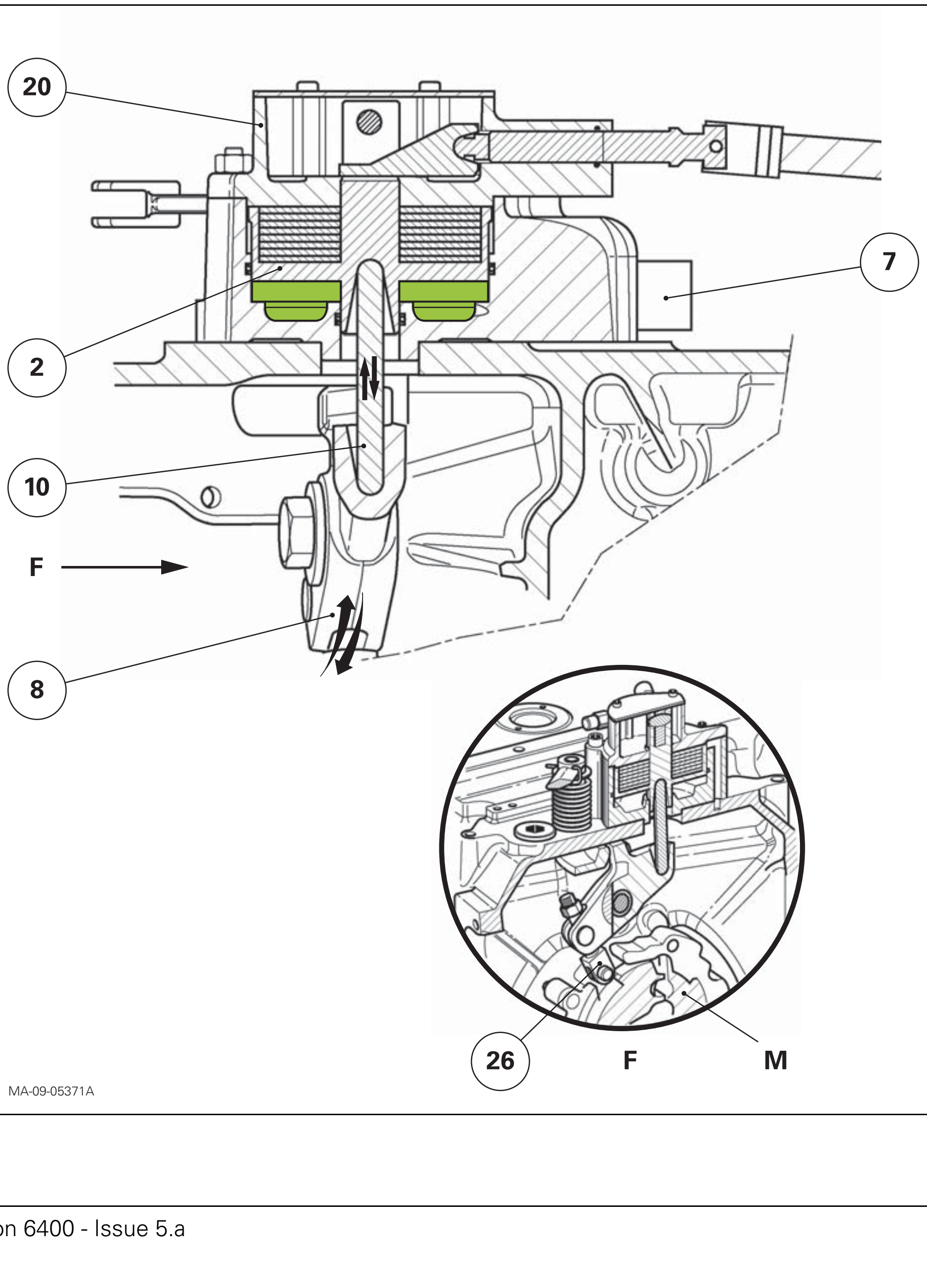

Fig. 7

B . Manual disengagement and engagement of the ParkLock

Manual disengagement (C) (Fig. 8)

If manual disengagement is necessary

The ParkLock must be disengaged manually:

- if the rear axle is to be removed for dismantling
- to provide tractor mobility in the event of a failure on the 17 or 21 bar hydraulic system or a fault on the electronic management system

Procedure

1. Using the remote control (1) linked to the special screw (5) on the cover plate, manually disengage the ParkLock by fully screwing in the special screw (5) until it no longer turns.

Description of the mechanical reaction during manual disengagement

When the special screw (5) is screwed in, the wedge (4) moves. This bevelled wedge mechanically pulls the piston (2) upwards, compressing the set of Belleville washers (14). The load which had been applied to the push rod (10) is cancelled. The mechanism (M) and the hand brake discs are then released to make the tractor mobile.

Manual engagement (D) (Fig. 8)

Procedure

2. If for whatever reason the ParkLock has been disengaged, using the remote control (1), completely unscrew the special screw (5) until it comes into contact with a "hard" point. This procedure restores the ParkLock original functions: disengagement (hydraulic function) and engagement (mechanical function).

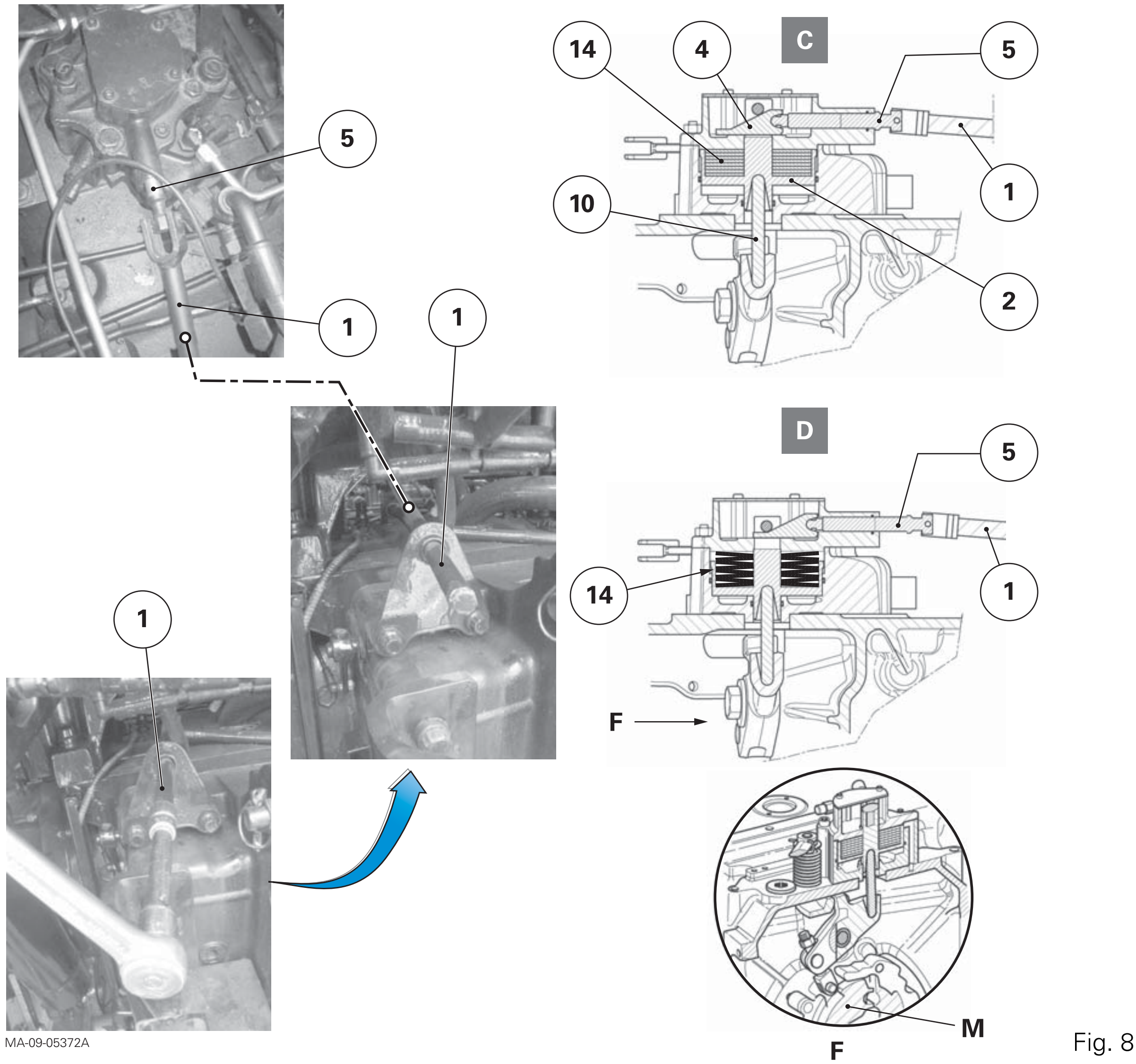

Fig. 8

C . Removing and refitting the ParkLock unit

Preliminary steps

3. Remove the components restricting access to the ParkLock unit.

4. Disconnect the connectors (TR5) to (TR8) (Fig. 9) connected to the switches (18) and (19) and the solenoid valves (21) and (22) (Fig. 10), marking them beforehand.

5. Disconnect the 17 or 21 bar supply pipe connected to the union (23) (Fig. 10).

6. Manually disengage the ParkLock (see § B).

Removal

7. Remove the M12 screws (27) and the nut (29) (if fitted) but not the M10 screws (15) (Fig. 10).

8. Separate and remove the ParkLock from the centre housing.

9. Recover the push rod (10) without allowing it to fall inside the centre housing.

Refitting

10. Clean the mating face of the ParkLock on the centre housing and on the unit (7).

11. Smear the bottom end of the push rod (10) with Molykote type grease or equivalent. Refit this rod into it compartment on the actuator lever (8).

12. Replace the two "O" rings providing the seal between the ParkLock unit (7) and the centre housing.

13. Smear the housing of the piston (2) with Molykote type grease or equivalent. Position and refit the ParkLock, fitting the upper end of the push rod (10) into the compartment on the piston (2).

14. Lightly smear the thread of the screws (27) and the thread of the nut (29) (if fitted) with Loctite 542 or equivalent.

IMPORTANT: *The thread of the screws and the stud (28) (if removed) must be smeared with Loctite as their ends protrude inside the centre housing.*

15. Tighten the screws (27) and the nut (29) to 100 to 130 Nm.

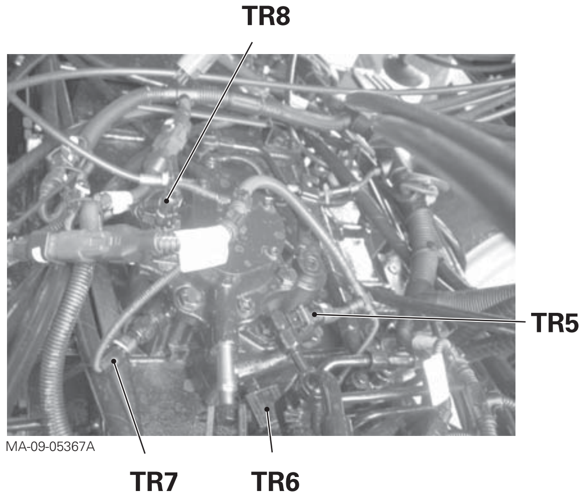

Fig. 9

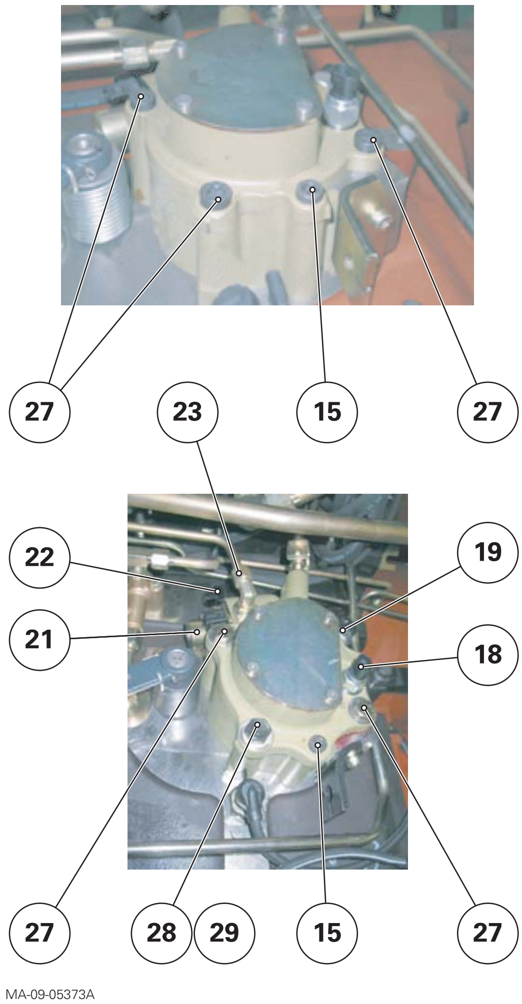

Fig. 10

Final steps

16. Refit the components which were taken off for hindering the removal of the ParkLock unit.

17. Restore the original functions to the ParkLock (disengagement and engagement) by completely unscrewing the special screw (5) (see § B).

18. Reconnect the 17 or 21 bar supply pipe connected to the union (23).

19. Reconnect the connectors (TR5) to (TR8) to the switches (18) and (19) and the solenoid valves (21) and (22).

20. Start the tractor engine.

21. Slowly move the tractor several metres over a track with a slight slope and immediately place the shuttle lever back in the neutral position. Before stopping the tractor, push the pushbutton to the engaged position (A) (Fig. 2) to engage the ParkLock and carry out an initial test.

IMPORTANT: *When engaging the ParkLock, check that the tractor is immobilised by noting a slight hesitation caused by the transmission locking.*

22. Repeat the above procedure several times to confirm that the ParkLock is operating correctly.

23. While seated in the operator's seat, move the tractor onto a track with a steeper slope.

Stop the engine and check:

- the efficiency of the ParkLock
- that the hand brake is operating correctly

24. Check that there are no leaks in the hydraulic system (union, mating face, switches and solenoid valves).

D . Disassembling and reassembling the ParkLock unit

Preliminary steps

25. Remove the ParkLock comprising the unit (7) and the cover plate (20) (see § C).

26. Unscrew and remove (Fig. 11, Fig. 12):

- the solenoid valves (21) and (22)
- the switches (18) and (19) fitted with their seal. These switches are located on the cover plate (20) and on the unit (7) respectively.

Recover the pushrod (11).

NOTE: *The pushrod (11) acts as a transmission component between the switch (19) and the piston (2).*

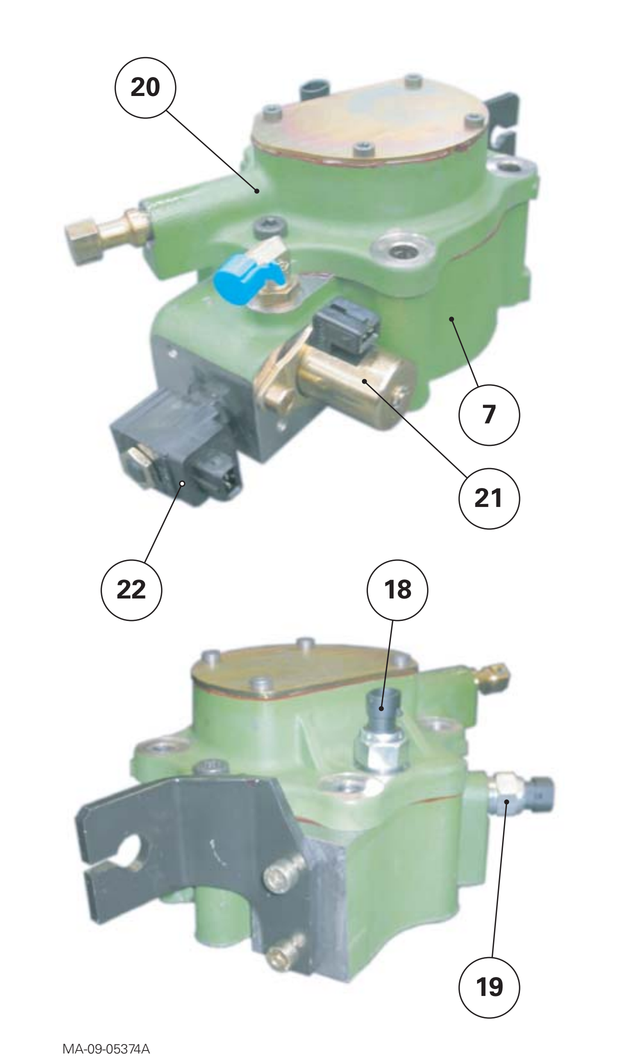

Fig. 11

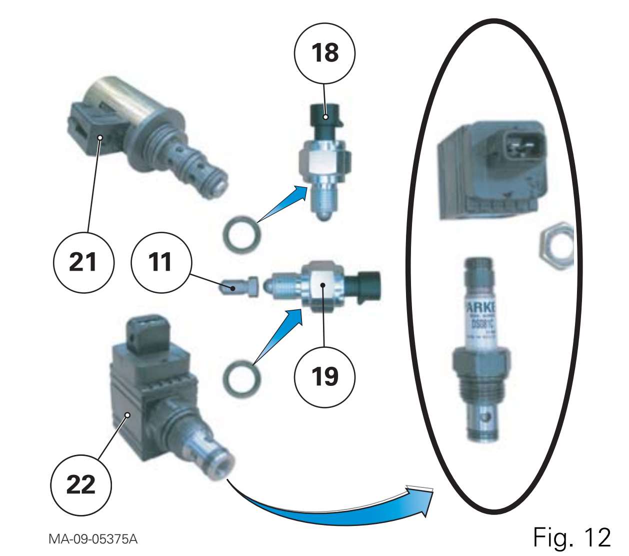

Fig. 12

Disassembly

27. Completely unscrew the special screw (5) so that the ParkLock is in the manual engagement position (D) (Fig. 8) and as a result, the Belleville washers (14) are almost released.

28. Unscrew the screws (17). Release and remove the cover plate (16).

29. Remove the circlip (25) and the pin (3).

30. Place the ParkLock in a press, protecting the underside of the unit (7) using two pieces of flexible protection (P) (Fig. 13).

Also slide a flexible protection (P) over the cover plate (20) (Fig. 13).

31. Apply the hydraulic press ram to the flexible protection (P) without exerting any force (F) on the cover plate (20) (Fig. 13).

Unscrew the screws (15) (Fig. 13).

Slowly decompress the hydraulic press ram to decompress the Belleville washers (14).

32. Remove:

- the cover plate (20)
- the Belleville washers (14), first noting their number and positioning (Fig. 14, Fig. 15)

Note: The eight Belleville washers are referenced in the spare parts catalogue in the form of a kit (Fig. 15).

33. On the cover plate (20):

- Drive out the spring pins (24)
- Completely unscrew the special screw (5)
- Recover the wedge (4)
- Remove the "O" ring (6) and discard it

34. Take out the piston (2) from the ParkLock unit (7).

35. Remove and discard the "O" rings (12) (13).

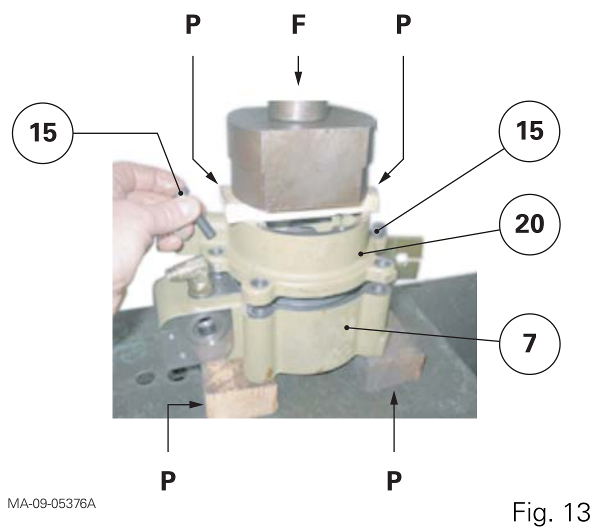

Fig. 13

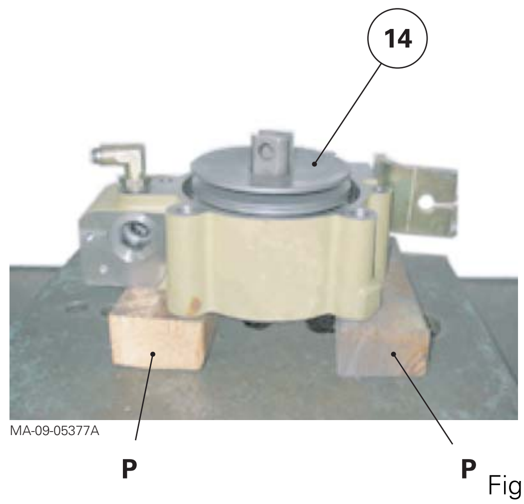

Fig. 14

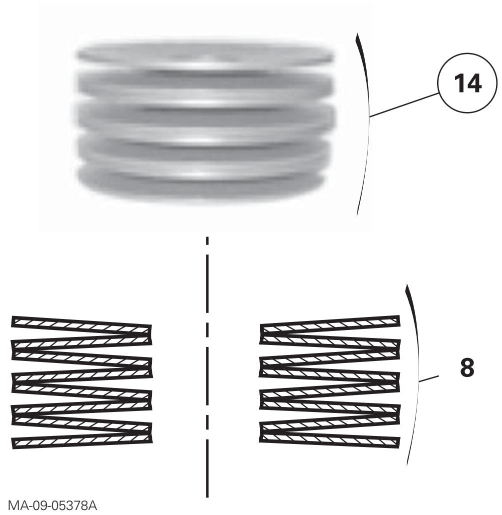

Fig. 15

Reassembly

36. Clean:
- the mating faces of the ParkLock unit (7)
- all parts.

Using a jet of compressed air or a flexible iron wire, check that the hydraulic channels of the ParkLock unit (7) are not blocked.

37. Check:
- that the pushrod (11) for the switch (19) moves freely in its housing
- that there is a rivet fitted to the outer end of each hydraulic channel of the ParkLock unit (7)

38. Temporarily remove the seals (12) and (13) from the piston (2). Test fit the latter inside the ParkLock unit (7). Check that the piston moves freely inside its bore with no "hard" points.

39. Eliminate any impurities that may have become accidentally lodged inside the chamber of the piston (2).

40. Lubricate the seals (12) and (13) with clean transmission oil. Fit these seals into the grooves of the ParkLock unit (7).

41. Hold the piston (2) above the ParkLock unit (7), positioning its flat section (Fig. 16) so that it is facing towards the return port (Fig. 17).

42. Fit the piston (2), gently tapping its centre in a circular motion using a plastic hammer. After fitting, check that there are no fragments of seal around the piston.

43. Lightly smear the upper mating face of the ParkLock unit (7) with Loctite 5206 or equivalent (Fig. 4).

44. Refit the Belleville washers (14) (Fig. 18) according to the layout in Fig. 15.

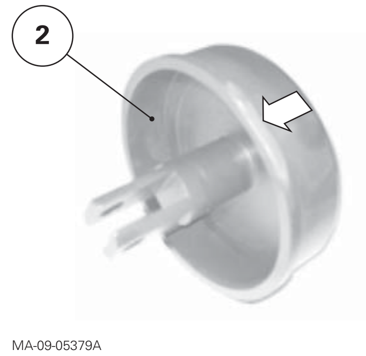

Fig. 16

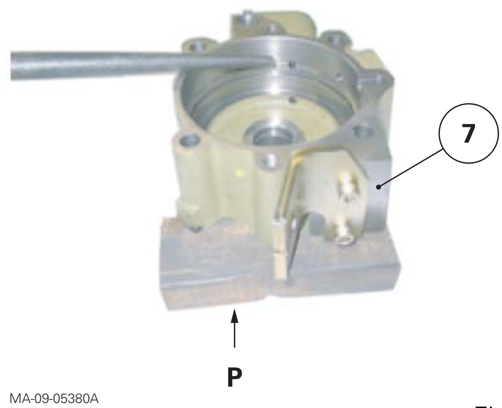

Fig. 17

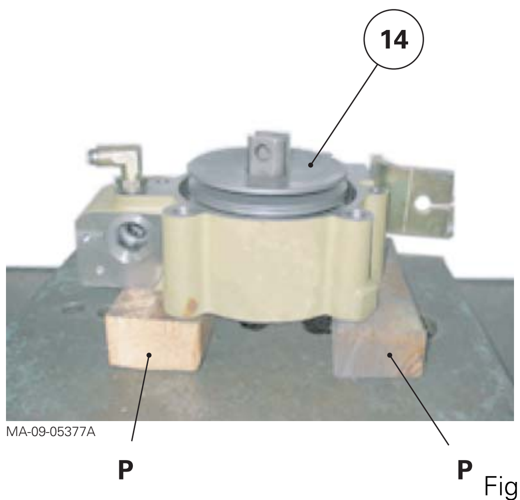

Fig. 18

45. Refit and position the cover plate (20) on the ParkLock unit (7) (Fig. 19). Test fit to check that the wedge (4) is correctly aligned with the clevis of the piston (2) (Fig. 19). If the alignment is incorrect, correct it.

46. Place the ParkLock in a press, using the same protections that were used for removal (see step 30).

47. Using the ram press, exert a moderate force (F) on the cover plate (20) (Fig. 20) so as to compress the Belleville washers. As soon as the cover plate (20) reaches the ParkLock unit (7), screw on and tighten the two screws (15) to 57-77 Nm.

48. Lubricate the "O" ring (6). Fit it into the groove of the cover plate (20).

49. On the cover plate (20), screw on the special screw (5) and fit the wedge (4) at the same time. Form a wedge/special screw assembly using two new spring pins.

50. Lightly smear the upper mating face of the cover plate (20) with Loctite 5206 or equivalent (Fig. 4).

51. Refit the cover plate (16). Tighten the screws (17) to a torque of 12 to 16 Nm.

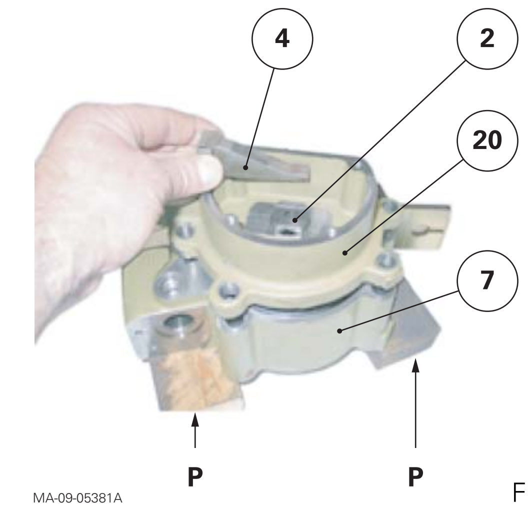

Fig. 19

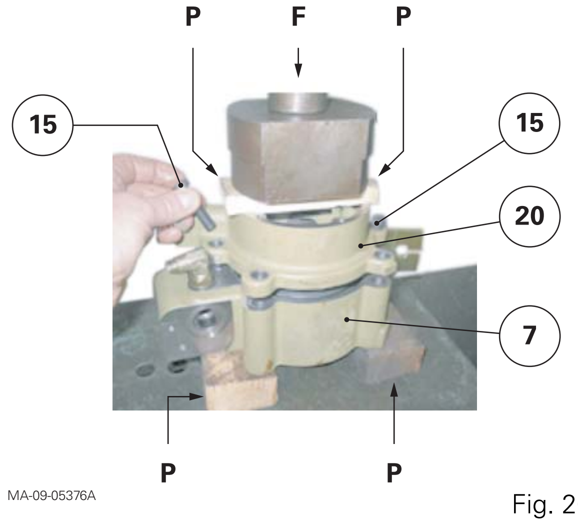

Fig. 20

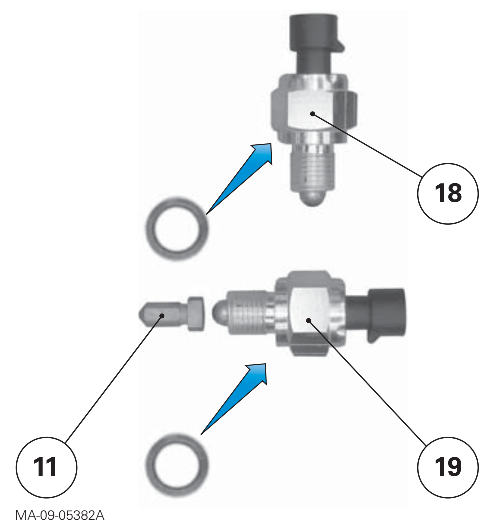

Fig. 21

Final steps

52. Ensure that each switch is fitted with a new seal.

53. Fit:

- the switch (18) (Fig. 21) onto the cover plate (20)
- the pushrod (11) and the switch (19) (Fig. 21) to the ParkLock unit (7).

54. Tighten the switches to a torque of 15 - 25 Nm.

55. Fit the solenoid valves (21) (22) in the same positions as before disassembly.

56. Tighten the following onto the solenoid valve (22):

- the spool to a torque of 18 – 20 Nm.
- the solenoid to a torque of 4 -5 Nm.

9H10 - Lift control spool valve - Open Centre

CONTENTS

A . General

The BOSCH ELC (EHR5) lift control spool valve is fitted to 6400 tractors equipped with an open centre hydraulic system.

It is fitted to the left-hand hydraulic cover of the centre housing (Fig. 1).

It regulates the flow rate of oil to and from the lift rams, according to the signals that it receives from the electronic linkage calculator (ELC).

It comprises a series of spools and valves, most of which cannot be repaired as separate parts.

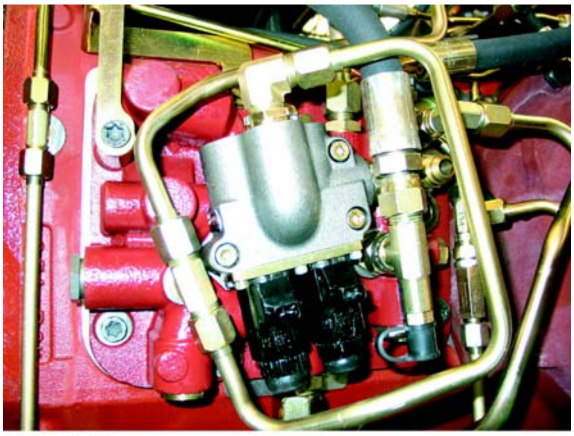

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Fig. 1

B . Layout of components and identification of ports

Layout of components

The BOSCH ELC (EHR5) hydraulic spool valve comprises two parts:

Hydraulic part

(1) Non-return valve
(2) Lifting spool valve
(3) Lowering spool vlave
(4) Flow rate control spool
(5) Shock valve (200 to 210 bar)
(6) Flow control spool spring
(9) Lifting spool spring
(10) Lowering spool spring
(11) Restrictor
(12) Lift control spool valve

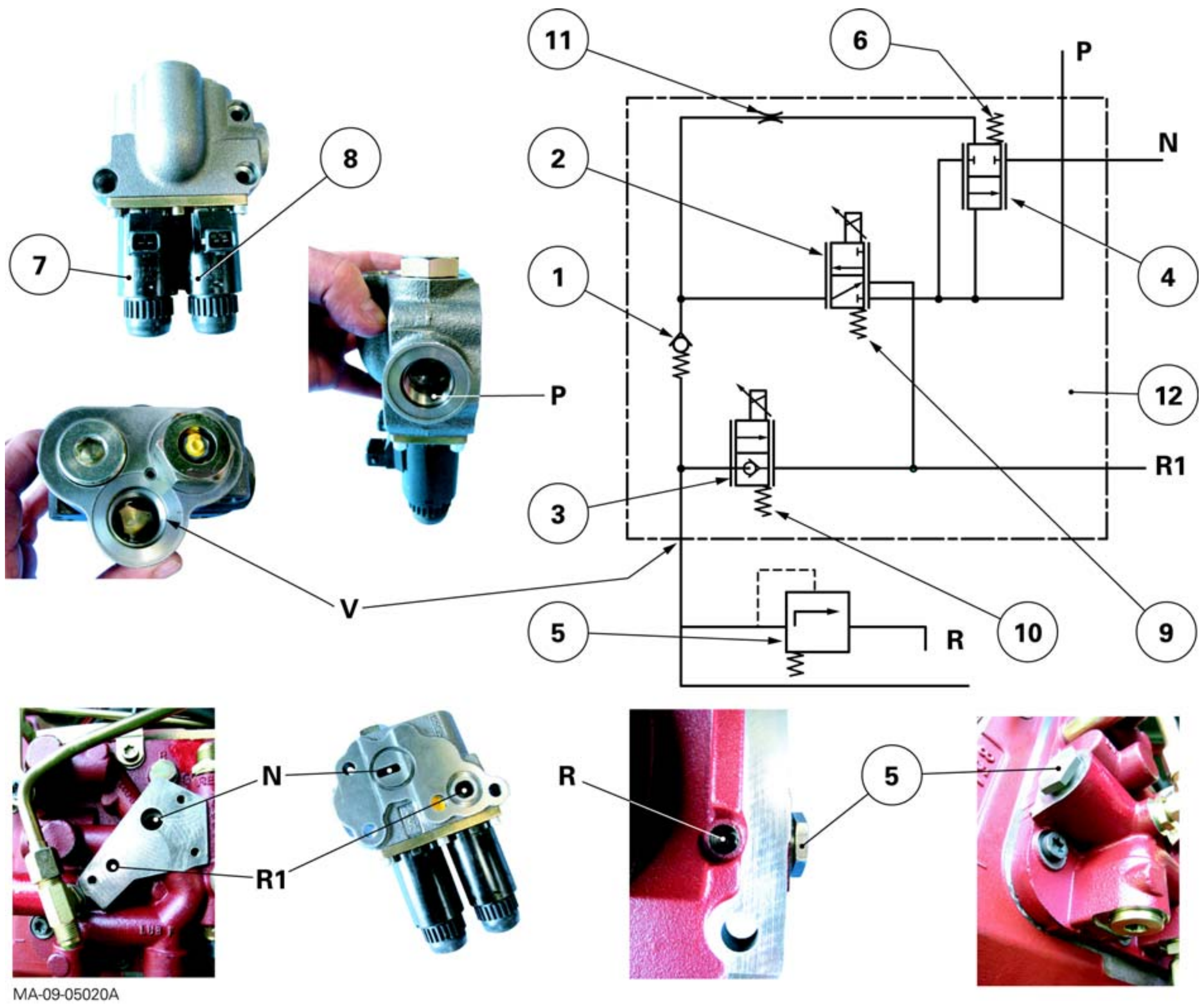

Fig. 2

Identification of ports:

N	Continuity channel
P :	Pressure
R, R1	Return to housing
V	Port to lift rams

Electric part

(7) Lowering solenoid valve
(8) Lifting solenoid valve

Reminder

To tell a hydraulic problem apart from an electrical problem, operate the push-buttons at the end of the solenoid valves (Fig. 3). This allows to manually control solenoid valve movement.

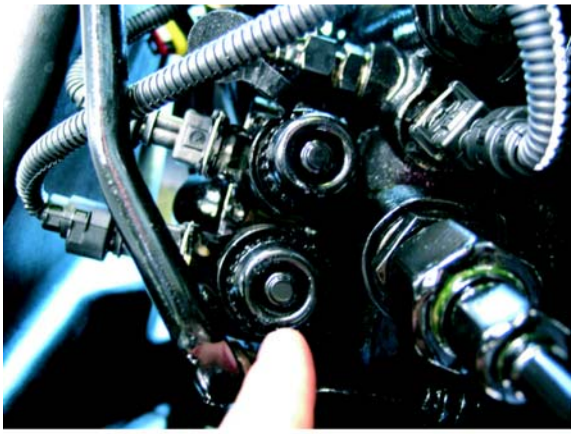
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Fig. 3

C . Neutral position

When the engine is stopped (Fig. 4):

- the lift control spool valve (12) is in neutral position;
- the lifting and lowering solenoid valve spools (2) and (3) are held in position by their respective springs;
- the flow rate control spool (4) is held down by its own spring.

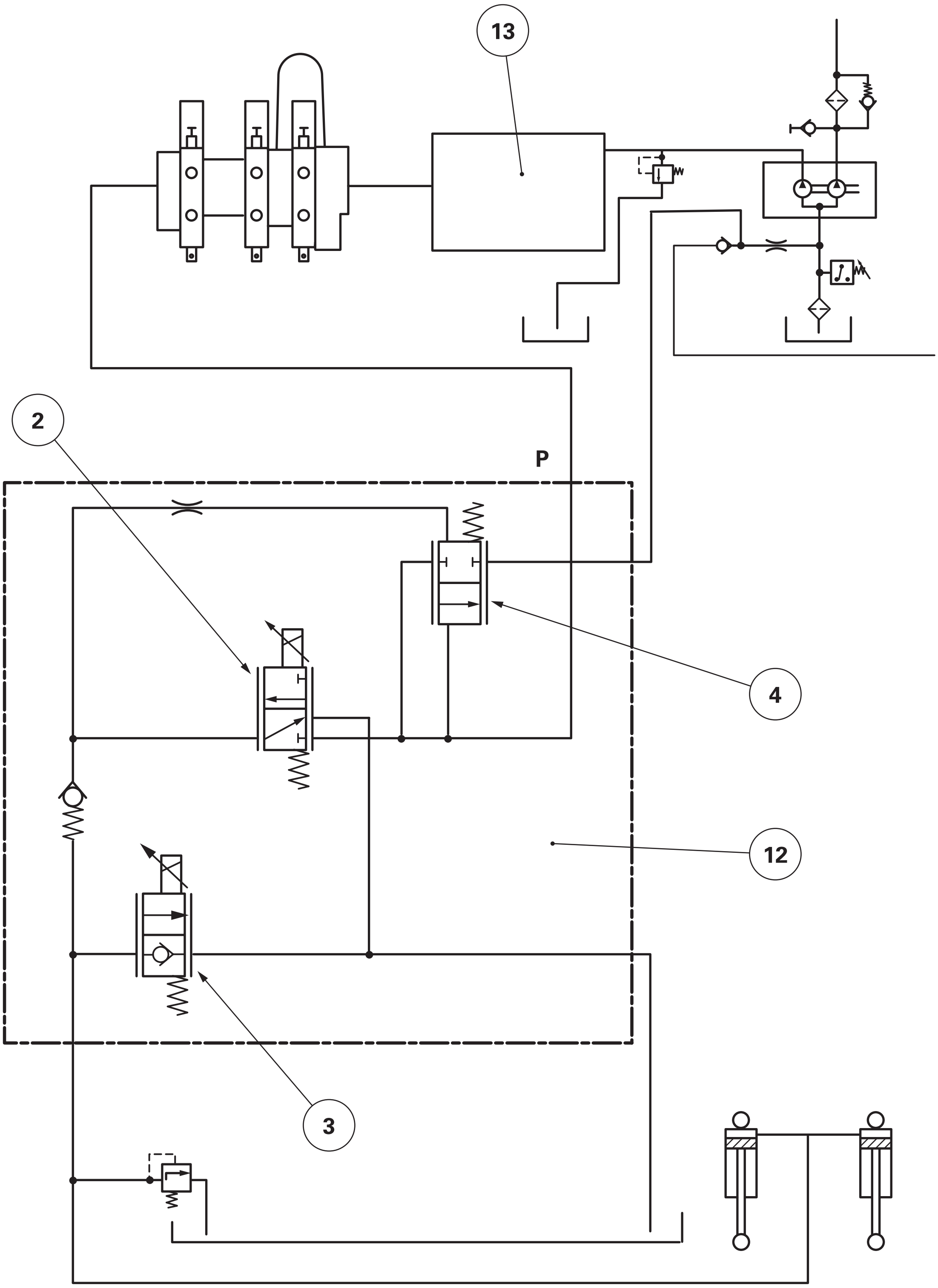

Fig. 4

Lift control spool valve - Open Centre

When the engine is running (Fig. 5):

The hydraulic pump supplies the lift control spool valve (12) via the trailer braking spool valve (13) (if fitted) and the auxiliary spool valves.

The pressure arriving from the port (P) moves the flow rate control spool (4) upwards, thus allowing the oil to flow into the continuity channel (N) and the hydraulic pump via the transfer pipe.

- **Remark**

  The continuity channel (N) connects the oil flowing in the Open Centre system and also controls the hydraulic flow of brake lubricant via a restrictor and a valve.

Legend (Fig. 5, Fig. 6, Fig. 7, Fig. 9)

(red)	High pressure
(green)	Return
(blue)	Suction

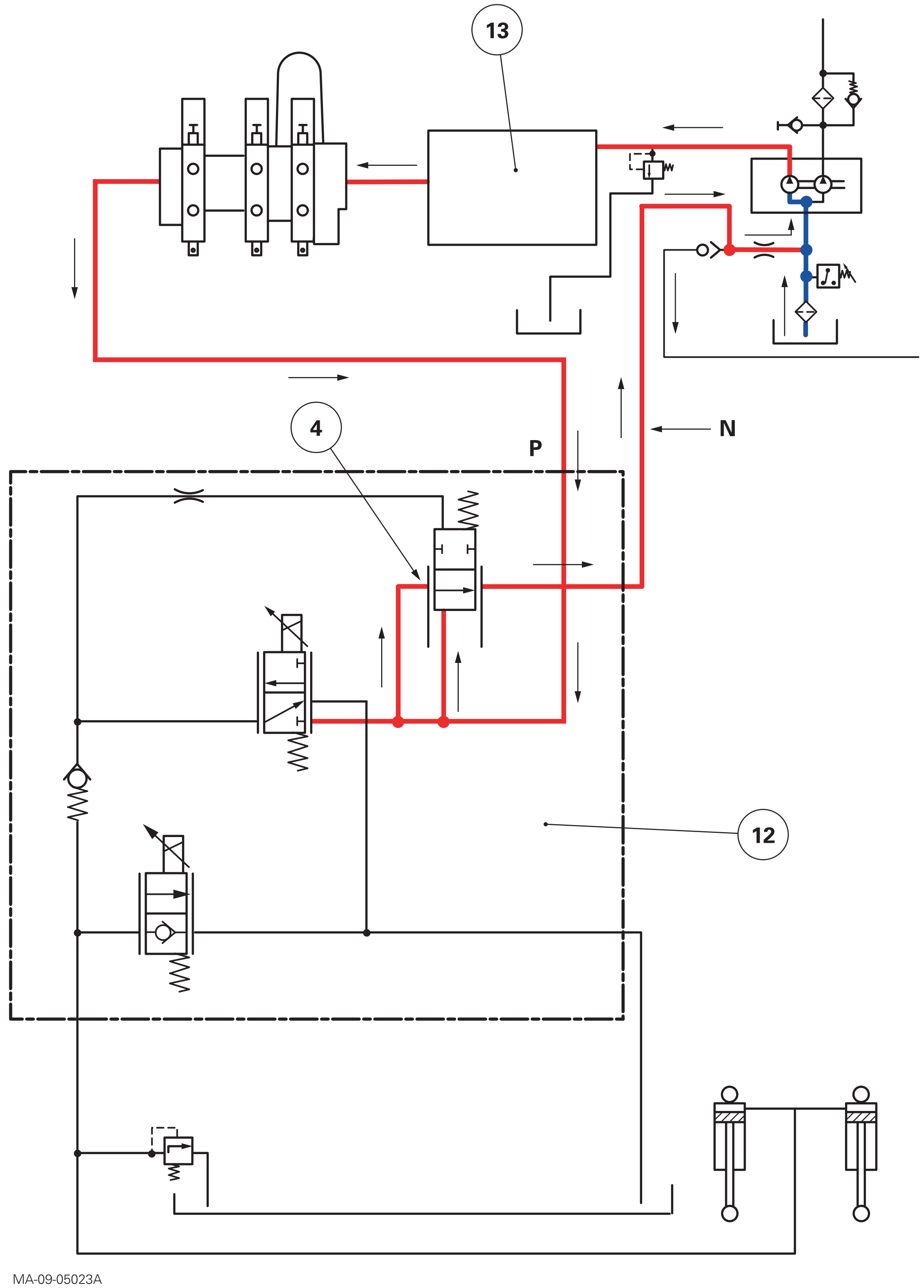

Fig. 5

D . Lifting position

The solenoid valve (8) is activated to lift the drawbars (Fig. 6). The lifting spool (2) is moved downwards, thus directing the main flow to the non-return valve (1). As soon as the pressure acting on the valve exceeds the pressure in the rams, the valve opens and the flow enters the port (V) to raise the hitch.

When the hitch is in the required position, the tractor electronic system stops the supply to the solenoid valve (8).

As a result:

- the non-return valve closes;
- the lifting spool valve is positioned on the return channel R1;
- the flow rate control spool (4) is fixed in raised position, allowing the oil to flow again in the continuity channel N.

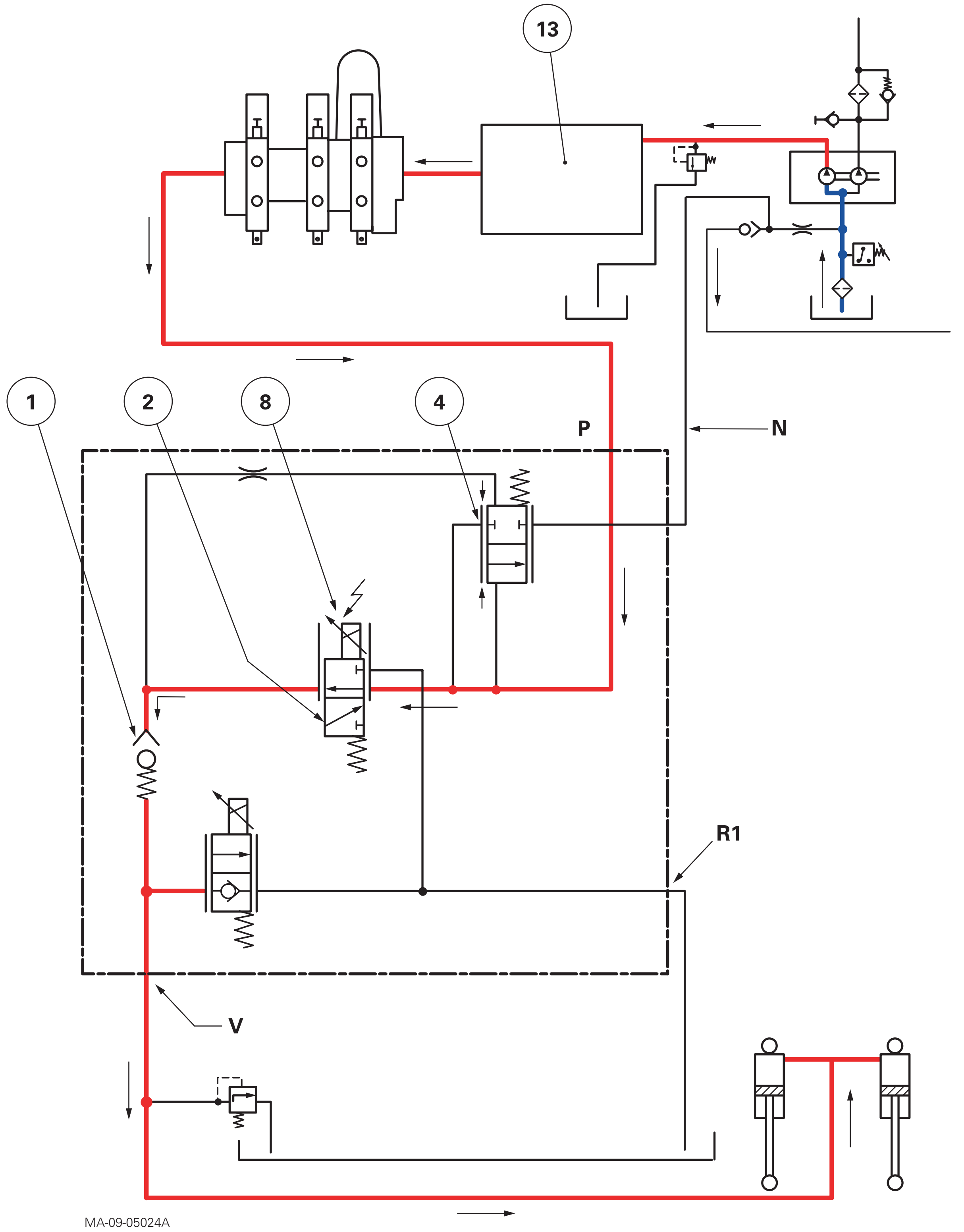

Fig. 6

E . Lowering position

The solenoid valve (7) is activated to lower the drawbars (Fig. 7).

The lowering spool (3) is moved downwards. Its position allows oil to return from the rams via the port (V) to the return R1.

Remark

The lowering phase has no effect on the flow rate control spool (4). The continuity flow rate N is thus directed to the pump via the transfer pipe.

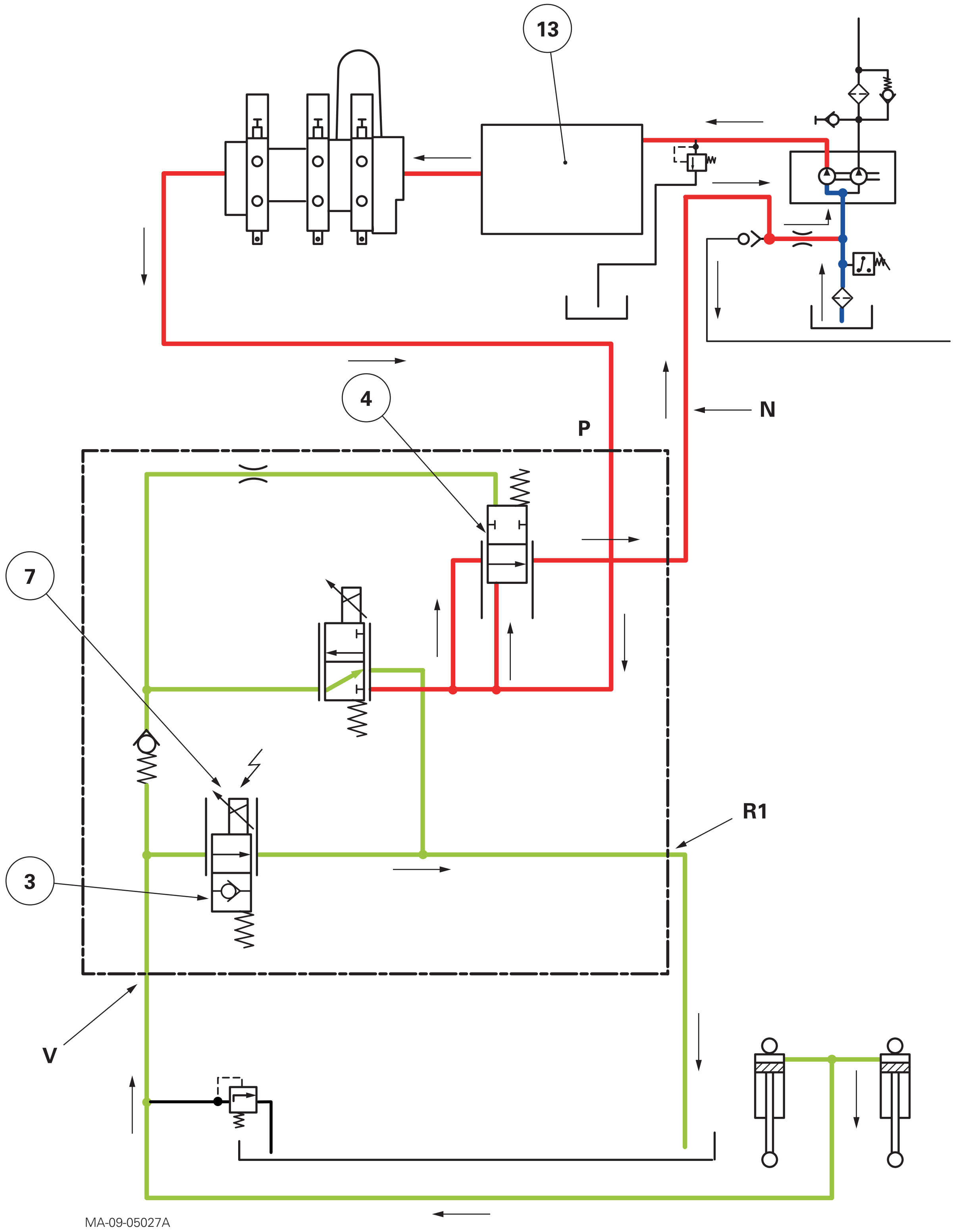

Fig. 7

F . Shock valve

Location

The shock valve (5) is housed at the front bottom of the left-hand hydraulic cover, (Fig. 8).

Function

It directs oil from the rams to the return in case of overpressure in the circuit (Fig. 9).

Example: Hitch bounces when transporting an implement.

Characteristics

The shock valve is calibrated at 200 to 210 bar.

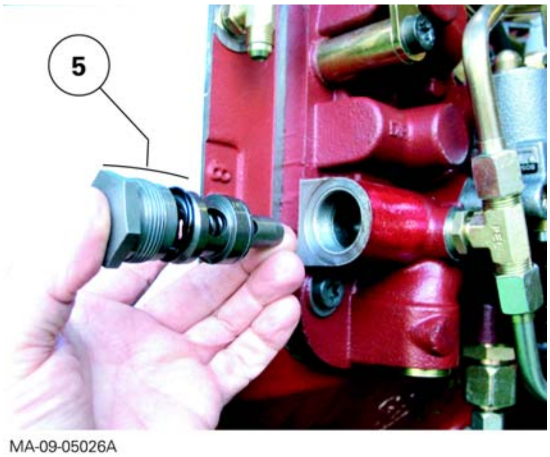

Fig. 8

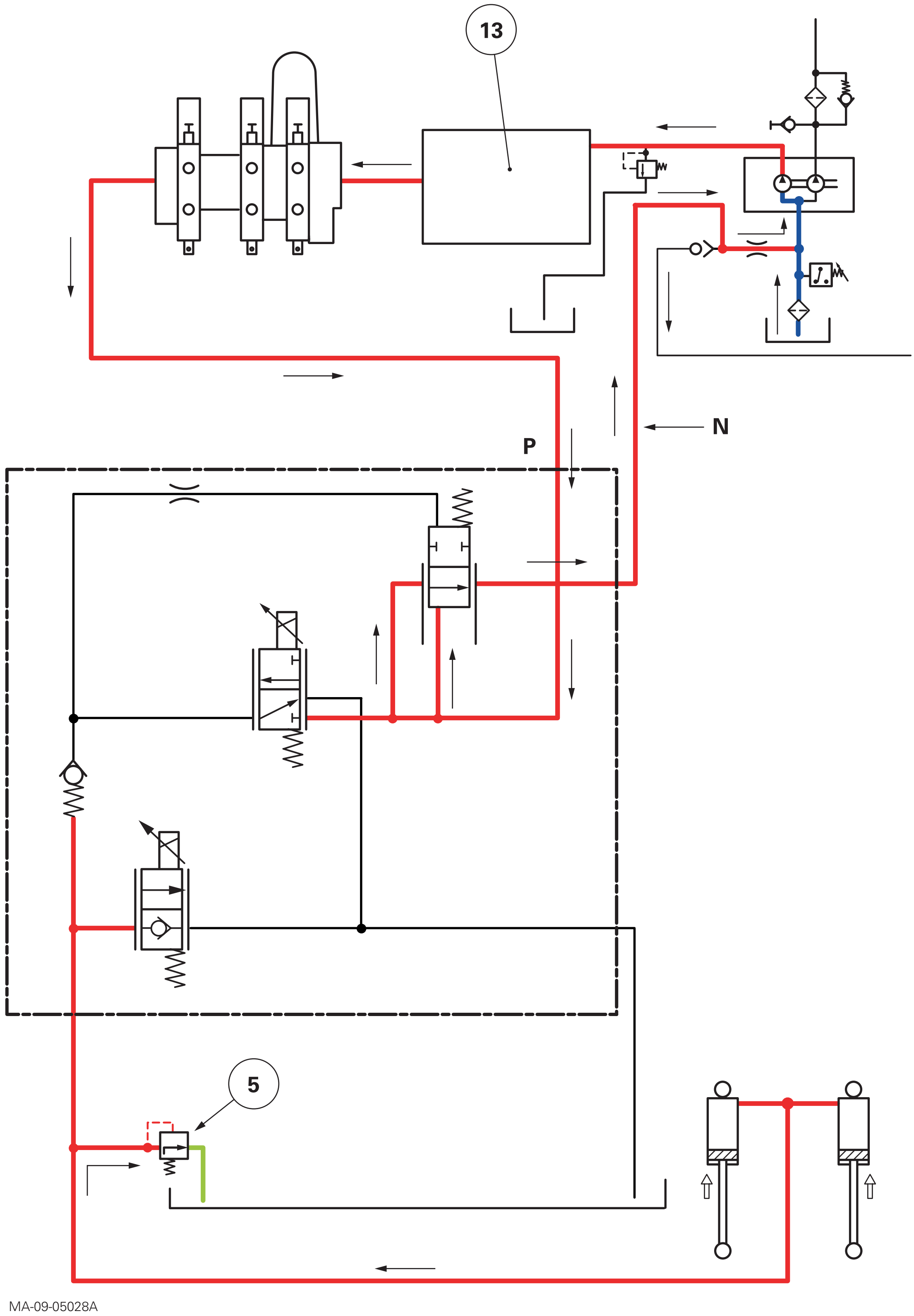

Fig. 9

G . Removing and refitting the spool valve

Preliminary operations

1. Immobilise the tractor. Chock the front wheels. Take off the rear wheel concerned.
2. Position a safety stand.
3. Detach the fuel tank from the gearbox or, if necessary, remove it after draining.

Removal

4. Identify then disconnect the wiring harnesses from the lifting (8) and lowering (7) solenoid valves (Fig. 10).

   Reminder

   The lowering solenoid valve is turned towards the front of the tractor.
5. Mark, disconnect and block (Fig. 11):
   - the hose (1) from the auxiliary spool valves;
   - the supply or return pipe (2) from the lift rams.
6. Extract the screws (1) and remove the lift control spool valve (12) without losing the O'rings (2) and (3) (Fig. 12).

Preparing for refitting

7. Clean the mating faces of the cover and lift control spool valve.
8. Replace the O'rings (if necessary).

Refitting

9. Refit the spool valve.
10. Fit and tighten the screws to a torque of 36 - 46 Nm.
11. Reconnect:
    - the pipes and hoses (see operation 5);
    - the solenoid valve harnesses (see operation 4).
12. Attach the harnesses using one or more clip retainers, if necessary.

Final operations

13. Attach or refit the fuel tank (see operation 3).
14. Refit the wheel. Remove the safety stand and trolley jack (see section 6).
15. Start the engine.
16. Check the operation of the lift control system and the oil tightness of the seals and unions.

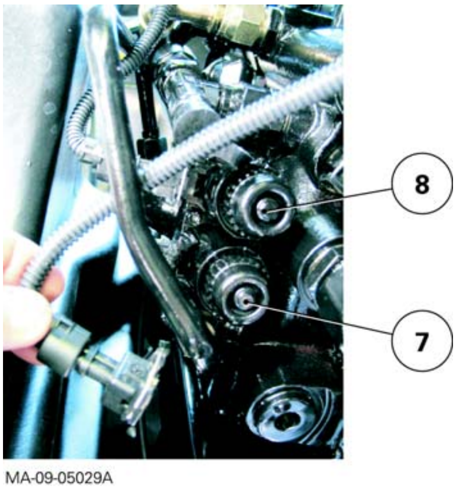

Fig. 10

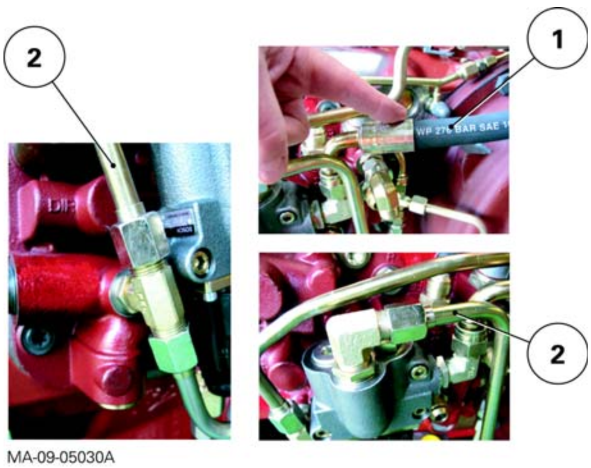

Fig. 11

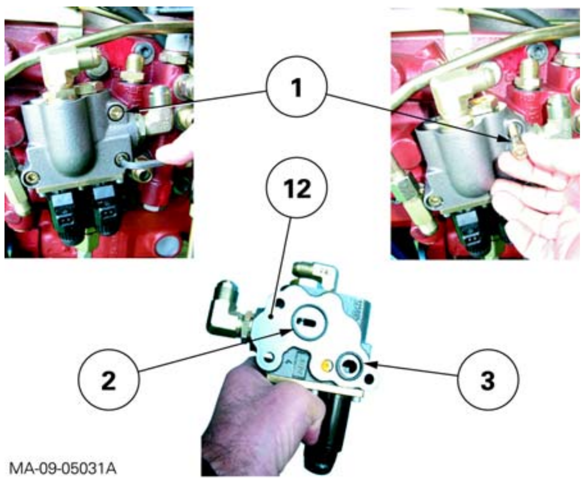

Fig. 12

9H20 - LS and TFLS lift control spool valve

CONTENTS

A . General

The function of the lift control valve (17) (Fig. 1) is to regulate the oil flow to and from the lift rams according to the signals transmitted by the ELC calculator.

The lift control valve contains an LS port for the Load Sensing system. This pilot port allows the valve to send pressure data to the regulator via the priority block(s).

This lift control valve is made up of elements themselves comprising spools and valves. Some of the elements cannot be repaired as spare parts.

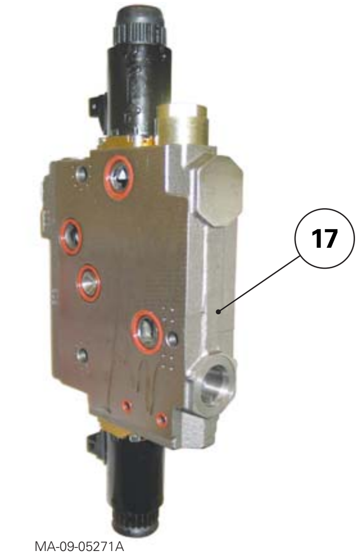

Fig. 1

B . Layout of components and identification of ports

Layout of components (Fig. 2)

The Bosch/Rexroth lift control valve consists of two parts:

Hydraulic part (spool valve)

(1) Non-return valve, maintaining the oil in the rams
(2) Spool valve assembly used in the lowering phase
(4) Control spool valve
(5) Flow regulating spool valve
(6) Shock valve
(9) Flow regulating spool spring
(10) Control spool spring
(11) Spool valve assembly spring

Electrical part (solenoid valves)

(7) Lowering solenoid valve
(8) Lifting solenoid valve

NOTE: *In order to determine whether the fault is of hydraulic or electric type, press the push-buttons at the ends of the solenoid valves; this eliminates the electronic effect of the lift function.*

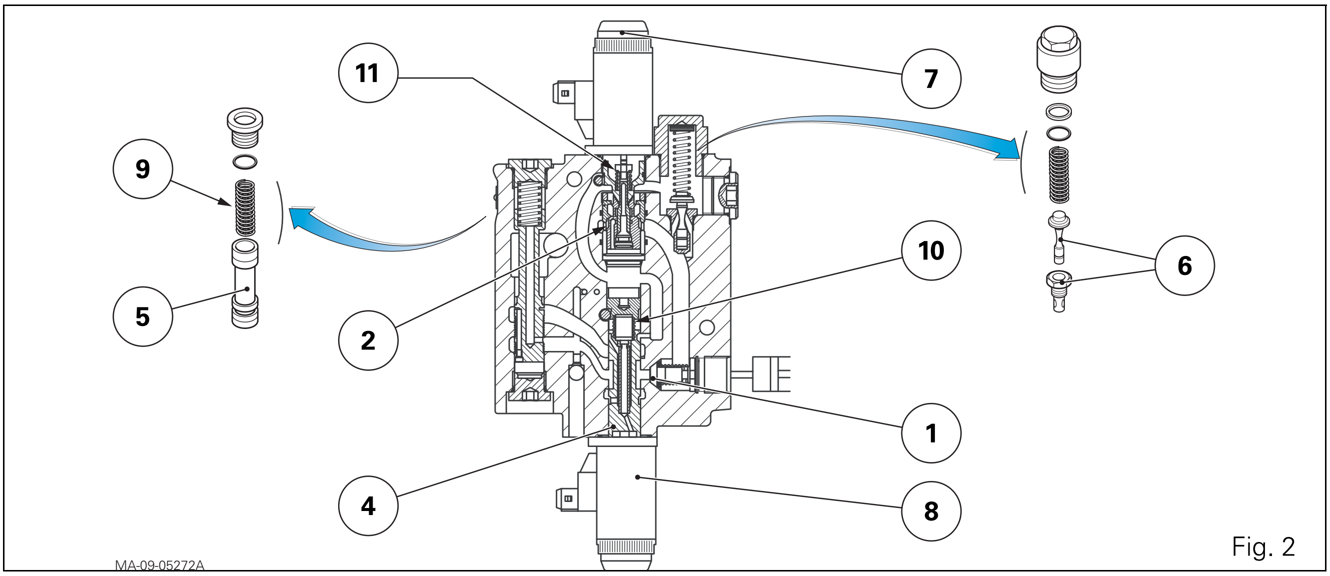

Fig. 2

Identification of ports (GPA20 and GPA40)...

On the inlet block (14) (Fig. 3, Fig. 4)

(12) HP supply from the two-cylinder pump via the priority block(s) (depending on model)

(13) LS signal to the balance block via the priority block(s)

On the lift control valve (17) (Fig. 3, Fig. 4)

(15) Rams return pipe or hose to housing

(16) HP ram supply

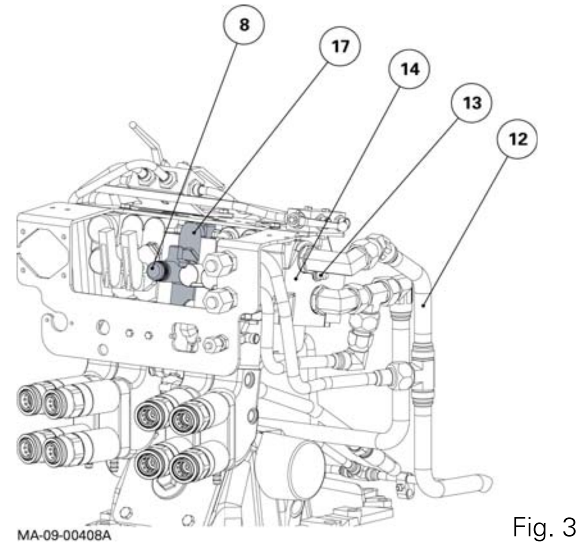

Fig. 3

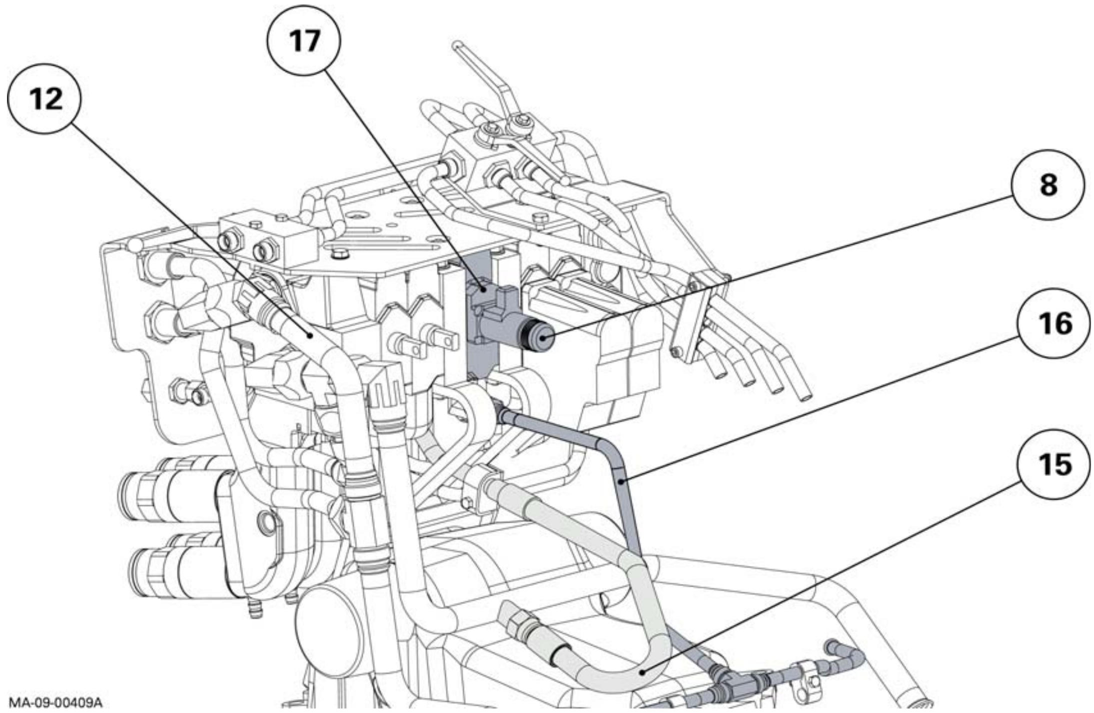

Fig. 4

LS and TFLS lift control spool valve

Identification of ports (GPA30)...

... on the right-hand end plate (Fig. 5)

(9) LS hose from the priority block(s)

... on the oil manifold (21) (Fig. 5)

(30) High pressure hose from the priority block(s)

... on the lift control valve (17) (Fig. 5)

(16) Lift ram supply pipes

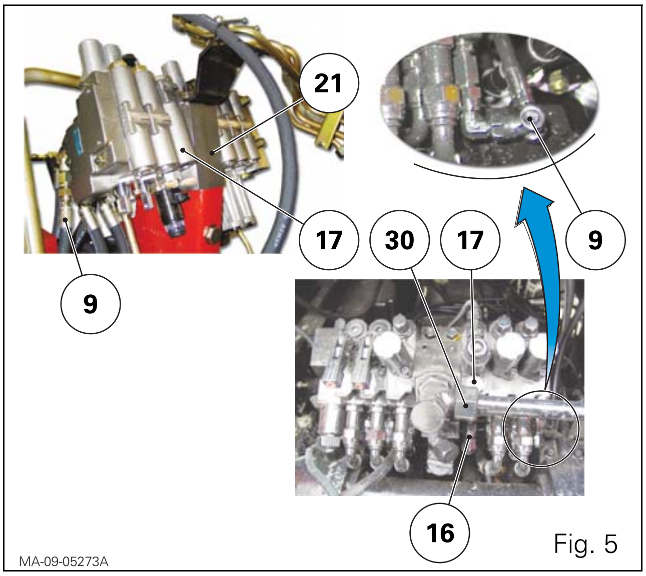

Fig. 5

C . Removing - refitting the spool valve block (GPA20 and GPA40)

To remove - refit the spool valve block (lift control valve and auxiliary spool valves), see the "Auxiliary spool valves" section in chapter 9.

D . Removing - refitting the spool valve block and disassembling - reassembling the lift control valve (GPA30)

Removing the auxiliary spool valves

1. Remove the complete auxiliary spool valve block/lift control valve in order to reach the lift control valve under optimum conditions of cleanliness.

Refitting the spool valve block

2. Refit the complete auxiliary spool valve block/lift control valve (see chapter 9).

3. If necessary, carry out the hydraulic tests related to the operations performed (see chapter 9).

Disassembling the lift control valve

4. **Carefully** clean the complete auxiliary spool valve block/lift control valve before carrying out servicing.

5. Split the components of the auxiliary spool valve block down to the lift control valve (see chapter 9).

Reassembling the lift control valve

6. Reassemble the complete auxiliary spool valve block/lift control valve (see chapter 9).

E . Diagram

GPA20 and GPA40 assembly fits

Legend (Fig. 6)

BP Priority block(s)
D To auxiliary spool valves
P High pressure from variable displacement pump via the priority block(s) (depending on version)
P2 Secondary high pressure port
R Return from auxiliary spool valves (beneath the oil level)
R1 Return from lift rams
V Lift rams
LS Signal to pump regulator via the priority block(s) (depending on version)

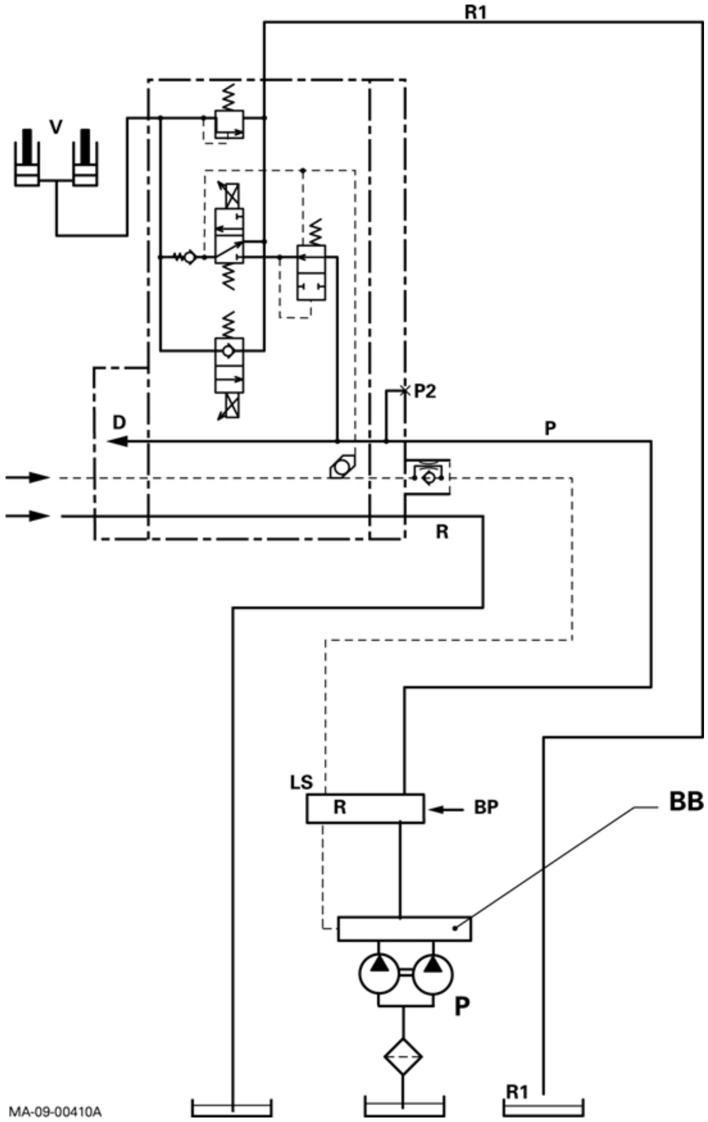

Fig. 6

LS and TFLS lift control spool valve

GPA30 assembly fit

Parts list (Fig. 7)

(1) Auxiliary spool valves
(7) or [(7) and (7A)]
Priority block(s)
(21) Oil manifold

Legend

A,B Outlets to couplers
P Pressure
P2 Pressure connector (provision for)
R Return
V Lift rams
LS Signal

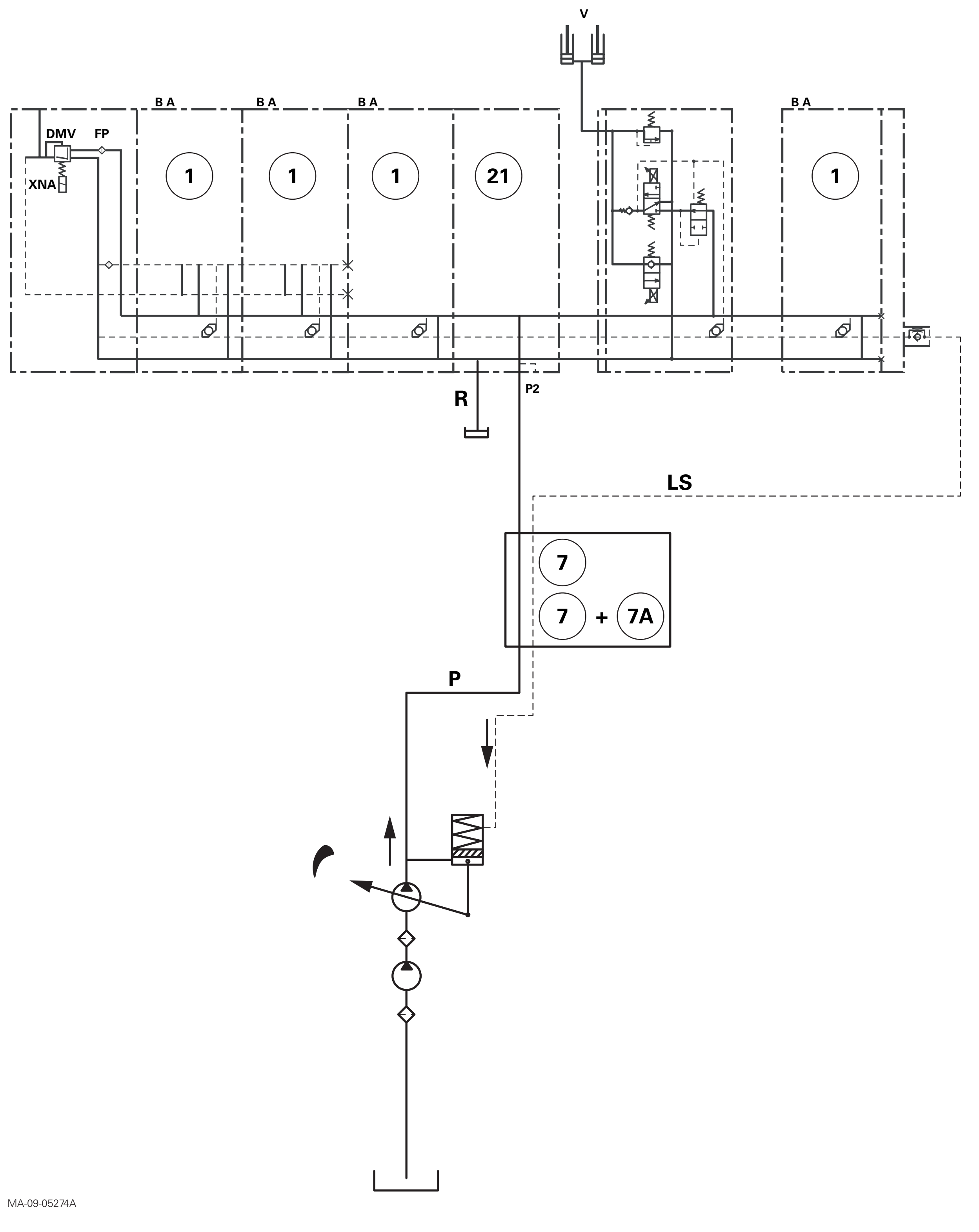

Fig. 7

F . Neutral position

When the engine is not running and the spool valve is in the neutral position, the control spool (4) and the spool valve assembly (2) are maintained respectively by the springs (10) and (11).

The flow rate adjustment spool (5) is pushed downwards by spring (9).

When the engine is running and the spool valve is at rest, no pressure information is transmitted to the variable displacement pump. The LS line communicates with the return.

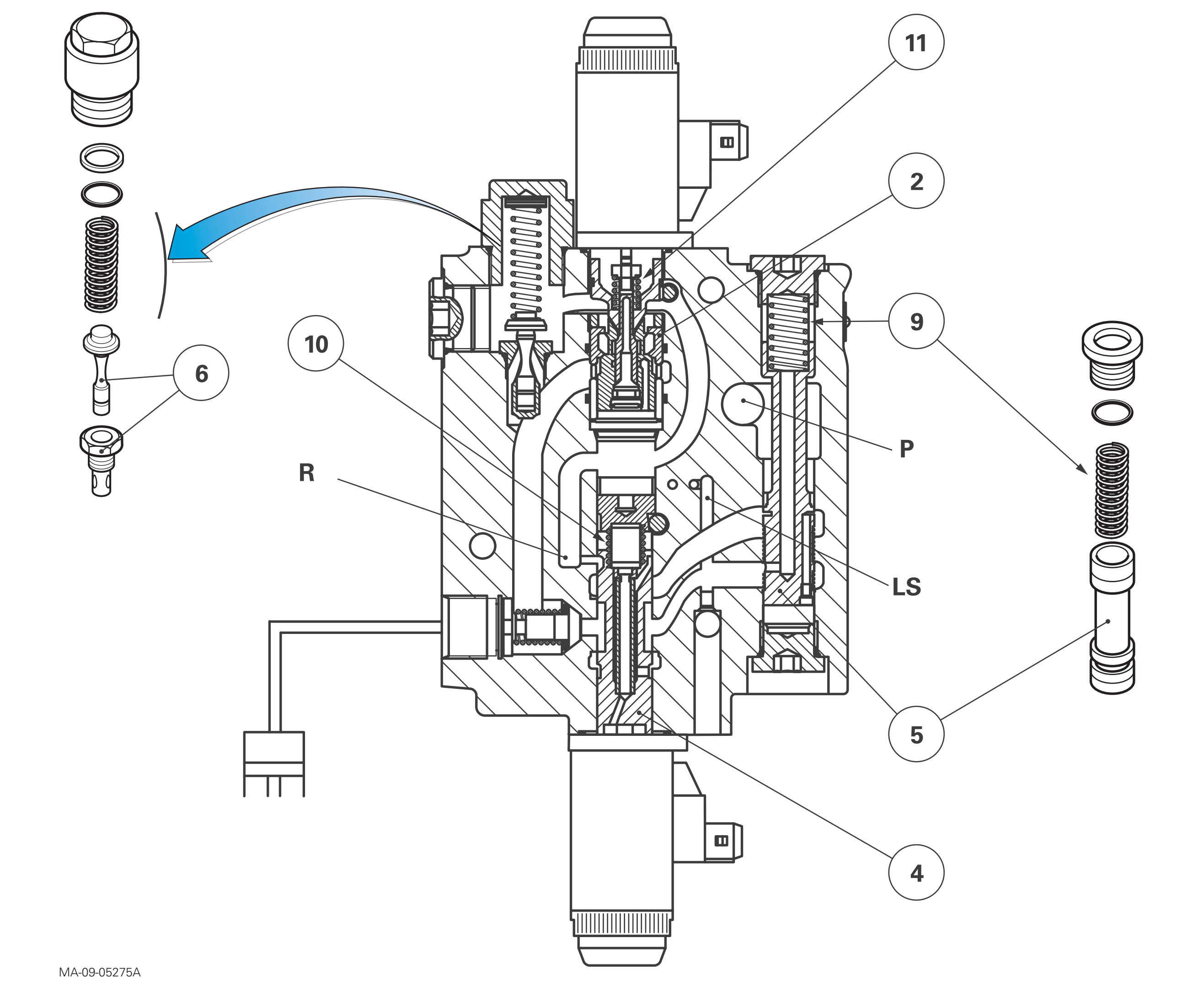

Fig. 8

G . Up position

When the MoveUp solenoid valve (8) is activated, the control spool (4) is moved upwards.

The LS pressure information acting on the upper face of the flow rate regulating spool (5) (spring (9) side) moves the spool downwards thus directing the flow to the control spool and the non-return valve (1).

The movement of the flow regulating spool valve is dampened by the volume of oil present in chamber D.

As soon as the pressure on the valve (1) is greater than that in the rams, the lifting arms rise.

The LS line communicates with the outlet line (16) to the lift rams thus informing the variable displacement pump regulator.

If the pressure in the rams is too high (shocks received by the lifting arm), the valve (6) opens and the excess pressure is directed to the return.

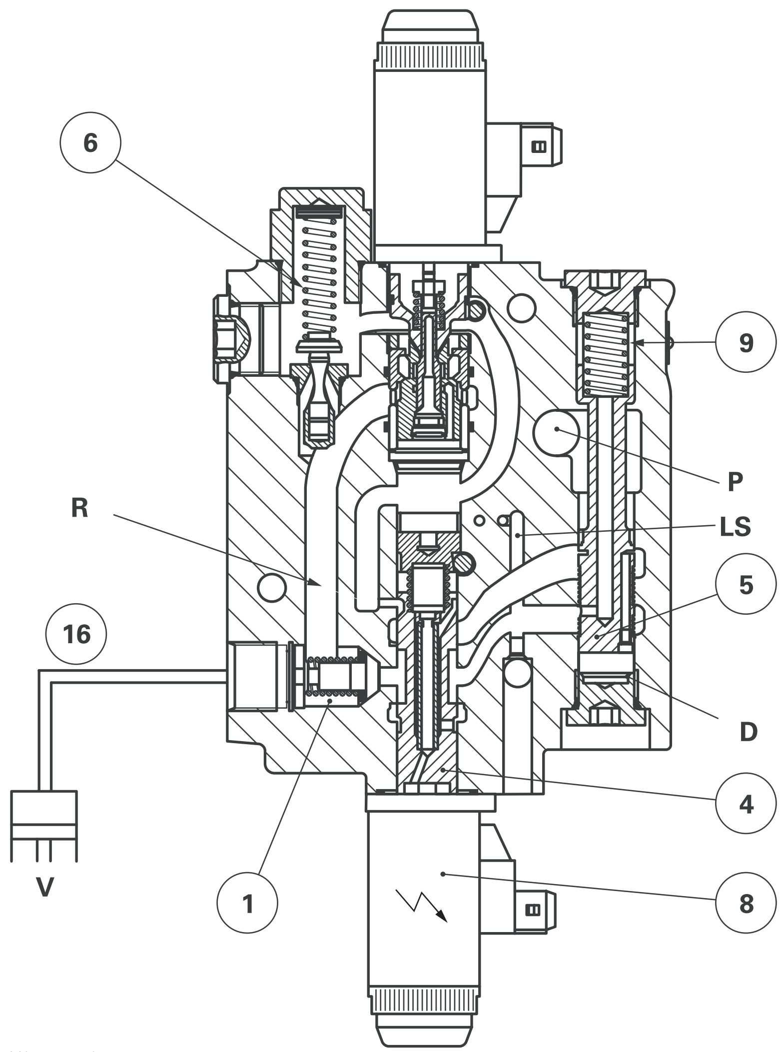

Fig. 9

H . Down position

When the solenoid valve (7) is activated to lower the lifting arm, the spool valve assembly (2) allows the oil coming from the rams to flow into the return.

The LS pressure information is transmitted to the side of the flow rate regulating spool (5) (spring (9) side) and to the variable displacement pump.

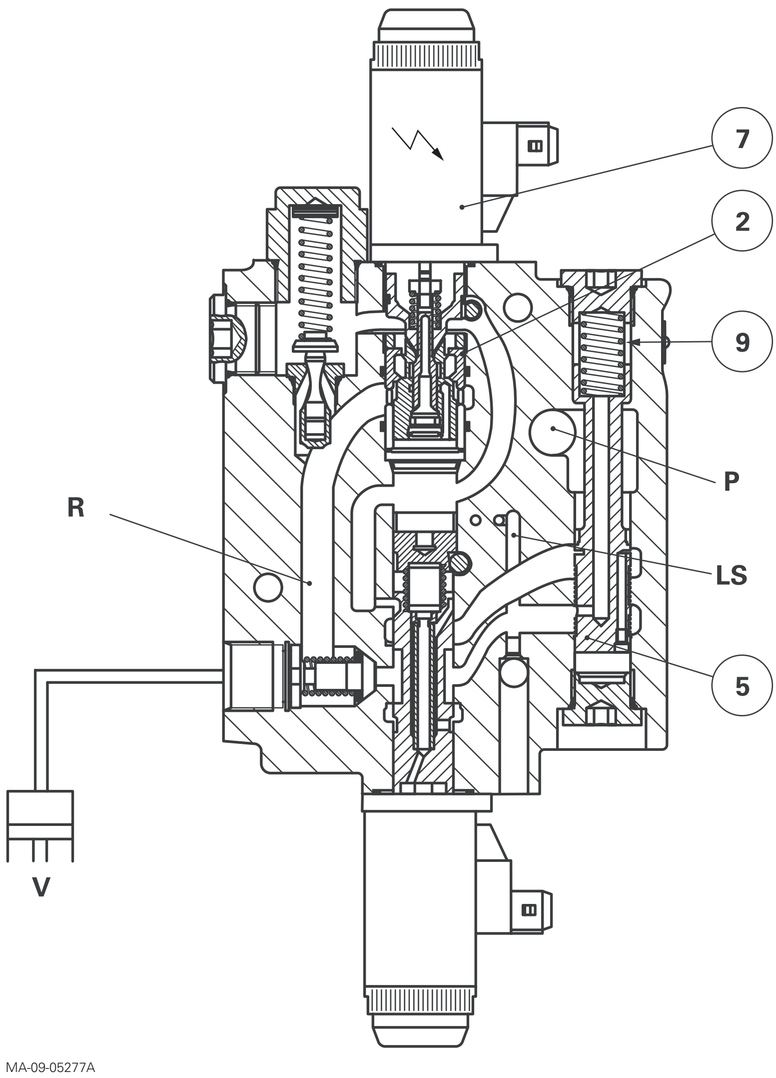

Fig. 10

9I10 - Auxiliary spool valves - Open Centre

CONTENTS

A . General

The Rexroth SM12 auxiliary spool valves are fitted on the high flow rate circuit. They are fed by oil coming from the trailer braking valve or the closing plate fitted in its place (depending on version).

When the spool valves are not activated, the oil is available for the lift control valve fitted downstream.

The auxiliary spool valves are mounted on a support which is itself fitted to the rear of the lift cover. Quick-disconnect couplings are fitted directly on the spool valve body. To obtain sufficient distance between couplings, the spool valves are fitted with blocks serving as spacers. These blocks are also used to let the oil flow to the next spool.

Characteristics

Functions: Double acting; Single and double acting (convertible)

These functions are also recognised via the abbreviations SA and DA.

Positions : Three; Four with one in floating position.

Return to neutral: By spring or by an automatic system.

Zero leak: With or without.

Each spool valve is activated by a lever in the cab and it has three phases of travel:

- 35% reduced flow rate;
- 45% progressive increase of flow rate and pressure;
- 20% full flow rate.

The progressive increase of flow rate and pressure ensures uniform operation of the implements.

This characteristic also allows two spool valves to be activated simultaneously, the total flow rate being shared. The flow rate to each quick-disconnect coupling is proportional to the position of the control lever.

The spool valve placed against the flow divider is spool valve No. 1.

Auxiliary spool valves - Open Centre

Available sets of spool valves (Fig. 1)

Set A - 2 spool valves

- Spool valve 1 and 2: 3-position, SA / DA with spring loaded return to neutral

Set B - 2 spool valves and flow divider

- Spool valve 1: 3-position, SA / DA with automatic return to neutral
- Spool valve 2: 4-position, DA with automatic return to neutral

Set C - 2 spool valves and flow divider

- Spool valve 1: 3-position, SA / DA with automatic return to neutral
- Spool valve 2: 3-position, SA / DA and zero leakage

Set D - 3 spool valves and flow divider

- Spool valve 1: 3-position, SA / DA with spring loaded return to neutral
- Spool valve 2: 3-position, SA / DA with automatic return to neutral and zero leakage
- Spool valve 3: 4-position, DA with automatic return to neutral

Set E - 3 spool valves and flow divider

- Spool valve 1: 3-position, SA / DA with automatic return to neutral
- Spool valve 2 and 3: 4-position, DA with automatic return to neutral

Set F - 4 spool valves and flow divider

- Spool valve 1: 3-position, SA / DA with spring loaded return to neutral
- Spool valve 2 and 3: 3-position, SA / DA with automatic return to neutral and zero leakage
- Spool valve 4: 4-position, DA with automatic return to neutral

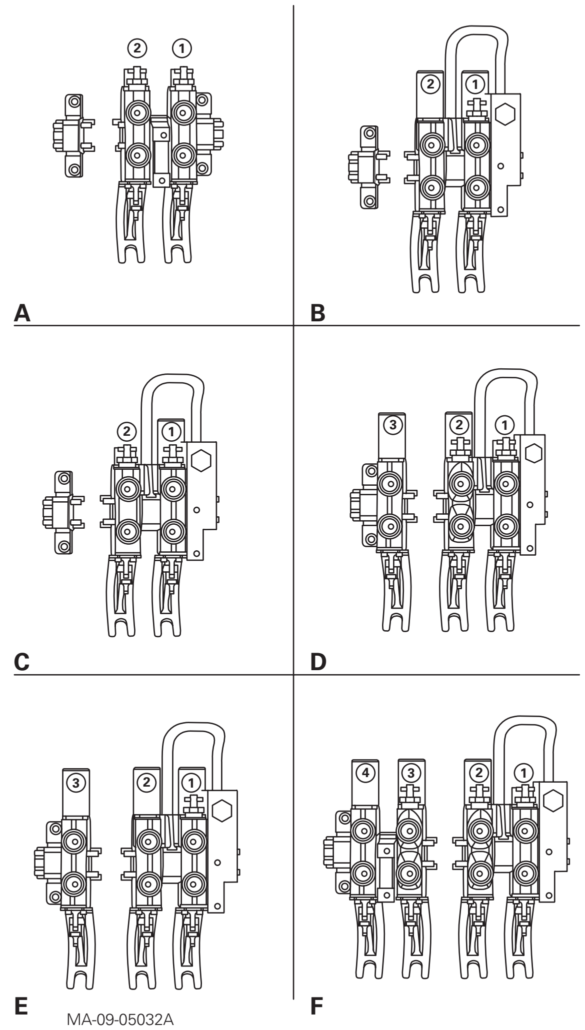

Fig. 1

Parts list (Fig. 2)

(1) Inlet unit with flow control valve
(2) Plates with seals
(3) Excess flow rate pipe
(4) Adjustment knob (flow divider)
(5) Single / double acting (SA / DA) change-over screw
(6) Spool valves (all versions)
(7) Intermediate block (excess flow rate)
(8) Set (2, 3 or 4 spool valves)
(9) Intermediate block
(10) Support
(11) End plate (connection with lift control valve)
(12) Screw
(13) Plug and seal (provisional return)
(14) Screw
(15) Cap and seal (filling)
(16) Plug and seal (provisional return)
(17) Studs and nuts
(18) Pin
(19) Stirrup
(20) Pin
(21) Support (control cable)
(22) Screw

Exploded view

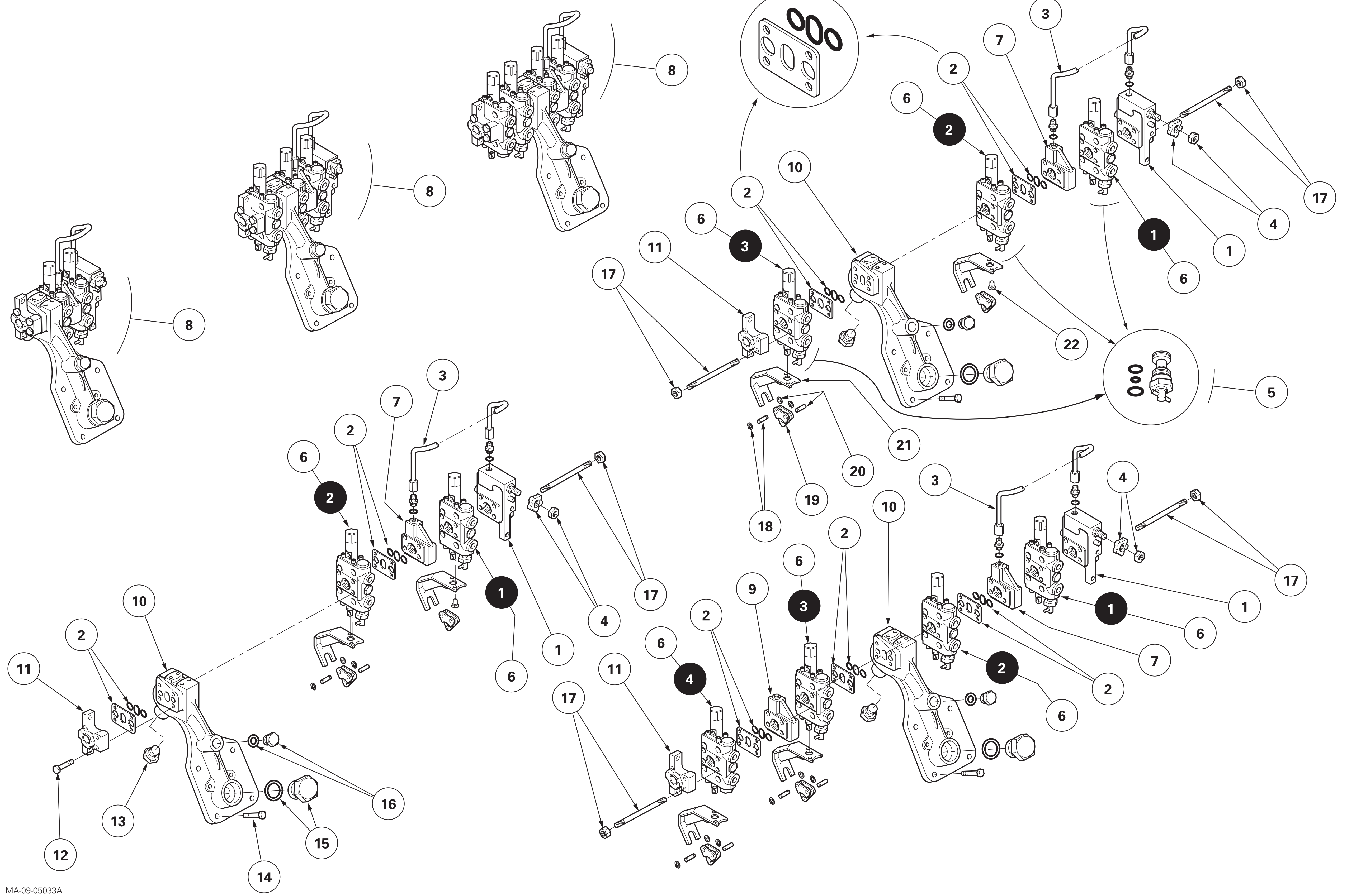

Fig. 2

B . Layout of channels and ports

Legend (Fig. 3, Fig. 4, Fig. 5)

A - B	Outlets or returns going to or coming from hydraulic slave device
N	Oil connection to lift control valve
P	Pressure (HP)
QX	Outlet port for excess flow rate
R	Return
X	Flow rate regulated to 1st spool valve
Vr	Outlet port to lift control valve

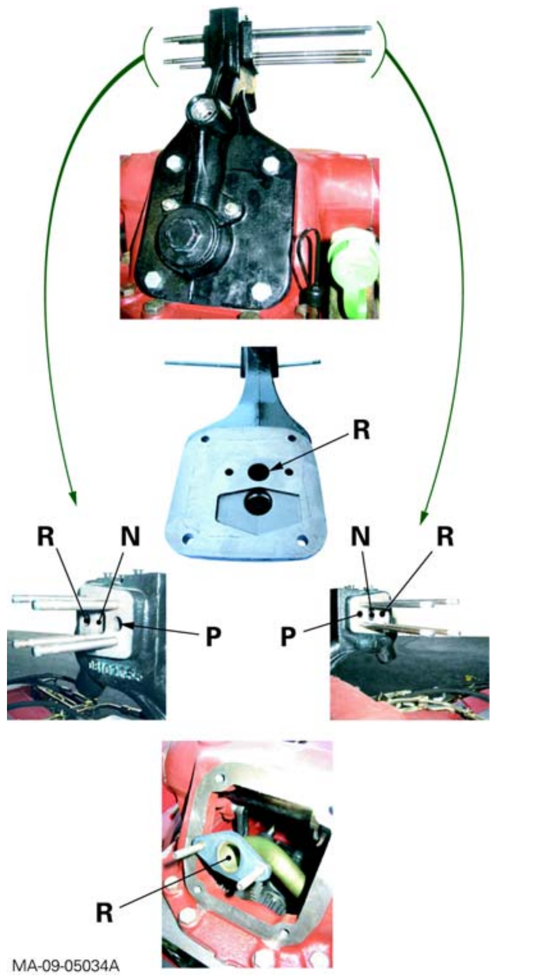

Fig. 3

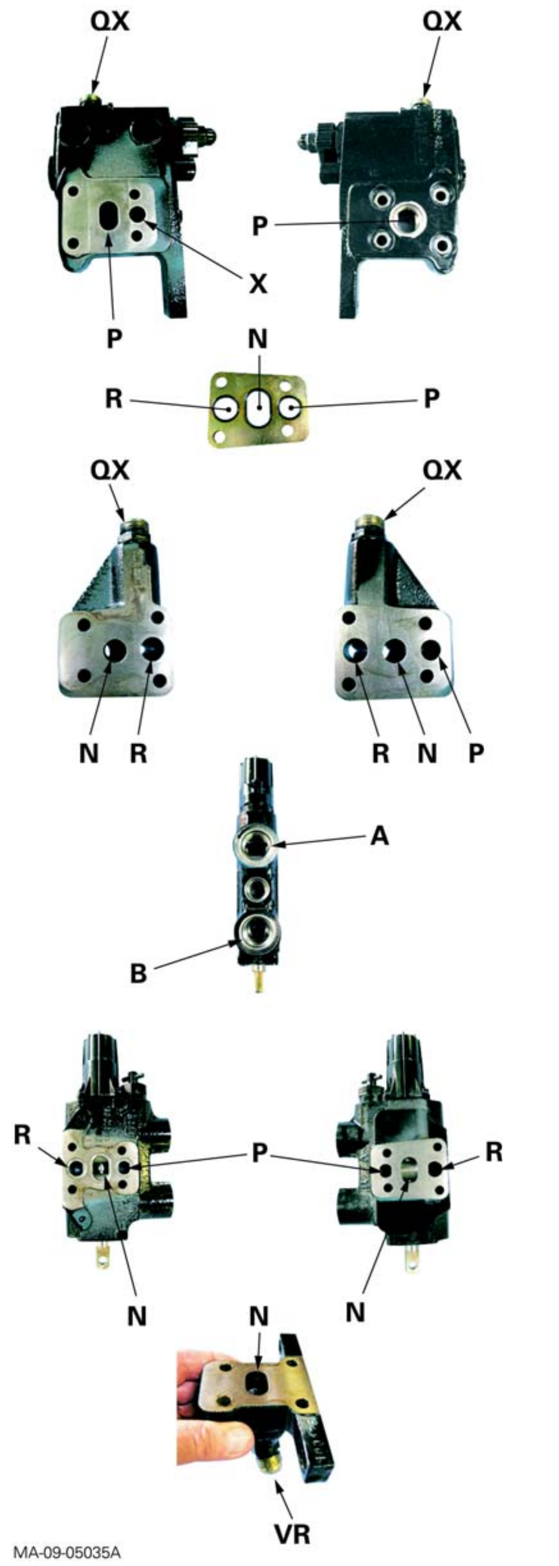

Fig. 4

Diagram

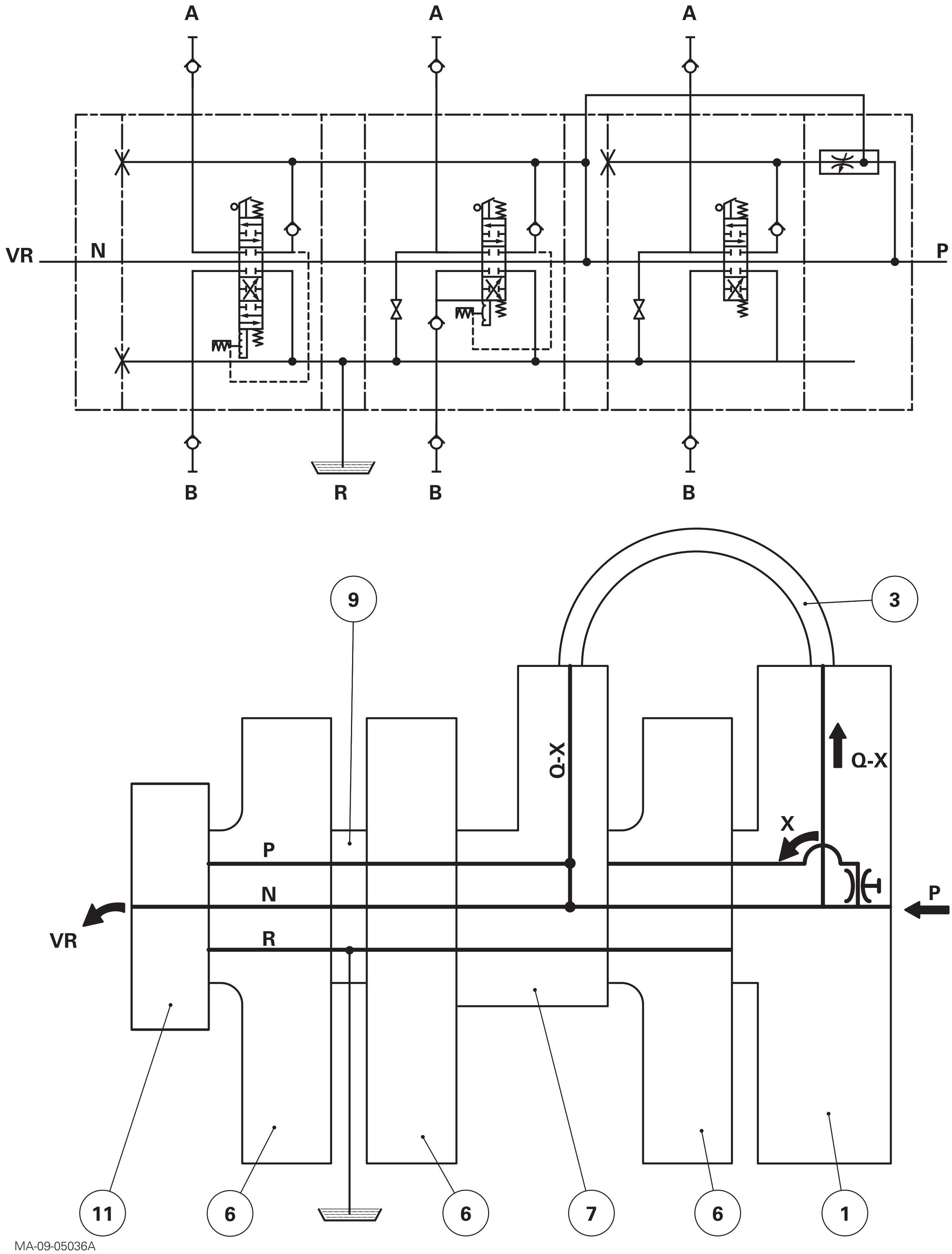

Fig. 5

C . Operating and adjusting the flow divider

Function of the flow divider

For operations requiring low oil flow rate, the flow divider allows to vary supply to the hydraulic slave device via a knob (4) used to adjust flow rate between "maximum stop" and "minimum stop" (Fig. 6). It is fitted at the inlet of the auxiliary spool valve assembly. It is supplied by oil from the high flow rate circuit passing through the trailer braking valve or the closing plate (depending on version).

Operation (Fig. 6)

The oil coming from port (P) is directed to port (X) and supplies the first spool valve. The flow is regulated according to the position of the knob (4).

Simultaneously, the pressure in channel (P) allows oil to pass through drilled hole (a) and restrictor (b).

The piston (1) is then moved to the right, allowing oil to be directed towards port (Qx). The intermediate block (7) receives the excess flow rate via the pipe (3) (Fig. 7).

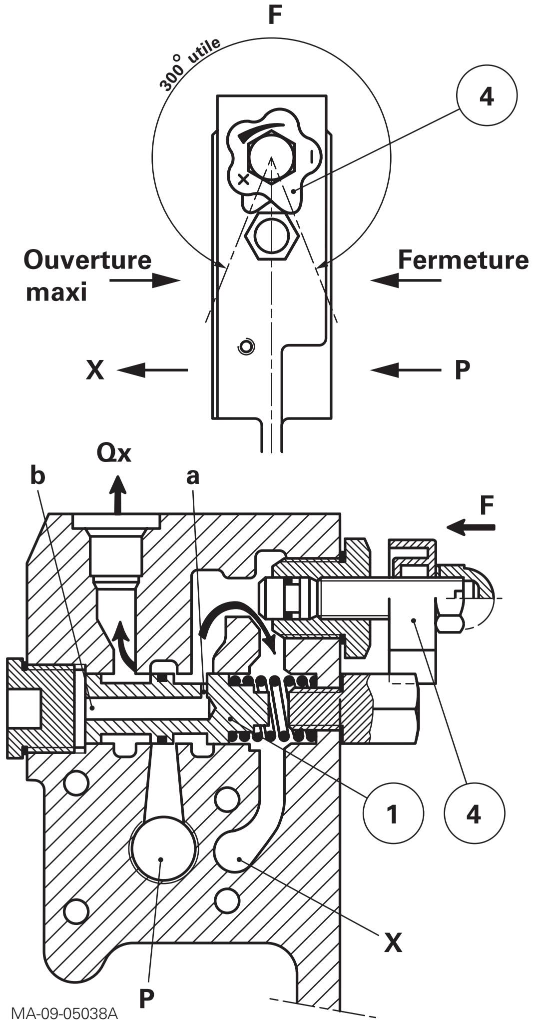

Fig. 6

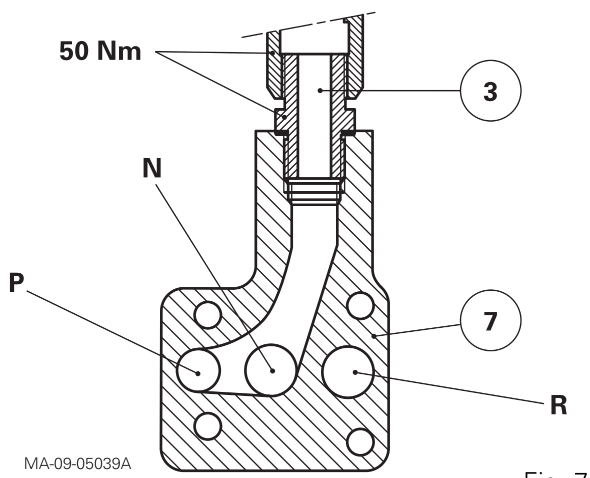

Fig. 7

Adjustment (Fig. 8)

1. Remove the stop screw (6), the locknut (1) and the washer (2).
2. Unscrew and remove the knob (4).
3. Without forcing the screw (3), tighten it until the valve (7) abuts against its seat.
4. Place the knob (4) in contact with the sleeve (5).
5. Unscrew the knob two full turns.
6. Fit and tighten the stop screw (6) to a torque of 20 Nm.
7. Turn the knob to its closed position (Fig. 6).
8. Fit washer (2) and tighten the locknut (1) to a torque of 30 - 40 Nm.

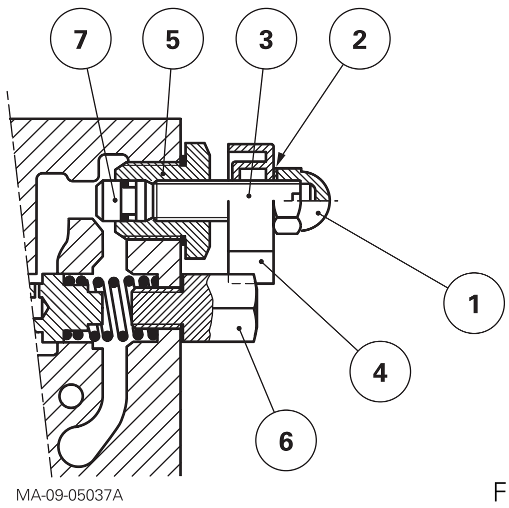

Fig. 8

D . Removing and refitting spool valves

Remark

Auxiliary spool valves can be removed and refitted directly on the tractor by removing each unit and leaving only the main support fitted to the lift cover (Fig. 3).

Preliminary operations

9. Remove unit(s) close to the auxiliary spool valves which might obstruct access to them.
(Example: hydraulic valve for automatic hook).

10. Disconnect:
- the supply hose (3) from the right-hand hydraulic cover (Fig. 9);
- the outlet hose (2) to the lift control spool valve (Fig. 9).

11. Separate the control cables of the supports and spool valves.

Removal

12. Remove the locknuts (1) located at the end of the spool valve set (Fig. 9).

13. Release and remove each hydraulic component after visually noting its position.
Note: Do not discard or lose plates and seals.
Remark
The spool valves are fitted either side of the main support.

14. If necessary (Fig. 10):
- Remove quick-disconnect couplings (A) and (B).
- Remove pins (1) and screws (2). Separate the cable support (3) from the spool valve.

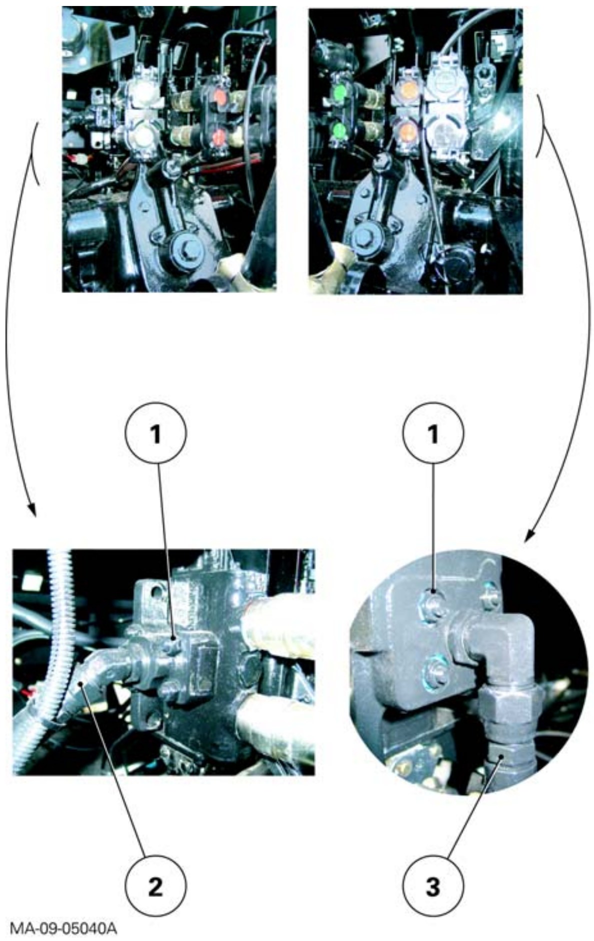

Fig. 9

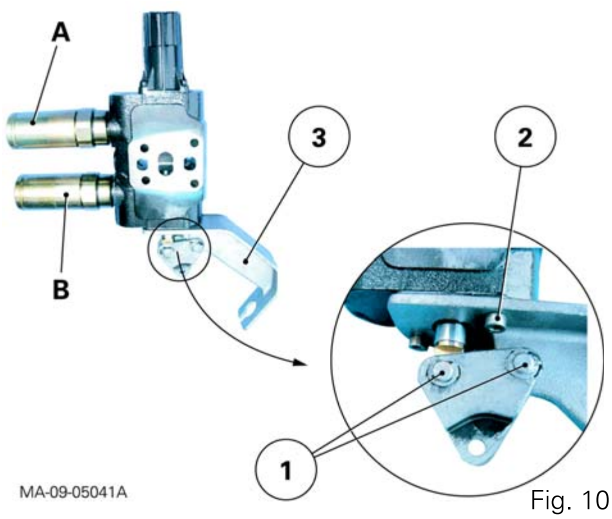

Fig. 10

Refitting

Refitting operations are not difficult. They therefore require carrying out the removal operations in reverse order.

However, during refitting it is necessary to ensure that:

- parts to be assembled are not dirty, corroded, dented, etc.
- seals are oiled.

The locknuts fitted at the end of the spool valve set should be tightened to a torque of 30 - 33 Nm.

Final operations

15. Check the correct operation of each spool valve on the two, three or four positions (depending on model).

16. Check the pressure on quick-disconnect couplings (see Hydraulic tests, section 9).

E . 3-position spool valve, SA / DA with spring loaded return to neutral

Operation (Fig. 11)

Oil from the high flow rate circuit passes through the trailer braking valve (3) (if fitted) or closing plate fitted to the right-hand hydraulic cover and supplies the various spool valves via the continuity channel (N).

The spool valves are fitted in series in priority over the linkage.

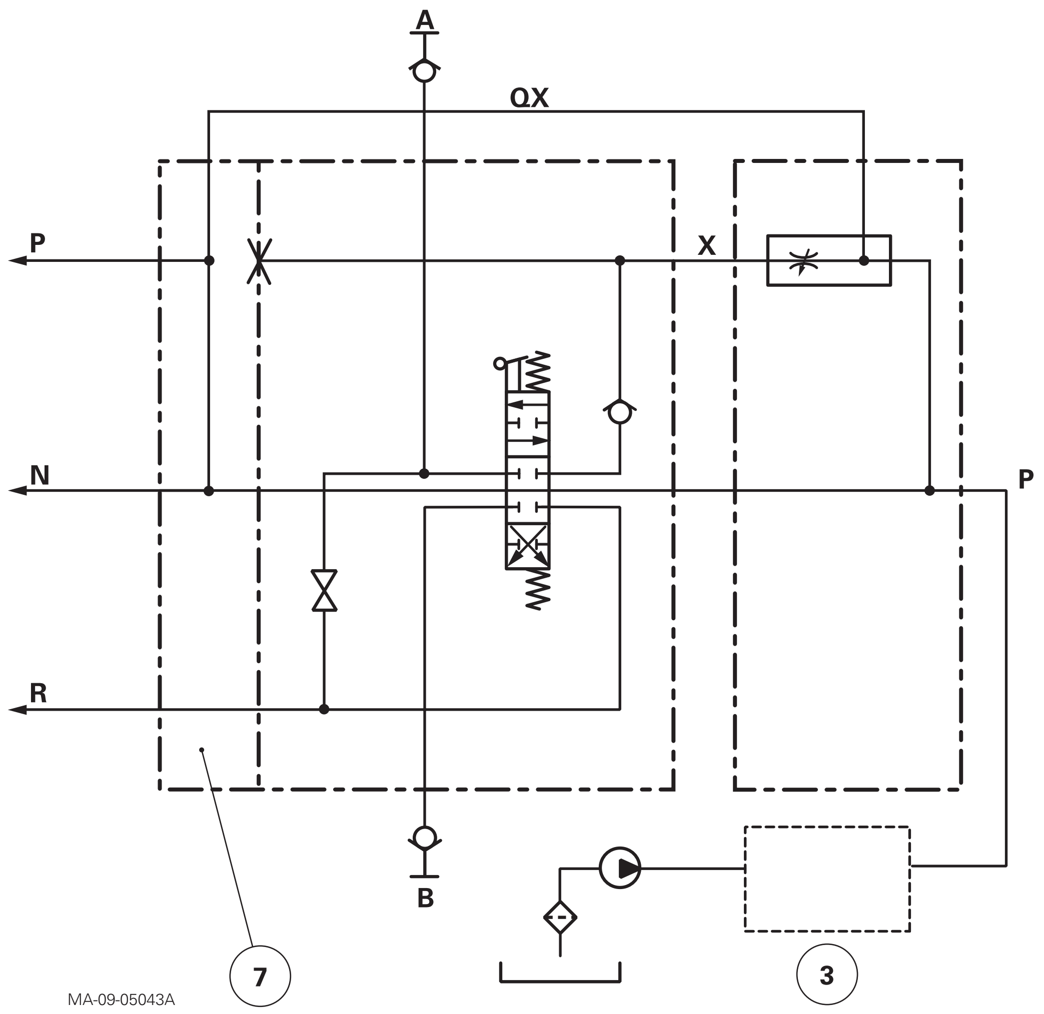

Fig. 11

Neutral position (Fig. 12)

Oil is not available from outlets (A) or (B). Oil is directed via the continuity channel (N) to the lift control valve and passes directly to the suction manifold of the pump when the linkage is in neutral position.

Channels (N) and (P) are linked in the intermediate block (7) (Fig. 7) to supply the subsequent spool valves.

Inlet - outlet position (Fig. 12)

When the spool (2) is moved upwards or downwards, the continuity channel is cut, the pressure increases and raises the valve (1).

The oil is then directed to the internal channels via grooves located on the spool. Depending on the spool position, outlets (A) or (B) are supplied.

Simultaneously, the oil returning from the ram is directed depending on the position of the spool, to outlets (A) or (B) to reach the return channel (R).

Single / double acting change-over (Fig. 12)

To obtain the single acting position, unscrew the valve (4). The outlet (A) then opens into the channel (R), and the outlet (B) supplies the hydraulic slave device.

To obtain the double acting position, screw in the valve (4).

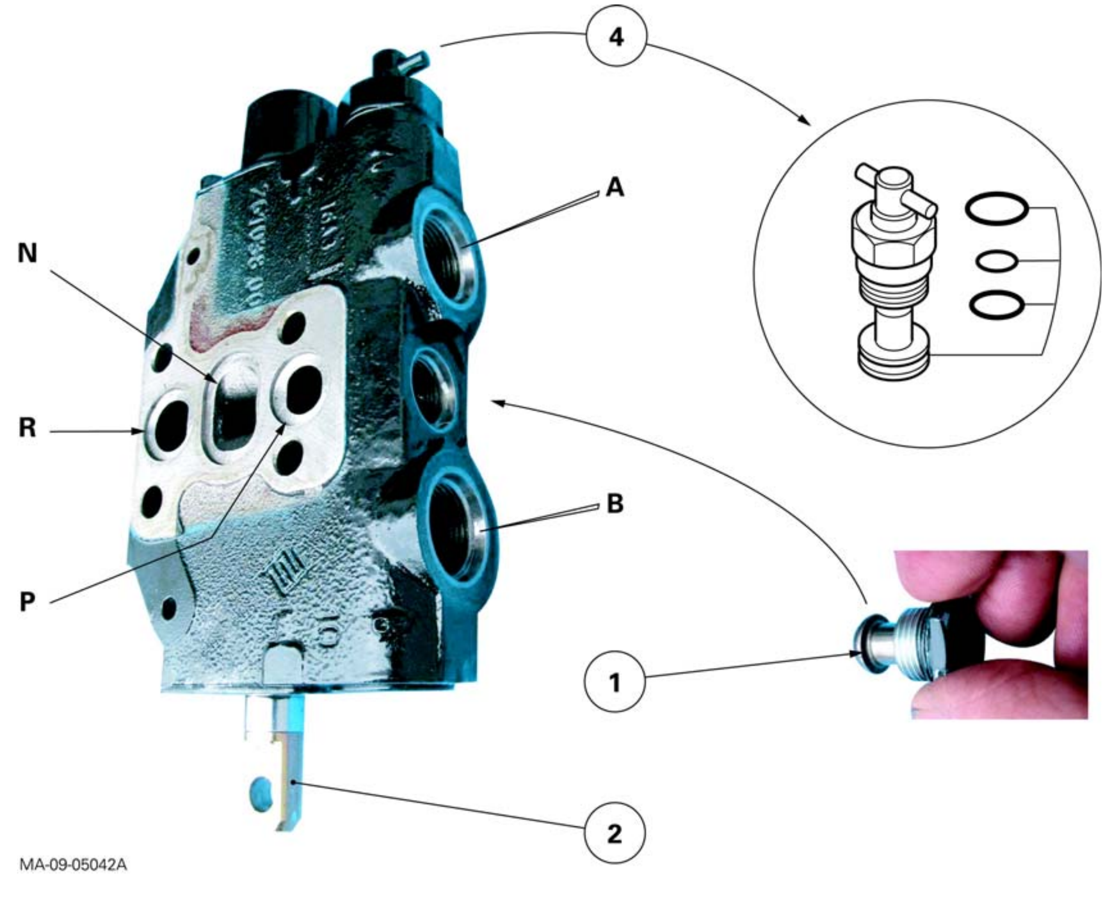

Fig. 12

F . 3-position spool valve, SA / DA with automatic return to neutral

Operation

Neutral position

The operating principle of the 3-position single or double acting spool valve with automatic return to neutral, is the same as for the previous 3-position SA / DA spool valve with spring loaded return to neutral.

Inlet - outlet position (Fig. 13)

Operation is identical to the 3-position SA / DA spool valve with spring loaded return to neutral, with automatic return to neutral as an added feature.

A system placed in the unit (1) locks when the spool (2) is activated.

The spool returns automatically when the pressure reaches 150 - 170 bar.

The pressure passes through bores machined in the spool. It then releases a system comprised of balls and springs allowing the automatic return of the spool to neutral.

The unit (1) is joined to channel (R).

Note: A residual pressure in the unit (greater than 2 bar) may cause undue return of the spool to neutral.

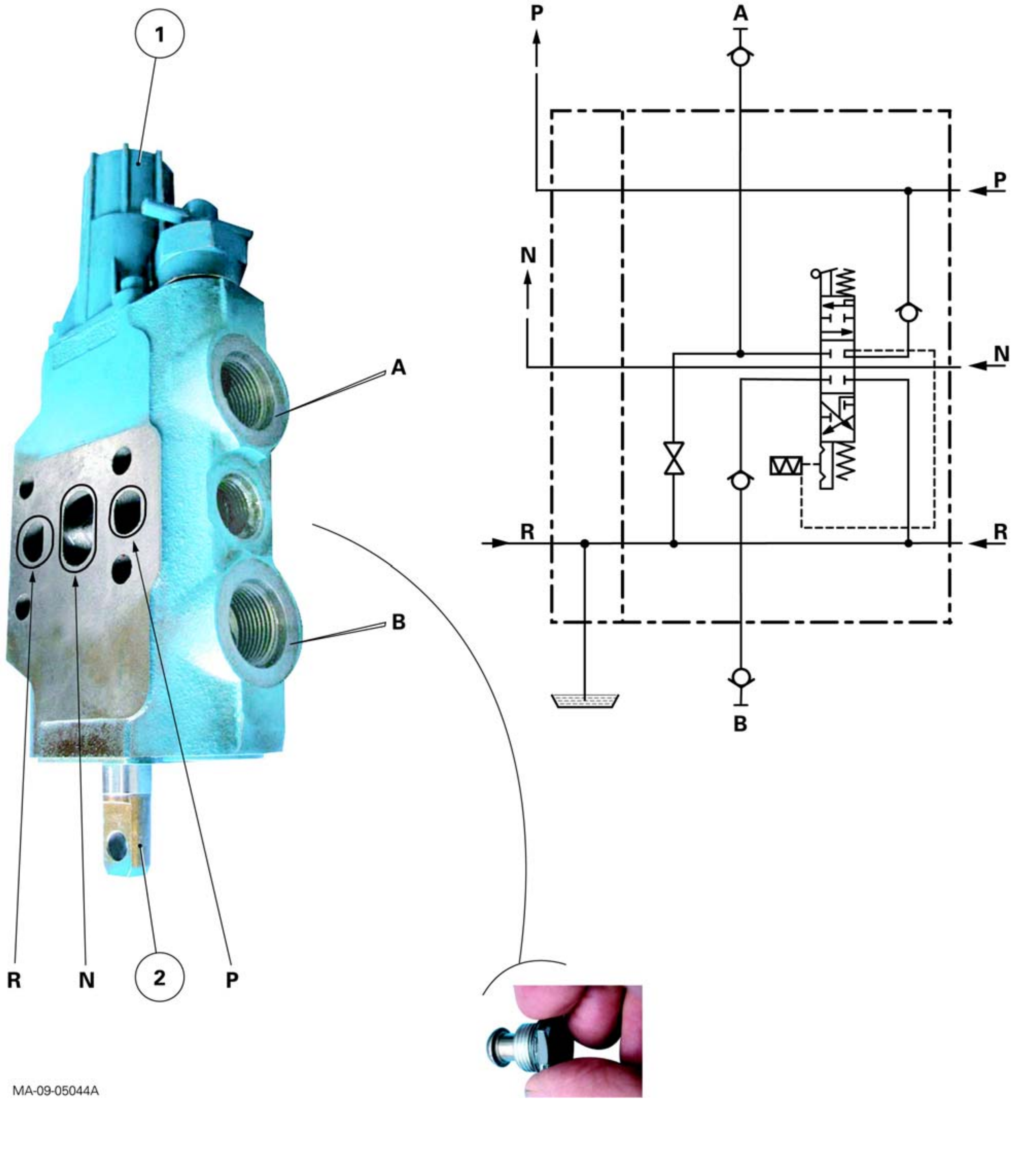

Fig. 13

G . 3-position SA / DA spool valve with non-return valve and automatic return

The operation of this spool valve is identical to those explained previously.

Operation of the non-return valve (Fig. 14)

When the spool (2) is moved upwards, the oil coming from channels (N) and (P) is directed to outlet (B) by lifting the non-return valve (3) which supplies the slave device.

In the neutral position, the non-return valve ensures the oil tightness of the circuit.

When the spool is moved upwards, the oil coming from the channels (N) and (P) lifts the valve (1). It is then directed to an internal channel via grooves machined on the spool, and supplies the slave device via the outlet (A).

The movement of the spool shifts the pushrod (4). This raises the ball, causing a drop in pressure on the slave device side, which allows the valve (3) to rise from its seat and oil to flow through to the channel (R).

Note: During disassembly of the spool (2), it is essential to first disassemble the non-return valve (3) and pushrod (4).

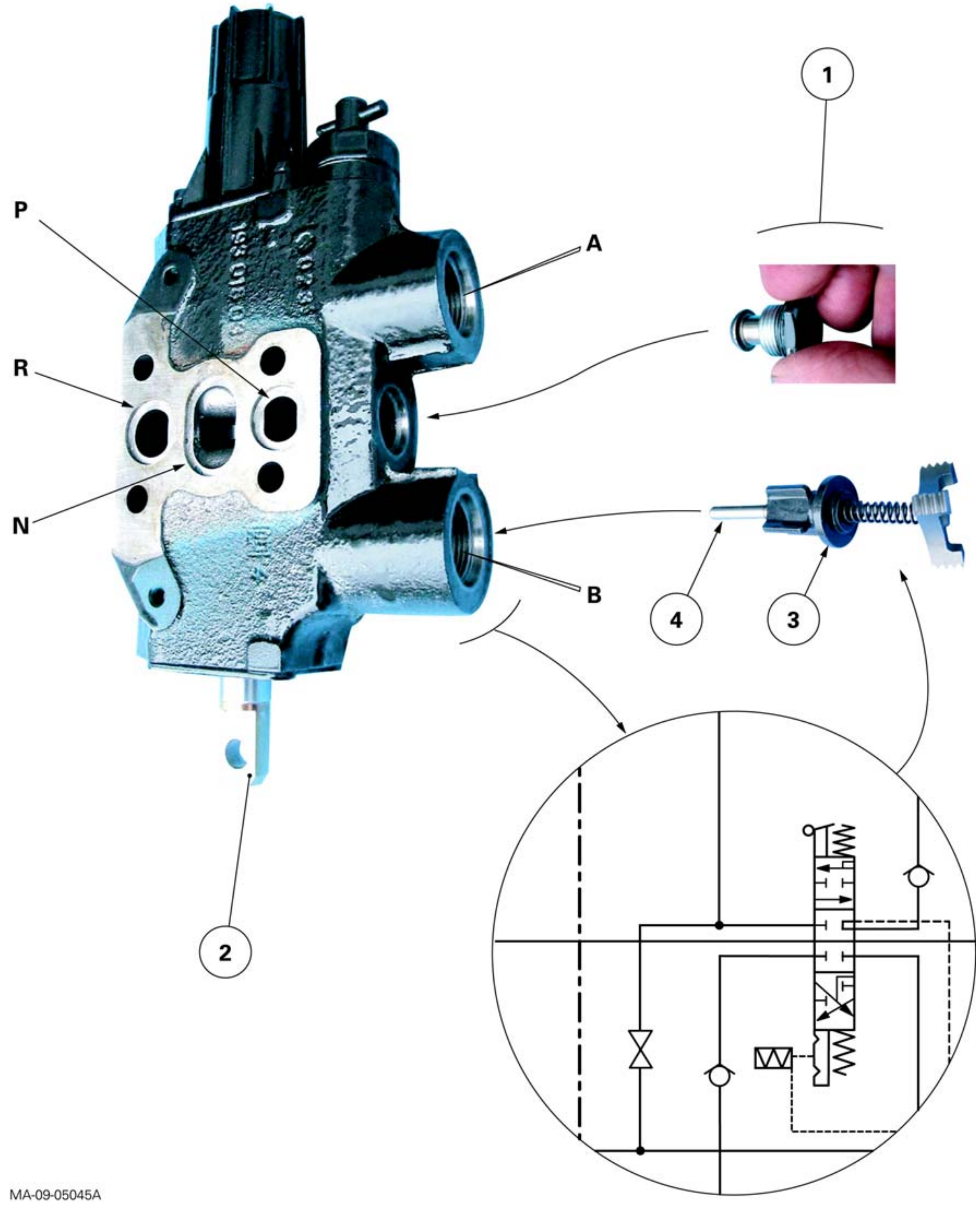

Fig. 14

H . 4-position DA spool valve, with automatic return to neutral and floating position

Operation (Fig. 15)

When the spool (2) is moved upwards or downwards, the same positions are obtained as in the previous spool valves.

The 4-position DA spool valve with automatic return to neutral and floating position has an added feature: a floating position (F) when the spool has moved its maximum distance out of the automatic return to neutral position (Fig. 16).

In this position (F), the outlet channels (A) and (B) open into the return channel (R). The oil then circulates freely.

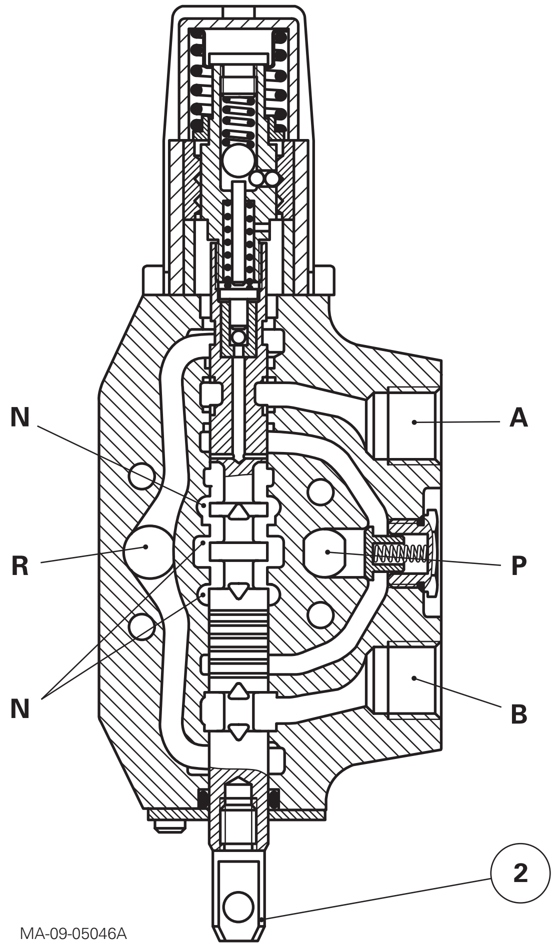

Fig. 15

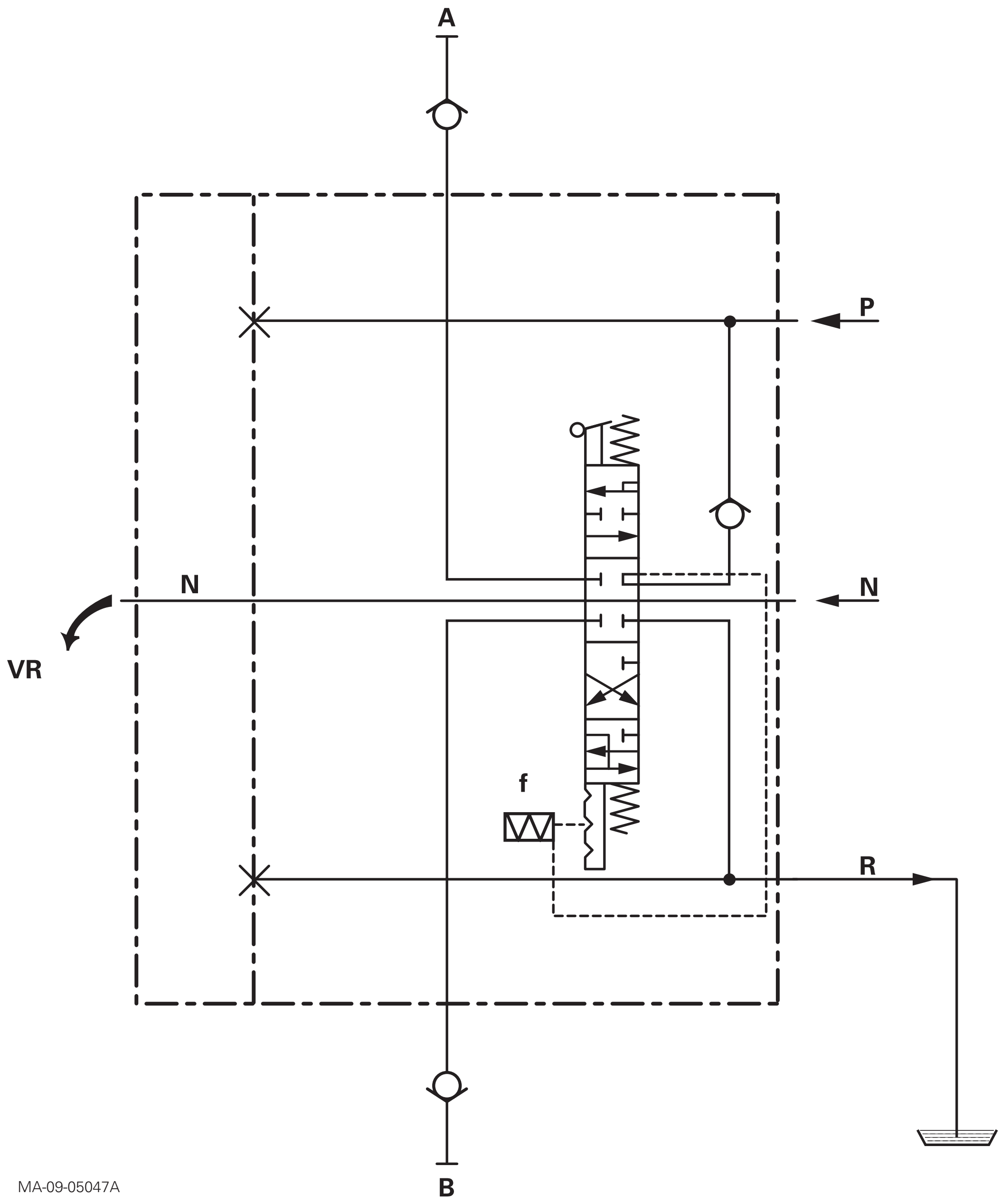

Fig. 16

I . Assembling and adjusting a control cable

Cab side

Special points

- The numbers (1) to (3) indicate the location of the levers on the console (Fig. 18).
- The console design allows the assembly of a fourth spool valve.

Remark

The control unit (1) is designed to incorporate the lever and cable (Fig. 17).

17. After assembling the unit, move the control lever to neutral position.

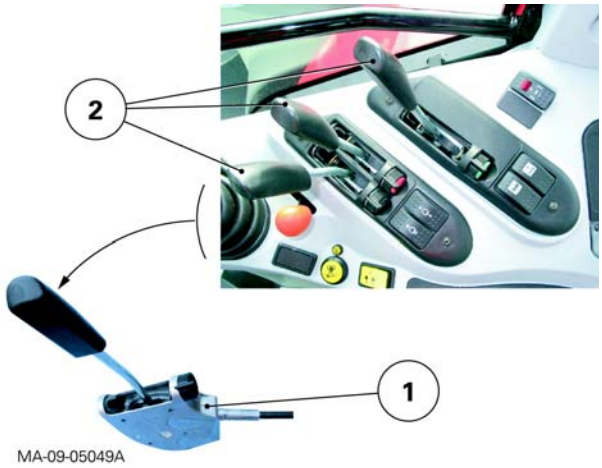

Fig. 17

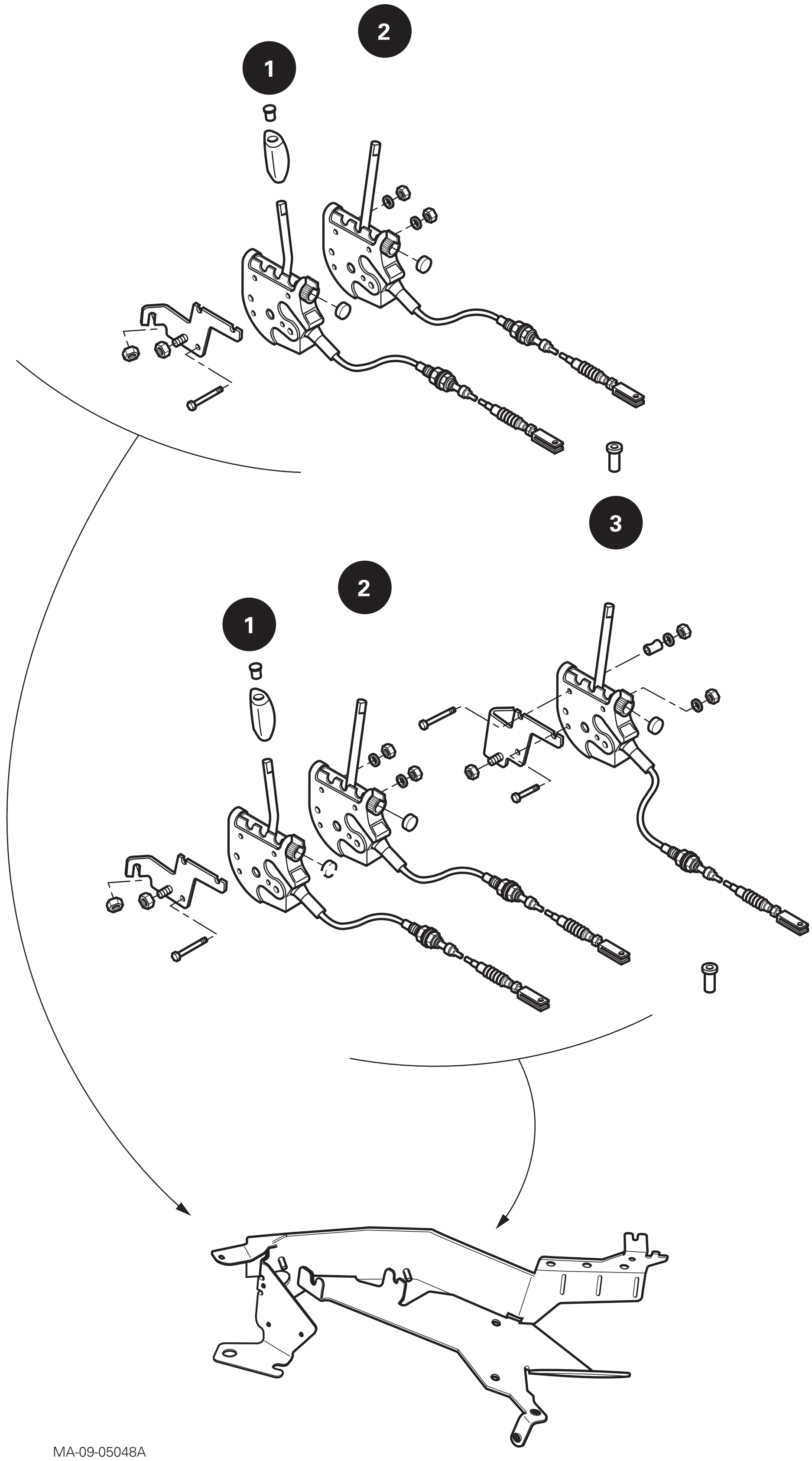

Fig. 18

Spool valve side (Fig. 20)

Special points (Fig. 19)

- If a stirrup (4) needs to be replaced, remove and replace it without turning the spool (2) of the spool valve.
- When assembling, the pins (3) should be lightly smeared with molybdenum disulfide or AS767 grease or equivalent.

18. Screw the clevis (1) to the threaded part of the cable (2).

19. Attach the clevis to the stirrup (4) using the hook (3). Tighten nut.

20. Adjust the stop (5) with the nut (6).

21. Tighten nut (7) and check that the cable is not constrained in any way.

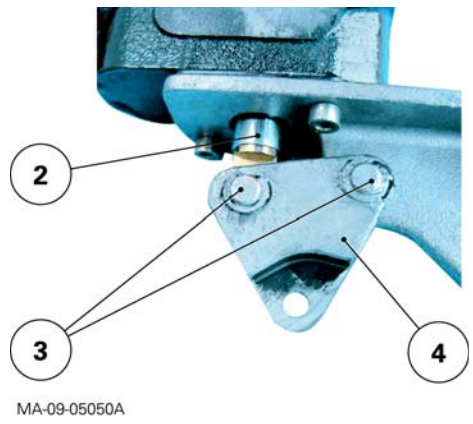

Fig. 19

Check

22. Start the tractor engine. Using the relevant lever (2) (Fig. 17), check that the three or four positions of the spool valve (depending on model) engage correctly.

Reminder

In case of faulty operation, separate the spool valve control and check the movement of the spool. If it operates correctly, check the cable adjustment again.

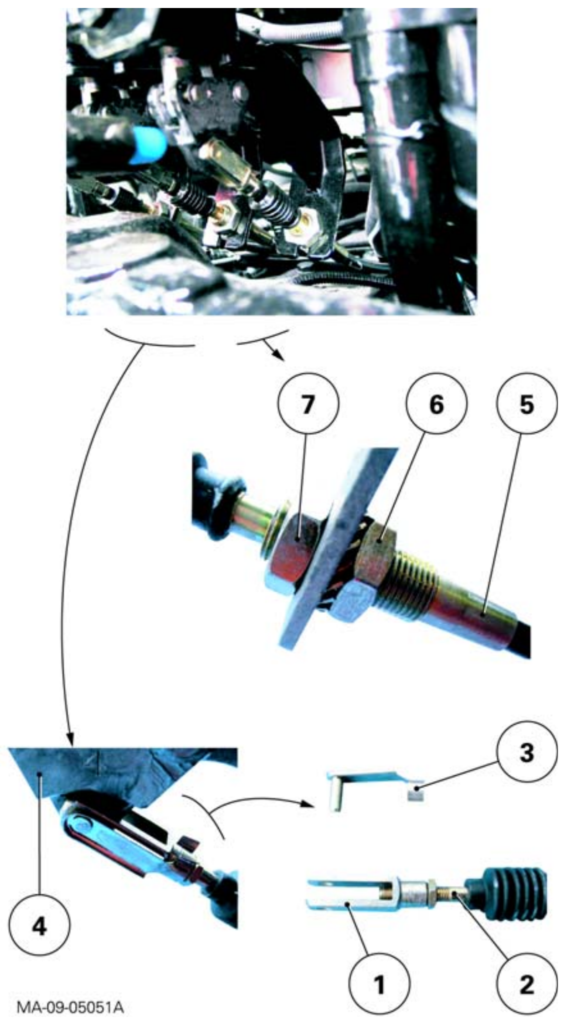

Fig. 20

9I20 - LS and TFLS auxiliary mechanical spool valves - GPA20 and GPA40

CONTENTS

A . General

The proportional auxiliary spool valves, of the Bosch/Rexroth SB23 LS type, are fitted to the high flow rate high pressure circuit. They are fed by the oil coming from the priority block(s).

When no functions are being activated, the entire flow rate is directed towards the spool valves. If certain priority functions are being supplied, the remaining flow is then available for the auxiliary spool valves.

Each spool valve has a flow regulating system controlled by a black, red, green or yellow button located directly on the each spool valve regulating valve stem.

The main spool of the valve is controlled by a cable linked to a lever in the cab. The spool directs oil towards either outlet port. Each outlet port is linked to the LS pilot line of the variable displacement pump regulating valve via the priority block(s).

The auxiliary spool valves are made up of elements themselves containing spools and valves.

Some elements cannot be identified as spare parts.

Different types of spool valve block components

A spool valve block can consist of three, four or five of the following components. It can combine components of similar type of or different types.

Component b

4-position component with flow rate regulation, double acting and automatic return to neutral.

Component c

4-position component with flow rate regulation, double acting, zero leak and automatic return to neutral.

Couplers

Quick-disconnect couplings are located on the spool valve support. They are sealed by covers of different colours (red, green and black) corresponding respectively to hydraulic ports A and B of auxiliary spool valves.

The dirty oil coming from the separation of hydraulic couplers flows into a transparent plastic tank that is fixed at the back of the left trumpet housing.

B . Operation

When the lever in the cab is pulled (spool (1) pushed, Fig. 1), the oil enters via channel P and travels towards the restrictor of the flow regulation control spool (5) and grooves of the main spool (1). The oil is then carried towards a main channel and lifts the ball of valve (2) to enter a chamber. displacement of the spool (1) simultaneously opens the one-way valve (3). The oil flows from the chamber towards port A and returns to the housing through port B via the hydraulic slave device.

The operating principle is identical when the lever is pushed (spool (1) pulled, Fig. 1). The oil flows from the chamber towards port B and returns to the housing through port A via the hydraulic slave device.

C . Layout of components and identification of ports

Layout of components (Fig. 1)

(1) Main spool
(2) Valve
(3) Non-return valve
(4) Flow regulation control rod
(5) Flow regulation control spool
(6) Housing and locking system
(7) Flow regulation control button

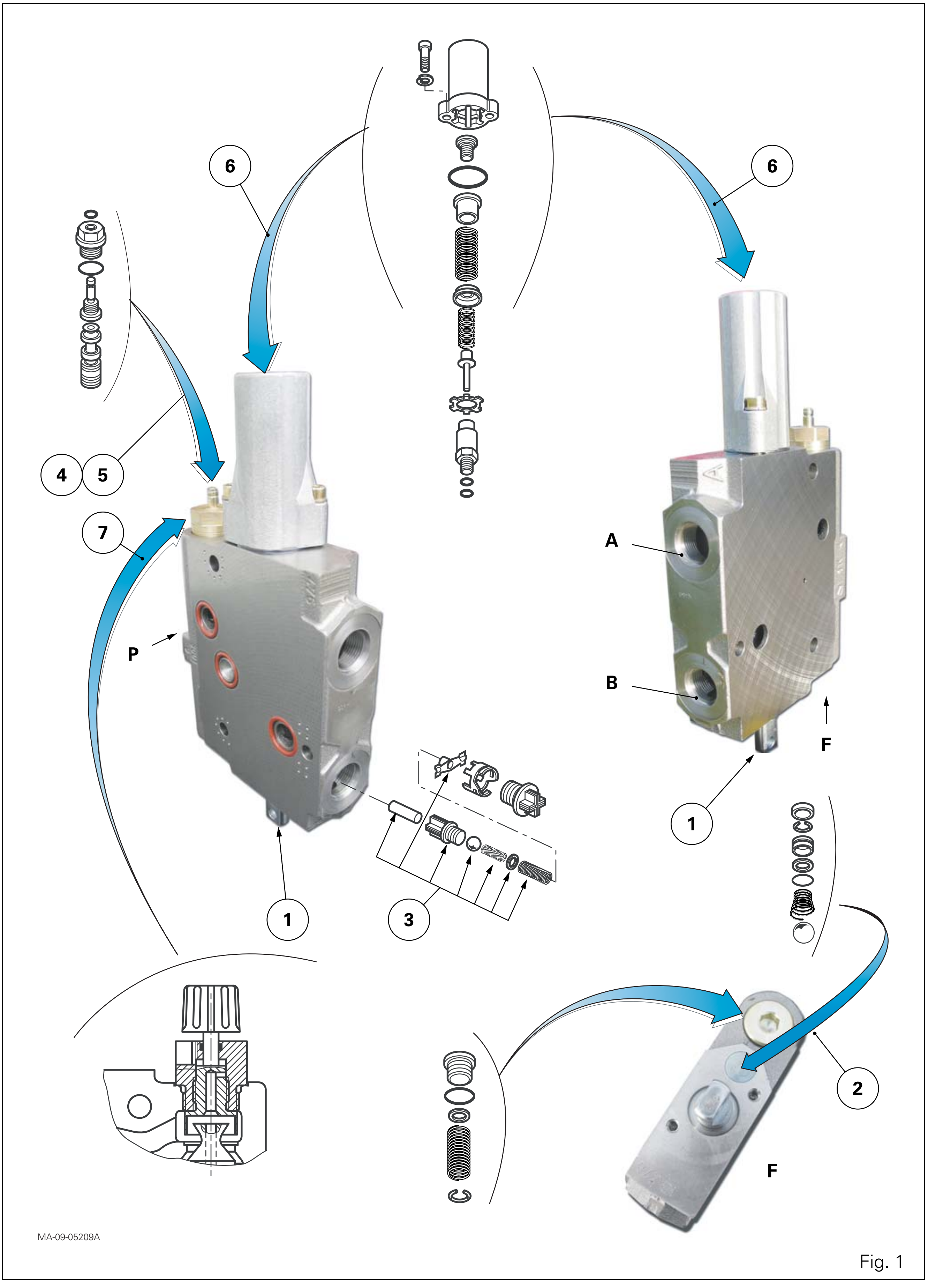

Fig. 1

LS and TFLS auxiliary mechanical spool valves - GPA20 and GPA40

Identification of ports...

... on the inlet block (14) (Fig. 4)

P High pressure supply from the variable displacement pump via the priority block(s) (depending on version).

R Return from auxiliary spool valves (beneath the oil level)

LS Signal to the variable displacement pump regulator via the lift control valve and the priority block(s) (depending on version).

... on the auxiliary spool valves (Fig. 2, Fig. 3)

A Outlet to coupler

B Outlet to coupler

C Restrictor

D Grooves

E Channel

F Chamber

P, R and LS
Marks identical to those of the inlet block (14)

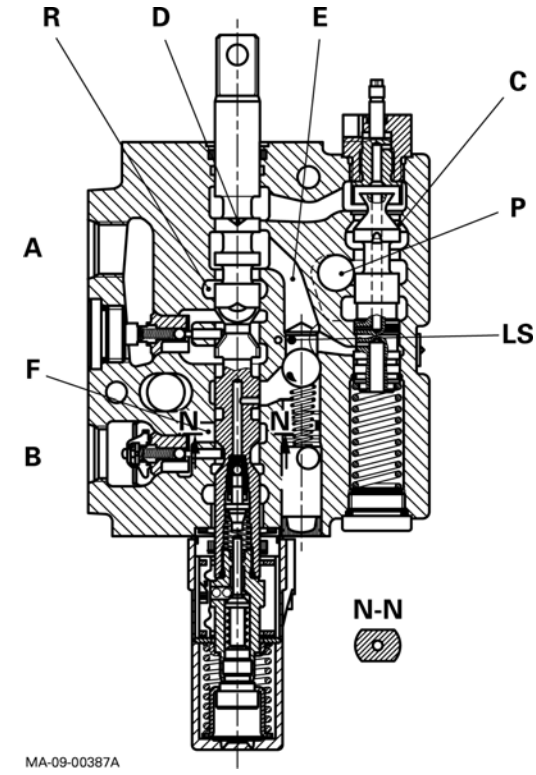

Fig. 2

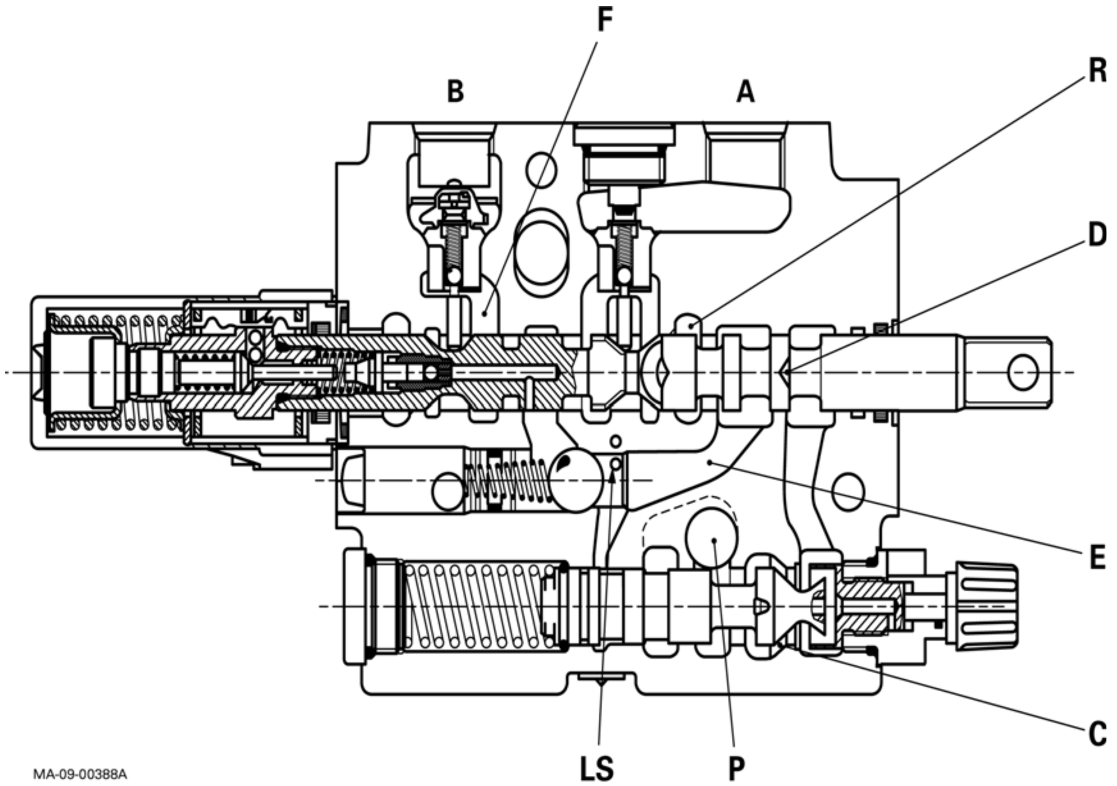

Fig. 3

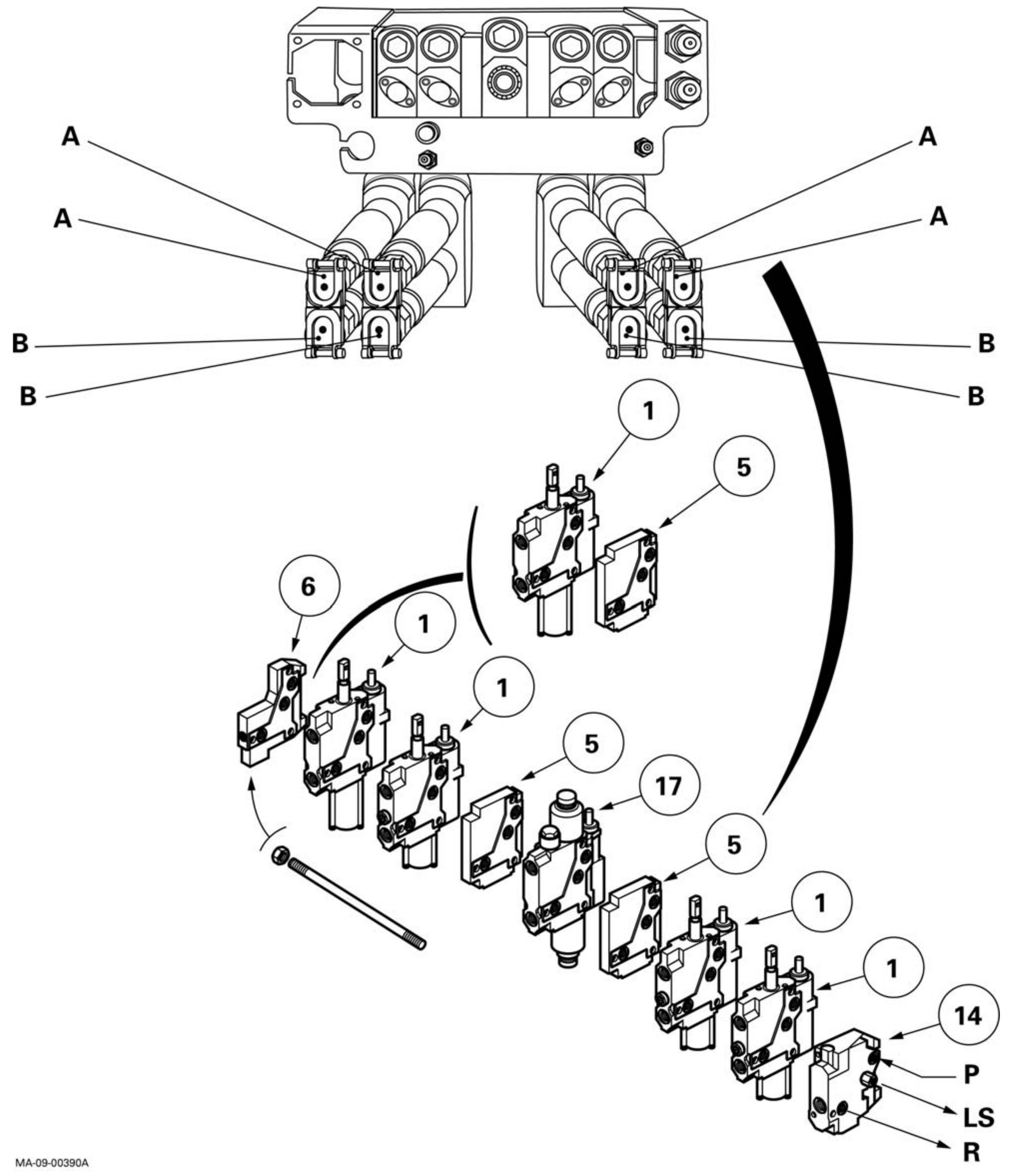

Fig. 4

Parts list (Fig. 4)

(1) Auxiliary spool valves
(5) Intermediary blocks
(6) End plate
(14) Inlet block
(17) Lift control spool valve

D . Diagram

Parts list (Fig. 5)

(17) Lift control spool valve

Legend

BP Priority block(s)
BB Balance block

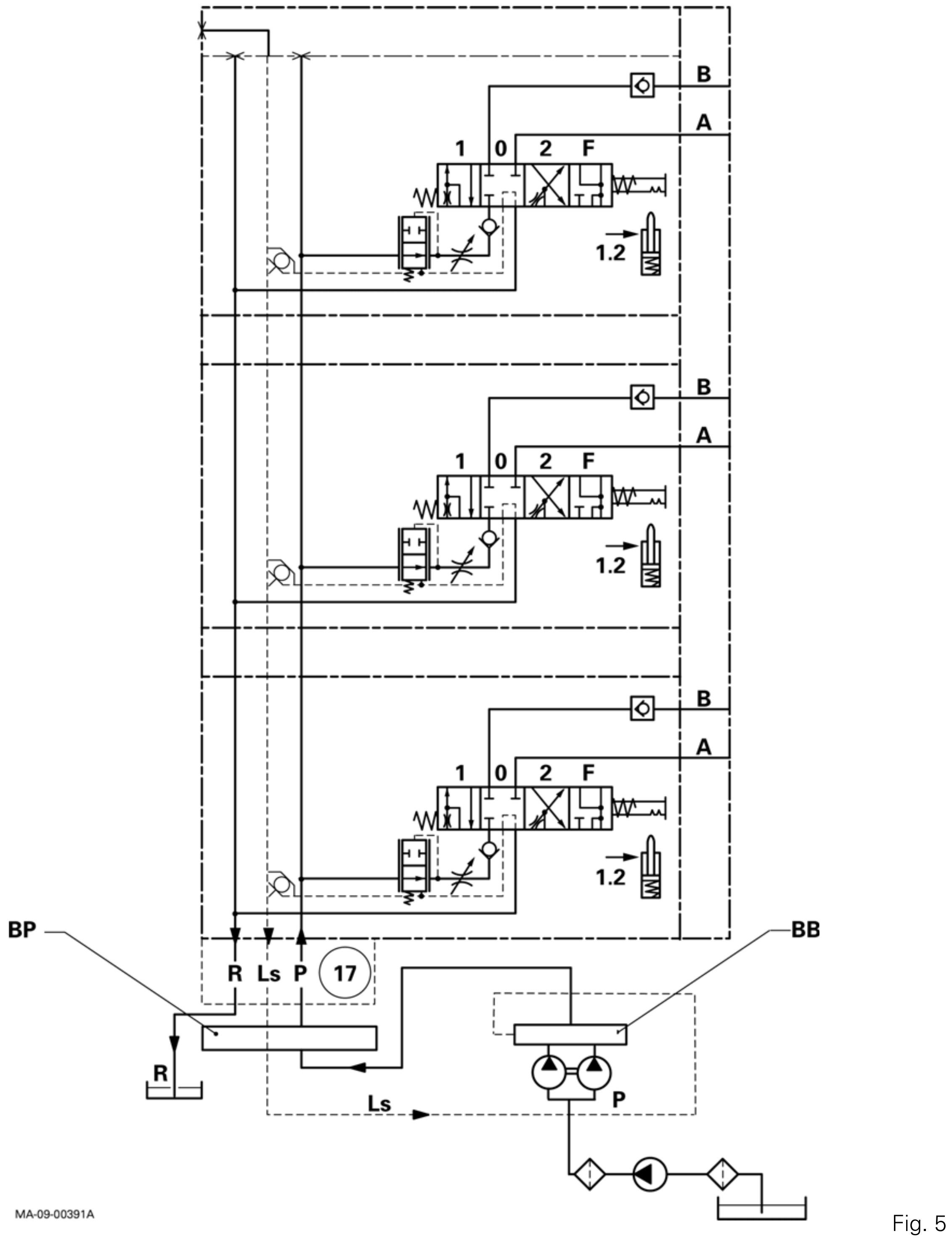

Fig. 5

E . Spool valve assembly

Preliminary operation

1. Disconnect the spool valve control cables.

Removing the spool valves (Fig. 6, Fig. 7)

IMPORTANT: *The spool valve block assembly must be removed complete.*

2. Locate and disconnect the electrical connectors.
3. Locate and disconnect the hydraulic pipe(s) fitted to the spool valves and couplers.
4. Remove support plate A.
5. Remove the spool valve block.

Removing the lift control spool valve

6. Remove the differential lock support (see operations 2 to 5). Place the assembly on a table. Separate the spool valve blocks.

NOTE: *The linkage spool valve is located in the middle of the spool valve block.*

Removing the inlet block (Fig. 7)

7. Remove the differential lock support (see operations 2 to 5). Place the assembly on a table.
8. Remove the inlet block.

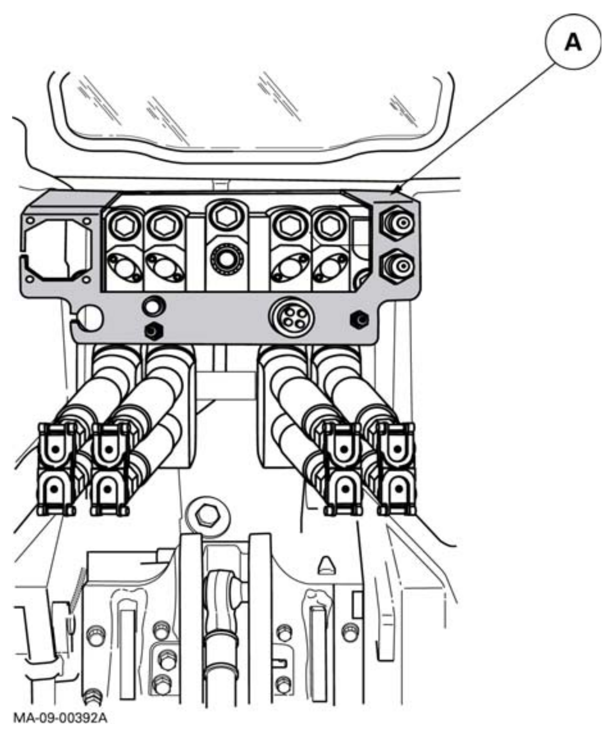

Fig. 6

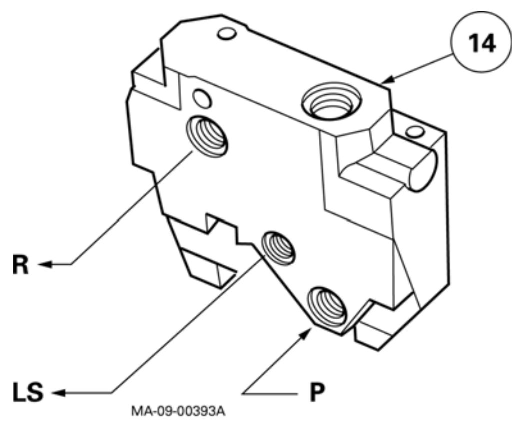

Fig. 7

Refitting the spool valves

9. Wipe clean the mating faces of the inlet block, the lift control spool valve, the auxiliary spool valves and the end plate. Check that each element is perfectly flat.

10. Check the tightness of the studs on the inlet block.

11. Place new seals (3) (4) (5) on each component of the spool valves Fig. 8).

12. Reassemble the spool valve block on the work-bench, following the assembly instructions (see § F).

13. Refit the complete block on the tractor.

14. Fit the hydraulic pipes to the spool valves and couplers according to the positions identified during the removal.

15. Reconnect the lifting and lowering solenoid valves according to the positions identified during the removal.

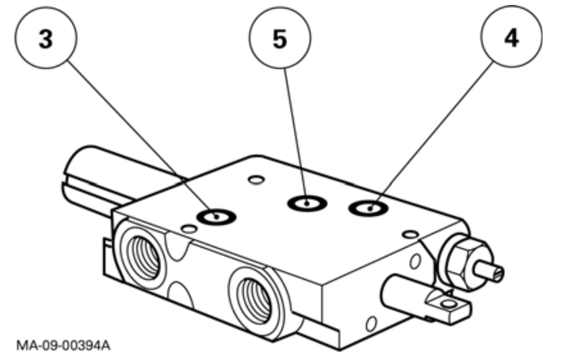

Fig. 8

Final operations

16. Fit and adjust control cables.

17. Start the engine.

18. At each position, check the operation:
- of the hydraulic system (see chapter 9, Tests).
- of the electronic system (see chapter 11, Tests).

19. Check the oil tightness of the spool valves and hydraulic unions.

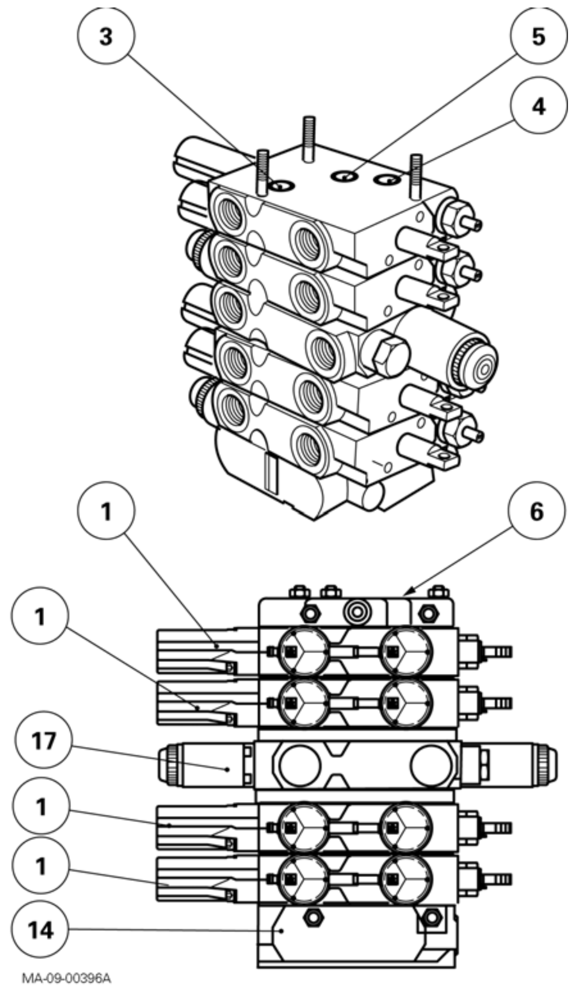

Fig. 9

F . Assembly procedure

***Important:** To obtain a correct assembly of the seals (3) (4) (5) (Fig. 9), the spool valve block must imperatively be assembled vertically (Fig. 9).*

Final assembly

20. Partially tighten the nuts in contact with the end plate.

21. Place the distribution block with the F faces on a flat surface to ensure correct alignment of the attachment points.

22. Tighten the nuts (8) of the end plate (6) to a torque of 30 - 33 Nm (Fig. 10).

23. Correctly fit the spool valve block on support S.

Fit and tighten the screws (10) (Fig. 11)

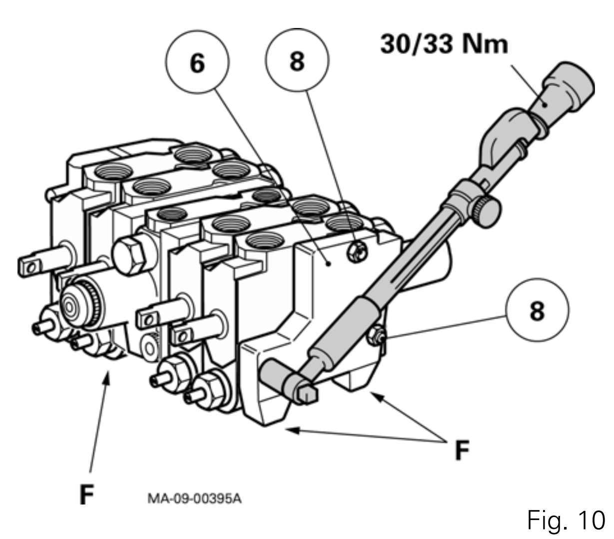

Fig. 10

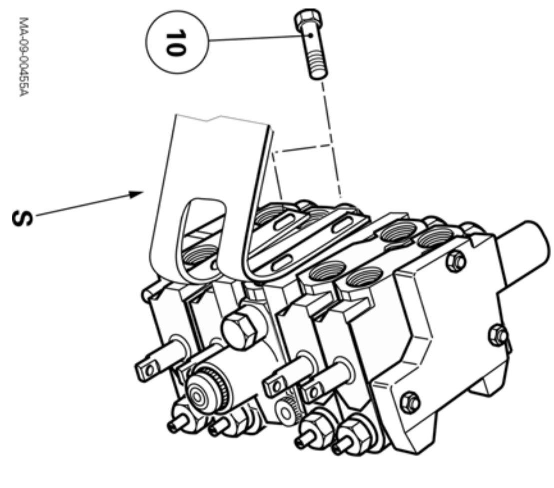

Fig. 11

G . Fitting and adjusting the control cables

Special points

- The pins (2) must be fitted with the threads slightly smeared with Loctite 241 or equivalent.
- Figures 1 to 3 in the dark circles show the assembly order of the levers which control the spool valves.
- The fitting of a fourth control lever is provided for on the cab console. It will be placed to the left of lever 1 (viewed from the driver's seat).
- The friction washers (1) are smeared with molybdenum sulphide grease before assembly.
- The nuts (3) must be tightened so as to obtain a slight resistance for the levers during operation.

On support (6) and lever (Fig. 12)

***Note:** Depending on the type of spool valve, the clevis (4) may be fitted on link A or B:*
- *assembly fit A: normal spool valves;*
- *assembly fit B: spool valves with floating position.*

24. Pass the cable through the flange (9) located at the rear right of the cab and then through the stirrup (8).

***Nota:** The hole in stirrup (8) is eccentric (Fig. 13). To fit a control for a spool valve with a floating position, this hole must be at the top so as to correctly align the cable and its fastening.*

25. Screw the clevis (4) flush with the threaded part of the cable (7) and fit it on link A or B of the lever concerned. Position clip (5).

Tighten the nut on the clevis and check that the cable is not constrained in any way.

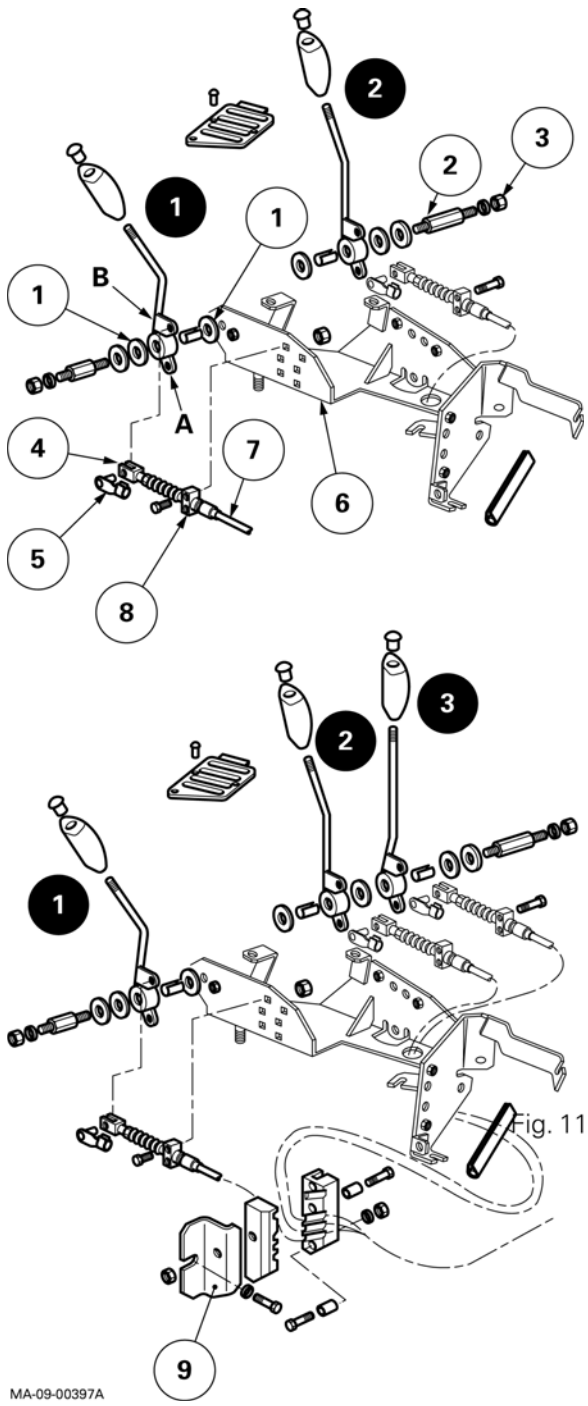

Fig. 12

On the spool valves (Fig. 14)

26. Without turning the main spool valves half a turn, check that they are in the neutral position.

27. Screw the clevis (1) so that it is flush with the threaded part of the cable (7). Tighten nut (3). Fit the pin (4).

28. Partially remove the bell housing (5). Fit the screws (6) without tightening them.

29. Turn and adjust the tubular cover in order to correctly centre the control lever in the slot specially provided on the console.

30. Lock the screws (6). Tighten the nut (2) to a torque of 20 Nm.

31. Check the correct operation of the spool valve controls in all three or four positions, depending on the type.

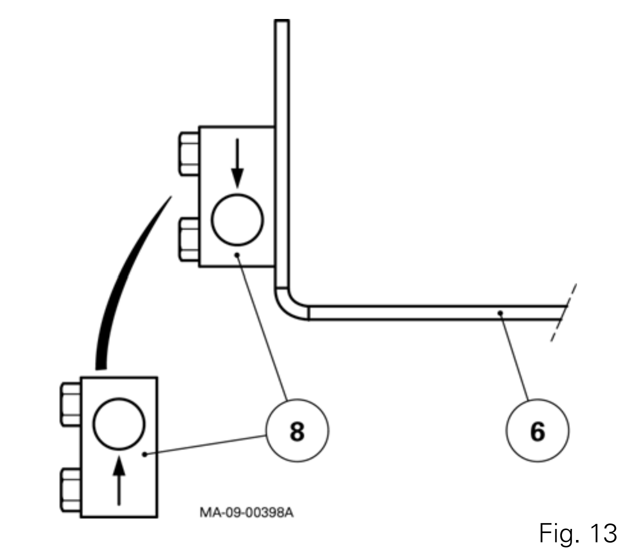

Fig. 13

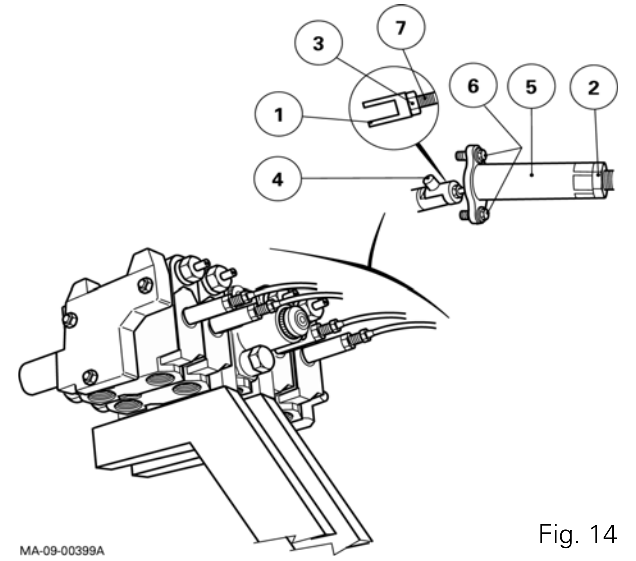

Fig. 14

9I21 - LS auxiliary mechanical spool valves - GPA30

CONTENTS

A . General

The proportional auxiliary spool valves, of the Bosch/Rexroth SB23 LS type, are fitted to the high flow rate high pressure circuit. They are fed by the oil coming from the priority block(s).

When no functions are being activated, the entire flow rate is directed towards the spool valves. If certain priority functions are being supplied, the remaining flow is then available for the auxiliary spool valves.

Each spool valve has a flow regulating system controlled by a black, red, green or yellow button located directly on the each spool valve regulating valve stem.

The main spool of the valve is controlled by a cable linked to a lever in the cab. The spool directs oil towards either outlet port. Each outlet port is linked to the LS pilot line of the variable displacement pump regulating valve via the priority block(s).

The auxiliary spool valves are made up of elements themselves containing spools and valves.

Some elements cannot be identified as spare parts.

Different types of spool valve block components

A spool valve block can consist of three, four or five of the following components. It can combine components of similar type of or different types.

Component b

4-position component with flow rate regulation, double acting and automatic return to neutral.

Component c

4-position component with flow rate regulation, double acting, zero leak and automatic return to neutral.

Couplers (Fig. 1)

The quick-disconnect couplings are held by a bracket on the centre housing. They are sealed by covers of different colours (red, green, black or yellow) corresponding respectively to hydraulic ports A and B of auxiliary spool valves.

When the auxiliary spool valve is at rest, a lever system (1) allows existing pressure to be relieved into the hydraulic hoses (2). These hoses link the spool valves with the concerned couplers (3). By acting on this system, the clean oil under pressure is directed to the return via a hose and pipe assembly (4) connected to the upper part of the intermediate housing. This drop in pressure facilitates the connecting of the male coupler to the female coupler. The contaminated oil, coming from the separation of the couplers, flows into flexible and transparent tanks (5) located on either side of the third-point linkage.

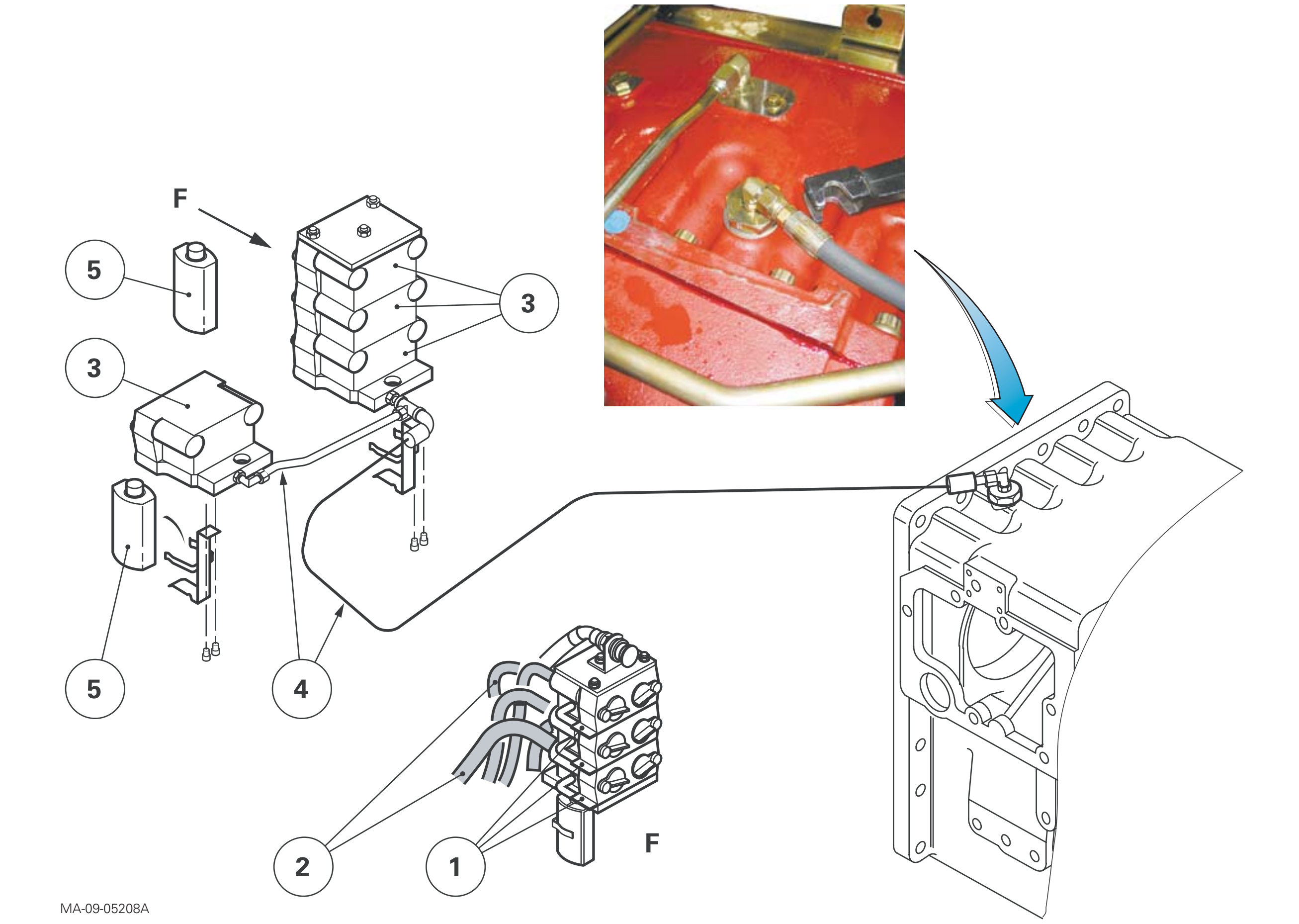

Fig. 1

B . Operation

When the lever in the cab is pulled (spool (1) pushed, Fig. 2), the oil enters via channel P and travels towards the restrictor of the flow regulation control spool (5) and grooves of the main spool (1). The oil is then carried towards a main channel and lifts the ball of valve (2) to enter a chamber. Displacement of the spool (1) simultaneously opens the one-way valve (3). The oil flows from the chamber towards port A and returns to the housing through port B via the hydraulic slave device.

The operating principle is identical when the lever is pushed (spool (1) pulled, Fig. 2). The oil flows from the chamber towards port B and returns to the housing through port A via the hydraulic slave device.

C . Layout of components and identification of ports

Layout of components (Fig. 2)

(1) Main spool
(2) Valve
(3) Non-return valve
(4) Flow regulation control rod
(5) Flow regulation control spool
(6) Housing and locking system
(7) Flow regulation control button

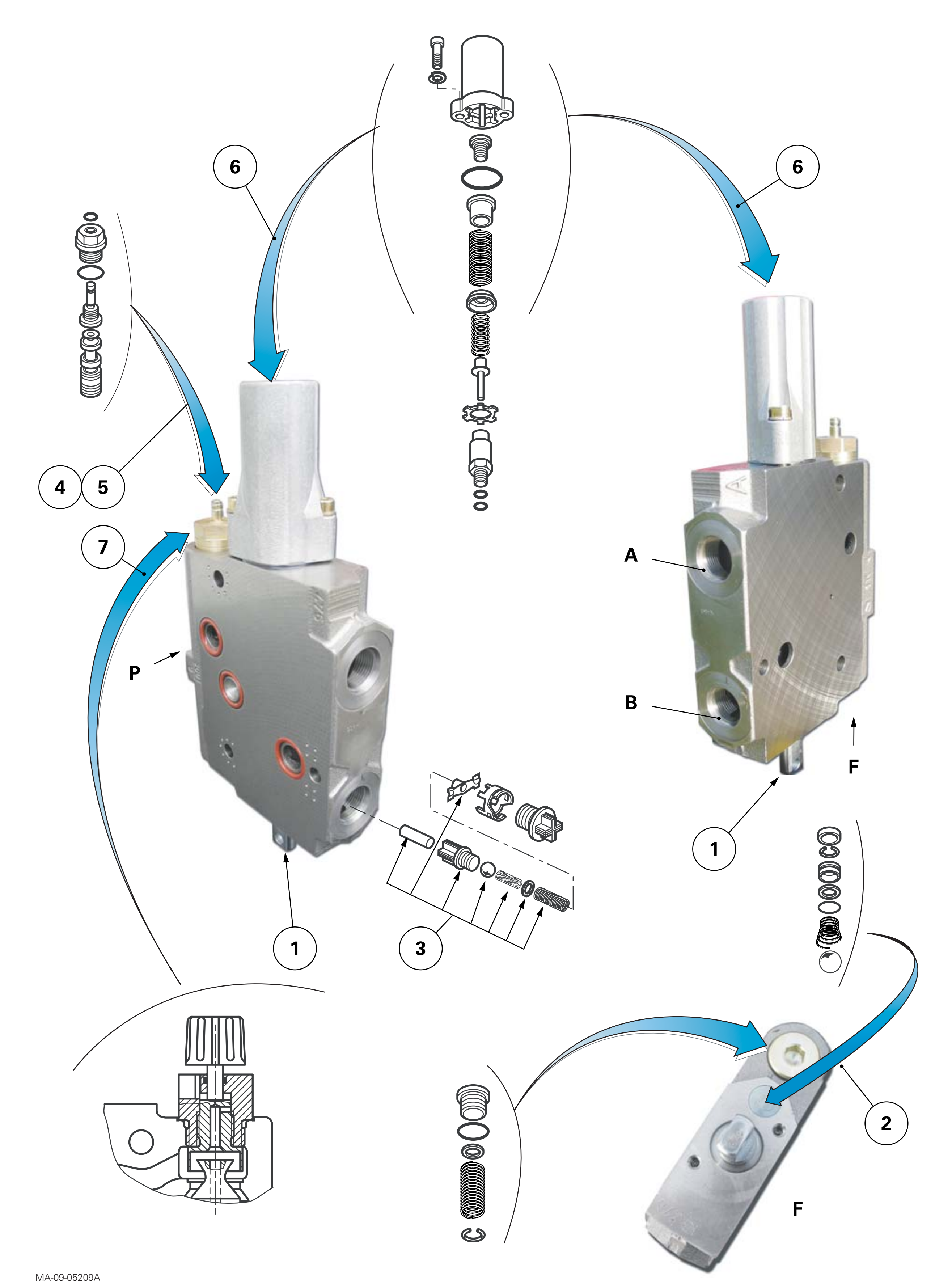

Fig. 2

Identification of ports...

... on the manifold (21) (Fig. 3)

P High pressure supply from the variable displacement pump via the priority block(s) (depending on version).
R Auxiliary spool valve return
r Return (provision for)
LS Signal to the variable displacement pump regulator via the priority block(s) (depending on version).

... on the auxiliary spool valves (Fig. 4)

A Outlet to couplers
B Outlet to couplers
P, R and LS
Markings identical to those of manifold (21)

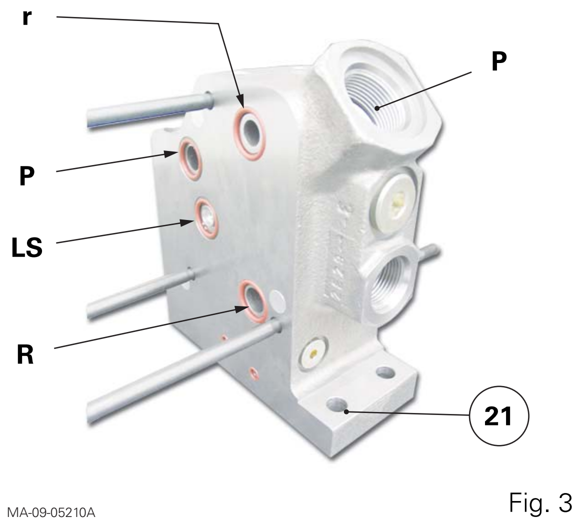

Fig. 3

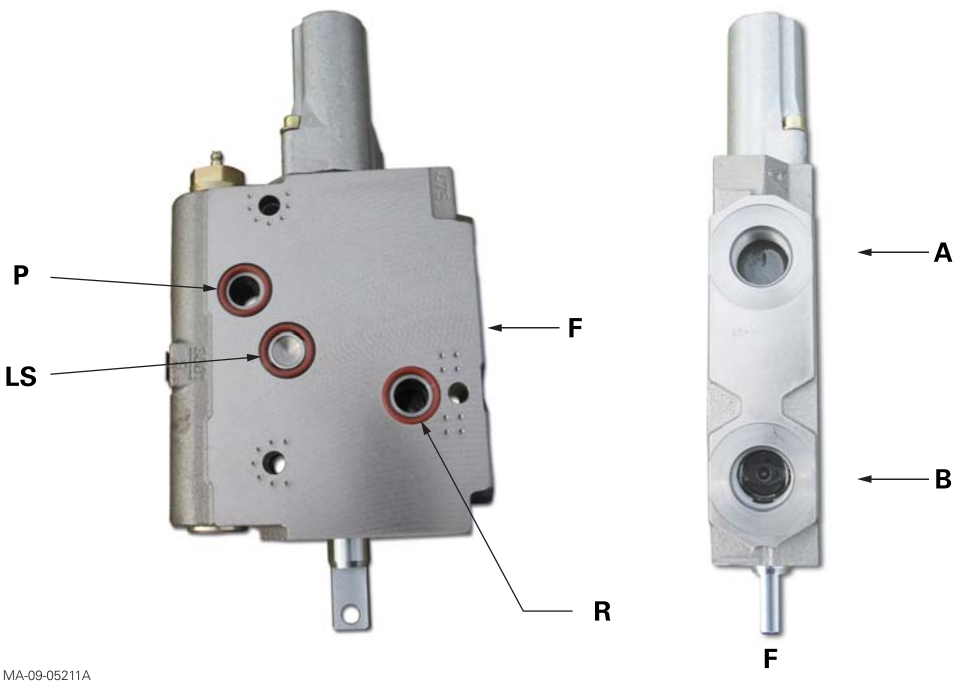

Fig. 4

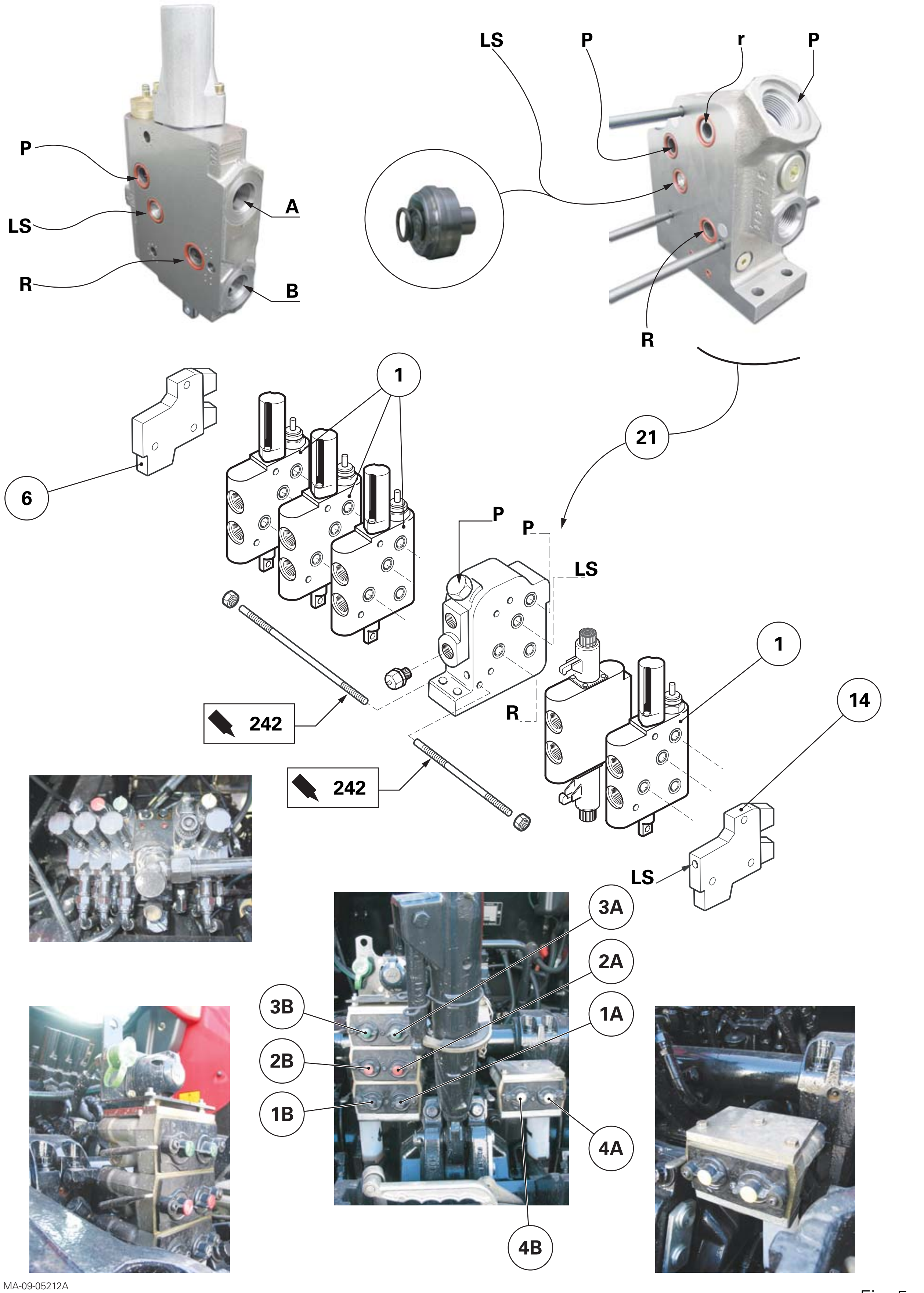

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Fig. 5

D . Diagram

Parts list (Fig. 6)

(1) Lift control spool valve
(7) or [(7) and (7A)]
Priority block(s)
(21) Oil manifold

Legend

A,B Outlets to couplers
P Pressure
P2 Pressure connector (provision for)
R Return
LS Signal

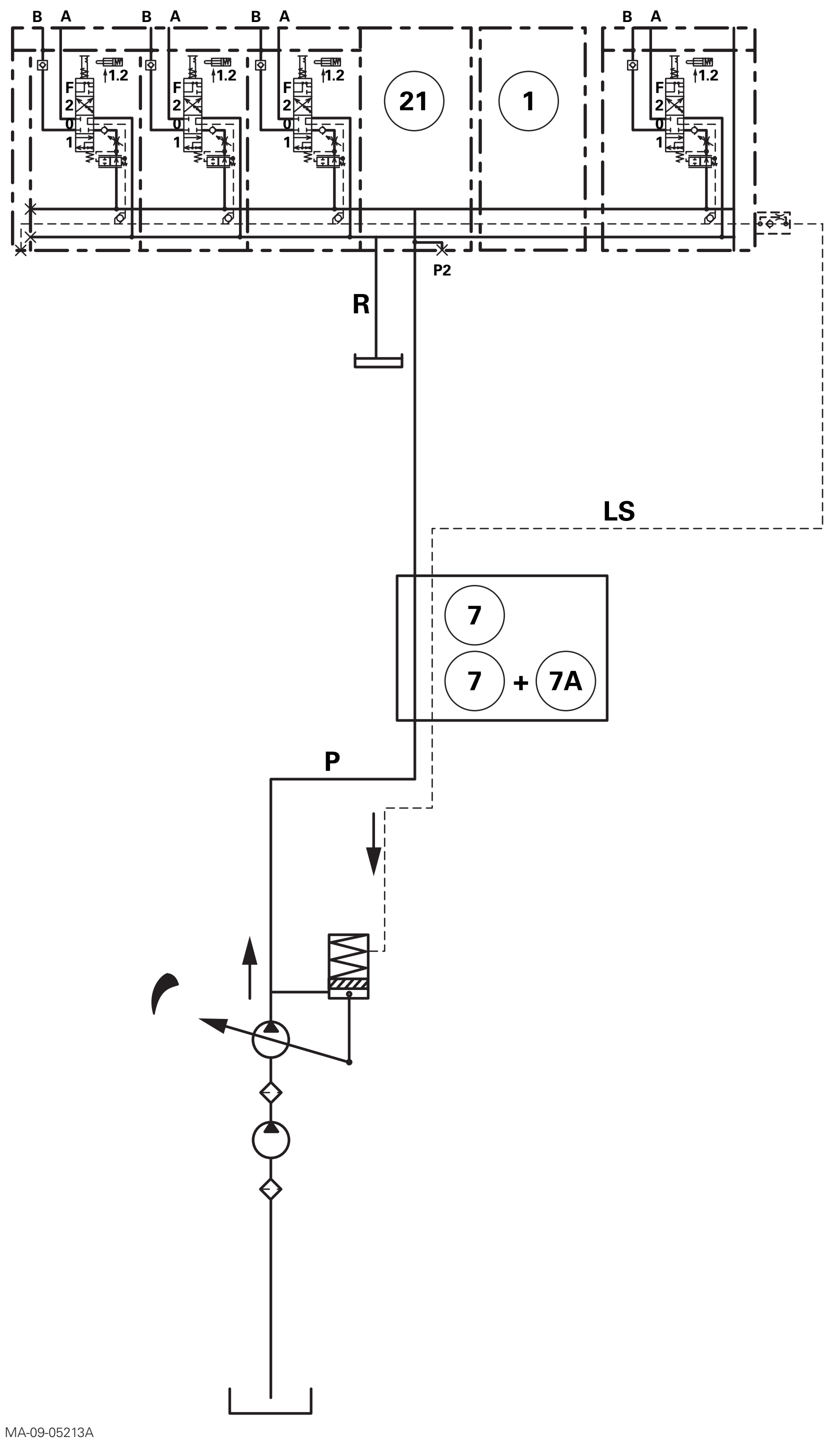

Fig. 6

E . Removing - refitting and disassembling - reassembling the spool valve blocks

Preliminary operations

1. Disconnect the control cables (7) of each spool valve component by uncoupling the sleeves (1) located under the cab (Fig. 7).
2. Mark the position of the hydraulics hoses connected to the couplers. Disconnect them from the spool valve block.
3. Disconnect (Fig. 8):
   - the high pressure pipe (30);
   - the lift ram supply pipes (16);
   - the LS hose (9).
4. Mark and disconnect the lift control valve solenoid valve harness (R10 Down - R11 Up).

Fig. 7

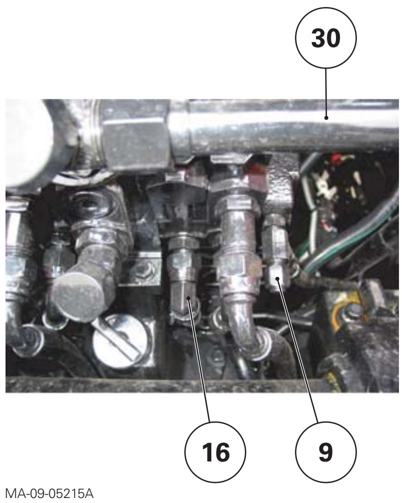

Fig. 8

Removal

5. Remove the screws (3) and flanges (2) from the manifold (21) (Fig. 9).
6. Sling the spool valve block. Separate it from the support (1). Place it in a clean work area.
7. If necessary, remove support (1) (Fig. 10).
8. Discard the O'ring (3) (Fig. 11).

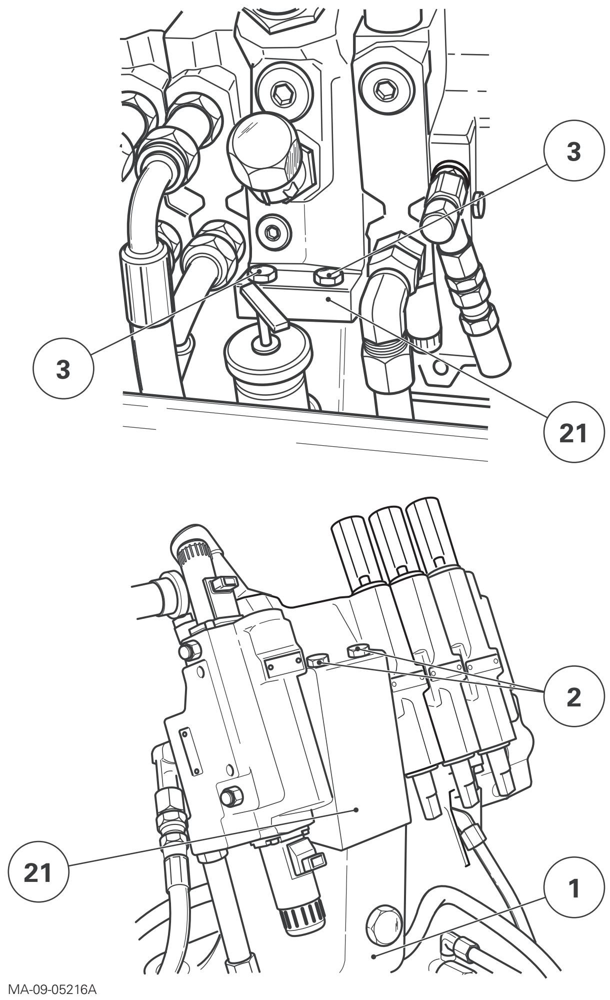

Fig. 9

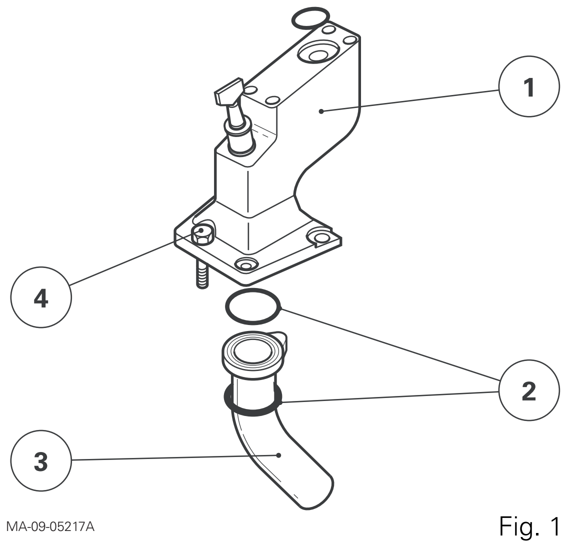

Fig. 10

Refitting

9. If it was necessary to remove the support (1) (Fig. 10), replace the return pipe (3) O'rings (2).
Tighten the screws (4).

10. Clean the manifold (21) mating face, along with that of the support (1).

11. If the studs (2) need replacing (Fig. 11), lightly smear the short thread of the new studs with Loctite 270 or equivalent.
Fit and tighten the studs.
Clean off any excess Loctite.

12. Replace the O'ring (3) (Fig. 11).

13. Refit the spool valve block on the support (1).
Tighten (Fig. 12):
- the screws (3) to a torque of 50 - 70 Nm;
- the nuts (2) to a torque of 90 - 120 Nm.

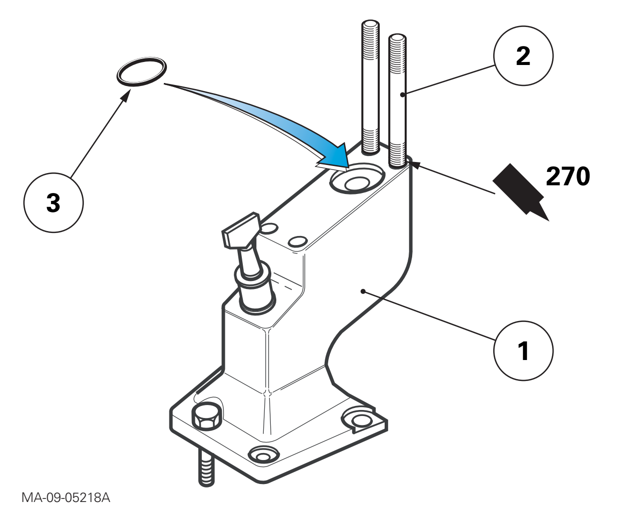

Fig. 11

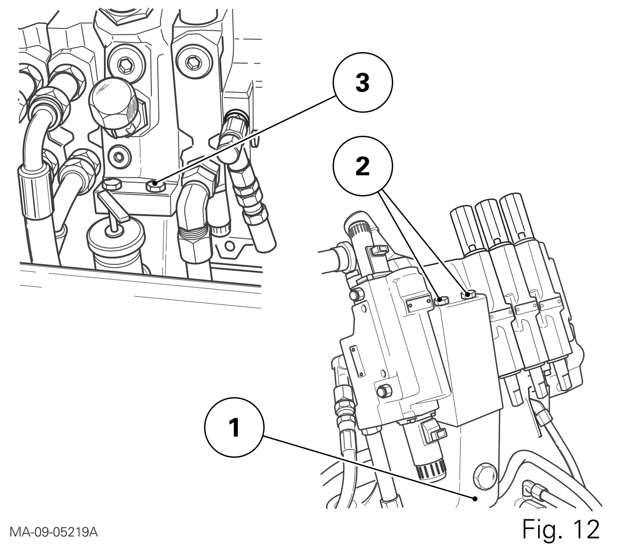

Fig. 12

Final operations

14. Reconnect the lift control valve solenoid valve harness (R10 - R11) according to the marks made during removal.

15. Reconnect:
- the LS hose (9);
- the lift ram supply pipes (16);
- the high pressure pipe (30).

16. Connect the coupler hoses to the spool valve block.

17. Reconnect the control cables (7) of each spool valve component, leaving an identical threaded length on either side of the link (2) (Fig. 13).

Couple the sleeves (1) (Fig. 13).

Adjust the control cables (see § F).

18. Carry out the hydraulic tests if one or more spool valve block components needed replacing (see chapter 9).

19. Check:
- spool valve component operation;
- the tightness of the spool valve block, pipes and hoses.

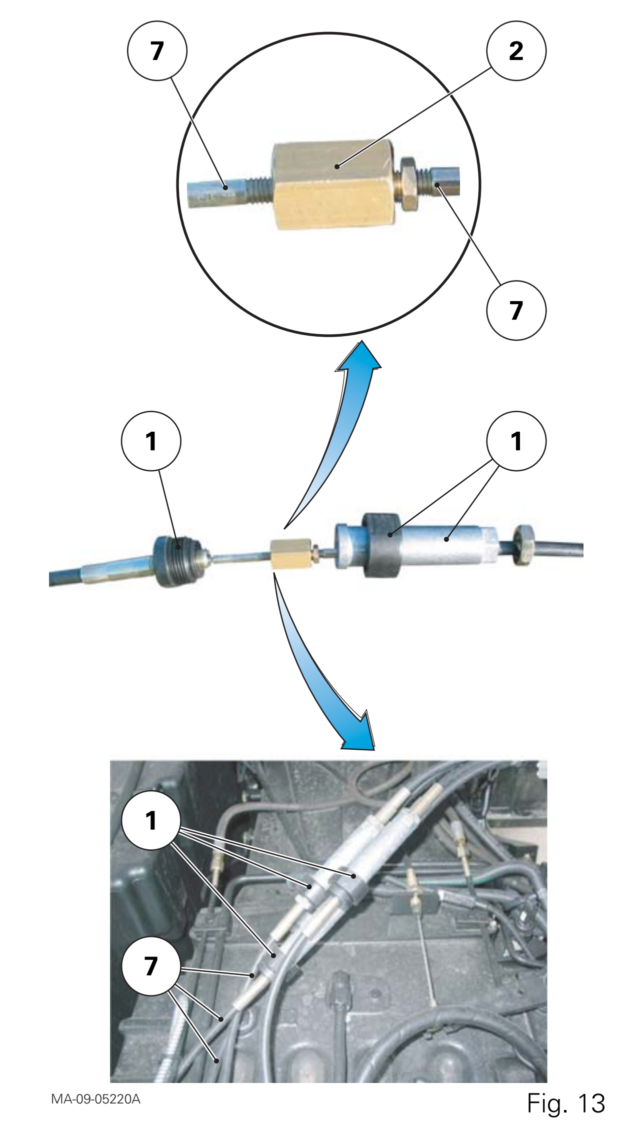

Fig. 13

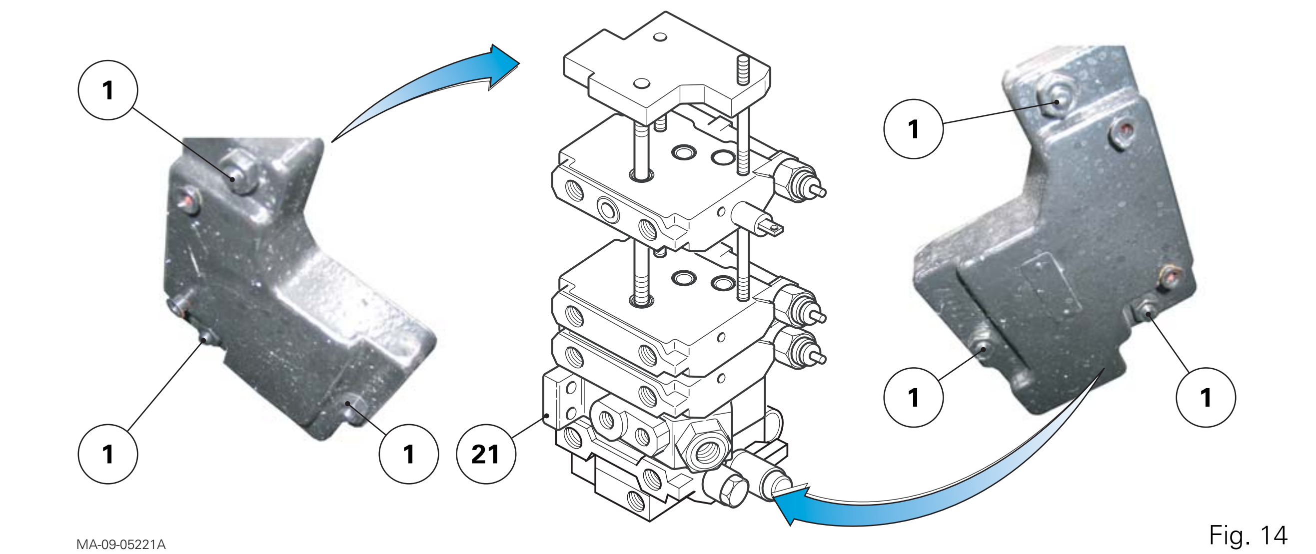

Fig. 14

Disassembly

20. Carefully clean the spool valve block prior to disassembling. Remove any traces of dried mud or earth that could contaminate any spool valve components that could be reused.

21. Place the spool valve block in a vertical position (Fig. 14).

22. Loosen the nuts (1) (Fig. 14).

Remove the end plate(s) (right and/or left) from the spool valve block.

23. Separately remove the concerned spool valve components, making sure not to lose:

- the O'rings between each component;
- the non-return valve (1) and its spring on the manifold (21) (Fig. 15).

24. If necessary, loosen the six studs screwed on either side of the manifold (21).

NOTE: *These studs may be of variable length depending on the number of components fitted onto the spool valve block.*

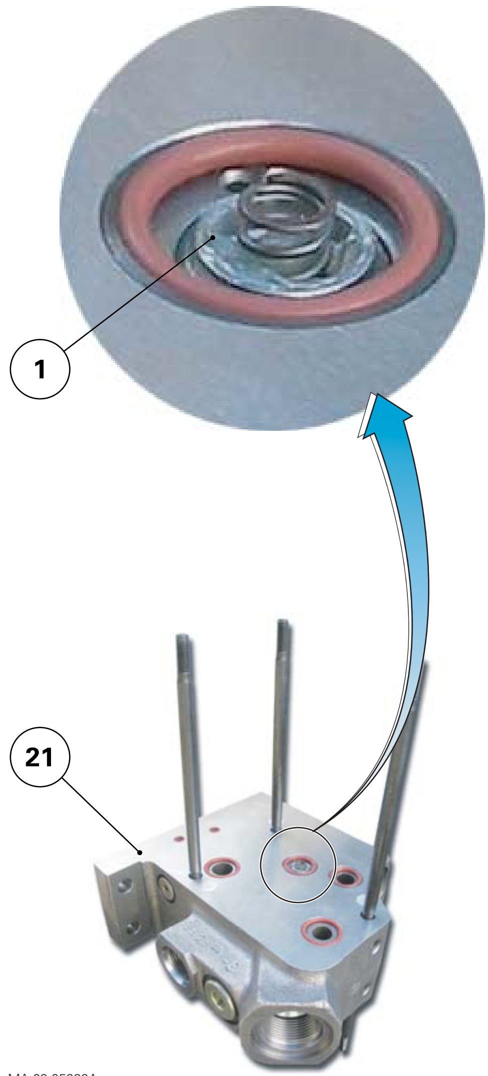

Fig. 15

Reassembly

25. Clean the mating faces:
- of the manifold (21), without removing the adhesive shims (pellets Fig. 17);
- the spool valve component(s) (auxiliary and lift control)

26. If the studs on the manifold (21) need to be replaced, lightly smear the short thread of the new studs with Loctite 242 or equivalent.

Fit and tighten the studs.

Clean off any excess Loctite.

27. Check the presence:
- of the seals (3) to (5) in each spool valve component spot-faced port (1) (Fig. 16);
- of the seals (3) to (7) in each manifold (21) spot-faced port (Fig. 19);
- of the non-return valve (1) and its spring on the manifold (21) (Fig. 19);
- of the adhesive shims (P pellets, Fig. 17).

28. Reassemble the spool valve block by assembling the spool valve component(s) on the manifold (21).

NOTE: *The lift control valve is integral to the auxiliary spool valve block components (see chapter 9). It is located between the manifold (21) and either the right-hand end plate or the 4th spool valve component (if fitted).*

29. Refit the end plate(s) (right and/or left) on the spool valve block.

30. Fit and alternately tighten the nuts (3) (Fig. 18) to a torque of 30 - 33 Nm.

IMPORTANT: *This torque must be respected in order to avoid any risk of spool valve component warping and subsequent spool seizing.*

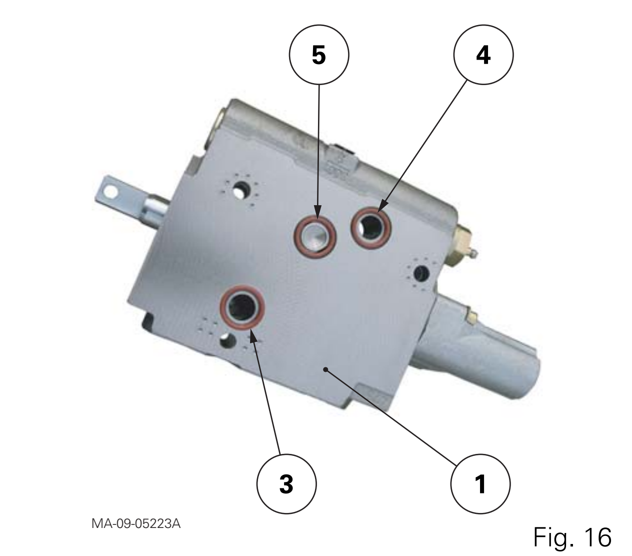

Fig. 16

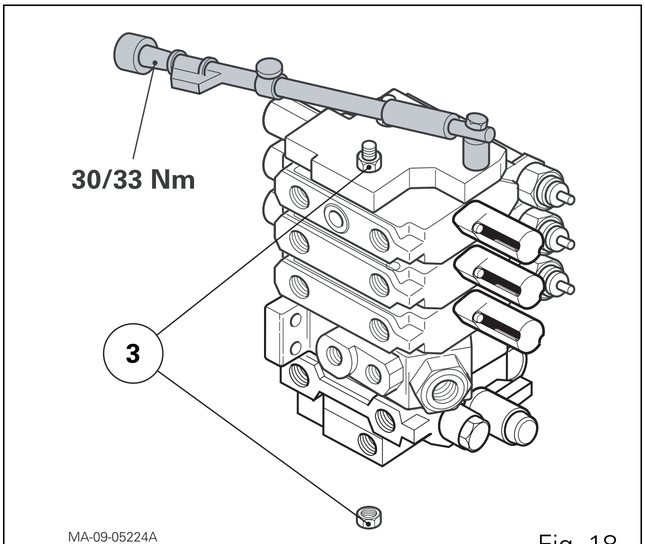

Fig. 18

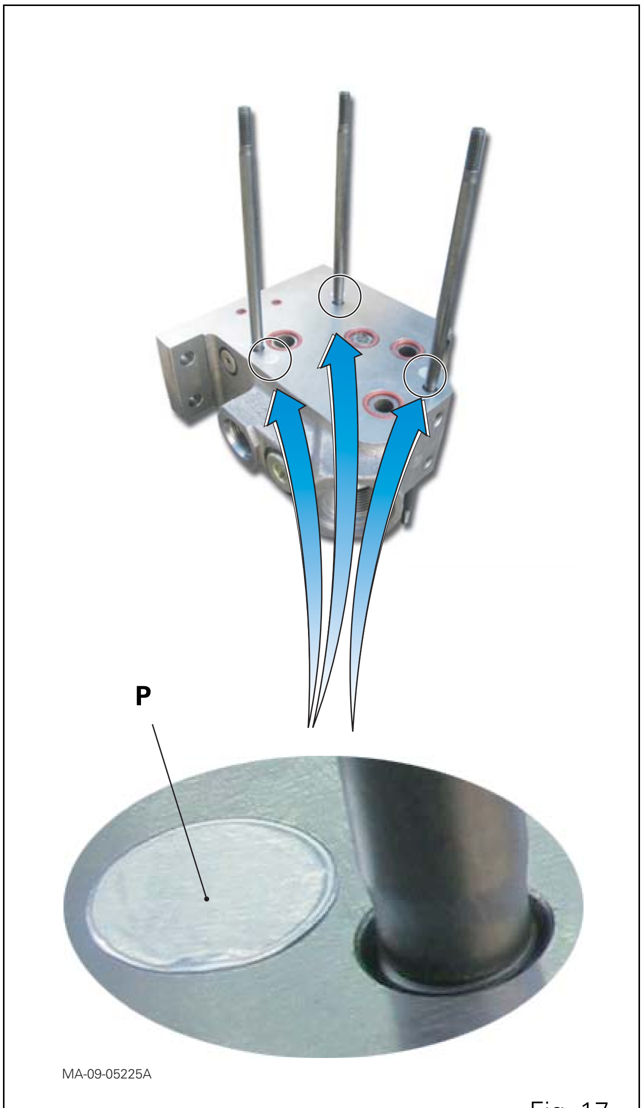

Fig. 17

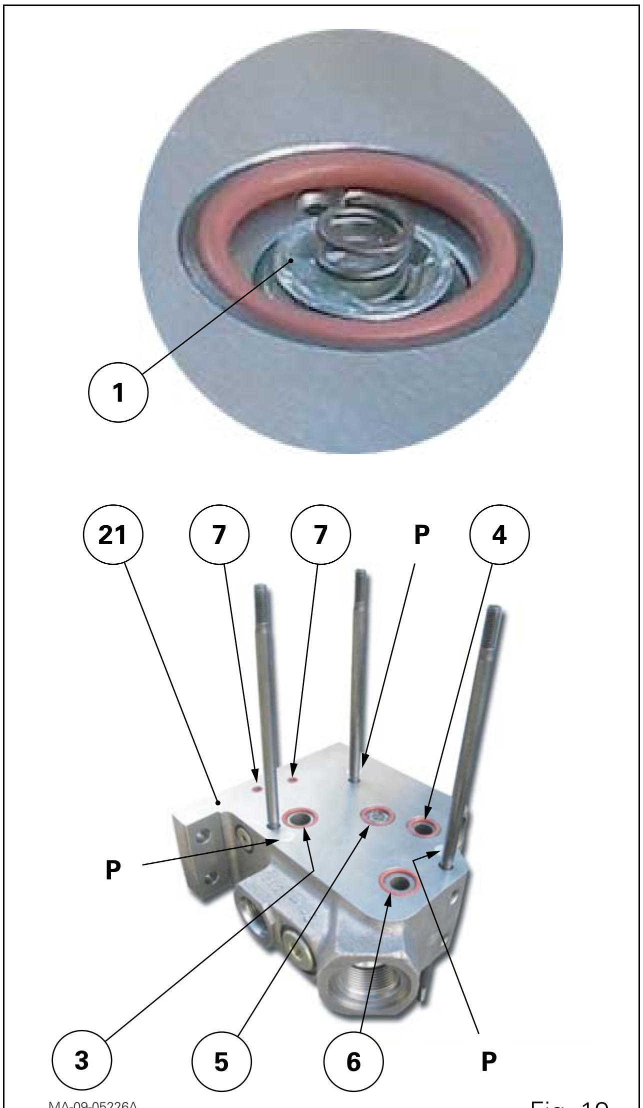

Fig. 19

F . Assembling and adjusting a control cable

To be performed on the console (Fig. 20)

31. Remove right-hand console cover.

32. Fit the unit (1) and its control cable on the suitable fixture.

33. Refit the console cover.

To be performed on the auxiliary spool valve (Fig. 21)

34. Check, without turning, that the valve spool is in neutral position.

35. Screw clevis (1) flush with the threaded part of cable (7).

Tighten nut (3).

Fit the pin (4).

36. Screw:

- the bell housing (8), partially;
- the screws (6) without tightening them.

37. Adjust the bell housing (8) by turning it from left to right to centre the lever (1) in the console opening (Fig. 20).

38. Lock the screws (6).

Tighten the nut (9) to a torque of 20 Nm.

39. Check the operation of the spool valve control in all four positions.

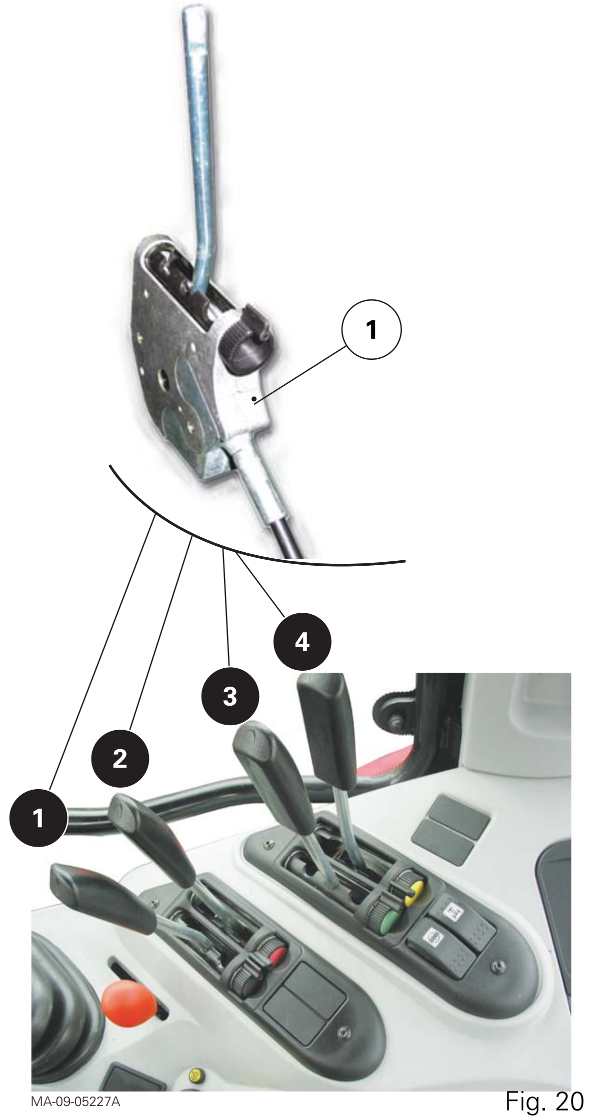

Fig. 20

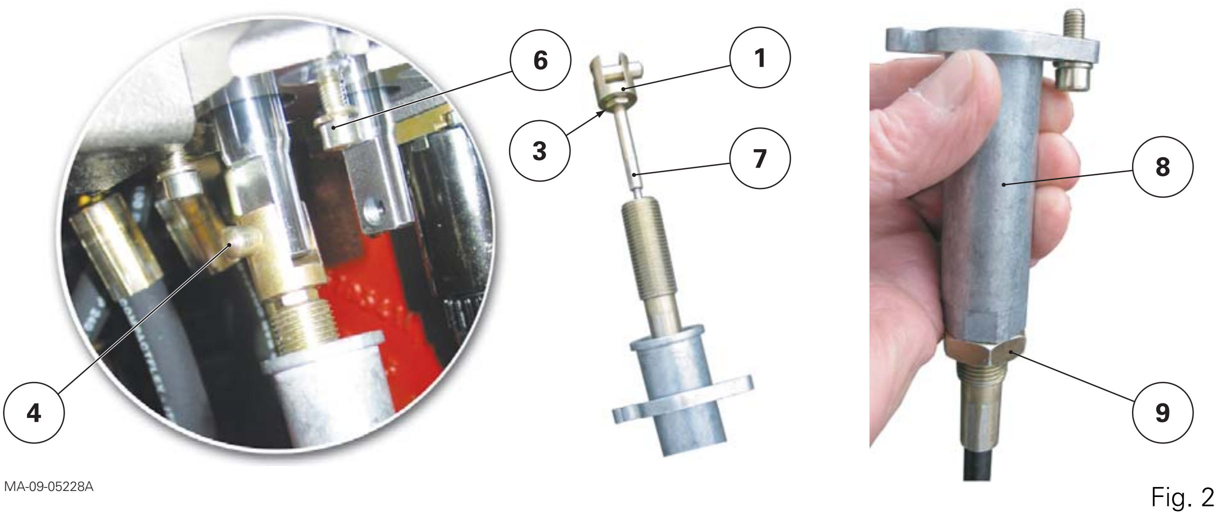

Fig. 21

9I30 - LS and TFLS electrohydraulic auxiliary spool valves - GPA20 and GPA40

CONTENTS

A . General

The Bosch/Rexroth SB23 LS spool valves controlling supply to the hydraulic couplers are comprised of:

- an hydraulic part;
- an electrohydraulic part comprising:
  - an ON/OFF solenoid valve and a 3-way pressure relief valve located on the end plate of the spool valve block,
  - a pilot valve fitted in the electrohydraulic unit.

This section shall concern the hydraulic part only. For the electrohydraulic part, see chapter 11.

The Bosch/Rexroth SB23 LS electrohydraulic control spool valves are supplied by high flow rate, high pressure oil from the priority blocks.

When no functions are being activated, the entire flow rate is directed towards the spool valves. When certain functions are being supplied, the excess flow then remains available to the auxiliary spool valves.

The adjustment of the flow rate, expressed as a percentage, may be displayed on the onboard computer (Datatronic) by the operator (see chapter 11).

The electrohydraulic spool valves controlled by a Joystick (1) (Fig. 1) are fitted with a floating Kick-out position (automatic return to neutral).

The main spool of the spool valve directs oil towards the outlet ports A or B.

Each outlet port is linked to the LS pilot line of the variable displacement pump regulating valve via the priority block(s).

The spool valves consist of both electronic and hydraulic components, the latter containing spools and valves.

Some elements cannot be repaired as spare parts.

Different types of spool valve block components

A spool valve block can consist of three, four or five of the following components. It can combine components of similar type of or different types.

Component a

Electrohydraulic component (Joystick)

Component b

Electrohydraulic component (Dual Control)

Component c

Mechanically controlled component (see chapter 9).

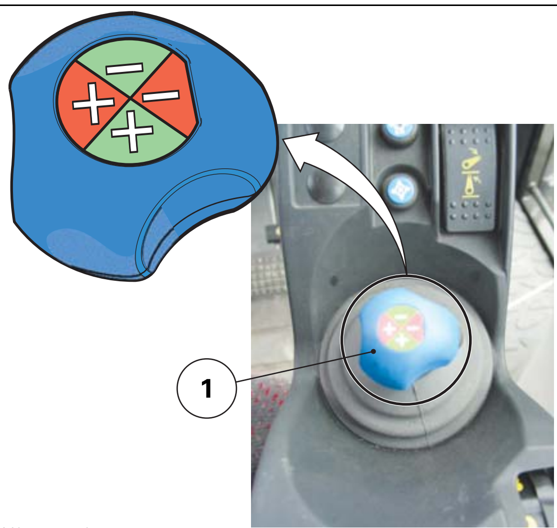

Fig. 1

LS and TFLS electrohydraulic auxiliary spool valves - GPA20 and GPA40

Parts list (Fig. 2)

(1) Auxiliary spool valves
(6) End plate
(14) Inlet block
(17) Lift control spool valve
(18) ON/OFF solenoid valve
(19) Electronic units

Exploded view

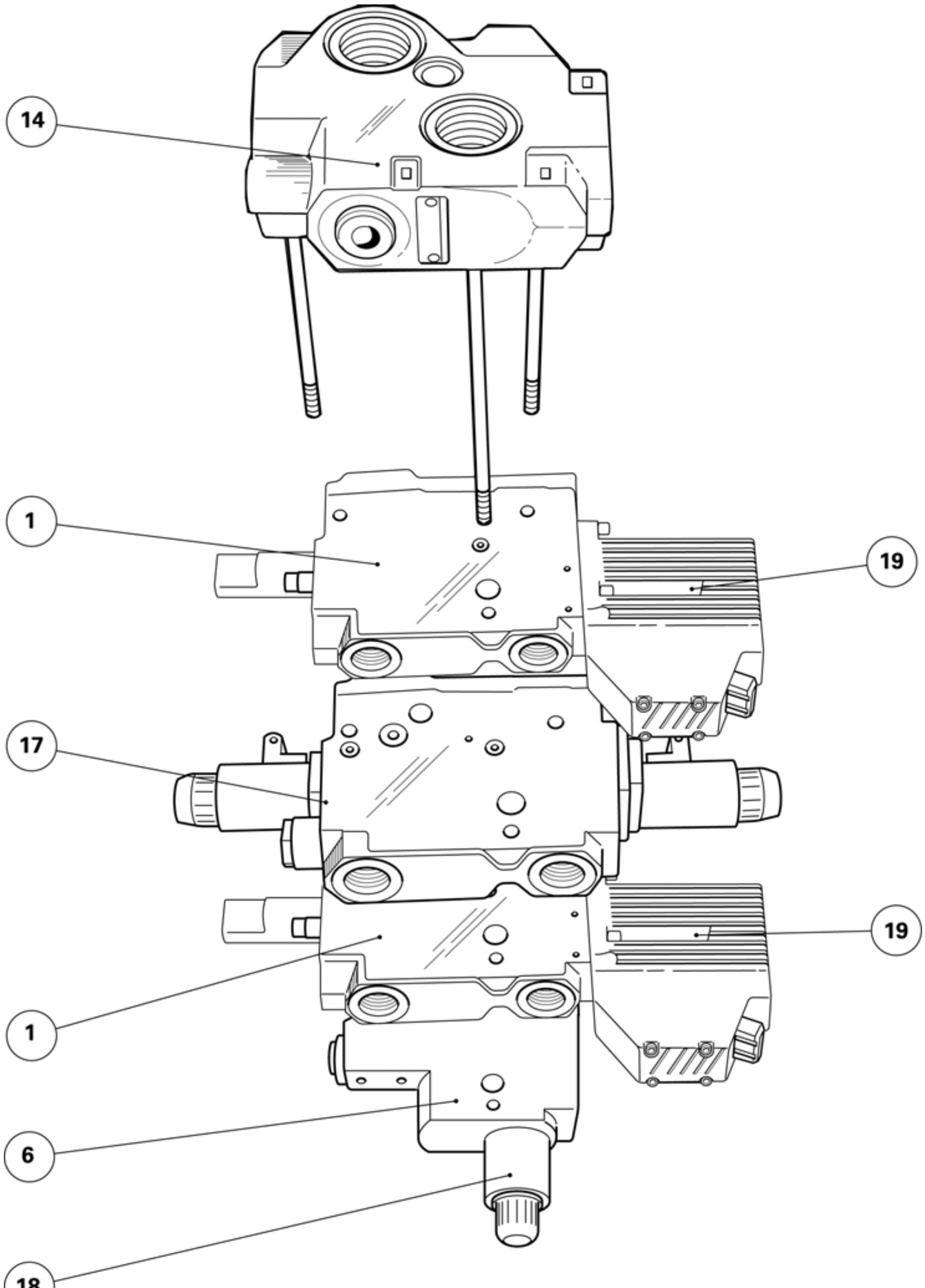

Fig. 2

Hydraulic connections between spool valves and couplers (Fig. 3 to Fig. 7)

NOTE: *Figures 1 to 4 indicate the assembly order of the auxiliary spool valves.*

Legend

M	Black and yellow, mechanical spool valve
X	Red, Joystick
Y	Green, Joystick
DC	Black, Dual Control
VR	Lift control valve
(5)	Support
(6)	Joystick lever

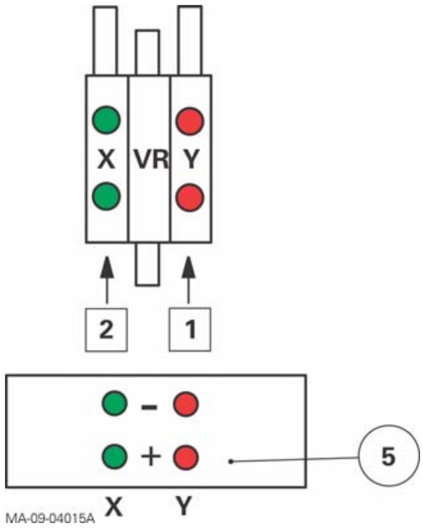

Fig. 3

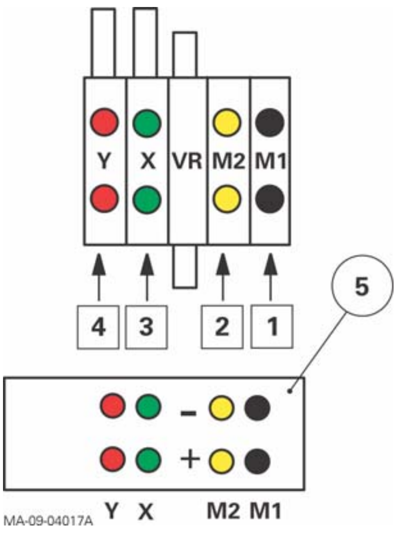

Fig. 4

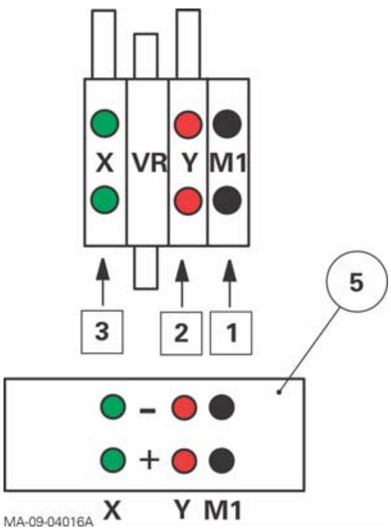

Fig. 5

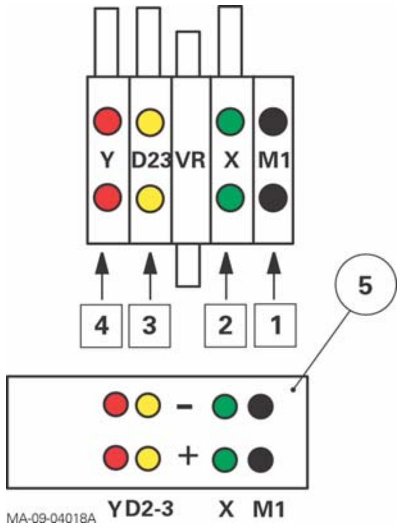

Fig. 6

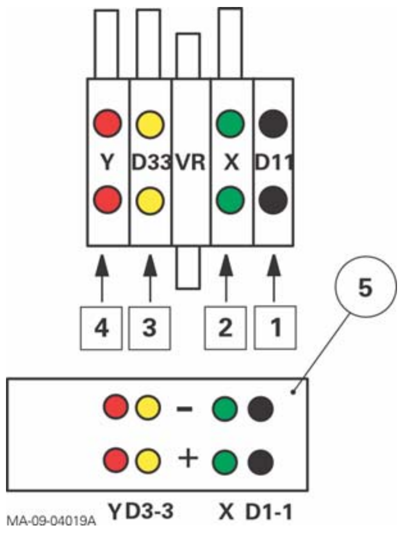

Fig. 7

B . Operation of the pressure relief valve and electrohydraulic unit

When the ON/OFF solenoid valve (18) located on end plate (6) is open, the flow from the pump is directed to the 3-way pressure relief valve (3) (Fig. 8). The 3-way pressure relief valve supplies the pilot valve (5) (Fig. 9) with a pressure of 21 - 24 bar via a pressure balancing valve. The pilot valve receives a signal from the digital device (6) and moves the main spool (1) of the auxiliary electrohydraulic spool valve (Fig. 9) according to the information received from the Joystick. The digital device is informed of the position of the main spool by a displacement sensor (7) (Fig. 9).

The pilot valve and the digital device are housed in the unit (2) fixed below the spool valve.

The pilot valve (5) (Fig. 9) is protected from possible oil contamination by a set of FP filters (25 microns) (Fig. 8).

Electronic unit (2) channels P and R (Fig. 9) are connected to channels P1 and R1 of the auxiliary electrohydraulic spool valve (Fig. 11).

Parts list (Fig. 9)

(1) Main electrohydraulic valve spool
(2) Electrohydraulic unit
(3) Return spring
(4) Piston
(5) Pilot valve
(6) Digital electronic system
(7) Displacement sensor

Legend

FP Set of filters (25 microns)
P Pressure
R Return

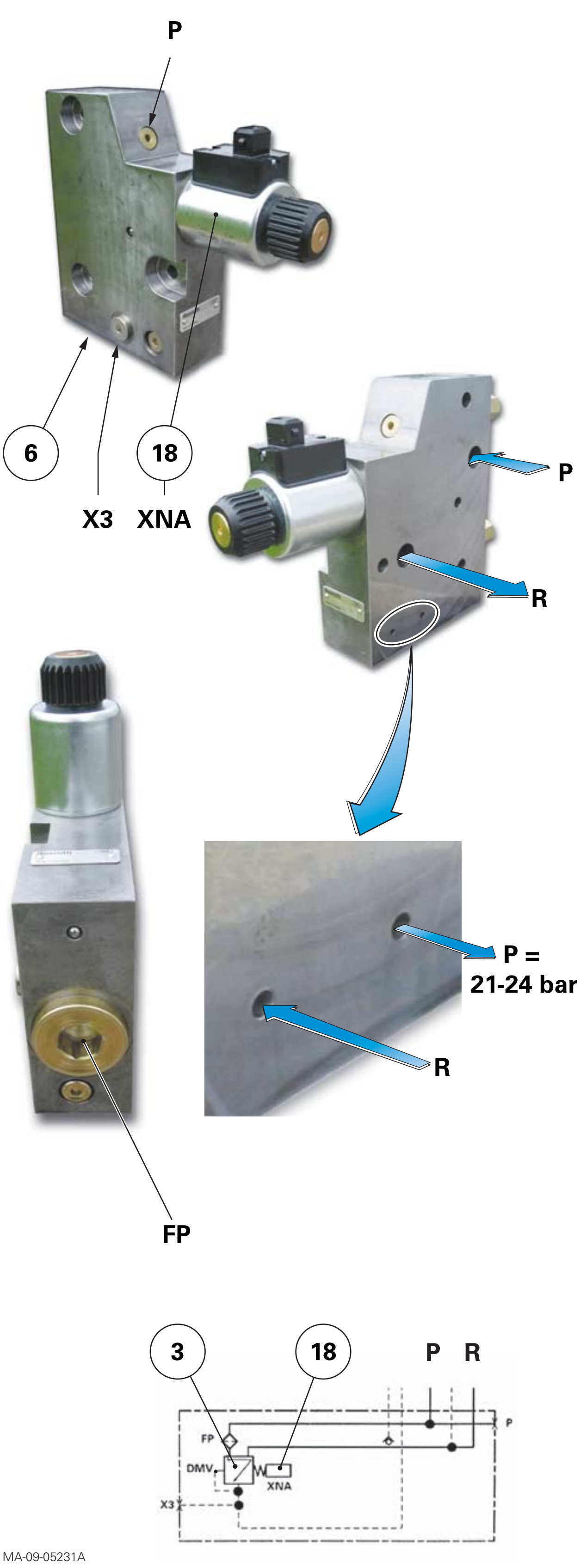
P
6
18
X3
XNA
P
R
P =
21-24 bar
R
FP
3
18
P
R
FP
DMV
XNA
X3
P
MA-09-05231A

Fig. 8

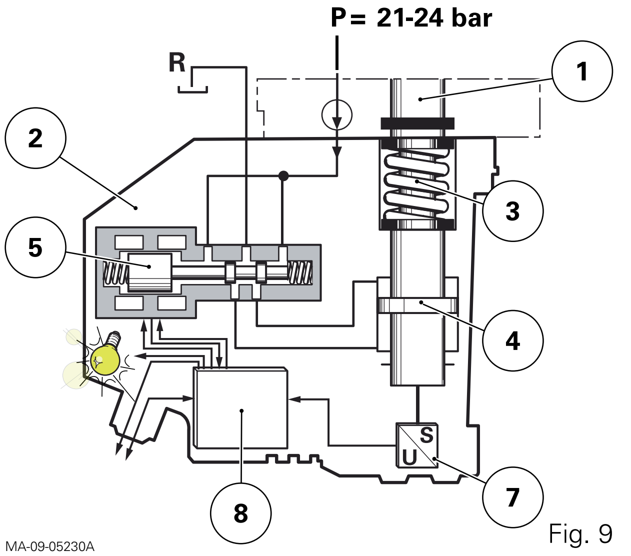
P= 21-24 bar
R
1
2
3
4
5
S
U
7
8
MA-09-05230A

Fig. 9

C . Operation of the auxiliary electrohydraulic spool valve

When the spool (1) is moved electrohydraulically upwards (Fig. 11) by the pilot valve (5) (Fig. 9), oil penetrates via channel P and travels to the flow regulation control spool restrictor (5) and the grooves of the main spool (1). The oil is then carried towards a main channel and lifts the ball of valve (2) to enter a chamber. Displacement of the spool (1) simultaneously opens the one-way valve (3). The oil flows from the chamber towards port B and returns to the housing through port A via the hydraulic slave device.

The operating principle is identical when the spool (1) is electrohydraulically moved down by the pilot valve (5) (Fig. 9). The oil then flows from the chamber towards port A and returns to the housing through port B via the hydraulic slave device.

The electrohydraulic spool valves can be manually controlled using a lever screwed onto the reversing lever (2) (Fig. 10).

Fig. 10

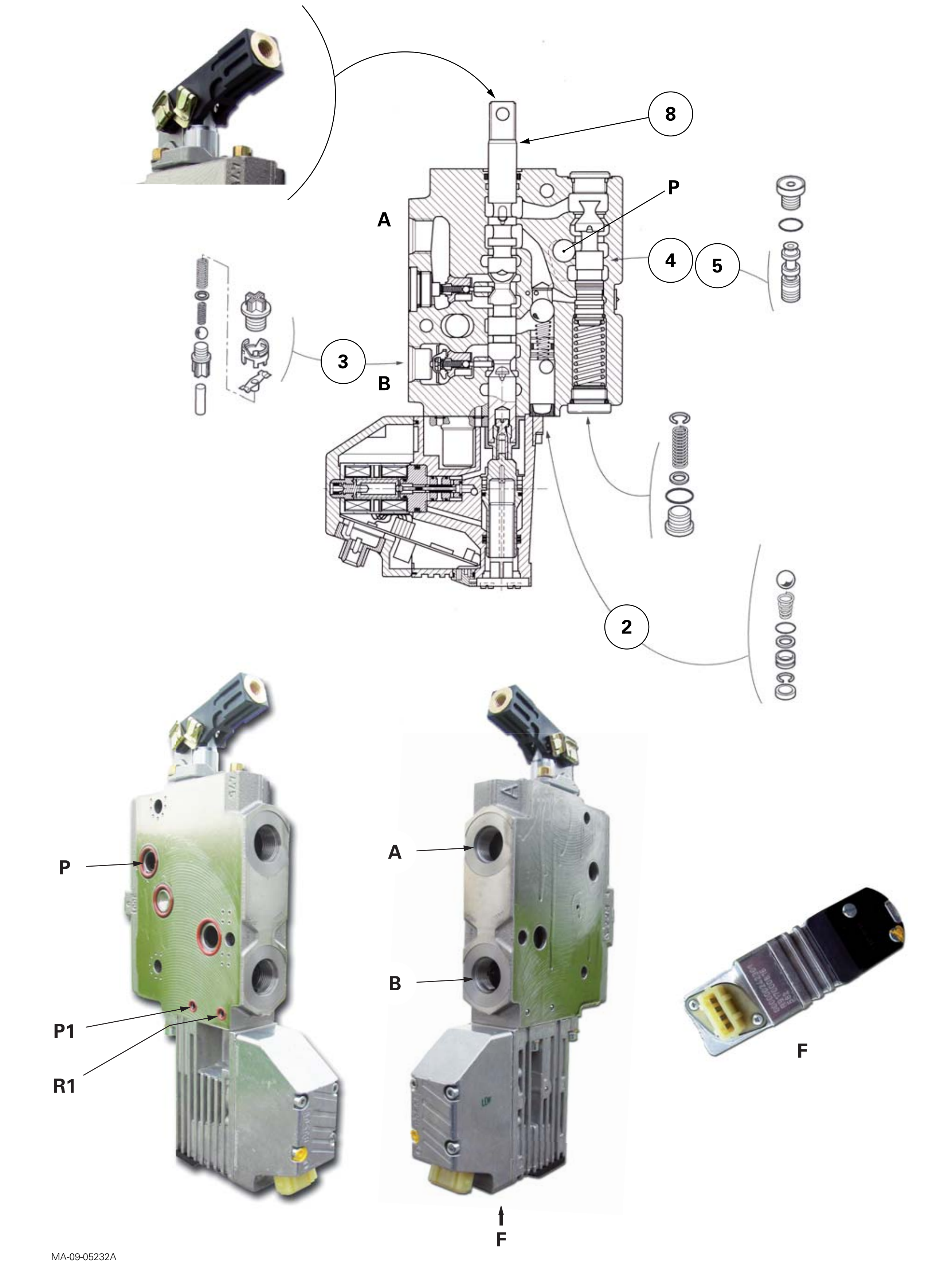

Fig. 11

D . Layout of components and identification of ports

Layout of components (Fig. 14)

(1) Main spool
(2) Valve
(3) Non-return valve
(4) Pressure balancing valve
(5) Cover

Identification of ports...

... on the inlet block (14) (Fig. 12, Fig. 13)

P High pressure inlet from the variable displacement pump via the priority block(s) (depending on version).
R Return from auxiliary spool valves (beneath the oil level)
LS Signal to the pump regulating valve via the lift control spool valve and the priority block(s) (depending on version)

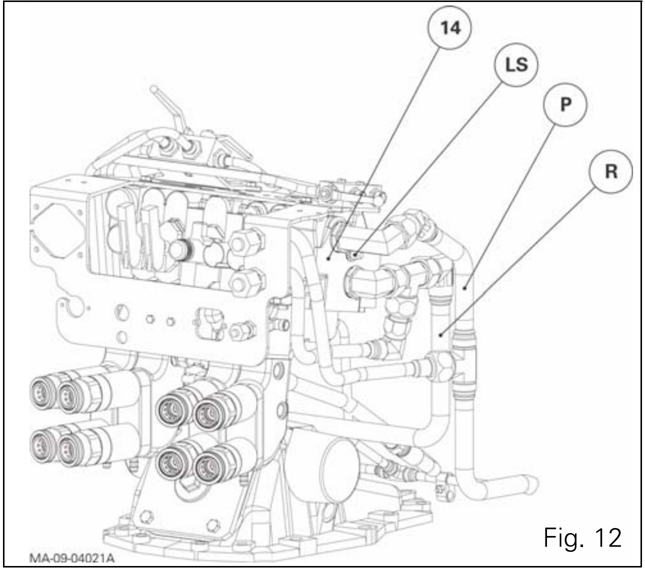

Fig. 12

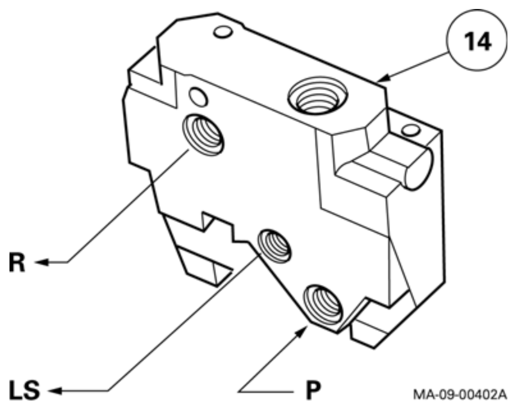

Fig. 13

Overall view

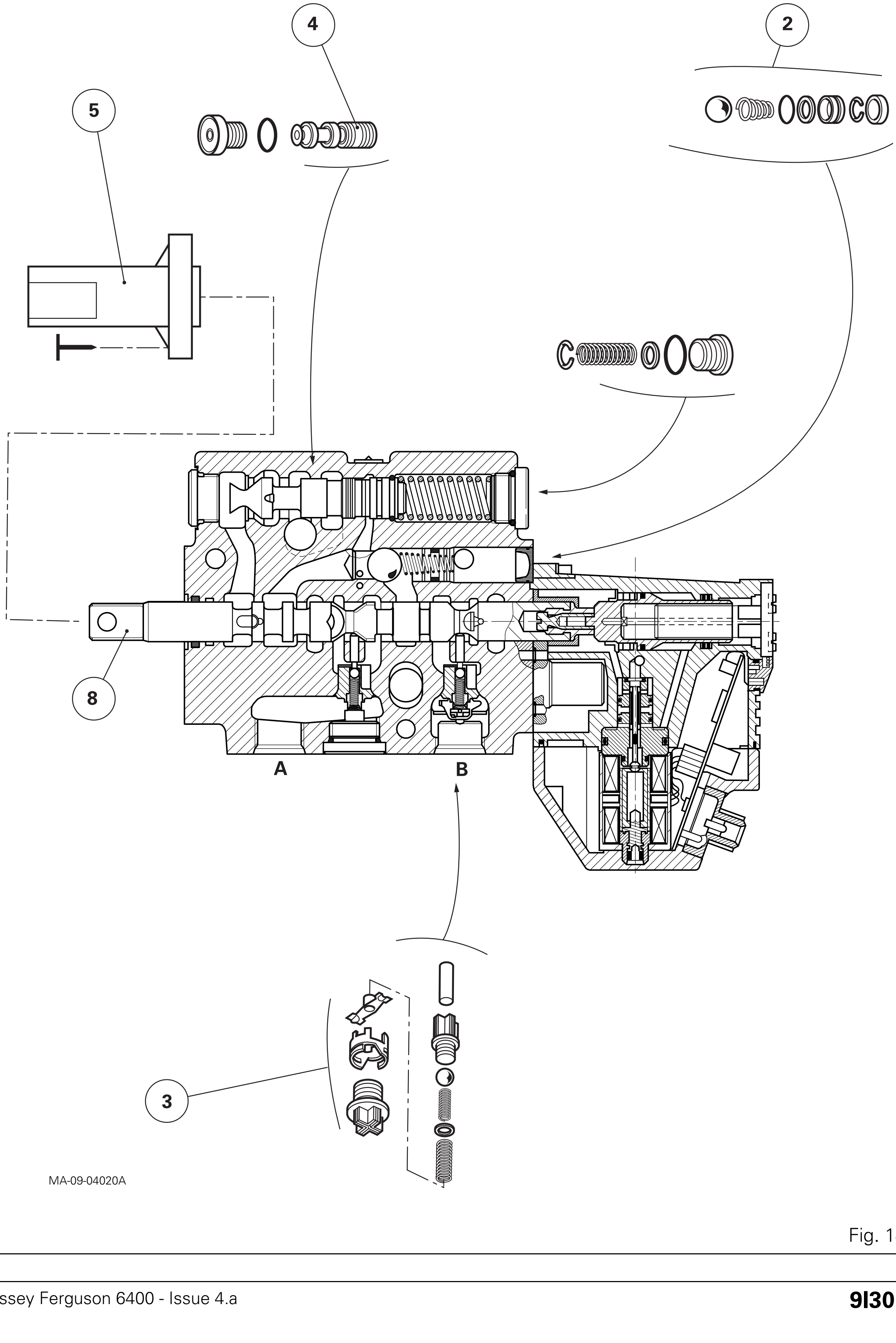

Fig. 14

... on the auxiliary spool valves (Fig. 15, Fig. 16)

A Outlet to coupler
B Outlet to coupler
C Restrictor
D Grooves
E Channel
F Chamber
P, R and LS
Marks identical to those of the inlet block (14)

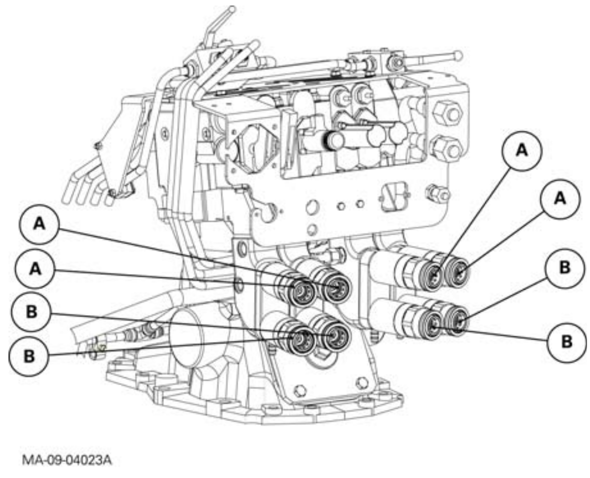

Fig. 15

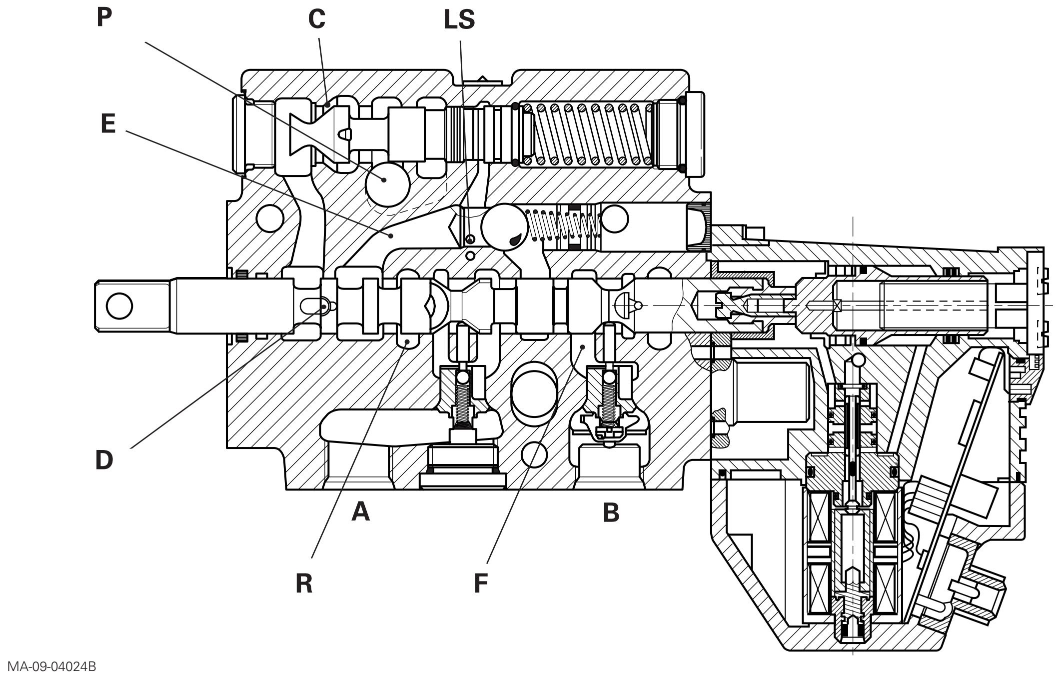

Fig. 16

E . Diagram

Parts list (Fig. 17)

(17) Lift control spool valve

Legend

BP Priority block(s)
P Balance block

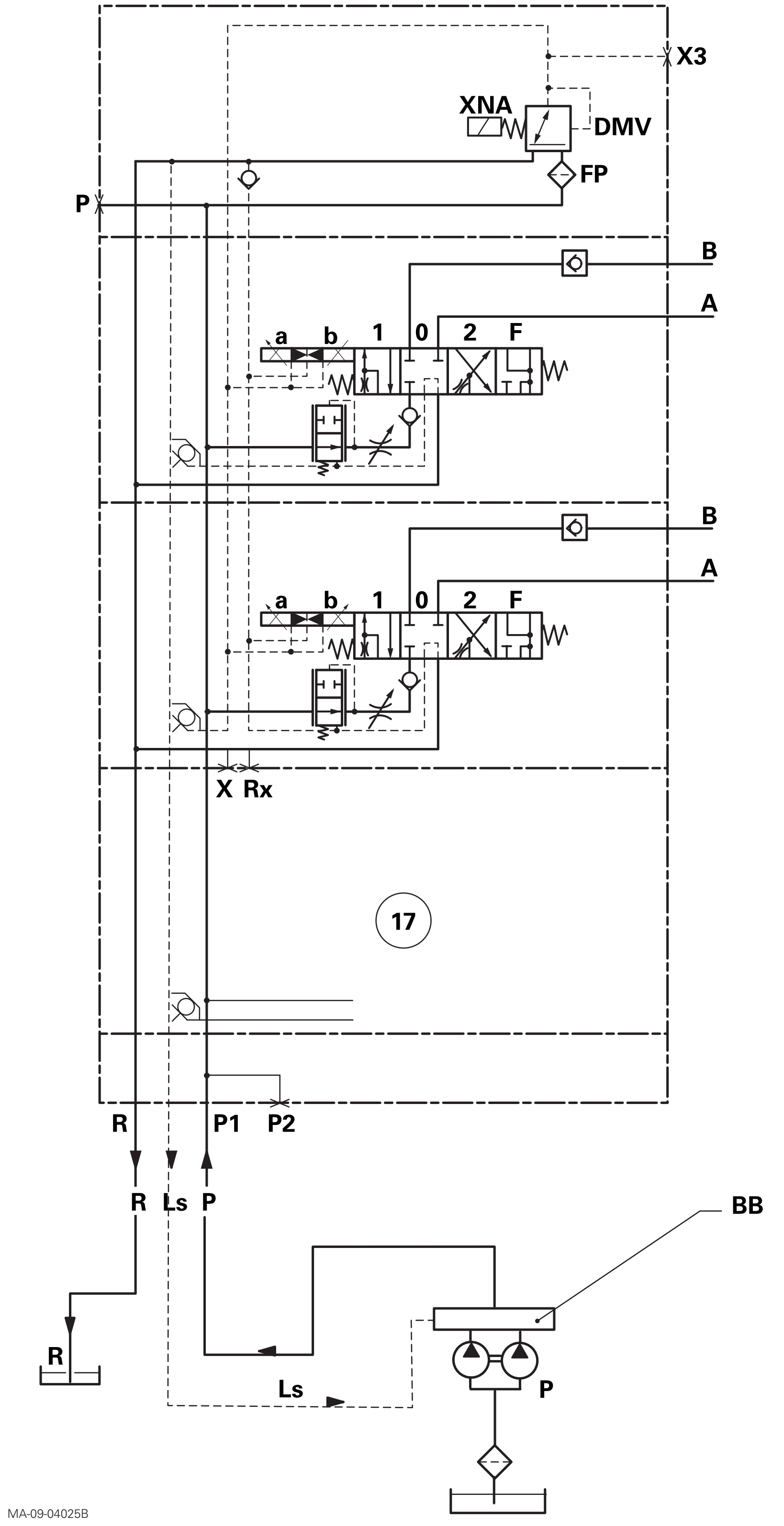

Fig. 17

F . Spool valve assembly

IMPORTANT: *On tractors where one or more elements of the auxiliary spool valves are operated mechanically, take care to disconnect the link cable(s) without turning the main spool of the valve a half turn (see chapter 9).*

Preliminary operations

1. Place the lift arms in the low position.

2. Disconnect:

- **on mechanically operated spool valves**
  - control cable (2), taking the above reminder into consideration (Fig. 18);
- **on Joystick or lever operated (Dual Control) spool valves (Fig. 19)**
  - solenoid valve (18), connector(s) C linked to the spool valve electrohydraulic unit(s), marking their position(s).

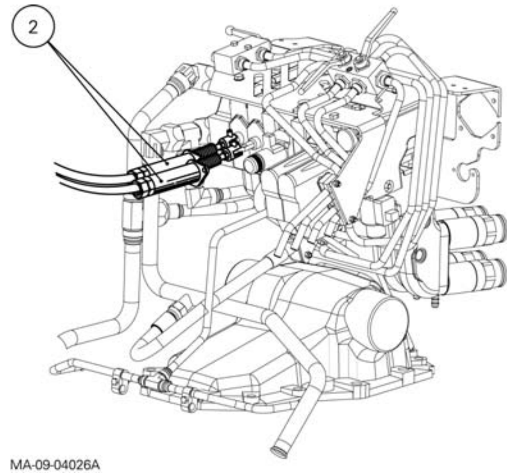

Fig. 18

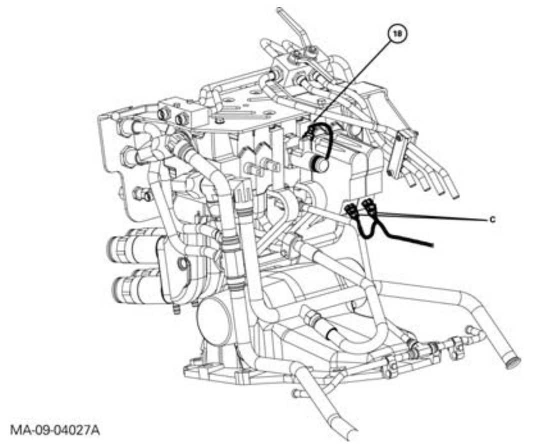

Fig. 19

Removing the spool valves

IMPORTANT 1: *The spool valve block assembly must be removed complete before working on it.*

IMPORTANT 2: *Any operations carried out on the spool valves require scrupulous cleanliness. First correctly clean the spool valves (lift control and auxiliary) and the areas around them before removing them.*

3. If necessary, remove all the spool valves one after the other and disconnect the hydraulic connections as they are removed.

Removing the lift control spool valve

4. Take off the supply and return pipes

5. Disconnect the connectors of the lifting and lowering solenoid valves

NOTE: *The brown connector is connected to the right-hand solenoid valve used to lower the lift control.*

6. Remove the spool valve assembly.

7. Remove lift control spool valve.

Removing the inlet block

***IMPORTANT:** In order to fit the auxiliary spool valves in horizontal position, it is necessary to remove the spool valve block assembly.*

8. Loosen the P – R and LS unions, disconnect the hydraulic union and electrical connectors, and remove the spool valve block.

9. Remove the inlet block.

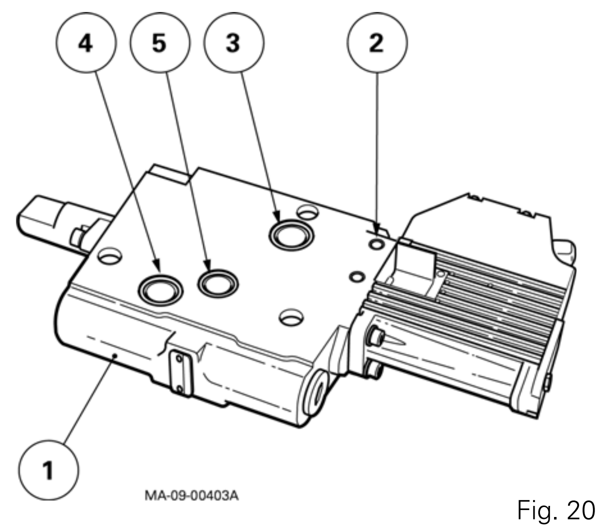

Fig. 20

Refitting the spool valves

10. Wipe clean the mating faces of the inlet block, the lift control spool valve, the auxiliary spool valves and the end plate. Check that each element is perfectly flat.

11. Check the tightness of the studs on the inlet block.

12. Position the new seals (2) (3) (4) and (5) on each element of the distribution block (1) (Fig. 20).

13. Assemble the distribution block on the workbench by superposing the elements and following the assembly procedure (see § G).

14. Refit the complete block on the tractor.

15. Reconnect the hydraulic pipes and electrical connectors.

Final operations

16. Reconnect:

- **on mechanically operated spool valves**
  - the lifting and lowering solenoid valve connectors in accordance with marks made during removal,
  - the control cable(s) taking the reminder in § F into consideration;
- **on Joystick or lever operated (Dual Control) spool valves**
  - the lifting and lowering solenoid valve connectors in accordance with marks made during removal,
  - the connector(s) linked to the electrohydraulic unit(s), according to marks made during removal,
  - the solenoid valve located on the end plate.

17. Start the engine, place the lift control arms in the low position.

18. At each position, check the operation of:

- the hydraulic system (see chapter 9, Tests).
- electronic system (see Chapter 11, Tests).

19. Check the oil tightness of the spool valves and hydraulic unions.

G . Assembly procedure

IMPORTANT: *To obtain the correct assembly of seals (2) to (5) (Fig. 20), the reassembly of each spool valve must be carried out vertically on the workbench.*

Assembly on the workbench

20. In this order, stack the input unit, an auxiliary spool valve, a support block, the lift control valve, an additional support block, and the auxiliary spool valves (Fig. 23).

21. Place a steel ruler R thrust against face F of the distribution block so as to align the fixing points equally and correctly (Fig. 22).

22. Tighten the nuts (1) to a torque of 30 - 33 Nm (Fig. 21).

23. After the assembly of the spool valves, carry out the reassembly operations (see § F).

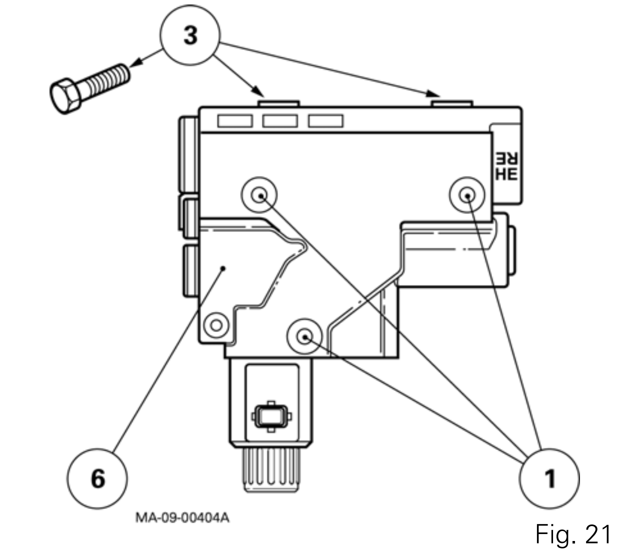

Fig. 21

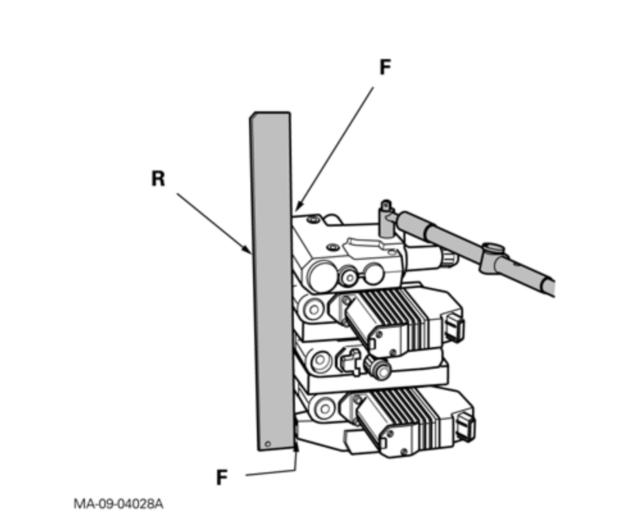

Fig. 22

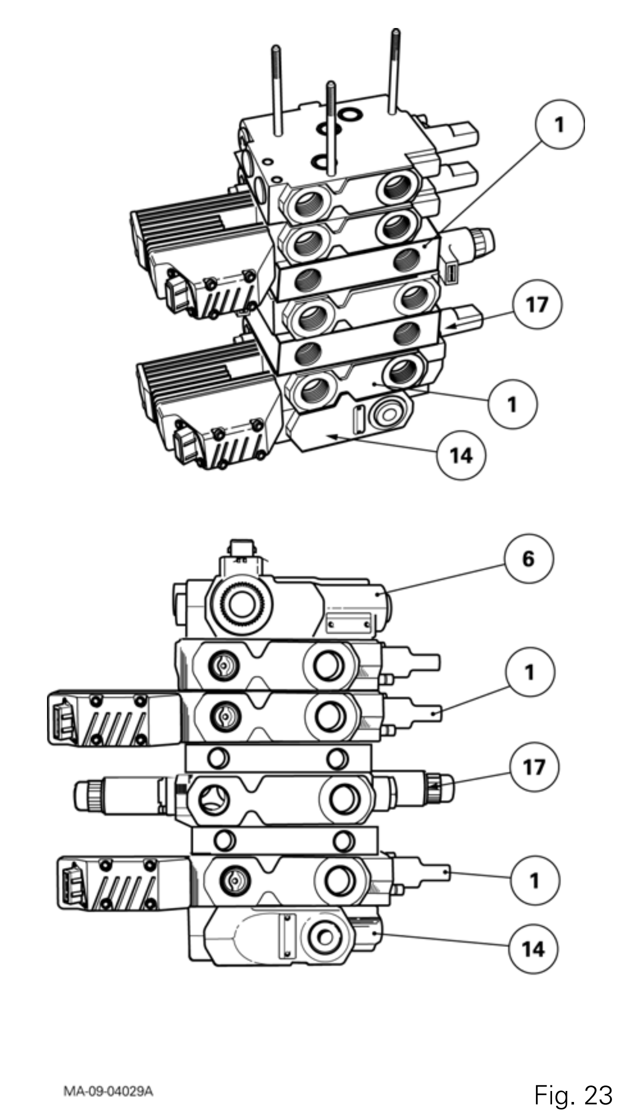

Fig. 23

9I31 - LS electrohydraulic auxiliary spool valves - GPA30

CONTENTS

A . General

The Bosch/Rexroth SB23 LS spool valves controlling supply to the hydraulic couplers are comprised of:

- an hydraulic part;
- an electrohydraulic part comprising:
  - an ON/OFF solenoid valve and a 3-way pressure relief valve located on the end plate of the distribution block,
  - a pilot valve fitted in the electrohydraulic unit.

This section shall concern itself with the hydraulic part only. For the electrohydraulic part, see chapter 11.

The Bosch/Rexroth SB23 LS electrohydraulic control spool valves are supplied by high flow rate, high pressure oil from the priority blocks.

When no functions are being activated, the entire flow rate is directed towards the spool valves. When certain functions are being supplied, the excess flow then remains available to the auxiliary spool valves.

The adjustment of the flow rate, expressed as a percentage, may be displayed on the onboard computer (Datatronic) by the operator (see chapter 11).

Joystick-controlled (1) electrohydraulic spool valves (Fig. 1) are fitted with a floating Kick-out position (automatic return to neutral).

The main spool of the spool valve directs oil towards the outlet ports A or B.

Each outlet port is linked to the LS pilot line of the variable displacement pump regulating valve via the priority block(s).

The spool valves consist of both electronic and hydraulic components, the latter containing spools and valves.

Some elements cannot be repaired as spare parts.

Different types of spool valve block components

A spool valve block can consist of three, four or five of the following components. It can combine components of similar type of or different types.

Component a

Electrohydraulic unit (Joystick)

Component b

Electrohydraulic component (Dual Control)

Component c

Mechanically controlled component (see chapter 9).

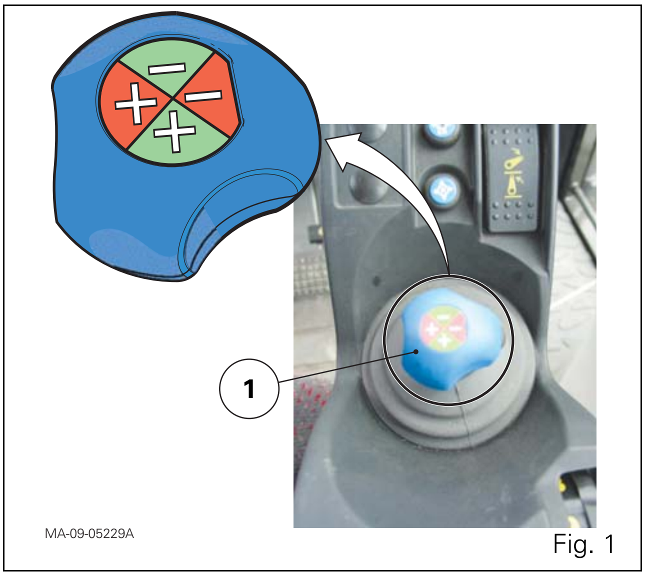

Fig. 1

Couplers (Fig. 2)

The quick-disconnect couplings are held by a bracket on the centre housing. They are sealed by covers of different colours (red, green, black or yellow) corresponding respectively to hydraulic ports A and B of auxiliary spool valves.

When the auxiliary spool valve is at rest, a lever system (1) allows existing pressure to be relieved into the hydraulic hoses (2). These hoses link the spool valves with the concerned couplers (3). By acting on this system, the clean oil under pressure is directed to the return via a hose and pipe assembly (4) connected to the upper part of the intermediate housing. This drop in pressure facilitates the connecting of the male coupler to the female coupler. The contaminated oil, coming from the separation of the couplers, flows into flexible and transparent tanks (5) located on either side of the third-point linkage.

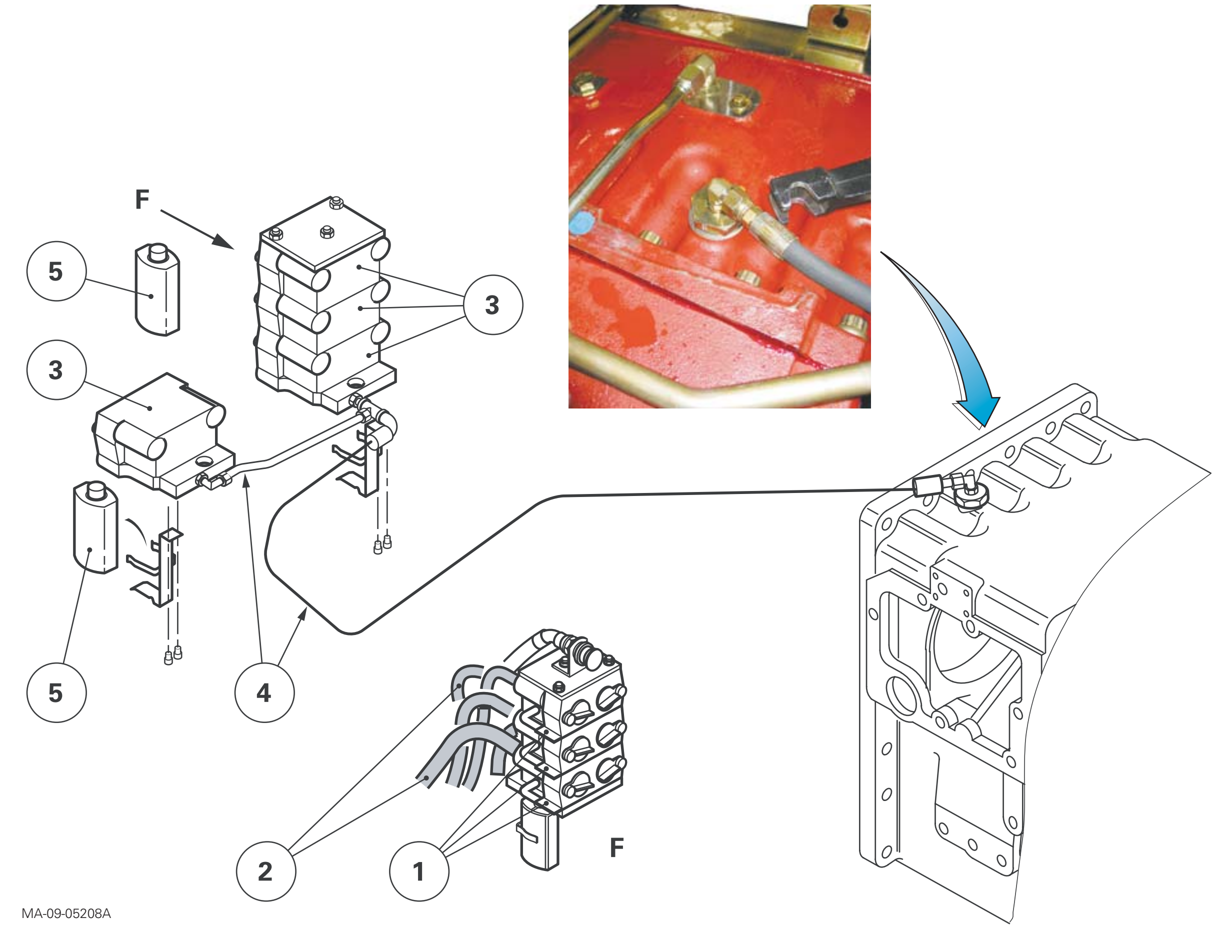

Fig. 2

B . Pressure relief valve and electro-hydraulic unit operation

When the ON/OFF solenoid valve (18) located on end plate (6) is open, the flow from the pump is directed to the 3-way pressure relief valve (3) (Fig. 3). The 3-way pressure relief valve supplies the pilot valve (5) (Fig. 4) with a pressure of 21 - 24 bar via a pressure balancing valve. The pilot valve receives a signal from the digital device (6) and moves the main spool (1) of the auxiliary electrohydraulic spool valve (Fig. 4) according to the information received from the Joystick. The digital device is informed of the position of the main spool by a displacement sensor (7) (Fig. 4).

The pilot valve and the digital device are housed in the unit (2) fixed below the spool valve.

The pilot valve (5) (Fig. 4) is protected from possible oil contamination by a set of FP filters (25 microns) (Fig. 3).

Electronic unit (2) channels P and R (Fig. 4) are connected to channels P1 and R1 of the auxiliary electrohydraulic spool valve (Fig. 6).

Parts list (Fig. 4)

(1) Main electrohydraulic valve spool
(2) Electrohydraulic unit
(3) Return spring
(4) Piston
(5) Pilot valve
(6) Digital electronic system
(7) Displacement sensor

Legend

FP Set of filters (25 microns)
P Pressure
R Return

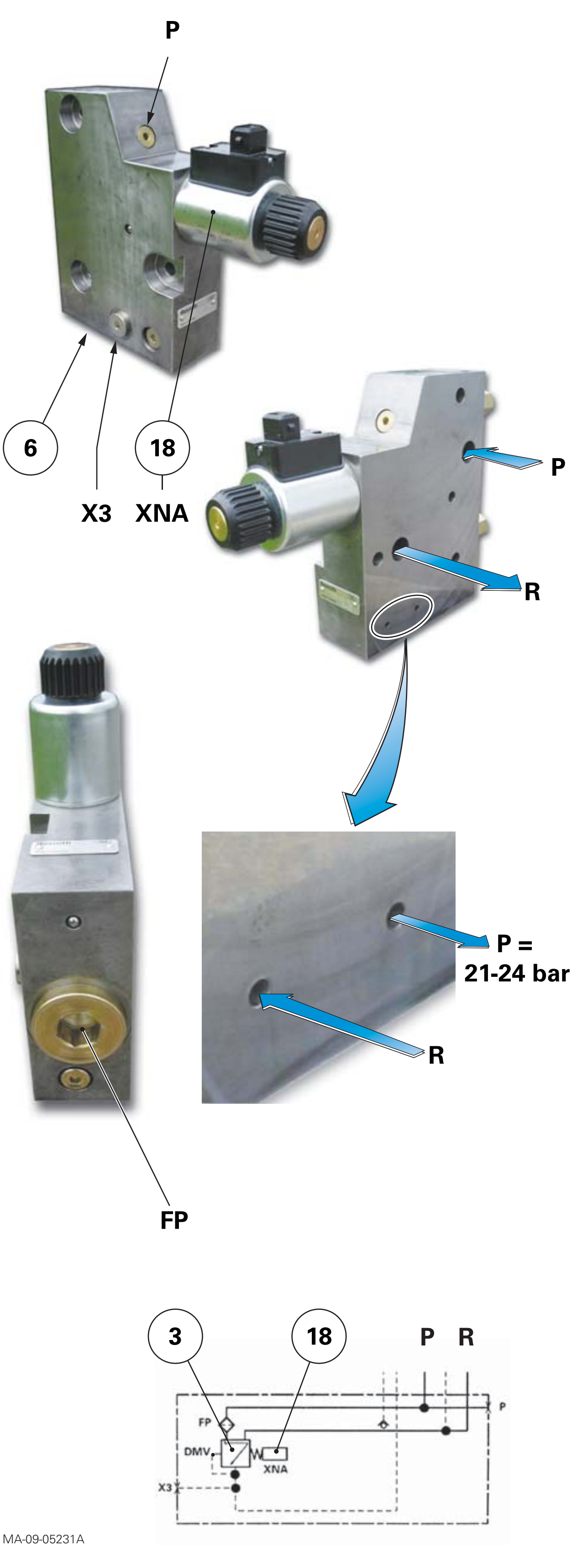
P
6
18
X3
XNA
P
R
P =
21-24 bar
R
FP
3
18
P
R
FP
DMV
XNA
X3
P
MA-09-05231A

Fig. 3

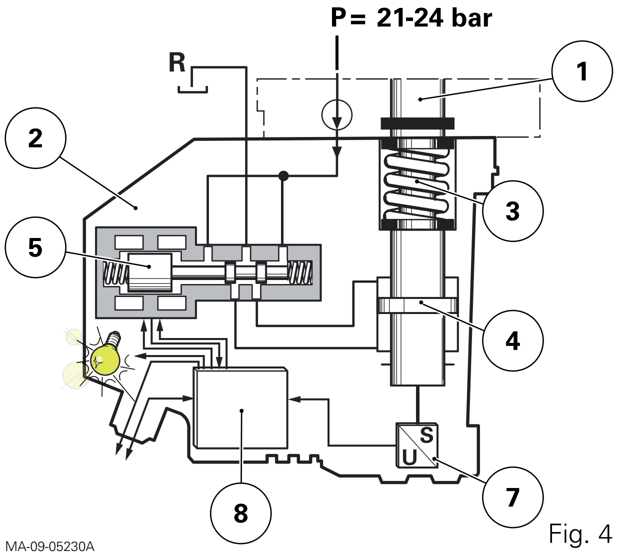
P= 21-24 bar
R
1
2
3
5
4
S
U
7
8
MA-09-05230A

Fig. 4

C . Operation of the auxiliary electrohydraulic spool valve

When spool (1) is moved electrohydraulically upwards (Fig. 6) by the pilot valve (5) (Fig. 4), oil penetrates via channel P and travels to the flow regulation control spool restrictor (5) and the grooves of the main spool (1). The oil is then carried towards a main channel and lifts the ball of valve (2) to enter a chamber. Displacement of the spool (1) simultaneously opens the one-way valve (3). The oil flows from the chamber towards port B and returns to the housing through port A via the hydraulic slave device.

The operating principle is identical when the spool (1) is electrohydraulically moved down by the pilot valve (5) (Fig. 4). The oil flows from the chamber towards port A and returns to the housing through port B via the hydraulic slave device.

The electrohydraulic spool valves can be manually controlled using a lever screwed onto the reversing lever (2) (Fig. 5).

Fig. 5

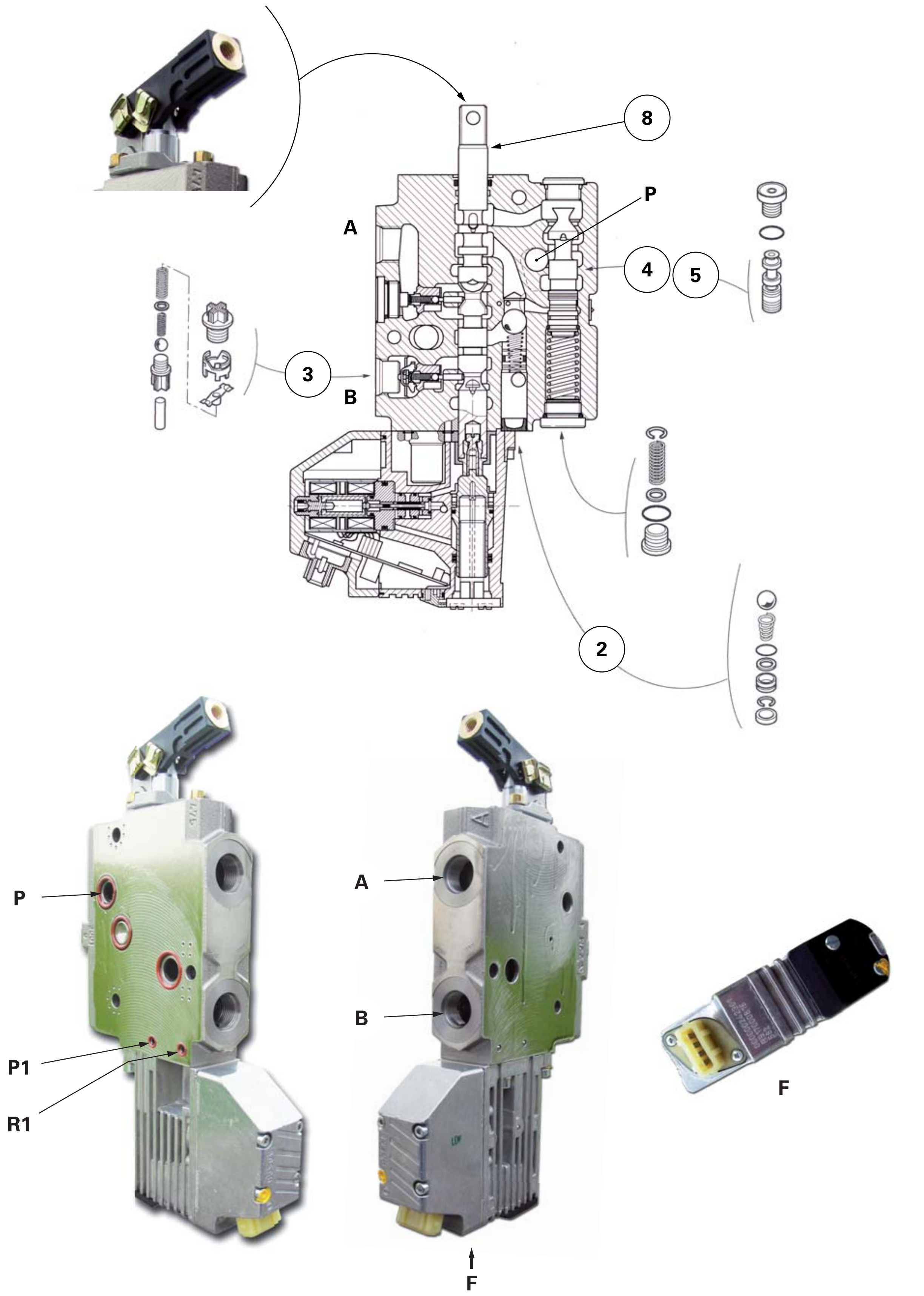

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Fig. 6

D . Identification of ports...

... on the manifold (21) (Fig. 7)

P High pressure supply from the variable displacement pump via the priority block(s) (depending on version).

R Auxiliary spool valve return

r Return (provision for)

LS Signal to the variable displacement pump regulator via the priority block(s) (depending on version).

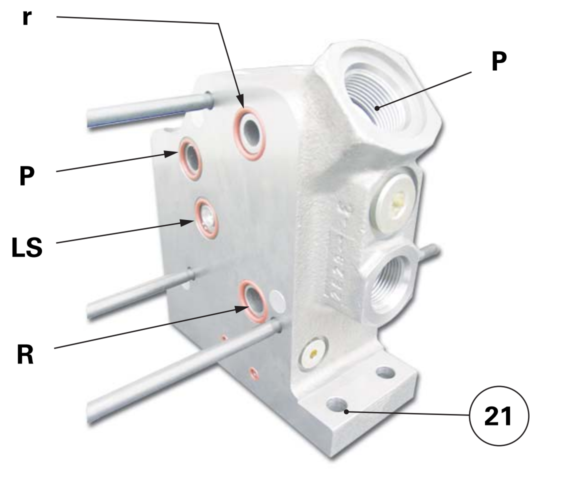

Fig. 7

... on the auxiliary spool valves (Fig. 8, Fig. 9, Fig. 10)

A Outlet to couplers

B Outlet to couplers

P, R and LS
Markings identical to those of manifold (21)

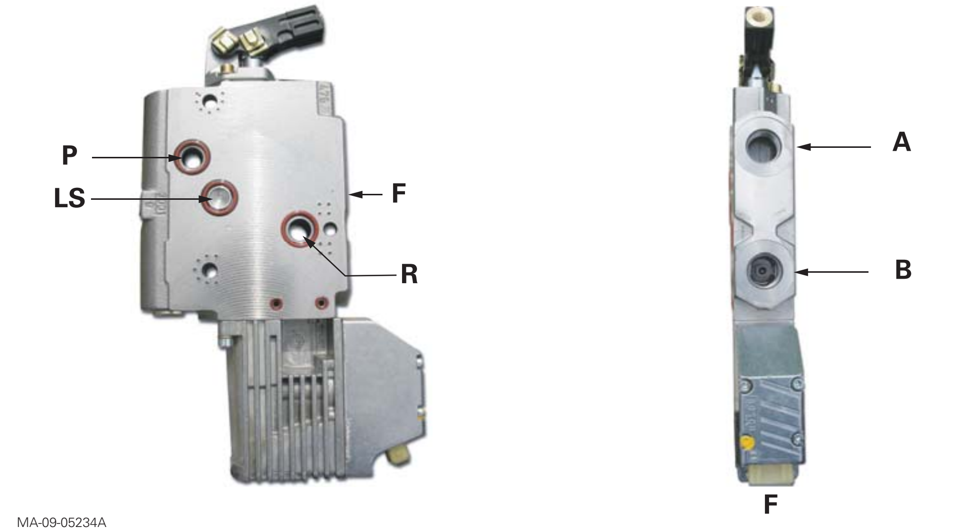

Fig. 8

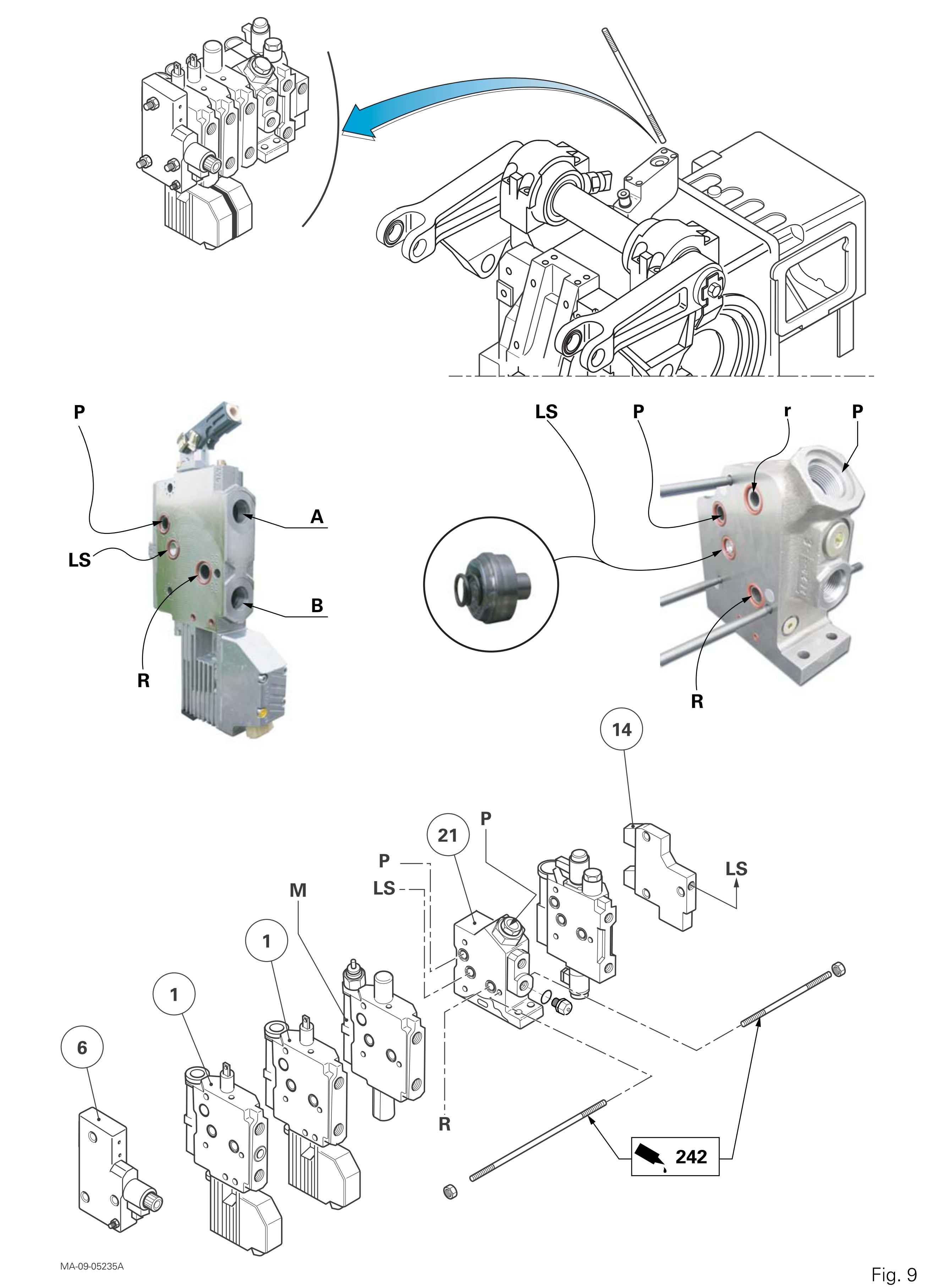

Fig. 9

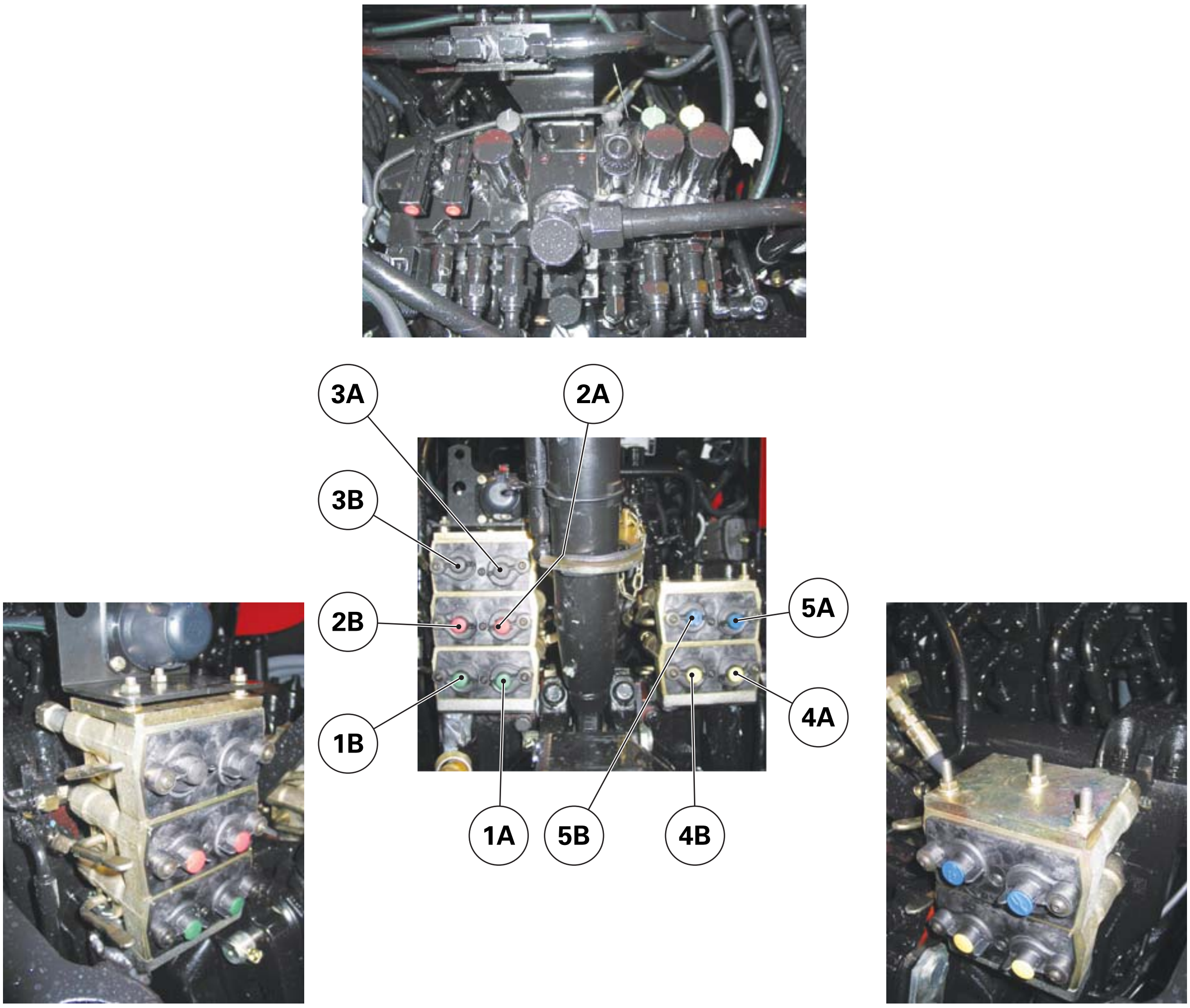

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Fig. 10

E . Diagram

Parts list (Fig. 11)

(1) Lift control spool valve
(7) or [(7) and (7A)]
Priority block(s)
(21) Oil manifold

Legend

A,B Outlets to couplers
P Pressure
P2 Pressure connector (provision for)
R Return
LS Signal

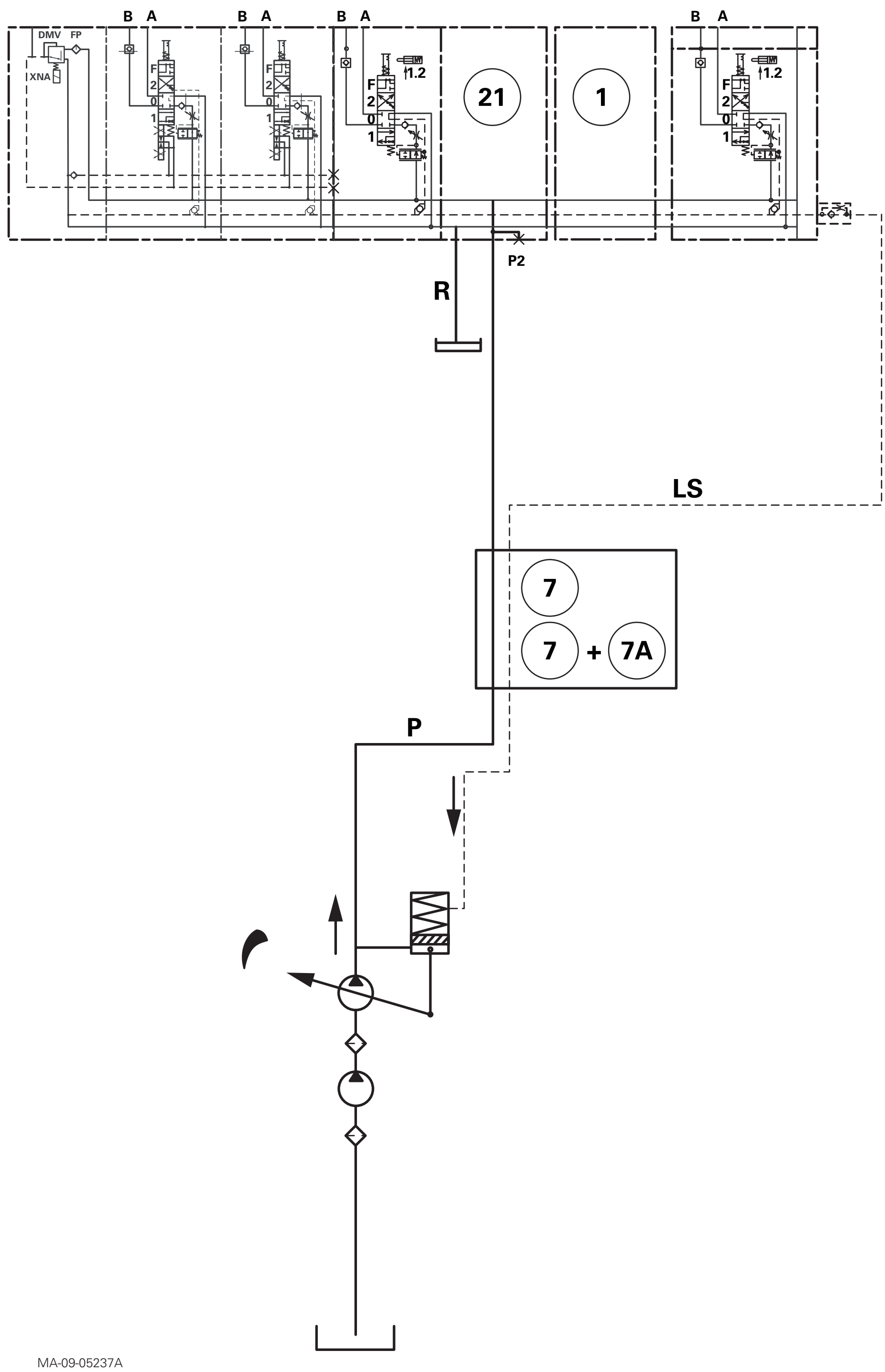

Fig. 11

F . Removing - refitting and disassembling - reassembling the electrohydraulic spool valve block

Preliminary operations

1. Disconnect the control cables (7) from the mechanical component(s) (if fitted).

2. Mark the position of the hydraulics hoses connected to the couplers. Disconnect them from the spool valve block.

3. Disconnect (Fig. 12):
- the high pressure pipe (30);
- the lift ram supply pipes (16);
- the LS hose (9).

4. Mark then disconnect:
- the lift control valve solenoid valve harness (R10 Down - R11 Up).
- the V2, V3, V4 connectors (depending on option) from the electrohydraulic spool valve pilot valve(s);
- the R23 connector from the end plate (6) ON/OFF solenoid valve.

Removal

5. Remove the screws (3) and flanges (2) from the manifold (21) (Fig. 15).

6. Sling the spool valve block. Separate it from the support (1). Place it in a clean work area.

7. If necessary, remove support (1) (Fig. 13).

8. Discard the O'ring (3) (Fig. 13).

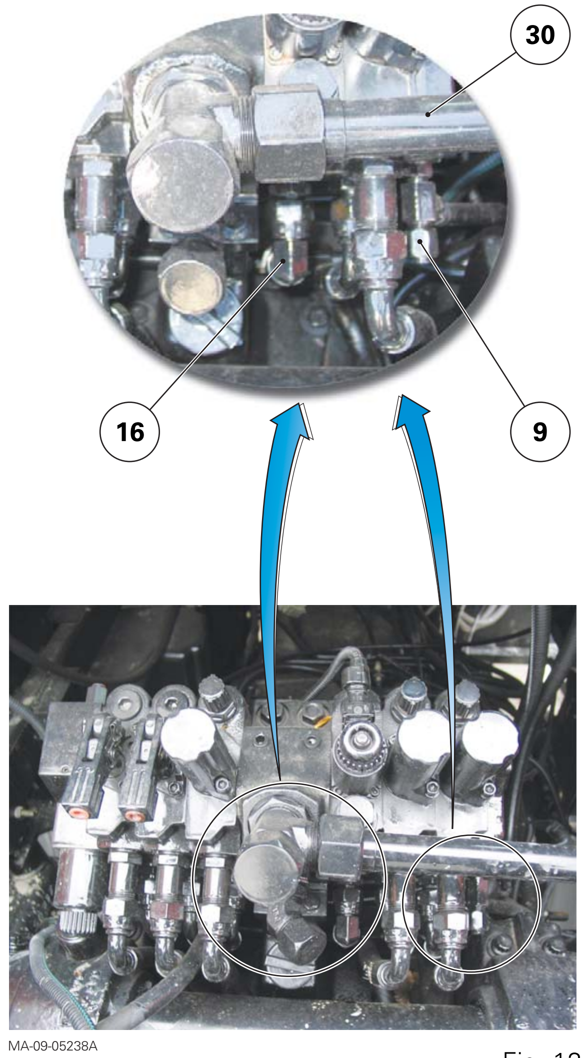

Fig. 12

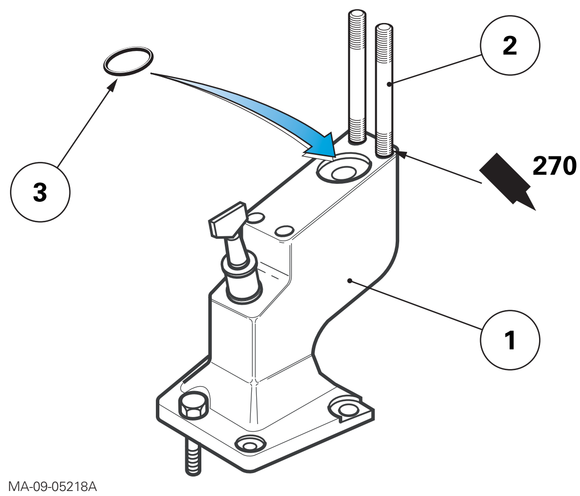

Fig. 13

Refitting

9. If it was necessary to remove the support (1) (Fig. 14), replace the return pipe (3) O'rings (2).

Tighten the screws (4).

10. Clean the manifold (21) mating face, along with that of the support (1).

11. If the studs (2) need replacing (Fig. 13), lightly smear the short thread of the new studs with Loctite 270 or equivalent.

Fit and tighten the studs.

Clean off any excess Loctite.

12. Replace the O'ring (3) (Fig. 13).

13. Refit the distribution block on the support (1).

Tighten (Fig. 16):

- the screws (3) to a torque of 50 - 70 Nm;
- the nuts (2) to a torque of 90 - 120 Nm.

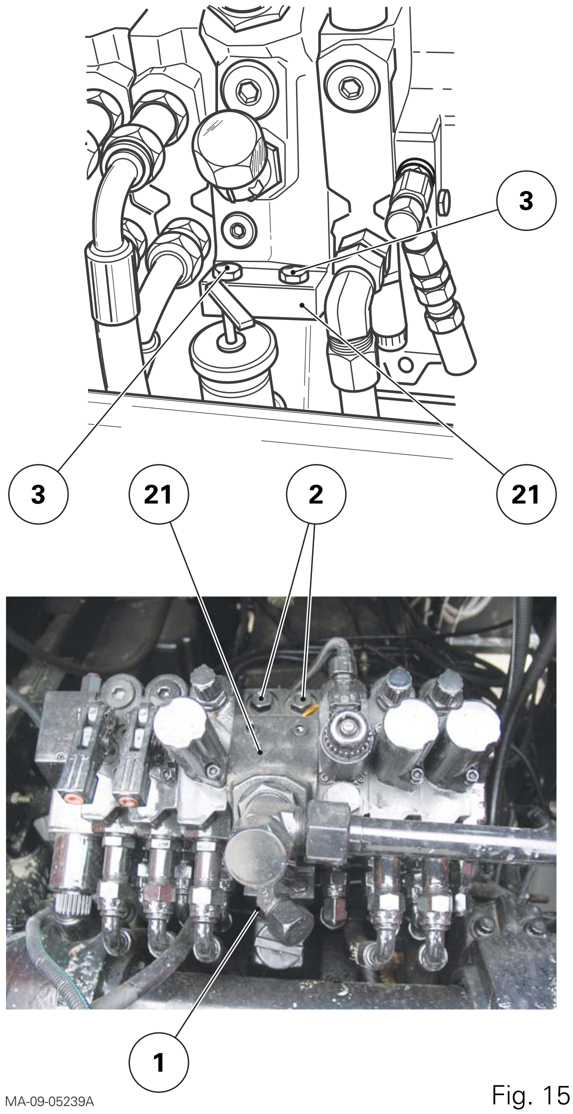

Fig. 15

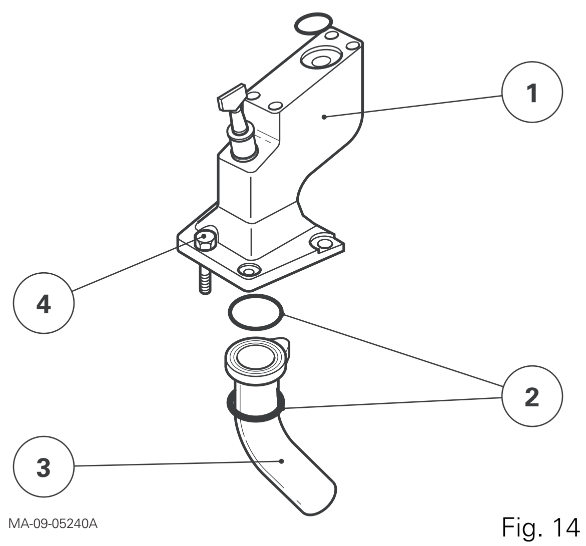

Fig. 14

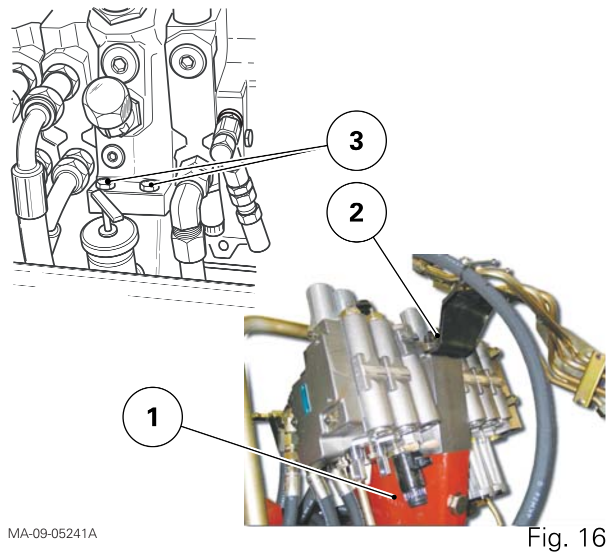

Fig. 16

LS electrohydraulic auxiliary spool valves - GPA30

Final operations

14. Reconnect the following according to the marks made during removal:
- the lift control valve solenoid valve harness (R10 - R11);
- the V2, V3, V4 connectors (depending on option) from the electrohydraulic spool valve pilot valve(s);
- the R23 connector from the end plate (6) ON/OFF solenoid valve.

15. Reconnect:
- the LS hose (9);
- the lift ram supply pipes (16);
- the high pressure pipe (30).

16. Connect the coupler hoses to the spool valve block.

17. If fitted, reconnect and adjust the control cables of each mechanical spool valve (see chapter 9).

18. Perform the hydraulic tests if one or more spool valve block components needed replacing (see chapter 9).

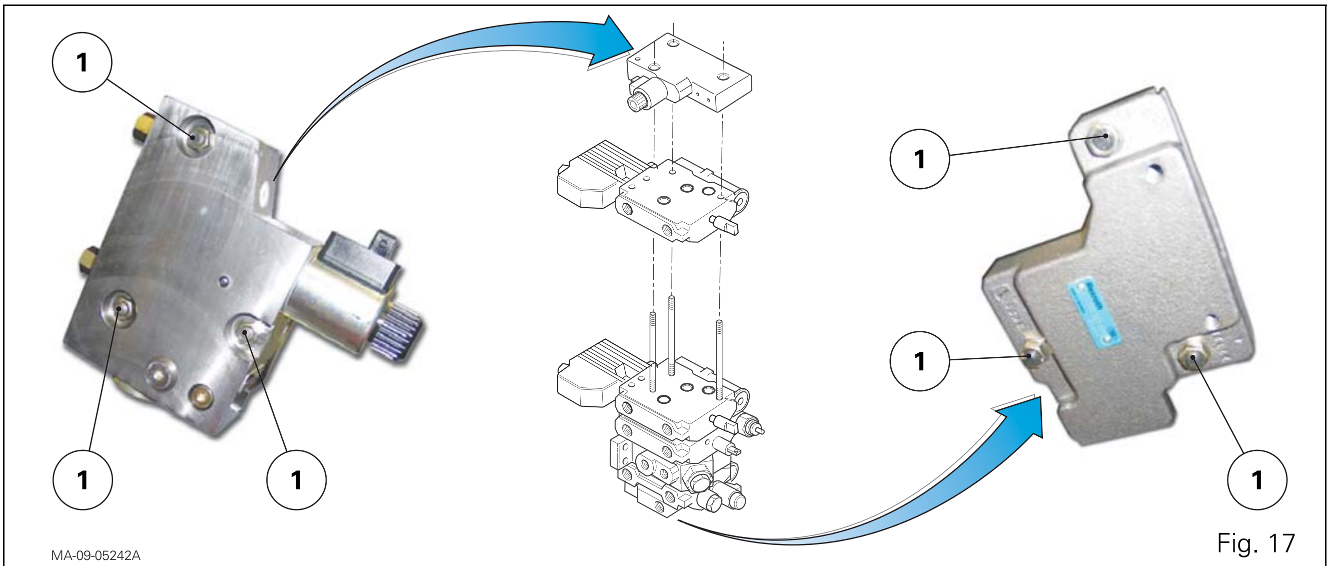

Fig. 17

Disassembly

19. Carefully clean the spool valve block prior to disassembling. Remove any traces of dried mud or earth that could contaminate any spool valve components that could be recovered.

20. Place the spool valve block in a vertical position (Fig. 17).

21. Loosen the nuts (1) (Fig. 17).

Remove the end plate(s) (right and/or left) from the spool valve block.

22. Separately remove the concerned spool valve components, making sure not to lose:

- the O'rings between each component;
- the non-return valve (1) and its spring on the manifold (21) (Fig. 18).

23. If necessary, loosen the six studs screwed on either side of the manifold (21).

Note: *These studs may be of variable length depending on the number of components fitted onto the spool valve block.*

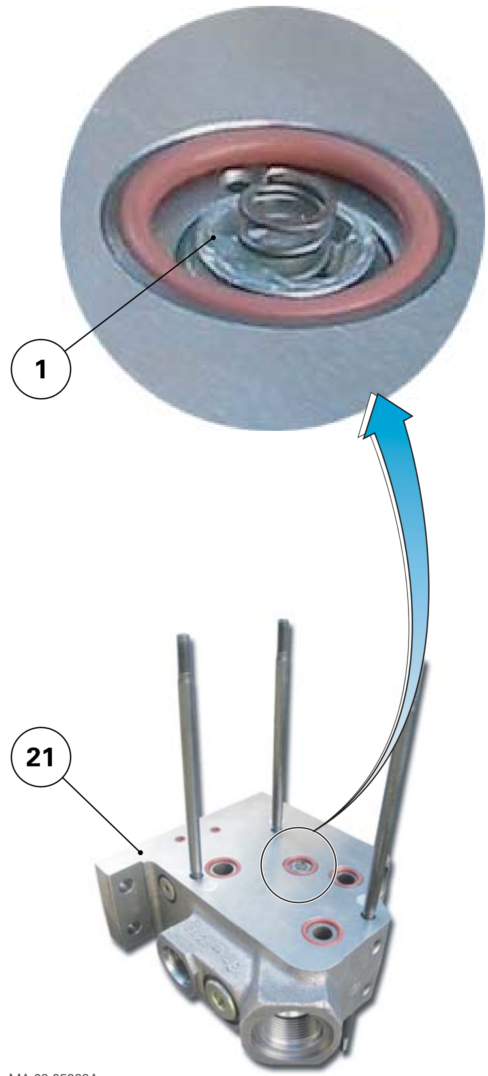

Fig. 18

Reassembly

24. Clean the mating faces:
- of the manifold (21), without removing the adhesive shims (pellets P, Fig. 20);
- the spool valve component(s) (auxiliary and lift control)

25. If the studs on the manifold (21) need replacing, lightly smear the short thread of the new studs with Loctite 242 or equivalent.

Fit and tighten the studs.

Clean off any excess Loctite.

26. Check the presence:
- of the seals (3) (4) (5) (7) in each spool valve (1) spot-faced port (Fig. 19);
- of the seals (3) to (7) in each manifold (21) spot-faced port (Fig. 22);
- of the non-return valve (1) and its spring on the manifold (21) (Fig. 22);
- of the adhesive shims (pellets P, Fig. 20).

27. Reassemble the spool valve block by assembling the spool valve component(s) on the manifold (21).

Note: *The lift control valve is integral to the auxiliary spool valve block components (see chapter 9). It is located between the manifold (21) and either the right-hand end plate or the 4th spool valve component (if fitted).*

28. Refit the end plate(s) (right and/or left) on the spool valve block.

29. Fit and alternately tighten the nuts (3) (Fig. 21) to a torque of 30 - 33 Nm.

Important: *This torque must be respected in order to avoid any risk of spool valve component warping and subsequent spool jamming.*

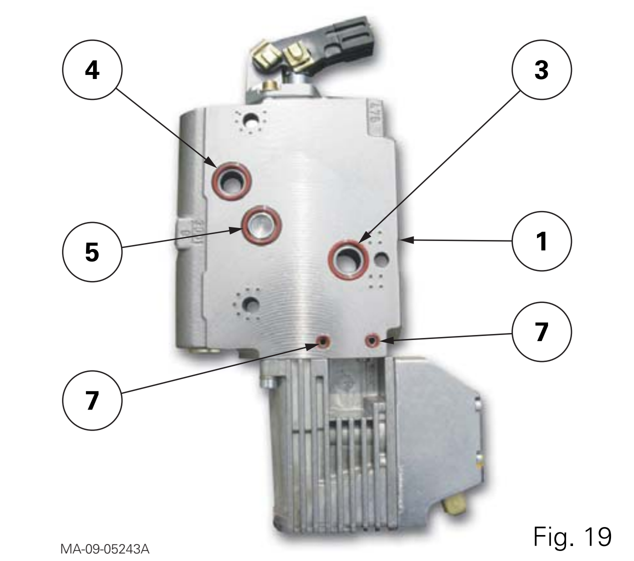

Fig. 19

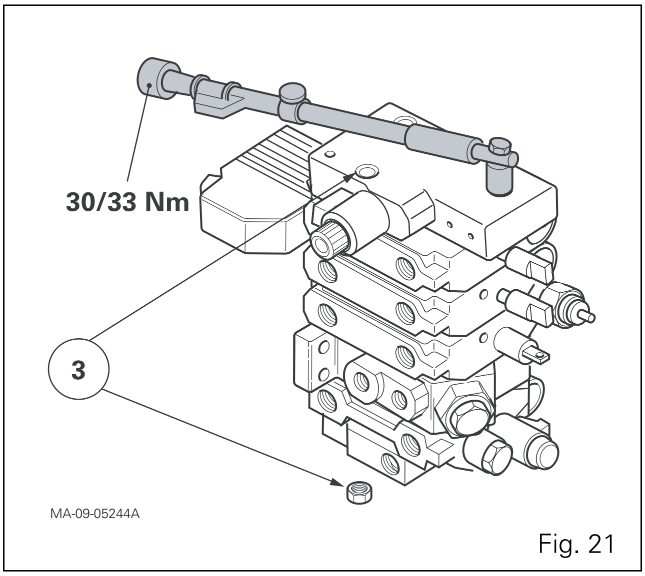

Fig. 21

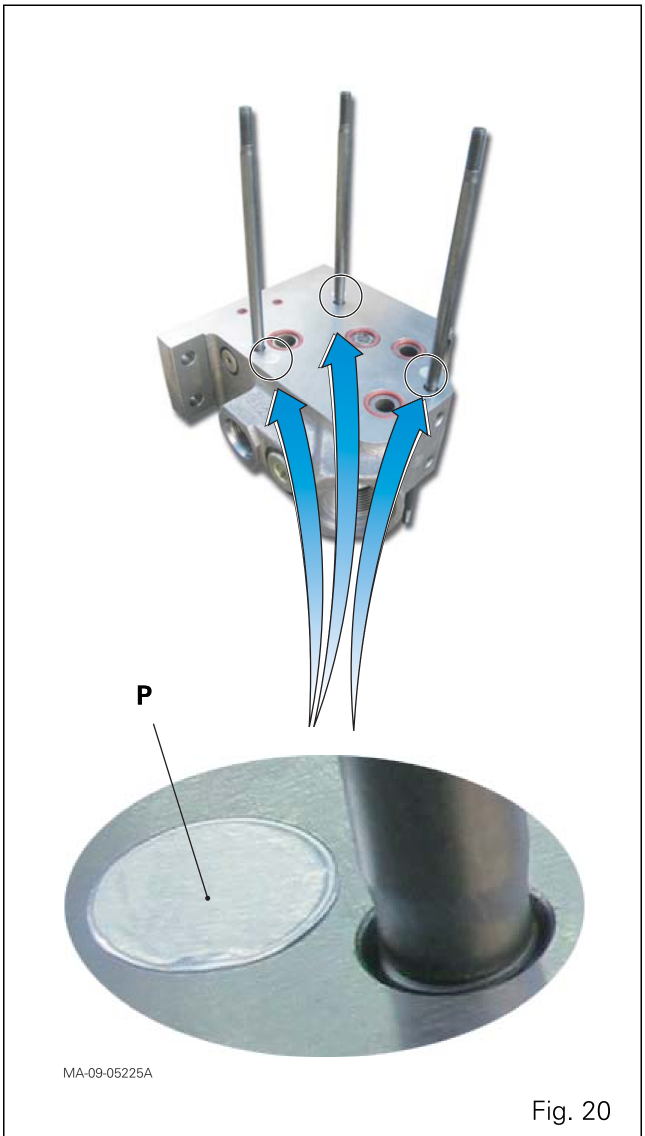

Fig. 20

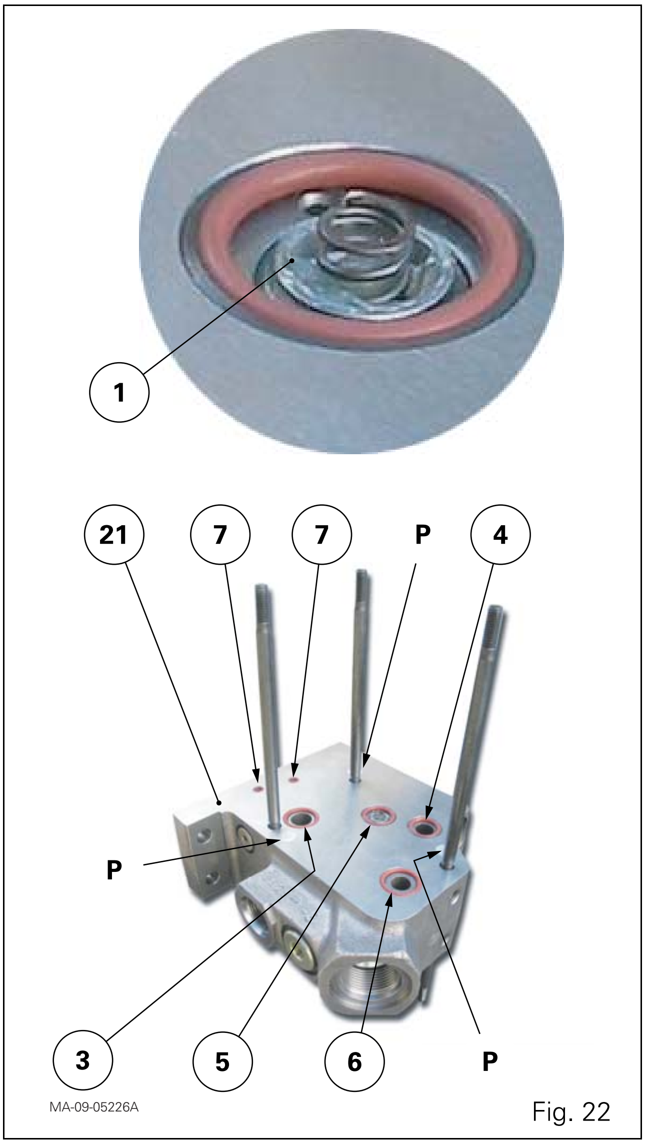

Fig. 22

9J10 - Steering column

CONTENTS

A . Operation of the steering column

Description (Fig. 2)

The steering column assembly comprises:

- a fixed lower part composed of a pipe and a body foot;
- a mobile upper part composed of a pipe, a welded stirrup and a unit containing the steering wheel height and tilt adjustment systems.

Height adjustment (Fig. 1, Fig. 2)

When the control lever (4) is moved upwards, the "T" rod makes the cranked lever (8) pivot, lowering the arm (15) articulated with the pin (14). The screw (5) integral with the arm presses against the brake plate (16), freeing it and allowing the upper part of the steering column to move. The spring (3) returns the lever (4) to position. The stop (25) limits the movement of both parts.

Tilt adjustment (Fig. 1, Fig. 2)

When the control lever (4) is moved downwards, press the T rod which pushes against the end of the notched lever (9), freeing it from the steering rack (10) and allowing to tilt the unit (20).

The two return springs (17) facilitate steering wheel positioning. The screw (5) allows to adjust the meshing of the steering rack (10) with the notched lever (9).

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Fig. 1

Steering column

Parts list (Fig. 2)

(1) Retaining washer
(2) Retaining washer
(3) Spring
(4) Control lever assembly
(5) Adjusting screw
(6) Screw
(7) Spring
(8) Cranked lever
(9) Notched lever
(10) Steering rack
(11) Pin
(12) Upper shaft
(13) Retaining washer
(14) Pin
(15) Arm
(16) Brake plate
(17) Springs
(18) Pin
(19) Pin
(20) Housing
(21) Mobile column
(22) Bearings
(23) Circlip
(24) Screw
(25) Stop
(26) Ring
(27) Ring
(28) Fixed column
(29) Lower shaft
(30) Rings
(31) Circlip

Overall view

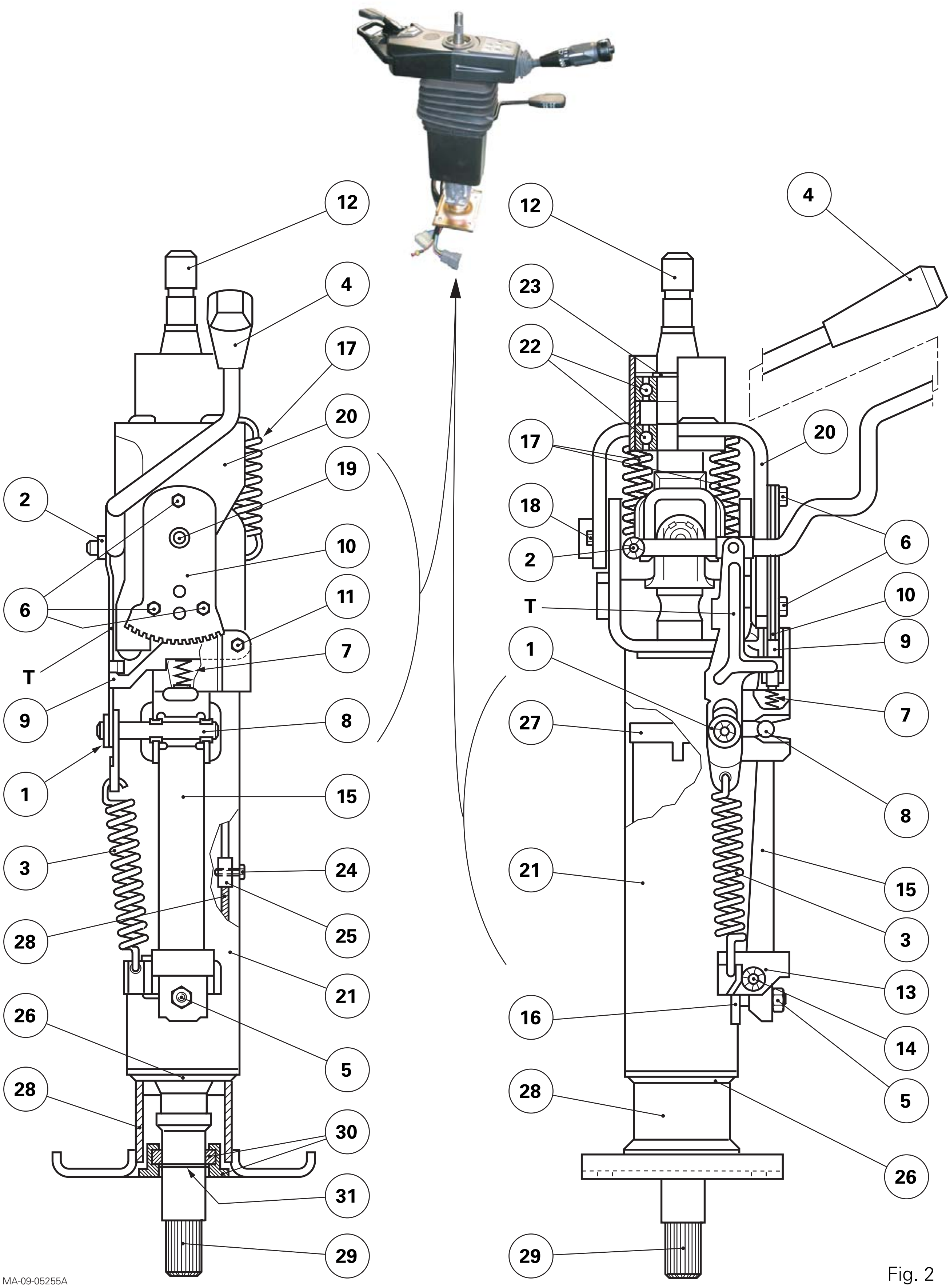

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Fig. 2

Steering column

Parts list (Fig. 3)

(1) Retaining washer
(2) Retaining washer
(3) Spring
(4) Control lever assembly
(5) Adjusting screw
(6) Screw
(7) Spring
(8) Cranked lever
(9) Notched lever
(10) Steering rack
(11) Pin
(12) Upper shaft
(13) Retaining washer
(14) Pin
(15) Arm
(16) Brake plate
(17) Springs
(18) Pin
(19) Pin
(20) Housing
(21) Mobile column
(22) Bearings
(23) Circlip
(24) Screw
(25) Stop
(26) Ring
(27) Ring
(28) Fixed column
(29) Lower shaft
(30) Rings
(31) Circlip

Exploded view

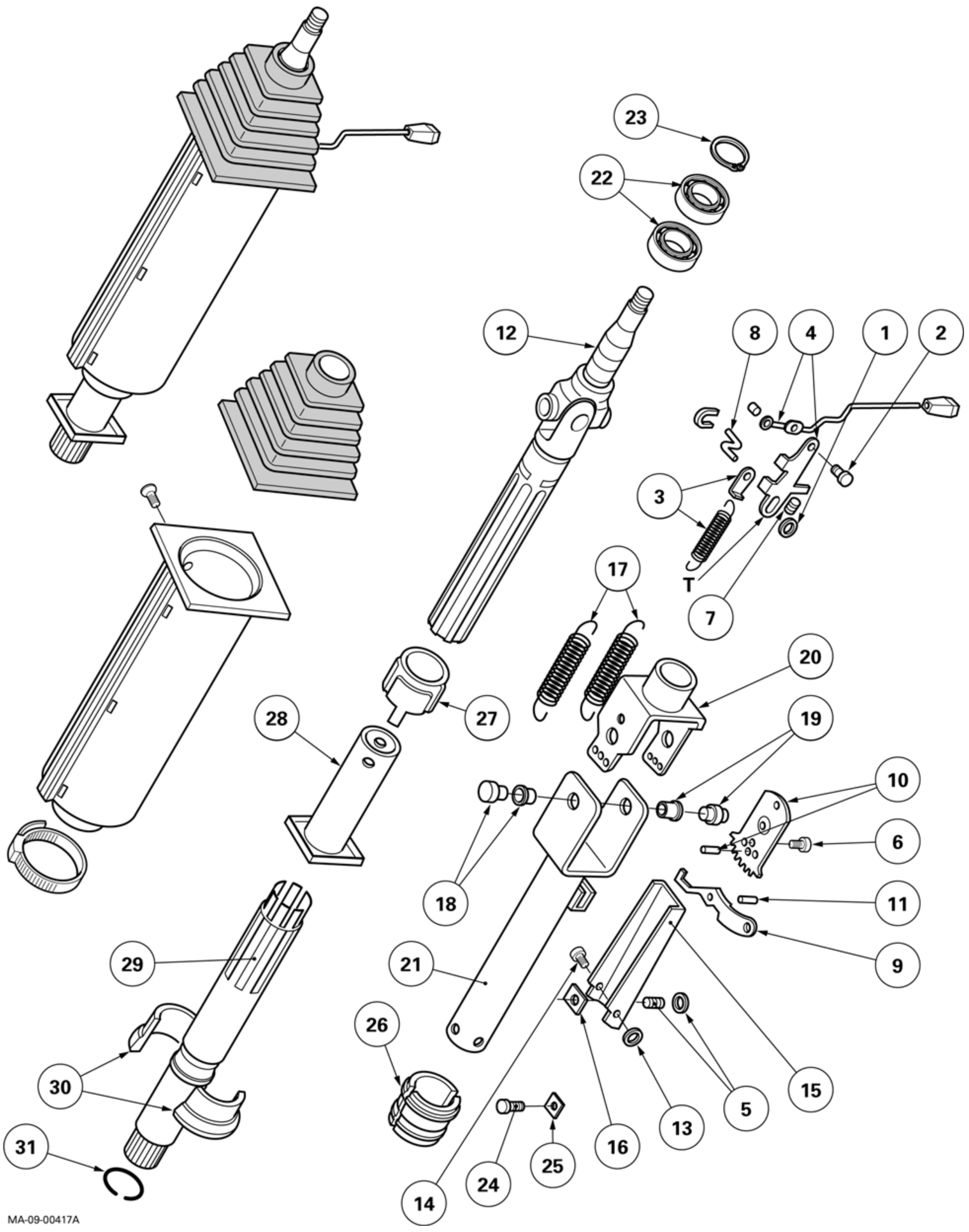

Fig. 3

B . Removing - refitting the steering column

Removal

1. Using the lever located to the right under the steering wheel, pull the steering column as far as possible towards the driver.
2. Remove the steering wheel, the instrument panel upper cover and any components that could hinder steering column removal.
3. Disconnect the control connectors (1) placed under the instrument panel (Fig. 4).
4. Remove the screws (2) fixing the column base to the cab support (Fig. 4).
5. Remove the assembly.

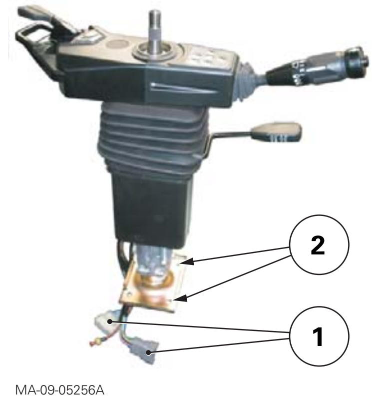

Fig. 4

Refitting

6. Check all steering column positions function correctly.
7. Lightly smear the shaft (29) splines with Anti-Seize grease or equivalent.
8. Carry out the operations 2 to 5 in reverse order.

IMPORTANT: *Tighten the steering wheel nut to a torque of 57 - 78 Nm.*

9. Check the correct operation of electrical equipment.

C . Removing - refitting the control lever assembly

Disassembly

10. Remove the steering column, carrying out operations 1 to 5.

11. Remove the half housings around the steering column. Remove the PowerControl lever and light switch.

12. Remove and discard the retaining washers (1) (2). Remove the spring (3), lever (4) with seal and lever (8).

Reassembly

13. Refit the levers (4) (8) and spring (3). Refit the retaining washers (1)(2).

14. Use the adjusting screw (5) to adjust the lever (4) and the T rod in contact with the notched lever (9).

15. Refit the steering column by repeating operation 11 in reverse order.

Refit the steering column, carrying out operations 6 to 9.

D . Removing - refitting the notched lever and the steering rack

Removal

16. Remove the steering column, carrying out operations 1 to 5.

17. Remove the half housings around the steering column. Remove the PowerControl lever and light switch.

18. Remove and discard the retaining washers (1) (2). Remove the spring (3), lever (4) with seal and lever (8).

19. Press on the notched lever (9) to compress the spring (7) Take out the screws (6). Remove the steering rack (10).

20. Drive out the pin (11). Remove the notched lever (9) and the spring (7).

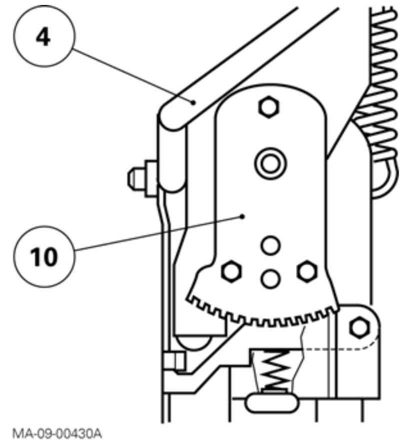

Fig. 5

Refitting

21. Carry out operation 20 in reverse order.

22. Compress the spring (7). Position the steering rack (10) as shown in Fig. 5 to avoid it restricting the lever (4). Fit and tighten the screws (6) smeared with Loctite 242 or equivalent.

23. Refit the lever (4), T rod and spring (3). Refit the retaining washers (1)(2).

24. Use the adjusting screw (5) to adjust the lever (4) and the T rod in contact with the notched lever (9).

25. Refit the steering column by repeating operation 17 in reverse order.

Refit the steering column, carrying out operations 6 to 9.

E . Disassembling - reassembling he locking mechanism

Disassembly

26. Remove the steering column, carrying out operations 1 to 5.

27. Remove the half housings around the steering column.

28. Take out the adjusting screw (5) (3 mm Allen key). Remove and discard the retaining washer (13). Drive out the pin (14).

29. Remove the arm (15) and brake plate (16).

Reassembly

30. Refit the arm (15) and brake plate (16).

31. Refit the pin (14). Refit the retaining washer (13).

32. Fit and adjust the screw (5), lever (4), and T rod in contact with the notched lever (9).

33. Refit the steering column by repeating operation 27 in reverse order.

Refit the steering column, carrying out operations 6 to 9.

F . Replacing shafts and bearings

Disassembly

34. Remove the steering column, carrying out operations 1 to 5.

35. Remove the half housings around the steering column. Remove the PowerControl lever and light switch.

36. Slide the seal onto the control lever (4).

37. Press on the notched lever (9) to compress the spring (7) Take out the screws (6). Remove the steering rack (10).

38. Remove the springs (17).

39. Loosen the pin (18). Drive out the pins (18) (19).

40. Separate the housing (20) on the mobile column (21).

41. Take off circlip (23). Separate the upper shaft (12) from the housing (20).

42. Drive out the lower shaft (29) of the mobile column (21).

43. Extract the bearings (22) from the housing (20).

Reassembly

44. Use a suitable tool to fit the bearings (22) into the housing (20).

45. Assemble the upper shaft (12) on the bearings (22). Fit the circlip (23).

46. Assemble the lower shaft (29) fitted with rings (30) and the circlip (31) on the fixed column (28).

Deform the column tube with a punch to lock the rings (30).

47. Join the housing (20) and mobile column (21) assemblies. Fit the pins (18) (19). Tighten the pin (18).

48. Refit the springs (17).

49. Compress the spring (7). Position the steering rack (10) as shown in Fig. 5 to avoid it restricting the lever (4). Fit and tighten the screws (6) smeared with Loctite 242 or equivalent.

50. Use the adjusting screw (5) to adjust the lever (4) and the T rod in contact with the notched lever (9).

51. Refit the steering column by repeating operation 35 in reverse order.

Refit the steering column, carrying out operations 6 to 9.

G . Replacing the guide rings

Disassembly

52. Remove the steering column, carrying out operations 1 to 5.

53. Remove the half housings around the steering column.

54. Loosen the screw (5). Remove the brake plate (16).

55. Remove the screw (24) from the stop (25).

56. Take out the ring (26).

57. Split the mobile column (21) from the fixed column (28).

58. Take out the ring (27).

Reassembly

59. Position the ring (27).

60. Fit the stop (25) in the groove of the fixed column (28).

61. Assemble the mobile column (21) with the fixed column (28).

62. Fit the screw (24) without tightening, in order to fit the ring (26). Once the ring is positioned correctly, moderately tighten the screw. Check that the mobile column (21) slides freely.

63. Refit the brake plate (16). Use the adjusting screw (5) to adjust the lever (4) and the T rod in contact with the notched lever (9).

64. Refit the steering column by repeating operation 53 in reverse order.

Refit the steering column, carrying out operations 6 to 9.

9K10 - Hydrostatic steering - Open Centre

CONTENTS

A . General

The steering unit (Orbitrol) is attached to the pedal console which is housed at the centre of the front firewall in the cab (Fig. 1).

Its characteristics are written on a plate riveted to the lower part of the spool valve.

The hydrostatic steering system has no mechanical connection between the steering wheel and steering ram.

The system comprises the following main components:

- a pressurised oil supply from the low flow rate stage of the hydraulic pump,
- a hydrostatic (Orbitrol) steering unit fitted in parallel,
- a central double acting ram.

General operation

The spool valve receives a priority supply from the low flow rate circuit. When the steering wheel is turned, the necessary flow of oil is directed to the corresponding side of the steering ram. Excess flow rate not required by the ram is directed via return ports to the 17 bar valve located on the left-hand hydraulic cover.

In case of an engine breakdown or hydraulic failure, the spool valve acts as a hand-operated pump so that the steering can be controlled.

Remark

Operating in this way requires greater effort to be applied to the steering wheel.

Fig. 1

Description of the hydrostatic steering unit (Orbitrol)

The Orbitrol comprises a selector spool valve, a spring centred supply sleeve and a drive shaft linked to the steering column.

It has four hydraulic ports:

- pressure;
- return to the 17 bar valve;
- two supplies to the steering ram.

The circuit is protected by a safety valve, two shock valves and two suction valves.

Parts list

(1) Screw
(2) Screw
(3) Seal
(4) Closing plate
(5) O'ring
(6) Stator
(7) Cotter pin
(8) O'ring
(9) Rotor
(10) Spacer
(11) Link shaft
(12) Washer
(13) Centring springs
(14) Needle bearing
(15) Ring
(16) Washer
(17) O'ring
(18) Relief valve
(19) Seal
(20) Shock valve
(21) Orbitol steering unit
(22) Non-return valve
(23) Suction valves
(24) Ring
(25) Spool valve
(26) Non-return valve
(27) Sleeve
(28) O'ring
(29) Distributor plate
(30) O'rings
(31) Manifold
(32) Screw

Overall view

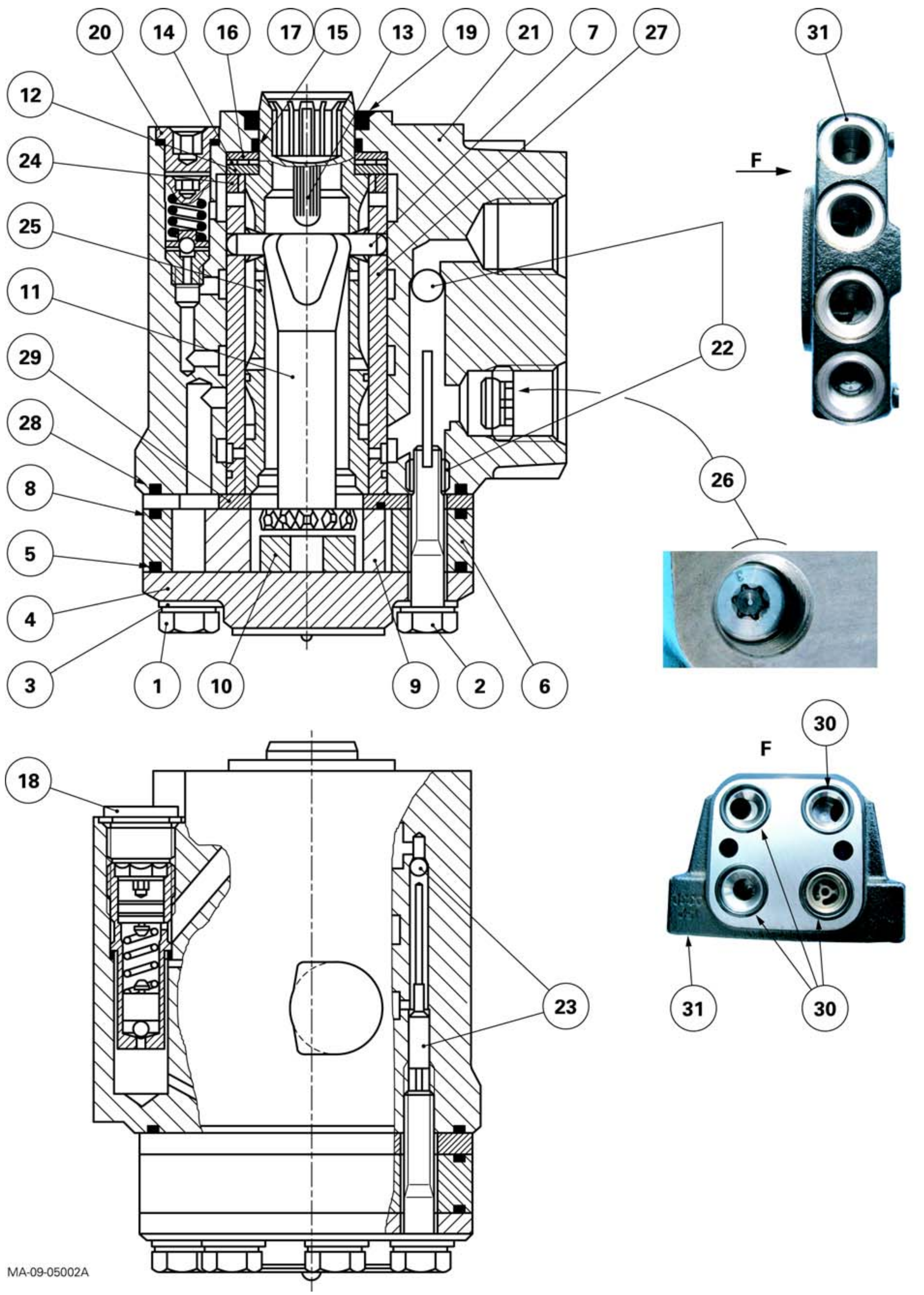

Fig. 2

Exploded view

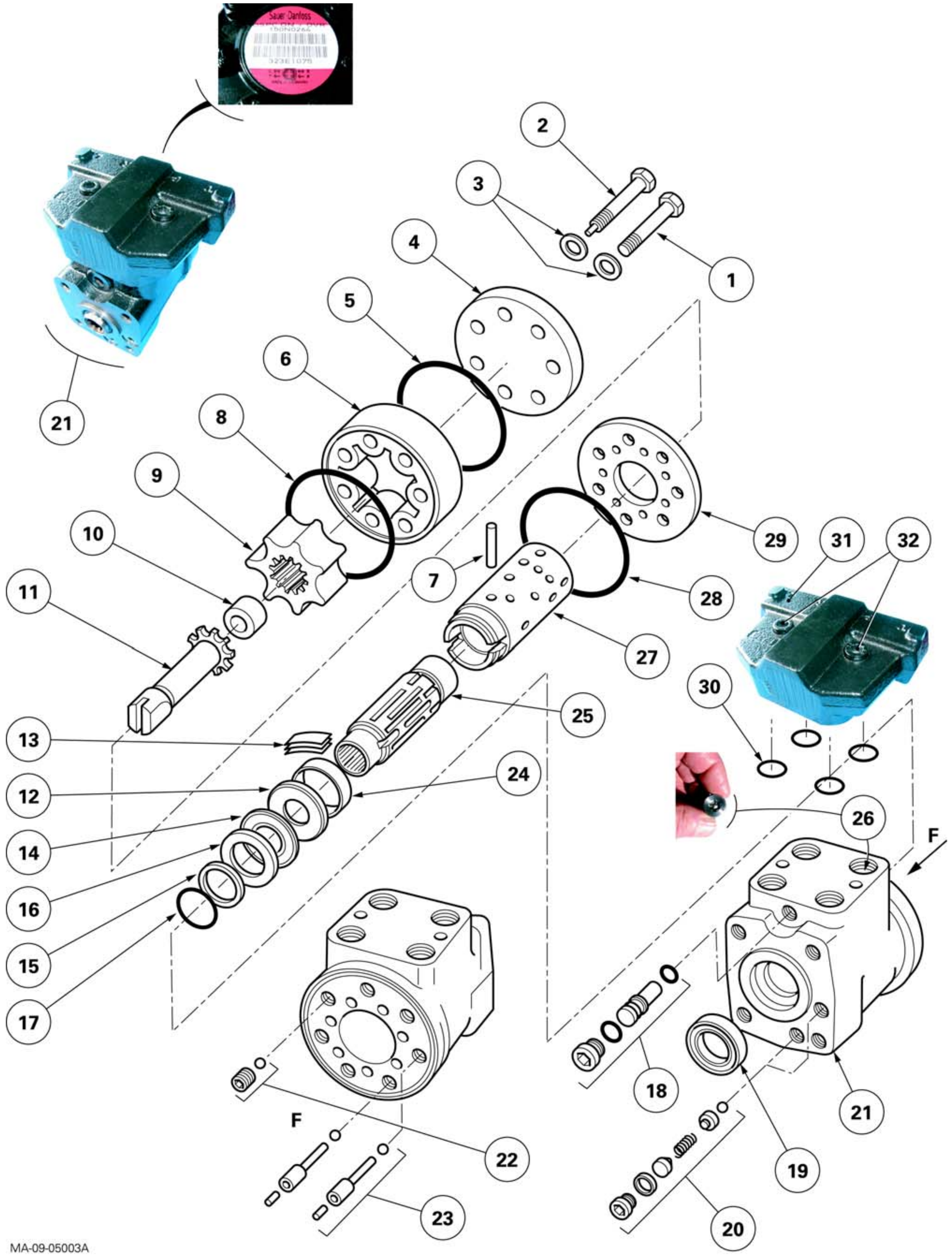

Fig. 3

B . Layout of the main components of the front axle and hydraulic ports

Front axle system (Fig. 4)

(1) 2RM axle beam
(2) 4WD fixed front axle
(3) 4WD suspended front axle

A Steering ram
B Location of steering column
LM Mechanical links (Fig. 5)

Hydraulic ports (Fig. 4)

L Supply to left-hand union of the steering ram
P Low flow rate - low pressure supply from the hydraulic pump (right-hand cover)
R Supply to right-hand union of the steering ram
T Supply to the 17 bar valve housed in the left-hand hydraulic cover

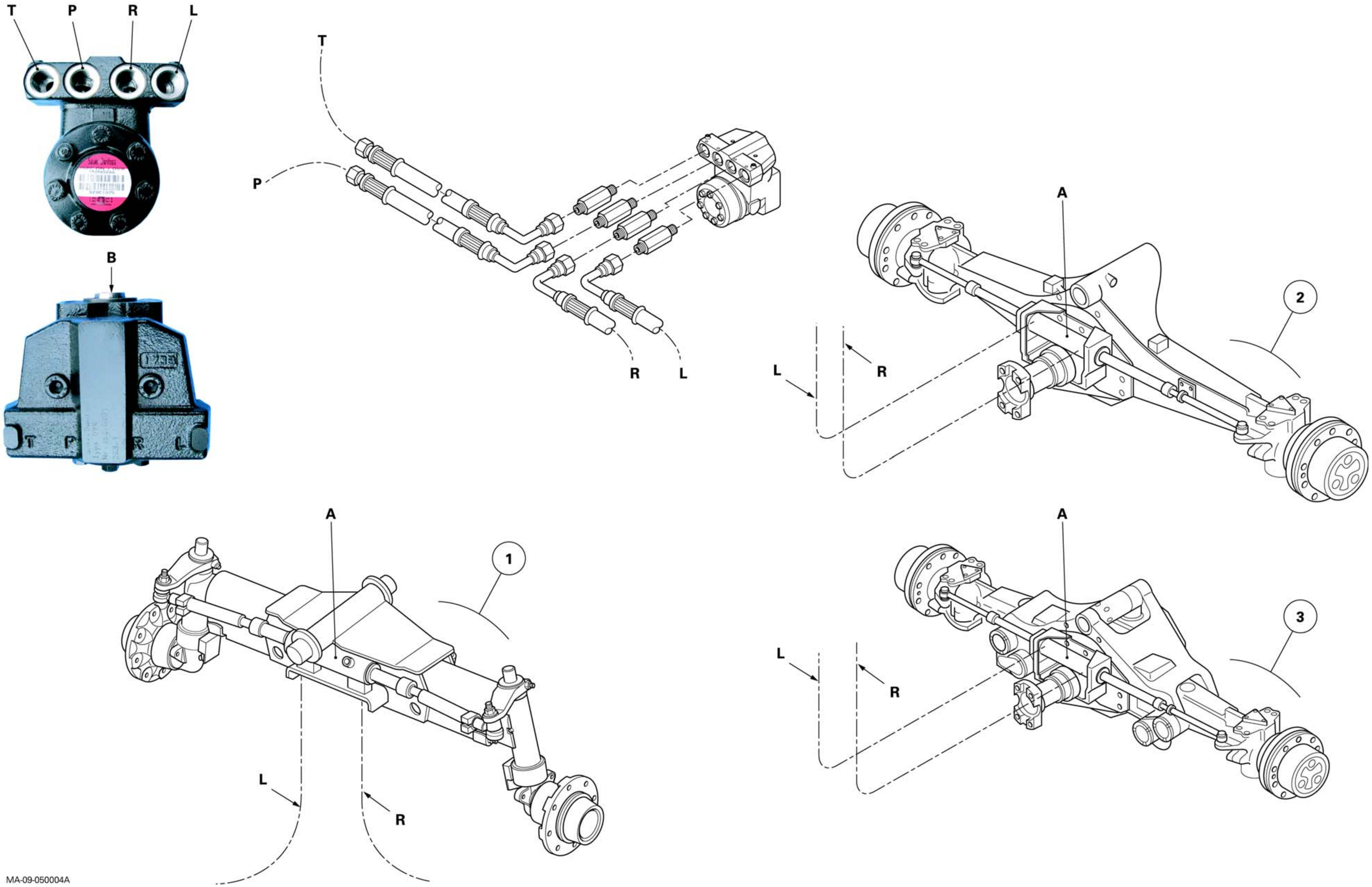

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Fig. 4

C . Diagram

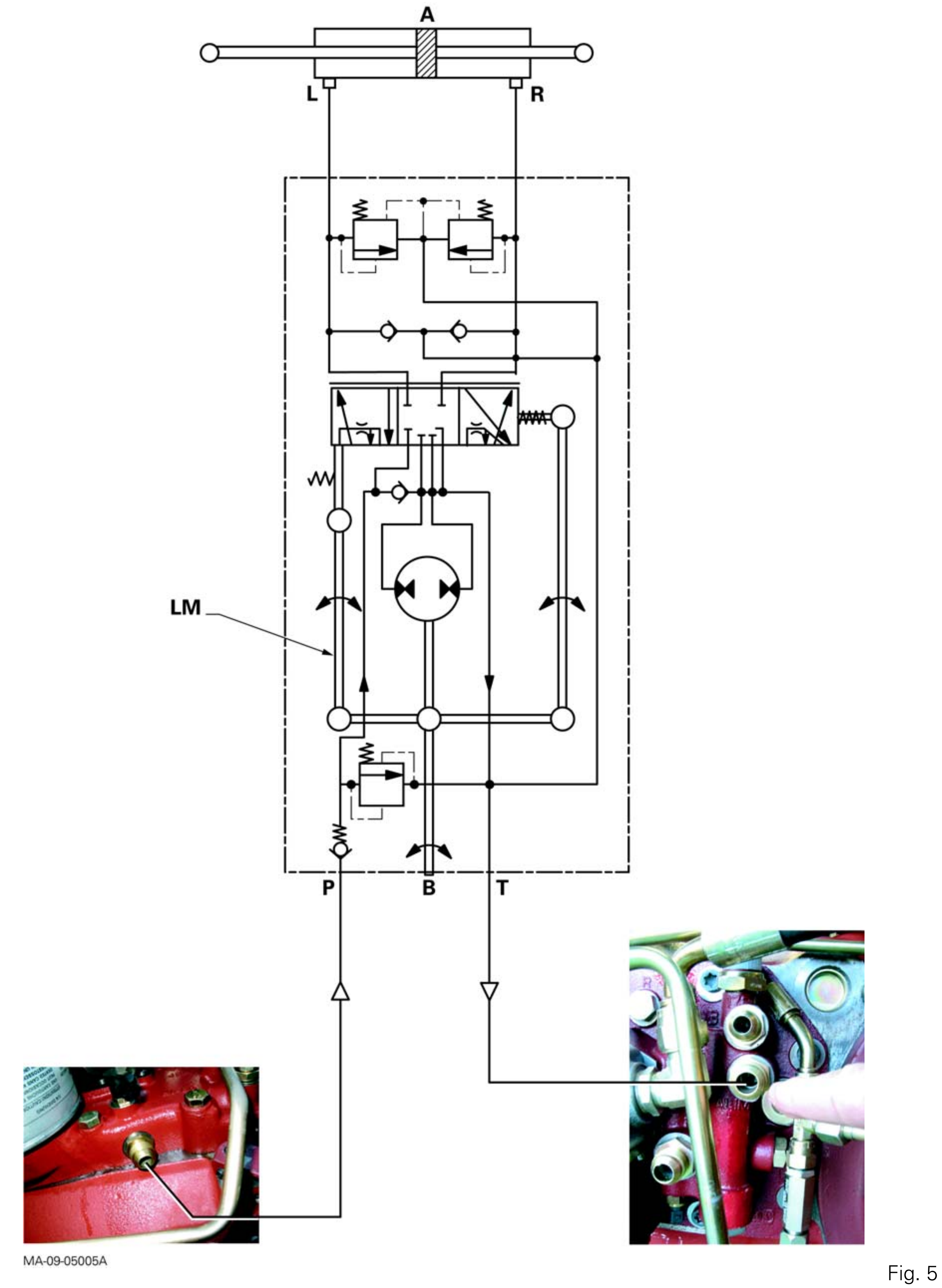


Fig. 5

D . Neutral position (engine running)

In neutral position (engine running) (Fig. 6), the spool valve (25) is centred in relation to the sleeve (27) by the springs (13). The channels (P1), (L) and (R) are not supplied.

The oil coming from port (P) passes directly via hose (T) to supply the 17 bar valve. The circuit is open centre. Two shock valves (20) and two suction valves (23) are located in ports (L) and (R) of the spool valve.

The shock valves (20) protect the circuit between the steering ram and the spool valve from overpressure caused by mechanical shocks to the front wheels.

The suction valves (23) allow the oil released by the shock valves (20) to pass from the right-hand channel to the left-hand channel or vice versa depending on the movement of the piston inside the steering ram.

Legend (Fig. 6)

(blue)	Inlet channel
(green)	Return channel
P1	Supply to the metering device

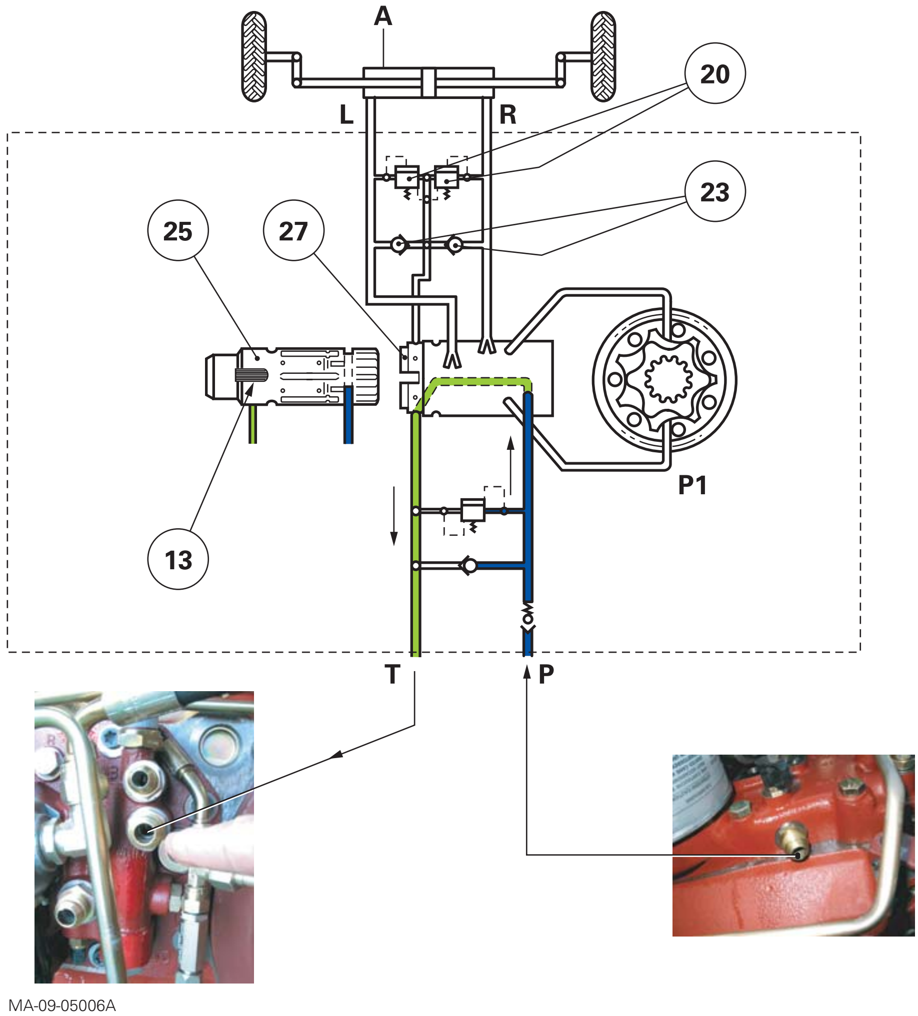


Fig. 6

E . Steering on lock position (engine running)

Action on the steering wheel (to the left or right) (Fig. 7) produces an angular displacement of the spool valve (25) in relation to the sleeve (27).

The flow coming from the pump is directed to the metering device (stator (6) and rotor (9)).

The rotor (9) is rotated and directs back into the cylinder a quantity of oil proportional to the rotational angle. The rotor (9) turns proportionally to the steering wheel.

Example:

Let us suppose that the steering wheel is turned by 5°. An angular displacement of 5° of the spool valve (25) is produced in relation to the sleeve (27).

The rotor (9) is driven in rotation as long as it is supplied. It drives with it the link shaft (11) (Fig. 2 and Fig. 3) and sleeve (27). When these have turned 5°, the spool valve (25) and sleeve (27) are centred again, by springs (13). The rotor ceases to be supplied and stops.

This same reasoning applies to greater angles. The quantity of oil delivered by the steering unit to the cylinder (A) is therefore proportional to the rotational angle of the steering wheel.

The spool valve (25) allows, whether steering lock is applied to the left or right, to direct oil fed by the metering device (stator (6) and rotor (9)) to port (L) or (R).

During rotation, the sleeve (27) ensures the synchronous communication of the metering device cavities with the circuit from the pump, on the one-hand, and the circuit to the cylinder (A), on the other hand.

A non-return valve (26) (Fig. 2 and Fig. 3) is screwed into the supply port of the spool valve. This one-way valve stops excessive pressure or blows received by the front wheels from being transmitted to the pump whenever steering lock is applied.

If the pressure in the circuit is too high, the relief valve (18) located in the spool valve is activated: the excess pressure is then directed to the channel (T).

Legend (Fig. 7)

- Inlet channel
- Return channel
- Delivery channel

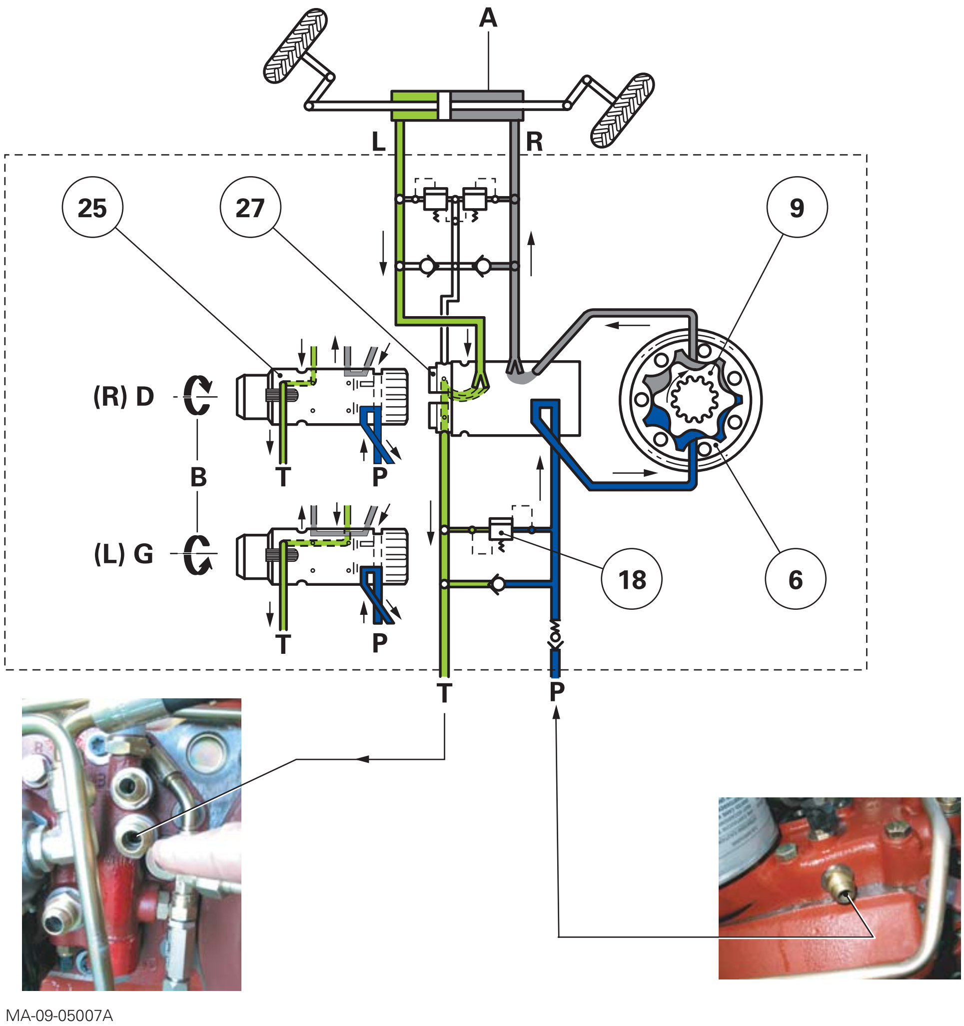


Fig. 7

F . Manual steering (engine stopped)

When the pump is no longer operating or the available pressure is too low, the metering device is no longer hydraulically driven. It is no longer power assisted.

In this case (Fig. 8), action on the steering wheel compresses the centring springs (13). The angular clearance between the pin (7) (Fig. 2 and Fig. 3) and the sleeve (27) is reduced to zero resulting in mechanical rotation of the metering device (stator (6) and rotor (9)). The steering unit then operates in the same way as a hand pump. The oil returning from steering ram (A) passes through the non-return valve (22) and supplies the metering device. The pressure generated is proportional to the torque applied to the steering wheel. The effort therefore required to turn the wheel in order to steer the tractor is much greater.

Legend (Fig. 8)

- Inlet channel
- Return channel
- Delivery channel

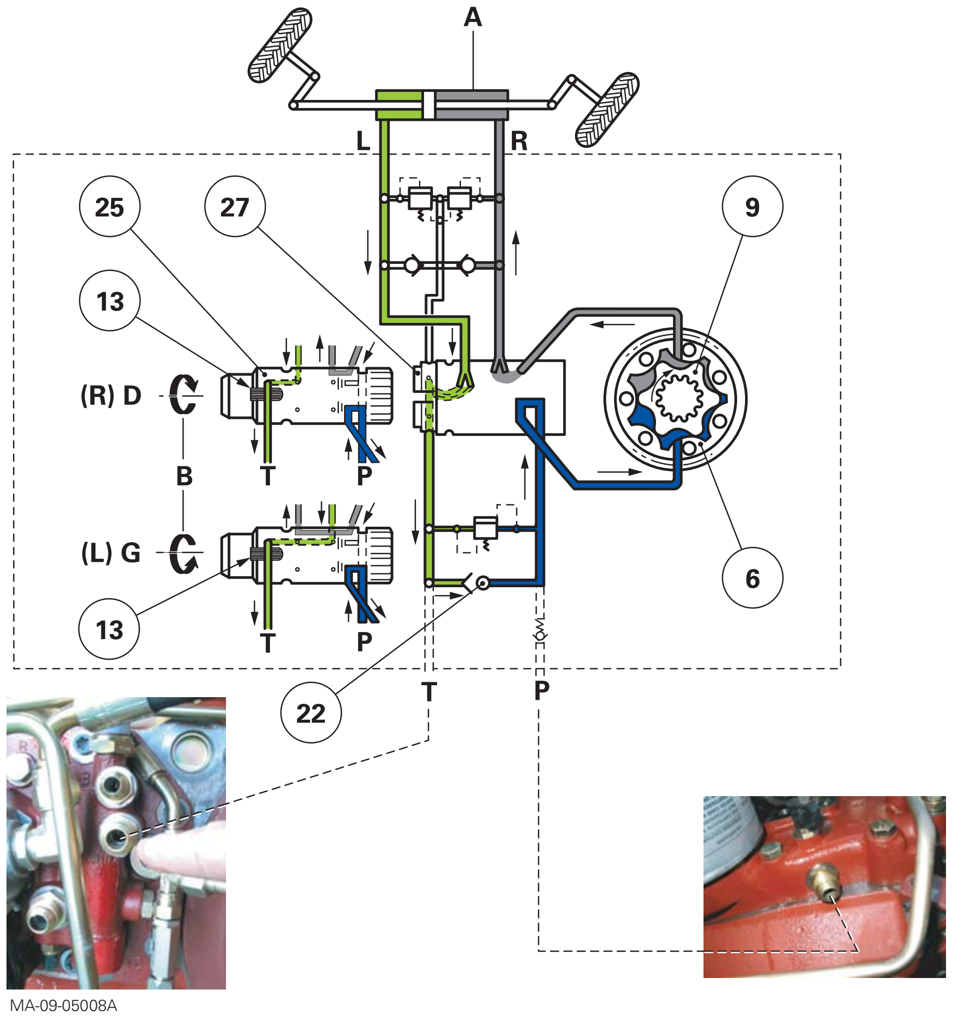


Fig. 8

G . Disassembling and reassembling the Orbitrol steering unit

Reminder

If the Orbitrol steering unit is defective, take care that it is replaced with a unit with exactly the same characteristics.

Example: OSPC 150 ON spool valve

OSP	=	Orbitrol steering pump
C	=	Valves incorporated in the steering unit
150	=	150 cm^3 per rotor revolution
ON	=	Open centre without feedback

Disassembly

1. Remove the spool valve from the tractor and tighten it in a clamp with soft jaws.
2. Remove the jaws (1) if necessary (Fig. 9). Take out the screws (3). Split the manifold (31) from the spool valve (21) (Fig. 10).
3. Collect the seals (2) and (30) (Fig. 9 and Fig. 10).
4. Take out the screws (1). Carefully mark the location of the screw (2) and then remove it.
5. Remove the closing plate (4), O'ring (5), stator (6) and O'ring (8).
6. Remove the spacer (10), the rotor (9), the distributor plate (29) and the O'ring (28).
7. Take out the splined link shaft (11).
8. Unscrew the threaded ring and take out the valve ball from the non-return valve (22).
9. Take out the two pins and valve balls from the suction valves (23) of the steering unit.
10. Extract the sleeve (27) and spool valve (25) assembly by pushing it out while checking that the pin (7) lies along the horizontal axis.
11. Remove the washers (12) and (16), the needle bearing (14) and the bush (24) from the sleeve / spool valve assembly.

    Remove the pin (7), and the centring springs (13) by pressing on their ends.

    Separate the sleeve (27) from the spool valve (25).

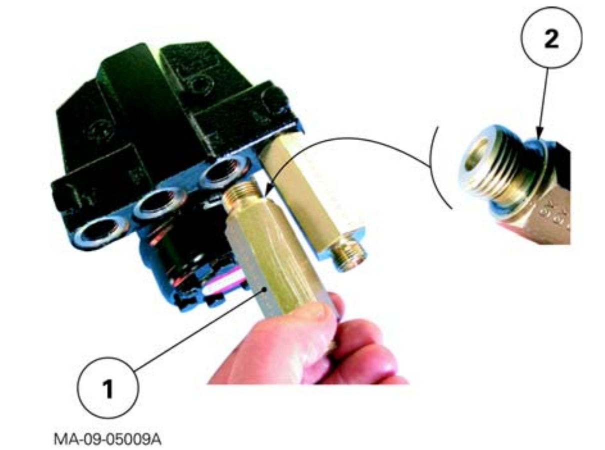


Fig. 9

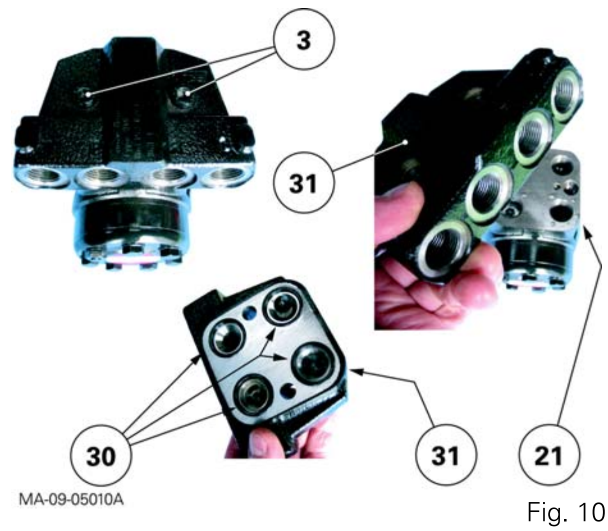


Fig. 10

12. Unscrew the plug from the relief valve (18).
Using an 8mm Allen wrench, disassemble the threaded bush and remove the seal, the spring and the valve (the crimped seat cannot be removed).

13. Unscrew the two plugs from the shock valves (20). Remove seals.
Using a 6mm Allen wrench, remove the threaded bushes and take out the springs, the valve balls and their seats (the crimped seats cannot be removed).

14. Extract the seal (19), the bush (15) and the O'ring (17).
Disassemble the non-return valve (26).

Reassembly

15. Check and clean the components. Replace any defective parts. Lubricate with clean transmission oil before reassembly.

16. Reassemble the non-return valve (26).

17. Fit the seal (19), the O'ring (17) and the ring (15).

18. Place the valve balls and springs in the recesses of the shock valves (20). Screw on the threaded bushes. Fit the seals and tighten the plugs.

19. Fit the valve and spring in the recesses of the relief valve (18). Screw in the threaded bush. Fit the seal and tighten the plug to a torque of 40-60 Nm.

20. Insert the spool valve (25) into the sleeve (27).
Position the centring springs (13) according to Fig. 11 and insert the pin (7).

21. Position the bush (24) on the sleeve and spool valve assembly so that the chamfer facilitates assembly in the steering unit.

22. Place the washers (12) and (16), the chamfer of washer (12) towards the centring springs (13), by inserting the needle bearing (14) between them.

23. Fit the sleeve and spool valve assembly in the steering unit by oscillating it slightly. Check that the pin (7) is held horizontally.

24. Place the two valve balls and the two pins in the recesses of the suction valves (23).

25. Fit the valve ball in the non-return valve recess (22). Screw in the threaded bush.

26. Position the splined link shaft (11).

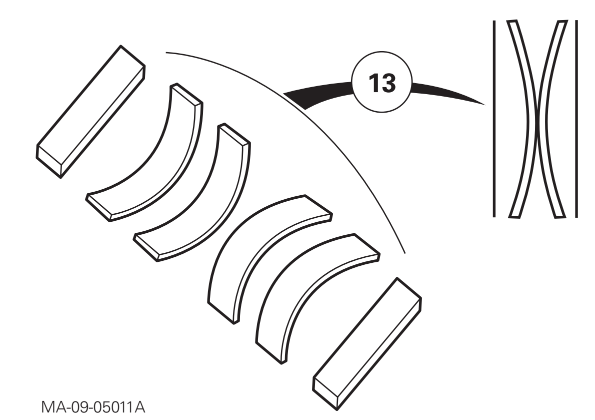


Fig. 11

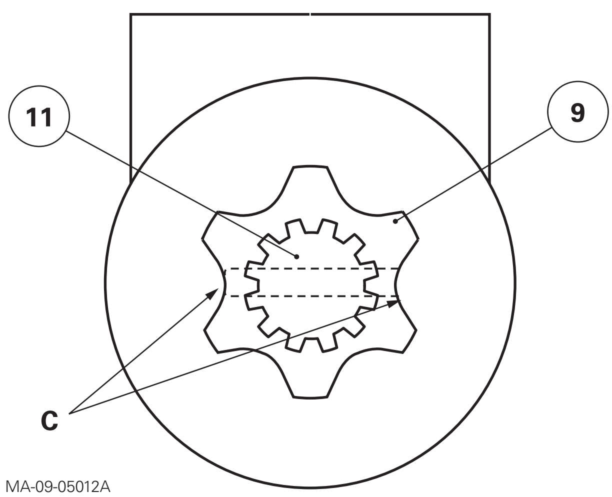


Fig. 12

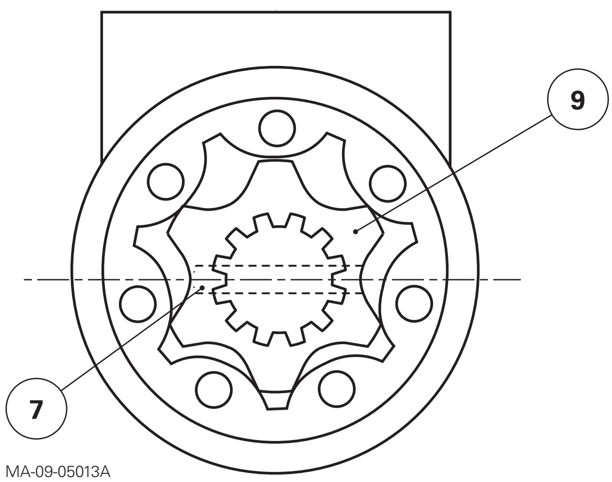


Fig. 13

27. Fit the O'ring (28) and the distributor plate (29).

28. Fit the rotor (9) so that the two concave depressions (C) lie along the axis of the slot in the splined link shaft (11) (Fig. 12). Refit the spacer (10).

29. Place the O'rings (5) (8) on the stator (6).

30. While avoiding moving the rotor (9), fit the stator (6). Then move it so that its fixing holes match with those of the steering unit.

Reminder: The rotor (9) and the pin (7) must be in the position shown in Fig. 13.

31. Refit the closing plate (4).

32. Replace the seals and fit:

- the screw (2) (in the positions marked during disassembly) (Fig. 2);
- the opposing screws (1) tightened to 30-35 Nm (Fig. 2) ;
- the manifold (31) on the steering unit (21) (Fig. 10) (screws tightened to 60 Nm);
- the sleeves (1) on the manifold (Fig. 9).

33. Using a test-bench or a suitable fixture, check the adjustment and correct operation of the steering unit.

34. Refit the steering unit on the tractor.

H . Removing / refitting and disassembling / reassembling the steering ram

Reminder

The general procedure is similar on fixed or suspended front axles.

Preliminary operation

35. Immobilise the tractor. Chock the rear wheels. Apply the handbrake.

Removal

Remark

To help release the steering ram from its overlap flange, first remove the front left-hand wheel and mudguard (if fitted).

36. Remove the locknuts (1) (Fig. 15) and drive ou the steering pivot balls using a suitable extractor tool.
37. Loosen nut (3). Remove the right-hand steering link rod (including pivot ball) (Fig. 16).
38. Disconnect and block the supply hoses (1) (right and left) (Fig. 14) from the ram, marking their positioning.
39. Take out the screws (2) (Fig. 15) and remove the ram.

Refitting

40. Refit the steering ram. Tighten the screws (2) to a torque of 120 Nm.
41. Reconnect the left-hand and right-hand supply hoses of the ram.
42. Refit the link rod and steering pivot balls.
43. Reassemble the wheel(s).
Tighten the nuts and screws to their indicated torque, depending on version (see section 6).
44. Adjust wheel alignment (see section 8).
Complete the operation by tightening:
- steering pivot ball nuts (1) to a torque of 220 Nm (Fig. 15);
- steering link rod nuts (3) (Fig. 16).

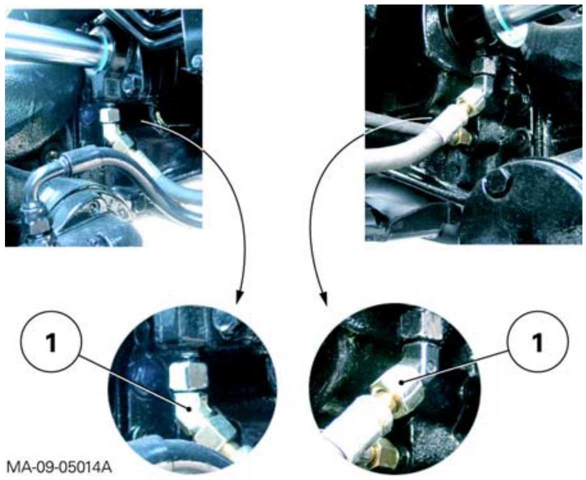


Fig. 14

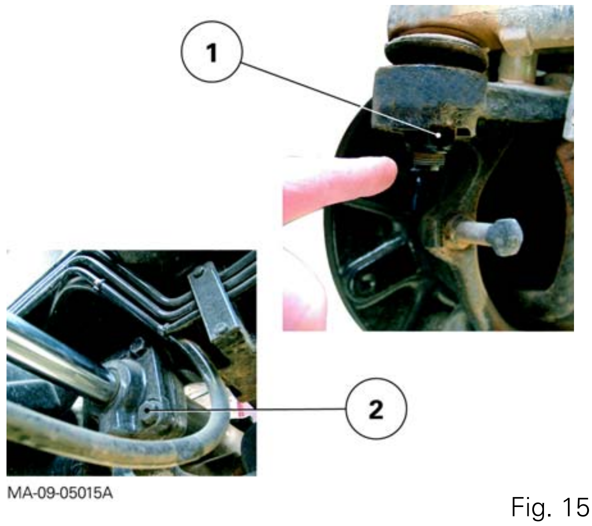


Fig. 15

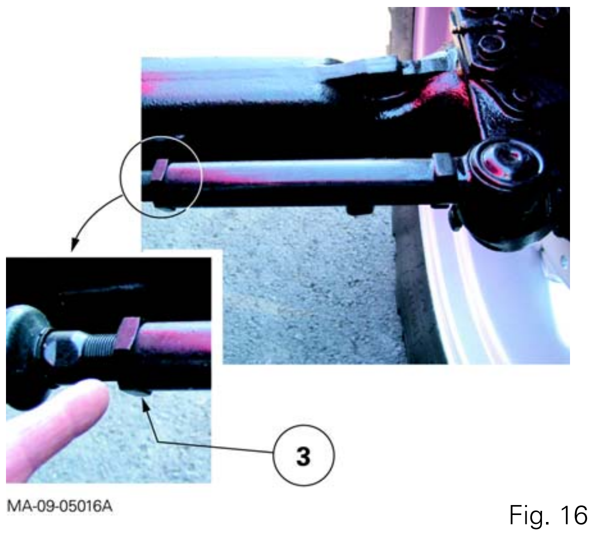


Fig. 16

Disassembly (Fig. 17)

Remark

The steering ram assembly (1) comprises the following parts (Fig. 17):

(2) Pack of seals
(4) Cylinder
(6) Piston pin
(7) Cover

45. Release and remove the ball joints (7) (Fig. 18).
46. Separate the cover (7) from the cylinder (4).
47. Take out the piston (6) from cylinder.
48. Discard all the seals (sealing ring, O'rings and dust seal).

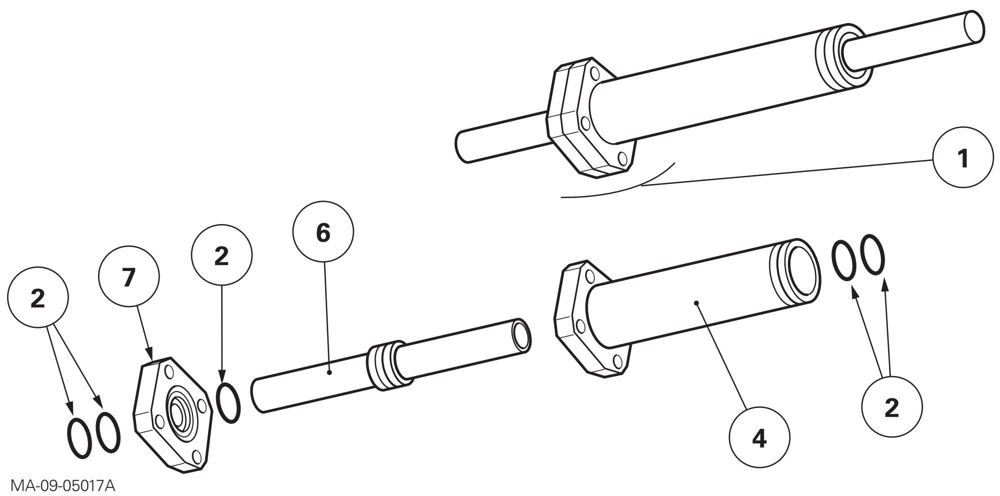


Fig. 17

Reassembly

Remark

Ensure that the internal bore of the cylinder and the operational parts of the piston rod are free of scratches: scratches can cause leaks in the steering unit.

49. Lubricate the seals, bushes and cylinder internal bore with clean transmission oil.

50. Fit the seals on the piston rod (6) cylinder (4) and the cover (7) respectively (Fig. 17).

51. Put together the steering ram without damaging the oil tight seals:

- slide the piston rod fitted with its seals in the cylinder bore;
- put the cover back on the cylinder, with the pressure inlet facing the right direction.

52. Tighten and lock the ball joints (7) (Fig. 18) to the torque of 300 Nm.

53. Refit the steering ram on the tractor.

54. Check the hydraulic pressure on the cylinder line (see section 9 - Tests).

Final operation

55. Carry out a road test on the steering system.

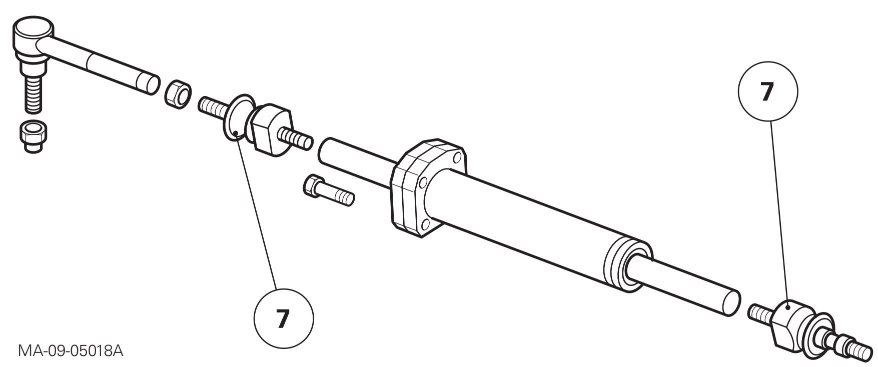


Fig. 18

9K20 - LS and TFLS hydrostatic steering - 125/160 cm^3

CONTENTS

A . General

The steering system is of the dynamic type (constant 0.5l /min flow rate - 6 bar standby pressure). Its control principle is of the Load Sensing (LS) type.

The Orbitrol steering unit (21) type is displayed on an adhesive plate located below the steering unit (Fig. 1). The steering unit has no mechanical links, other than the steering column itself, between the steering wheel and steering ram.

The system comprises the following main components:

- a pressurised oil feed from the variable displacement pump;
- a steering unit that can be, according to the type of front axle:
  - OSPF 125 LS dynamic,
  - OSPF 160 LS dynamic;
- a double acting steering ram (1) with a different profile according to the type of tractor or front axle (Fig. 2).

The steering unit is supplied via the priority block(s) (depending on version) by the high flow rate high pressure circuit. When the steering wheel is turned, the necessary flow of oil is directed to the corresponding side of the steering ram. The other side of the ram is connected to the gearbox selector cover return ports.

In the event of a variable displacement pump failure, the steering unit acts as a manual pump, thus allowing the tractor to continue to be steered. This operation, performed without hydraulic assistance, obviously requires significant effort to turn the steering wheel.

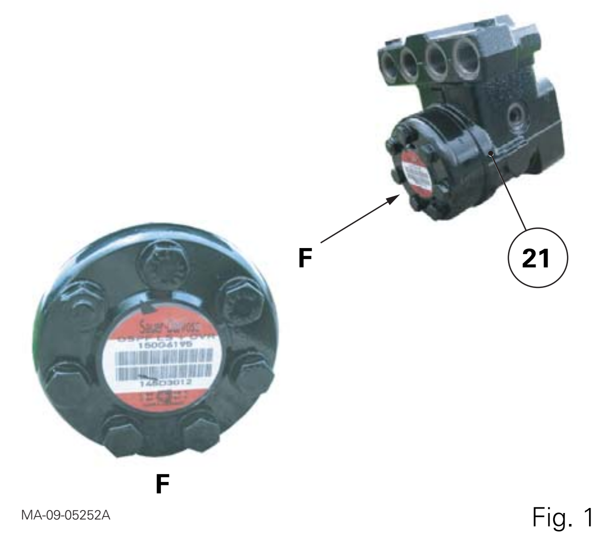


Fig. 1

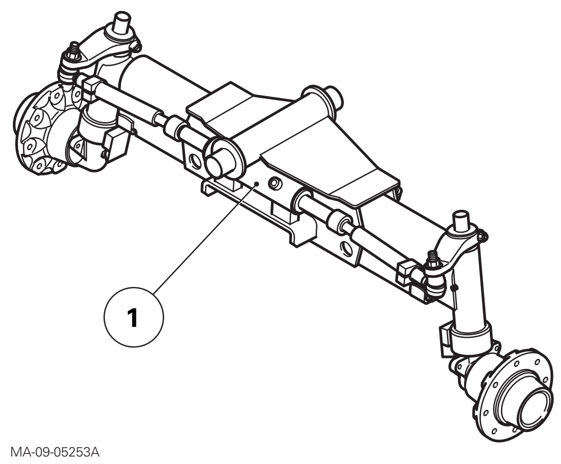


Fig. 2

Description of the steering unit

The steering unit comprises a selector spool valve, a spring centred supply sleeve and a drive shaft linked to the steering column.

The steering unit comprises five ports:
- pressure;
- return to selector cover;
- two supplies (left and right) to the steering ram;
- Load Sensing

The circuit is protected by a safety valve, two shock valves and two suction valves.

B . The principle of Load Sensing

Steering unit

The LSD steering unit possesses a fifth LS port.
This port is connected:
- either to the closed steering unit circuit when steering is in neutral position;
- or with the pressure supply line when the steering wheel is turned.

Parts list (Fig. 3)

(1) Screw
(2) Screw
(3) Seal
(4) Closing plate
(5) O'ring
(6) Stator
(7) Cotter pin
(8) O'ring
(9) Rotor
(10) Spacer
(11) Link shaft
(12) Washer
(13) Centring springs
(14) Needle bearing
(15) Bush
(16) Washer
(17) O'ring
(18) Relief valve
(19) Seal
(20) Shock valve
(21) Orbitrol steering unit
(22) Non-return valve
(23) Suction valves
(24) Bush
(25) Spool valve
(26) Non-return valve
(27) Sleeve
(28) O'ring
(29) Distributor plate

Overall view

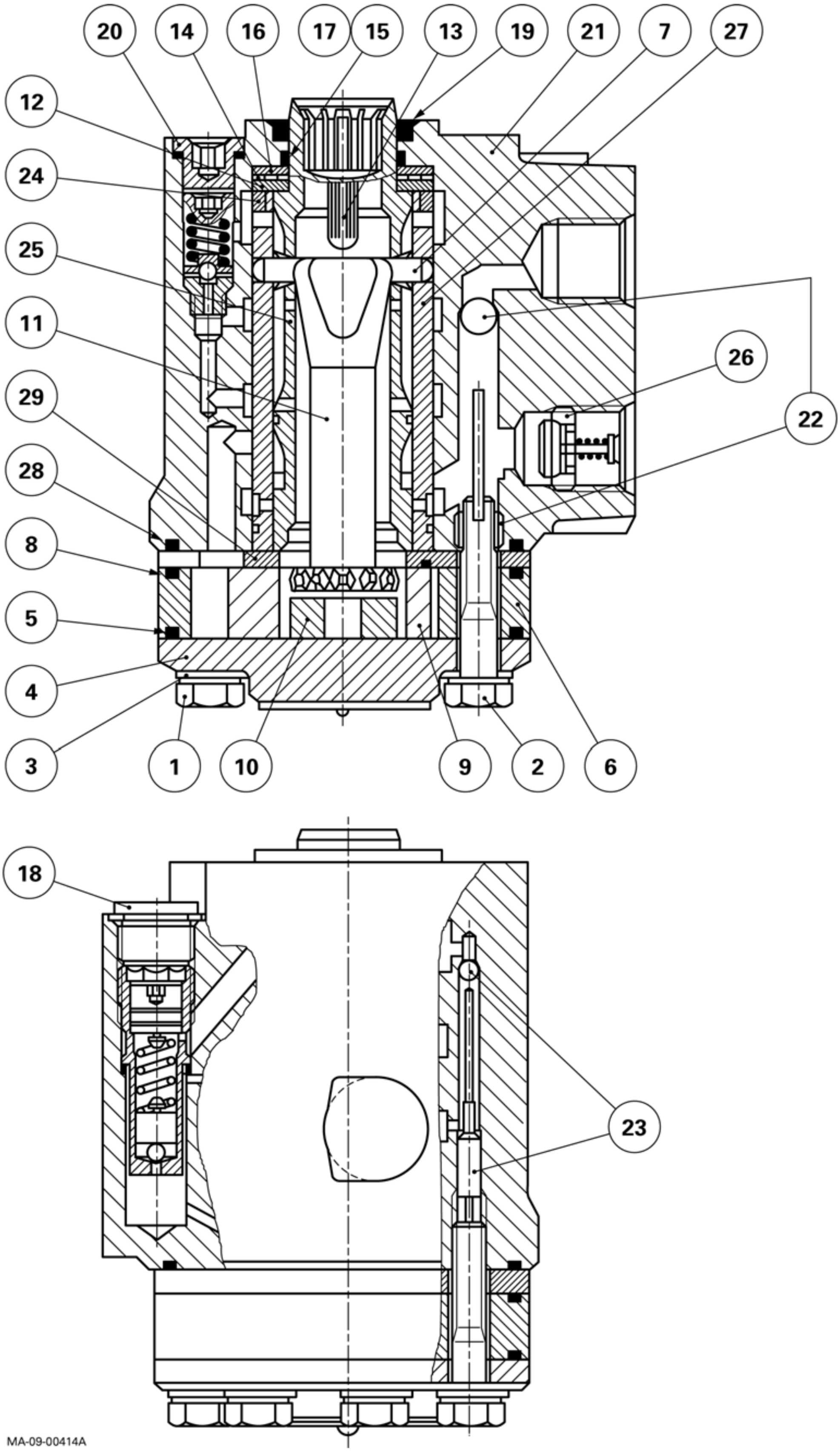
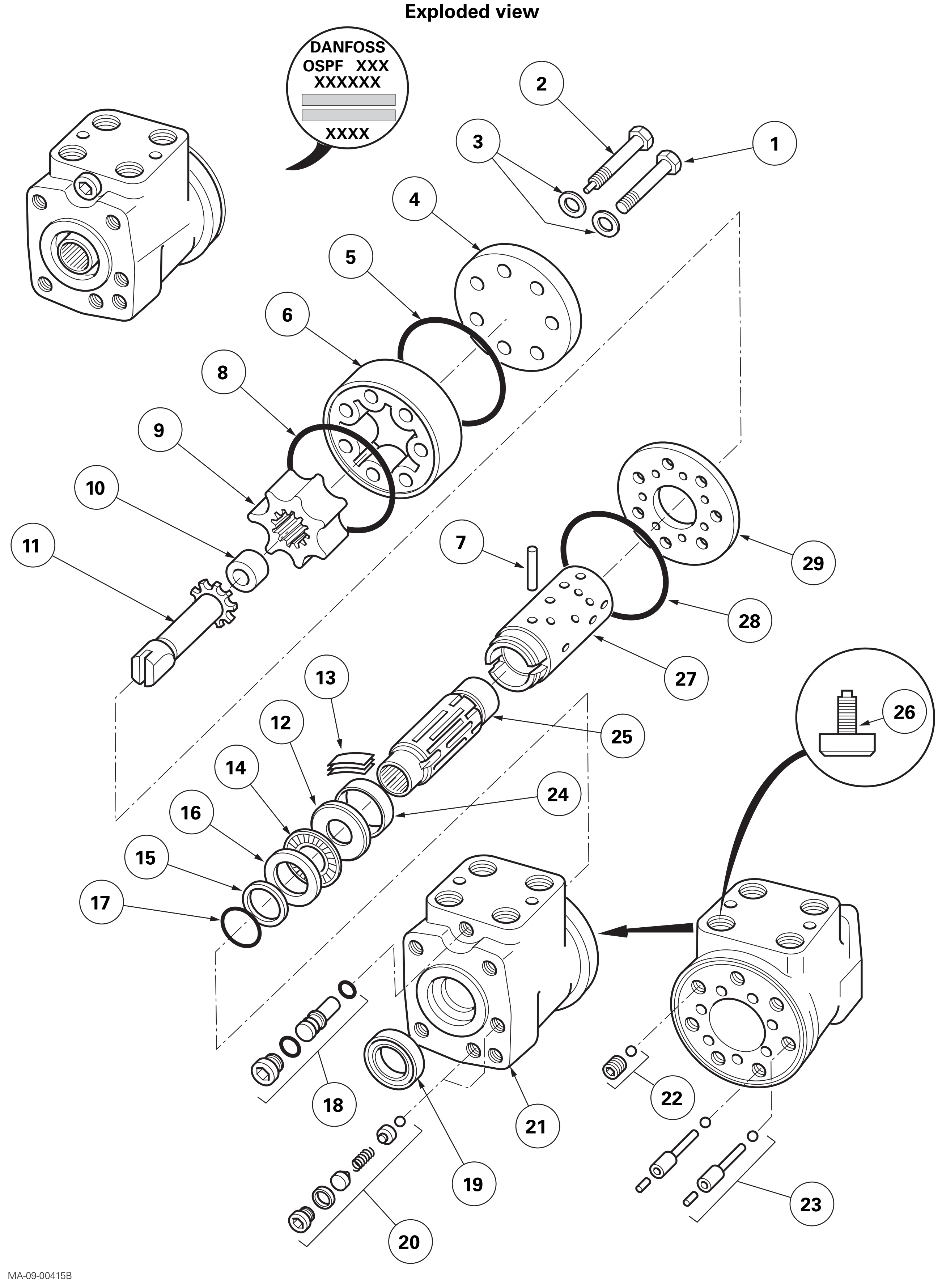


Fig. 3

Parts list (Fig. 4)

(1) Screw
(2) Screw
(3) Seal
(4) Closing plate
(5) O'ring
(6) Stator
(7) Cotter pin
(8) O'ring
(9) Rotor
(10) Spacer
(11) Link shaft
(12) Washer
(13) Centring springs
(14) Needle bearing
(15) Bush
(16) Washer
(17) O'ring
(18) Relief valve
(19) Seal
(20) Shock valve
(21) Orbitrol steering unit
(22) Non-return valve
(23) Suction valves
(24) Bush
(25) Spool valve
(26) Non-return valve
(27) Sleeve
(28) O'ring
(29) Distributor plate


Exploded view
DANFOSS
OSPF XXX
XXXXXX
XXXX
1
2
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MA-09-00415B

Fig. 4

C . Layout of channels and ports

Parts list (Fig. 5)

(1) 2 WD or 4 WD axle (2 WD on figure shown)

Legend

A Double acting steering ram
AV Front axle face
B Location of steering column
L Supply to left-hand union of the steering ram
LS Signal to variable displacement pump
P Pressure
R Supply to right-hand union of the steering ram
T Return to housing via gearbox selector cover

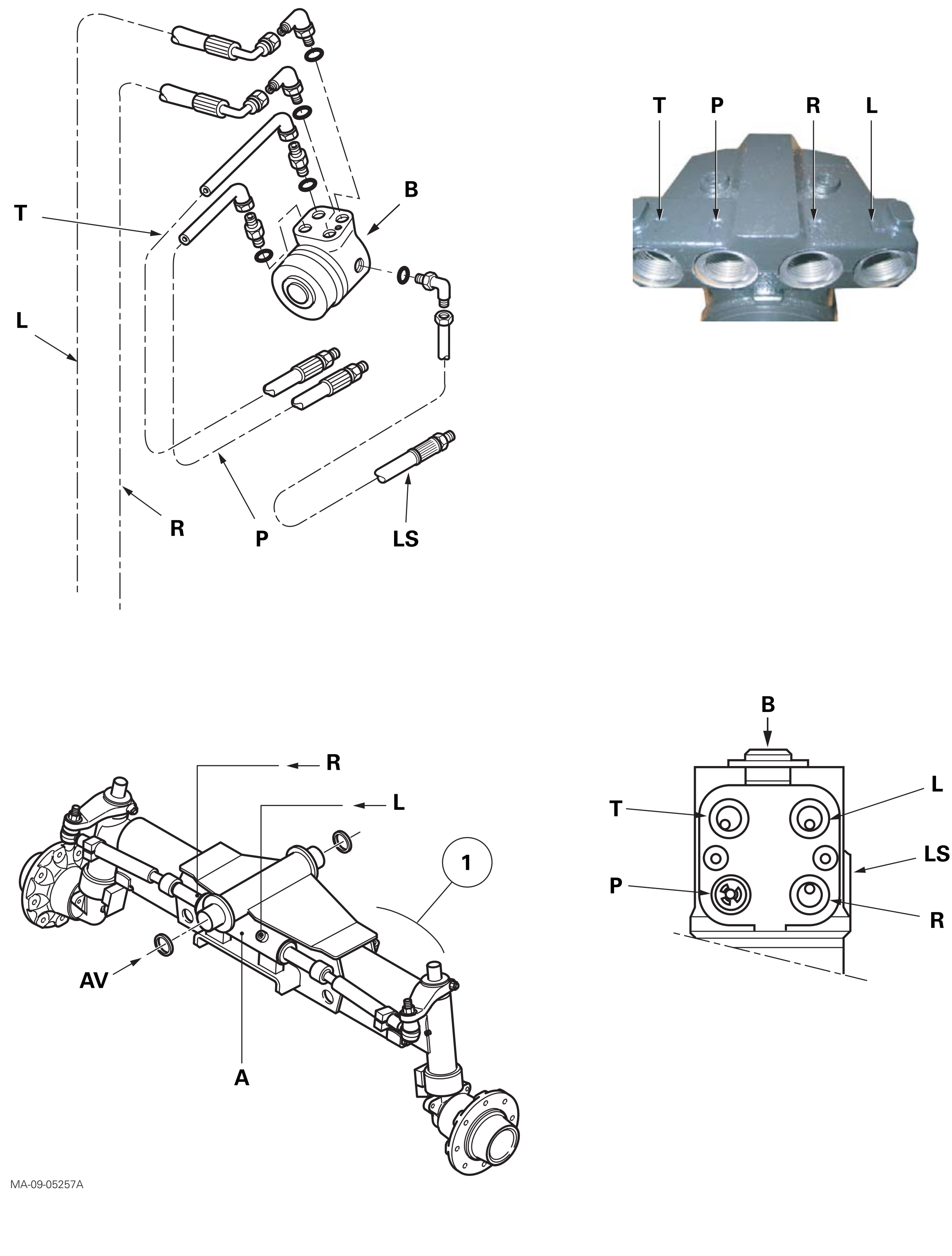


Fig. 5

D . Diagram

Legend (Fig. 6)

A Double acting steering ram
B Steering column
BP Priority block(s)
L LH hydraulic port of the steering ram
LM Mechanical links
LS Signal
P Pressure
R RH hydraulic port of the steering ram
T Return

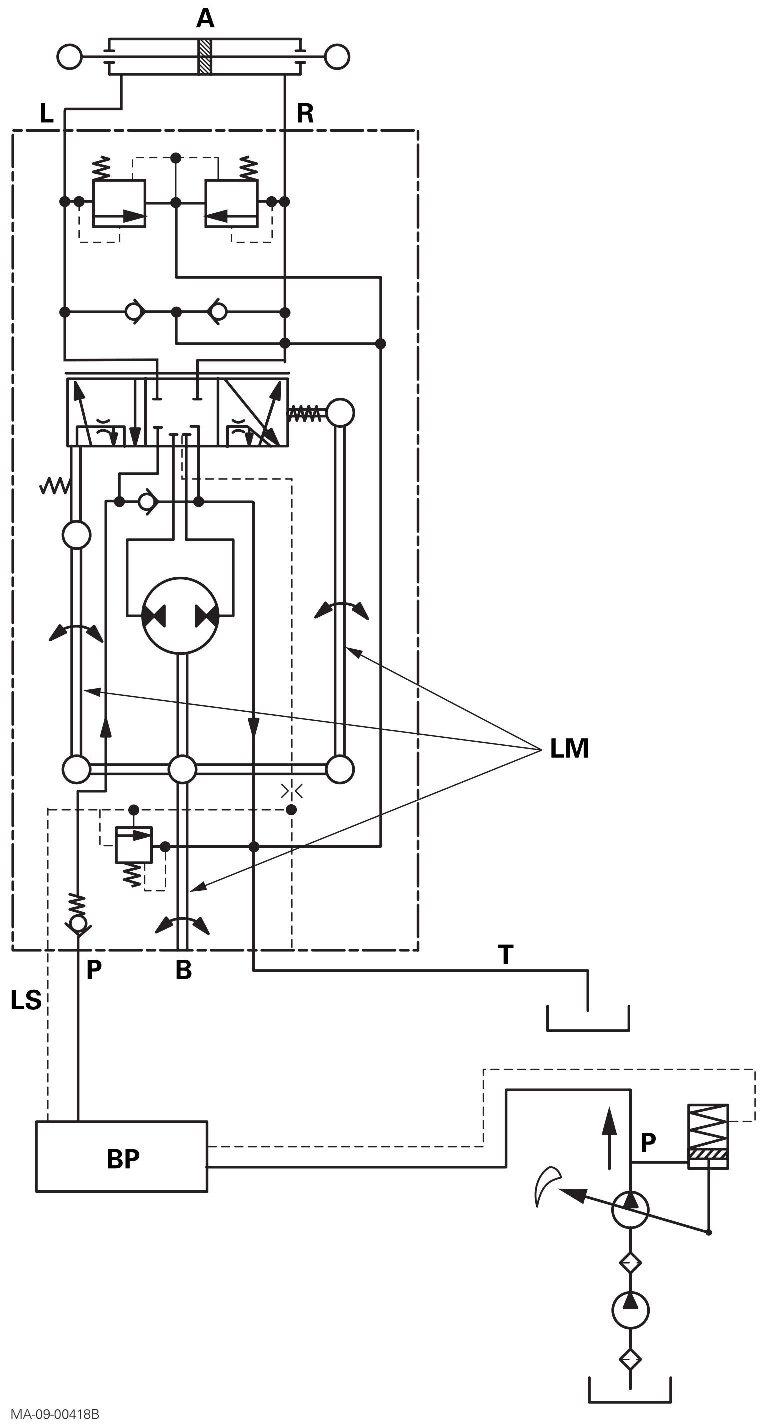


Fig. 6

E . Neutral position (engine running)

In this position the spool valve (25) is centred in relation to the sleeve (27) by the springs (13) (Fig. 7). The channels P1, L, R are not supplied.

The oil coming from the variable displacement pump via channel (2) is directed in priority to the Orbitrol unit via channel (1).

With the steering in a neutral position, there is no flow in this channel.

The circuit is closed centre.

Two shock valves (20) and two suction valves (23) are located in ports L and R of the spool valve.

The shock valves (20) protect the circuit between the steering ram and the spool valve from over pressure caused by mechanical shocks to the front wheels.

The suction valves (23) allow the oil released by the shock valves (20) to pass from the right-hand channel to the left-hand channel or vice versa depending on the movement of the piston inside the steering ram.

Legend (Fig. 7)

A	Double acting steering ram
BP	Priority block(s)
L	LH hydraulic port of the steering ram
LS	Signal
P	Pressure
P1	Supply to the metering device
R	RH hydraulic port of the steering ram
T	Return

Inlet channel

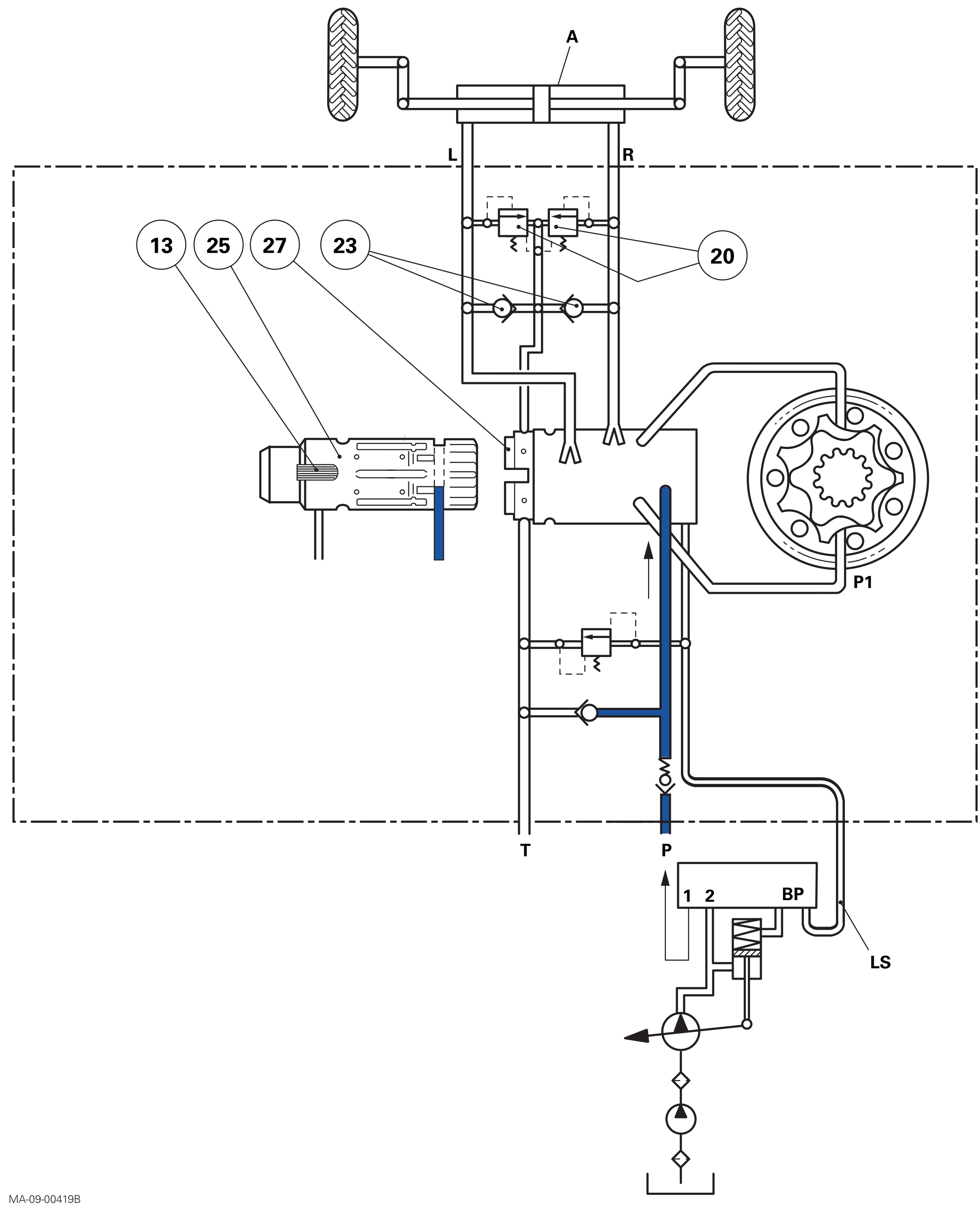


Fig. 7

F . Steering on lock position (engine running)

Action on the steering wheel (to the left or right) (Fig. 8) produces an angular displacement of the spool valve (25) in relation to the sleeve (27) and the opening of the closed Orbitrol circuit.

The pilot flow coming from the Orbitrol enters via channel (4) thus allowing for the flow required for the metering device (stator (6) and rotor (9)) to pass into channel (1).

The rotor (9) is rotated and directs back into the cylinder a quantity of oil proportional to the angle of rotation. The rotor (9) turns proportionally to the steering wheel.

Example: Let us suppose that the steering wheel is turned by 5°. An angular displacement of 5° of the spool valve (25) is produced in relation to the sleeve (27).

The rotor (9) is driven in rotation as long as it is supplied. It drives with it the link shaft (11) (Fig. 3, Fig. 4) and the sleeve (27).

When the latter have turned 5°, the spool valve (25) and the sleeve (27) are once again centred by the springs (13) (Fig. 8). The rotor ceases to be supplied and stops.

This same reasoning applies to greater angles. The quantity of oil delivered by the steering unit to the steering ram A is therefore proportional to the rotational angle of the steering wheel.

The spool valve (25) allows, whether steering lock is applied to the left or right, to direct oil fed by the metering device (stator (6) and rotor (9)) to port L or R.

During rotation, the sleeve (27) ensures the synchronous communication of the cavities in the metering device with the circuit from the pump, on the one-hand, and the circuit to the steering ram, on the other hand.

A non-return valve (26) is screwed into the supply port of the steering unit (Fig. 4). This valve is one-way. It prevents excessive pressure exerted to the front wheels from being transmitted to the pump when the steering lock is applied.

If the pressure in the steering circuit is too high, the relief valve (18), located in the steering unit, opens and the excess pressure is released to channel T.

Legend (Fig. 8)

A	Double acting steering ram
BP	Priority block(s)
L	LH hydraulic port of the steering ram
LS	Signal
P	Pressure
R	RH hydraulic port of the steering ram
T	Return

- Inlet channel
- Delivery channel
- Return channel
- Pilot flow channel

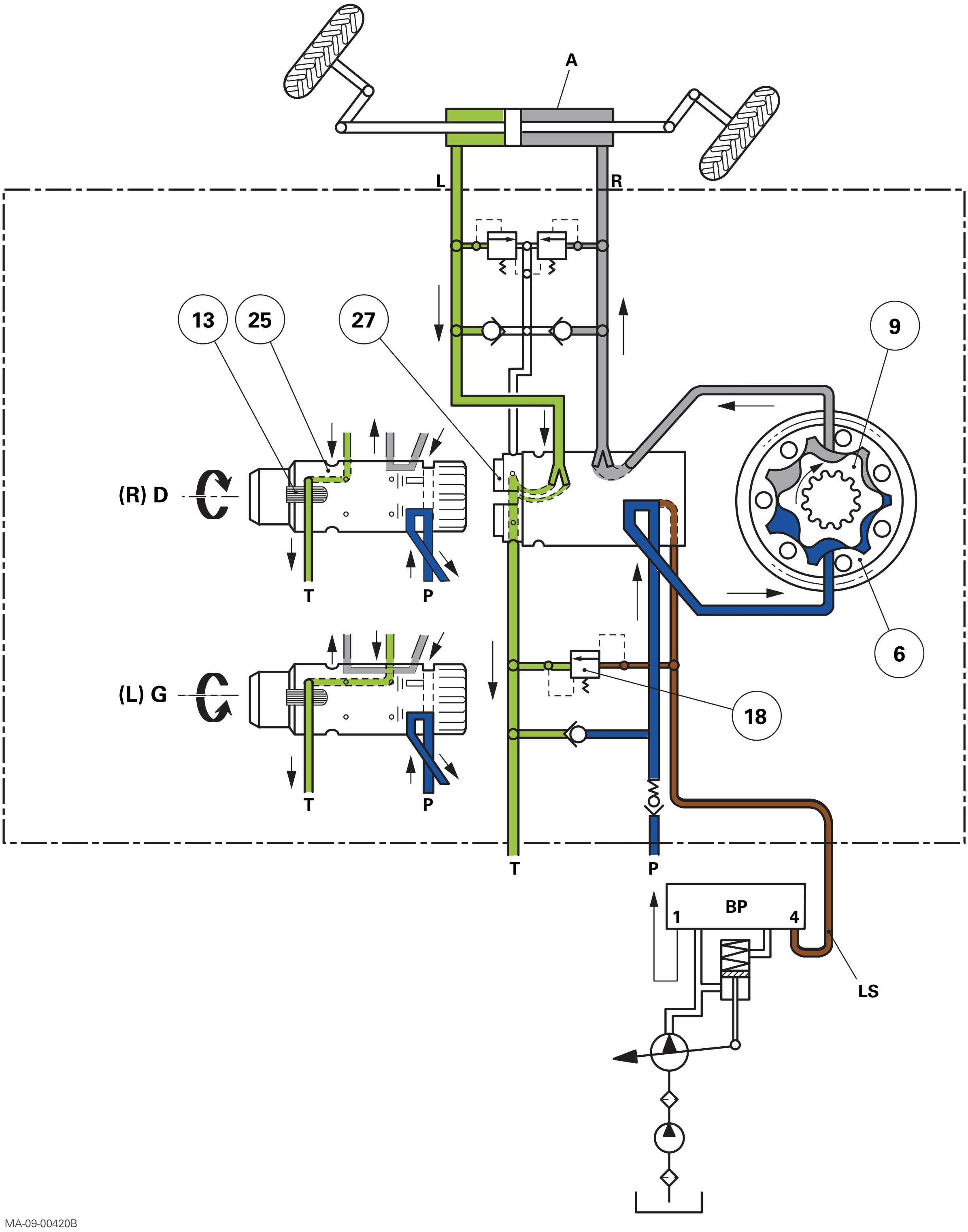


Fig. 8

G . Manual steering (engine stopped)

When the pump is no longer operating or the available pressure is too low (Fig. 9), the rotor (9) is no longer hydraulically driven. It is no longer power assisted.

In this case, action on the steering wheel compresses the centring springs (13). The angular clearance between the pin (7) (Fig. 3 and Fig. 4) and the sleeve (27) is reduced to zero resulting in mechanical rotation of stator (6) and rotor (9). The steering unit then operates in the same way as a hand pump.

The oil arriving from steering ram A passes through the non-return valve (22) and supplies the metering device.

The pressure generated is proportional to the torque applied to the steering wheel. A great effort is therefore required to turn the wheel in order to steer the tractor.

Legend (Fig. 9)

A	Double acting steering ram
BP	Priority block(s)
L	LH hydraulic port of the steering ram
LS	Signal
P	Pressure
R	RH hydraulic port of the steering ram
T	Return

Inlet channel

Delivery channel

Return channel

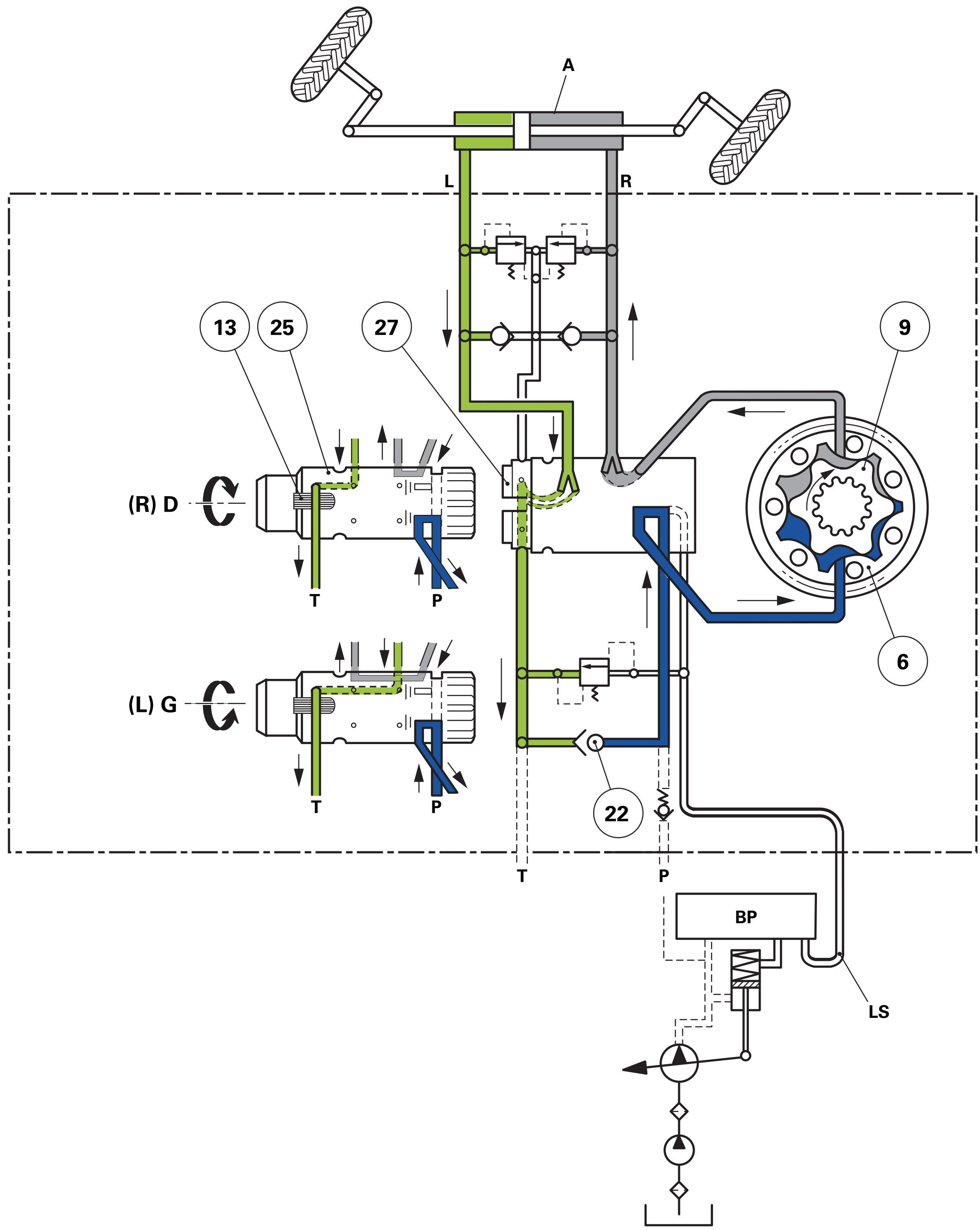


Fig. 9

H . Disassembling - reassembling the Orbitrol steering unit

Important: *If the Orbitrol steering unit cannot be repaired, it must be replaced by a new unit with the same properties.*

Disassembly

1. Remove the steering unit from the tractor.

2. Place the steering unit in a vice fitted with plastic jaws.

3. Take out the screws (1). Carefully mark the location of the screw (2) and then remove it.

4. Remove the cover plate (4), O'ring (5), stator (6) and O'ring (8).

5. Remove the spacer (10), the rotor (9), the distributor plate (29) and the O'ring (28).

6. Take out the splined link shaft (11).

7. Unscrew the threaded bush and recover the ball from the non-return valve (22).

8. Take out the two axle pins and the balls from the suction valves (23) of the steering unit.

9. Extract the sleeve (27) and spool valve (25) assembly by pushing it out while checking that the pin (7) lies along the horizontal axis.

10. Remove the washers (12) (16), the needle bearing (14) and the bush (24) from the sleeve and spool valve assembly.

Remove the pin (7), and the centring springs (13) by pressing on their ends.

Separate the sleeve (27) from the spool valve (25).

11. Unscrew the plug from the relief valve (18). Using an 8 mm Allen wrench, disassemble the threaded bush and remove the seal, the spring and the valve (the crimped seat cannot be removed).

12. Unscrew the two plugs from the shock valves (20) and remove the seals.

Using a 6 mm Allen wrench, remove the threaded bushes and take out the springs and valve balls from their seats (the crimped seats cannot be removed).

13. Extract the seal (19), the bush (15) and the O'ring (17).

14. Disassemble the non-return valve (26).

Reassembly

15. Check and clean all components. Replace any defective parts. Lubricate the components with clean transmission oil.

16. Reassemble the non-return valve (26).

17. Fit the seal (19), the O'ring (17) and the ring (15).

18. Place the valve balls and springs in the recesses of the shock valve (20). Screw in the threaded bushes, fit the seals and tighten the plugs.

19. Fit the valve and spring in the recesses of the relief-valve (18), screw in the threaded bush. Fit the seal and tighten the plug to a torque of 40 - 60 Nm.

20. Insert the spool valve (25) into the sleeve (27).

Position the centring springs (13) according to Fig. 10 and insert the pin (7).

21. Position the bush (24) on the sleeve and spool valve assembly so that the chamfer facilitates assembly in the steering unit.

22. Place the washers (12) (16), the chamfer of washer (12) towards the centring springs (13), by inserting the needle bearing (14) between them.

23. Fit the sleeve and spool valve assembly in the steering unit by oscillating it slightly. Check that the pin (7) is held horizontally.

24. Fit the two valve balls and the two pins in the recesses of the suction valves (23).

25. Fit the valve ball in the recess of the non-return valve (22) and screw in the threaded bush.

26. Position the splined link shaft (11).

27. Fit the O'ring (28) and the distributor plate (29).

28. Fit the rotor (9) so that the two concave depressions C lie along the axis of the slot in the splined link shaft (11) (Fig. 11). Refit the spacer (10).

29. Place the O'rings (5)(8) on the stator (6).

30. Align the stator (6) fitting holes with those of the steering unit. Refit the stator on the steering unit without moving the rotor (9).

Note: *The rotor (9) and the pin (7) must be in the position shown in Fig. 12.*

31. Refit the cover plate (4).

32. Refit the screw (2) (in the same location as marked during disassembly) and the screws (1) fitted with their seals (3). Tighten opposing screws to a torque of 30 - 35 Nm.

33. Using a test-bench or a suitable fixture, check the adjustment and correct operation of the steering unit.

34. Refit the steering unit on the tractor.

35. Check the oil tightness of the hydraulic unions.

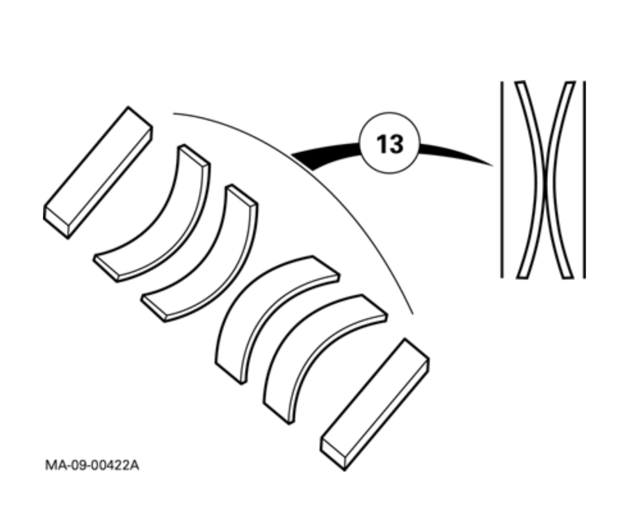


Fig. 10

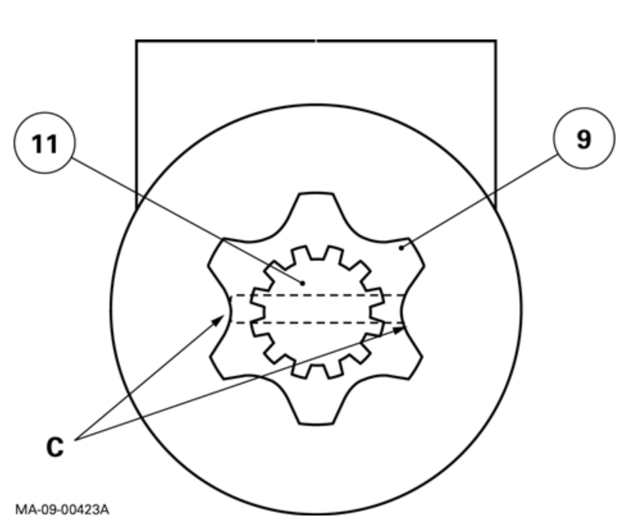


Fig. 11

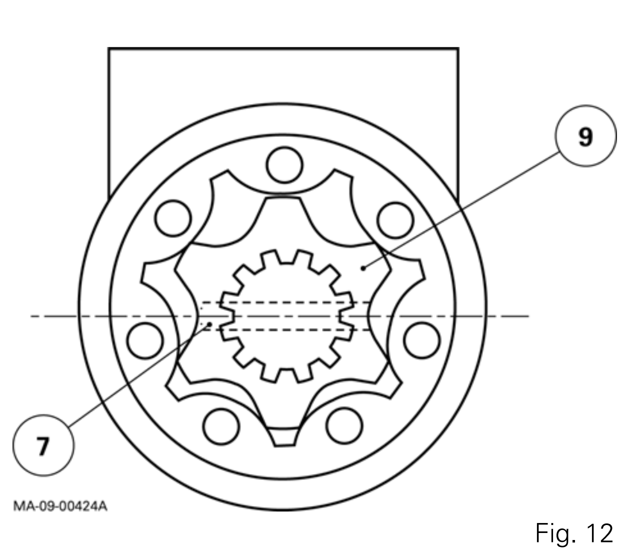


Fig. 12

9K21 - LS and TFLS hydrostatic steering - 80/205 cm^3 and 80/240 cm^3

CONTENTS

A . General

The steering system is of the dynamic type (constant 0.5l /min flow rate - 6 bar standby pressure). Its control principle is of the Load Sensing (LS) type.

The orbitrol steering unit (26) type is displayed on an adhesive plate located below the steering unit (Fig. 1). The steering unit has no mechanical links, other than the steering column itself, between the steering wheel and steering ram.

The system comprises the following main components:
- a pressurised oil feed from the variable displacement pump;
- a steering unit that can be, according to the type of front axle:
  - OSPDF 80/205 cm³,
  - OSPDF 80/240 cm³;
- a double acting steering ram (1) (Fig. 2).

The steering unit is supplied via the priority block(s) (depending on version) by the high flow rate high pressure circuit. This circuit also supplies the integrated spool (18) and the two gears (27)(28), (30)(31).
When the steering wheel is turned, the necessary flow of oil is directed to the corresponding side of the steering ram. The other side of the ram is connected to the gearbox selector cover return ports.

In the event of a variable displacement pump failure, only the steering unit gear (27)(28) (Fig. 3) acts as a manual pump, thus allowing the tractor to continue to be steered. This operation, performed without hydraulic assistance, obviously requires significant effort to turn the steering wheel.

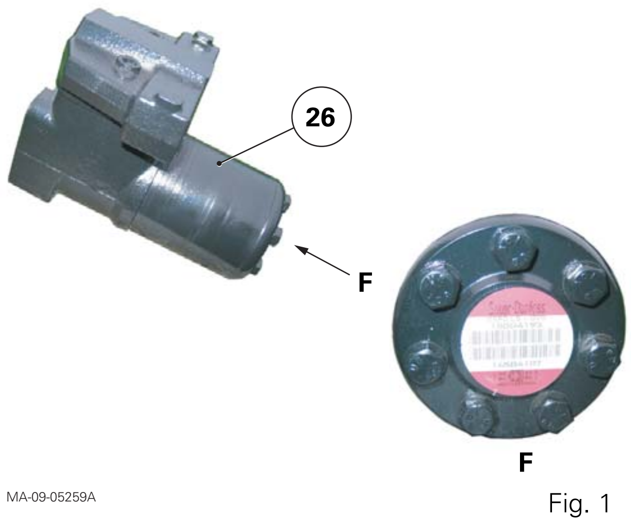


Fig. 1

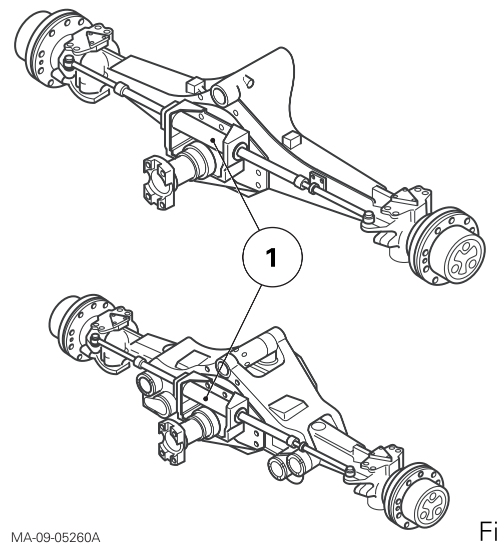


Fig. 2

Description of the steering unit

The steering unit comprises:

- two gears of different capacity, each consisting of a rotor and a stator. These two gears are mechanically coupled to a drive shaft, itself connected to the steering column;
- a spring centred supply sleeve;
- an integrated spool in the body (19) (Fig. 3).

The steering unit comprises five ports:

- pressure;
- return to the selector cover;
- two supplies (left and right) to the steering ram;
- Load Sensing

The circuit is protected by a safety valve, two shock valves and two suction valves.

B . The principle of Load Sensing

Steering unit

The LSD steering unit possesses a fifth LS port.

This port is connected:

- either to the closed steering unit circuit when steering is in neutral position;
- or with the pressure supply line when the steering wheel is turned.

Parts list (Fig. 3)

(1) Lip seal
(2) Centring springs
(3) Bush
(4) O'ring
(5) Cotter pin
(6) Sleeve
(7) Spool valve
(8) O'ring
(9) Link shaft
(10) O'ring
(11) Plate
(12) O'ring
(13) Plate
(14) O'ring
(15) Spacer
(16) O'ring
(17) O'ring
(18) Integrated spool
(19) Spool body
(20) Seals
(21) O'ring
(22) Washer
(23) Needle bearing
(24) Washer
(25) Relief valve
(26) Orbitrol steering unit
(27) Rotor (gear type 80 cm^3)
(28) Stator (gear type 80 cm^3)
(29) O'ring
(30) Stator (gear type 205 cm^3 or 240 cm^3)
(31) Rotor (gear type 205 cm^3 or 240 cm^3)
(32) Plate
(33) Spring
(34) O'ring
(35) Closing plate
(36) Screw

Overall view

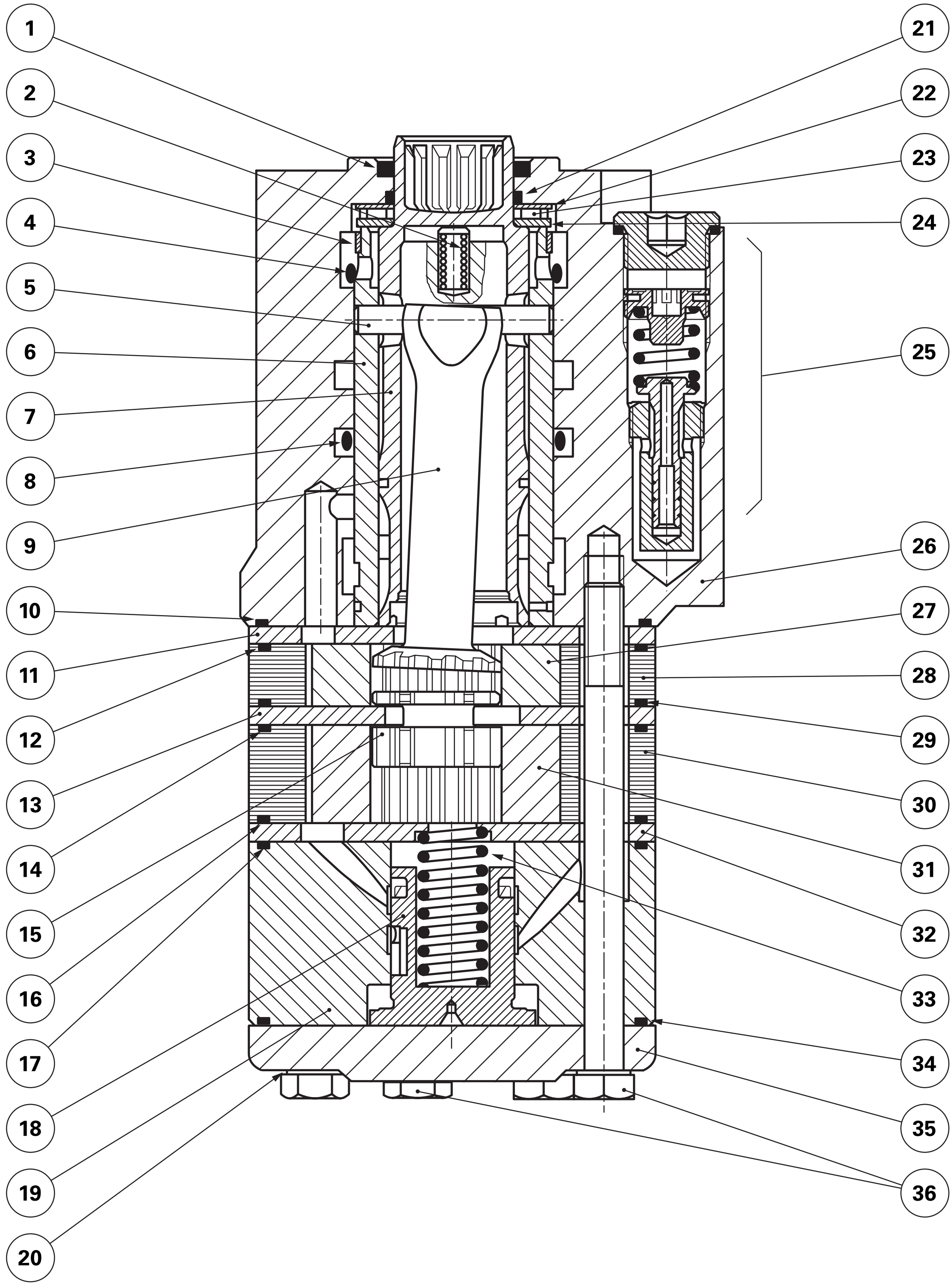


Fig. 3

LS and TFLS hydrostatic steering - 80/205 cm^3 and 80/240 cm^3

Parts list (Fig. 4)

(1) Lip seal
(2) Centring springs
(3) Bush
(4) O'ring
(5) Cotter pin
(6) Sleeve
(7) Spool valve
(8) O'ring
(9) Link shaft
(10) O'ring
(11) Plate
(12) O'ring
(13) Plate
(14) O'ring
(15) Spacer
(16) O'ring
(17) O'ring
(18) Integrated spool
(19) Spool body
(20) Seals
(21) O'ring
(22) Washer
(23) Needle bearing
(24) Washer
(25) Relief valve
(26) Orbitrol steering unit
(27) Rotor (gear type 80 cm^3)
(28) Stator (gear type 80 cm^3)
(29) O'ring
(30) Stator (gear type 205 cm^3 or 240 cm^3)
(31) Rotor (gear type 205 cm^3 or 240 cm^3)
(32) Plate
(33) Spring
(34) O'ring
(35) Closing plate
(36) Screw
(37) Shock valves
(38) Non-return valve
(39) Spacers
(40) Non-return valve
(41) Suction valve
(42) Cotter pin

Exploded view

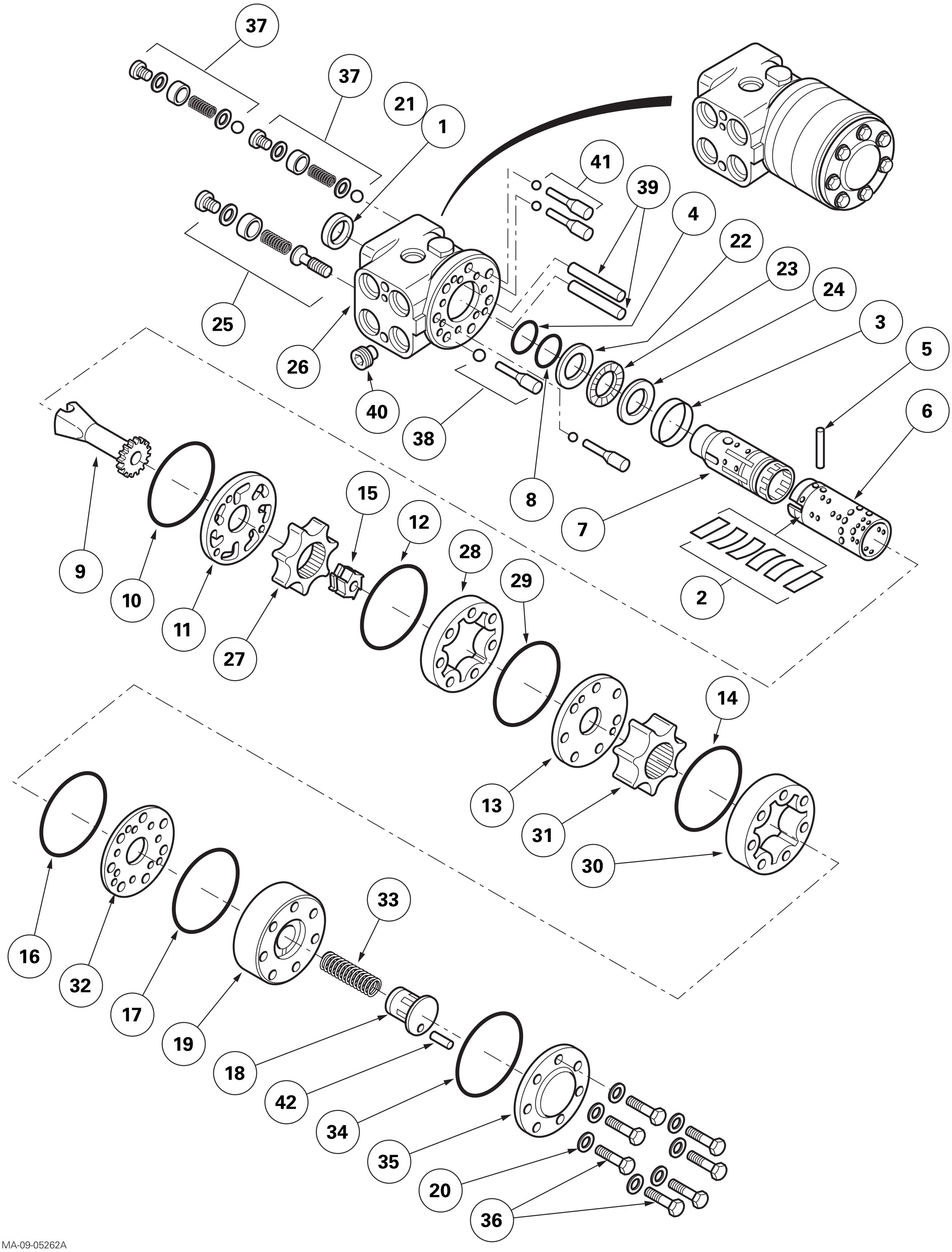


Fig. 4

C . Layout of channels and ports

Parts list (Fig. 5)

(1) CARRARO fixed 4 WD front axle
(2) CARRARO suspended 4 WD front axle

Legend

A Double acting steering ram
B Location of steering column
L Supply to left-hand union of the steering ram
LS Signal to variable displacement pump
P Pressure
R Supply to right-hand union of the steering ram
T Return to housing via gearbox selector cover

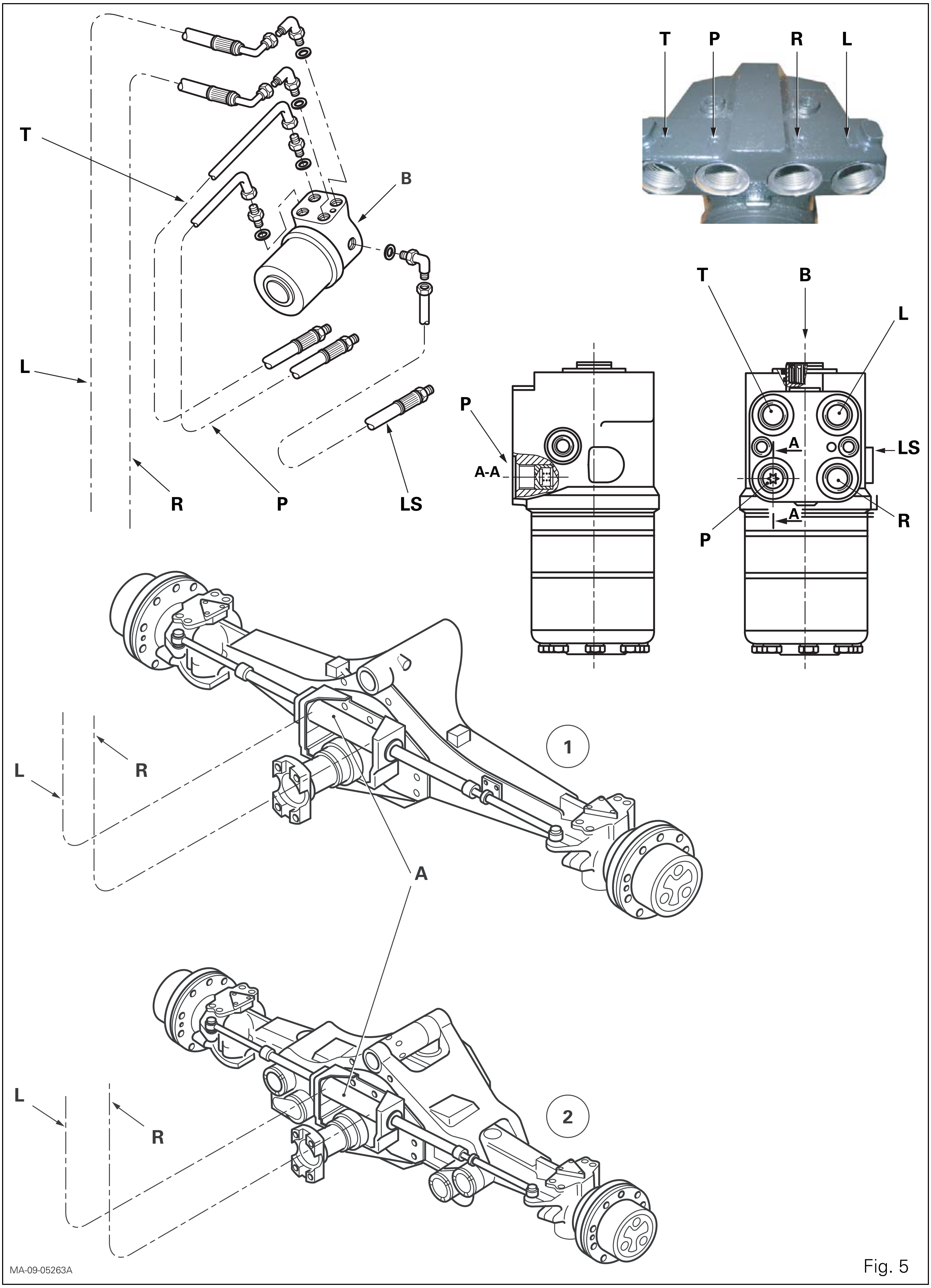


Fig. 5

D . Diagram

Legend (Fig. 6)

A	Double acting steering ram
B	Steering column
BP	Priority block(s)
L	LH hydraulic port of the steering ram
LM	Mechanical links
LS	Signal
P	Pressure
R	RH hydraulic port of the steering ram
T	Return

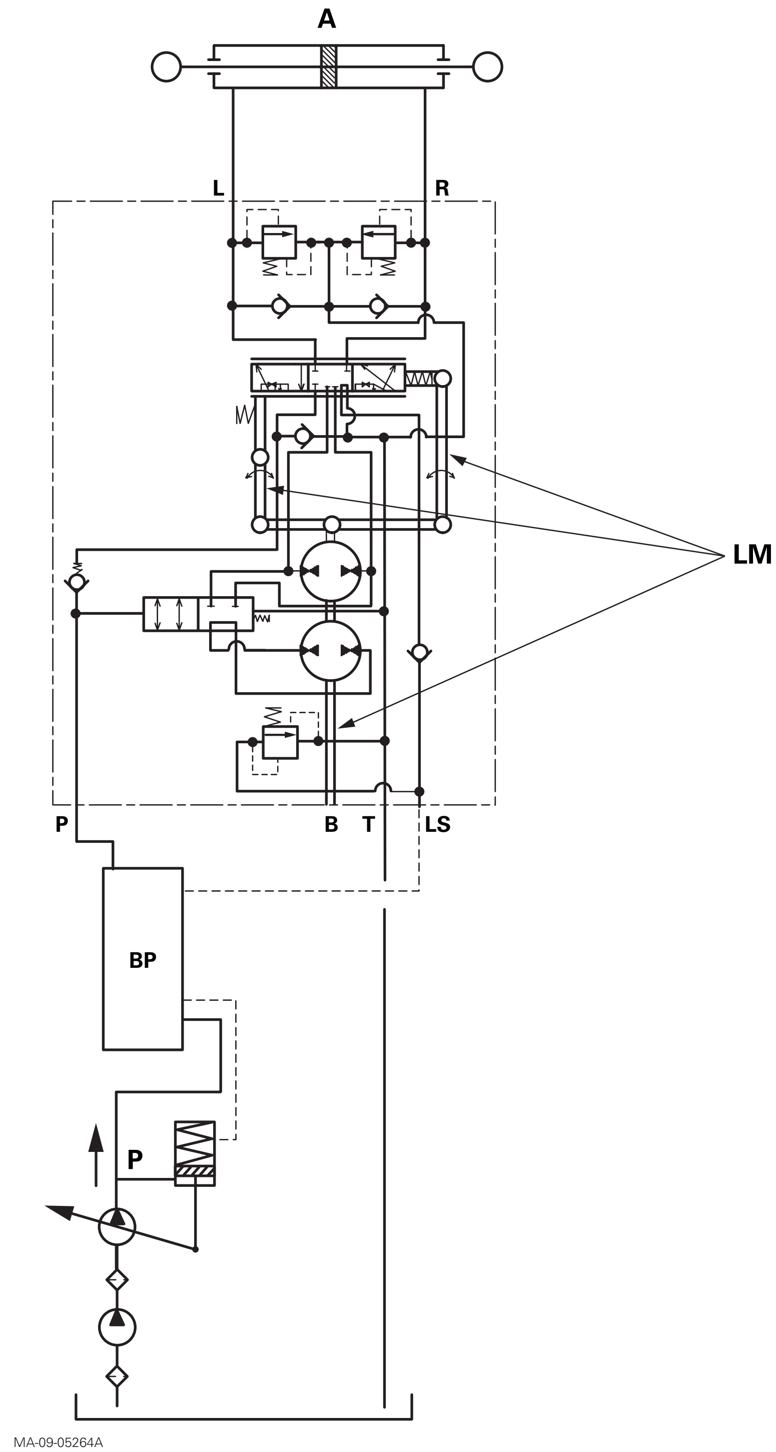


Fig. 6

E . Neutral position (engine running)

In this position the spool valve (7) is centred in relation to the sleeve (6) by the springs (2) (Fig. 7). The channels P1, L, R are not supplied.

The oil coming from the variable displacement pump via channel (2) is directed in priority to the Orbitrol unit via channel (1).

With the steering in a neutral position, there is no flow in this channel.

The circuit is closed centre.

Two shock valves (37) and two suction valves (41) are located in ports L and R of the spool valve.

The shock valves (37) protect the circuit between the steering ram and the spool valve from eventual pressure overloads caused by shocks to the wheels.

The suction valves (41) allow the oil released by the shock valves (37) to pass from the right-hand channel to the left-hand channel or vice versa depending on the movement of the piston inside the steering ram.

Legend (Fig. 7)

A	Double acting steering ram
BP	Priority block(s)
L	LH hydraulic port of the steering ram
LS	Signal
P	Pressure
P1	Supply to metering devices (stators (28) (30) and rotors (27) (31)).
R	RH hydraulic port of the steering ram
T	Return

Inlet channel

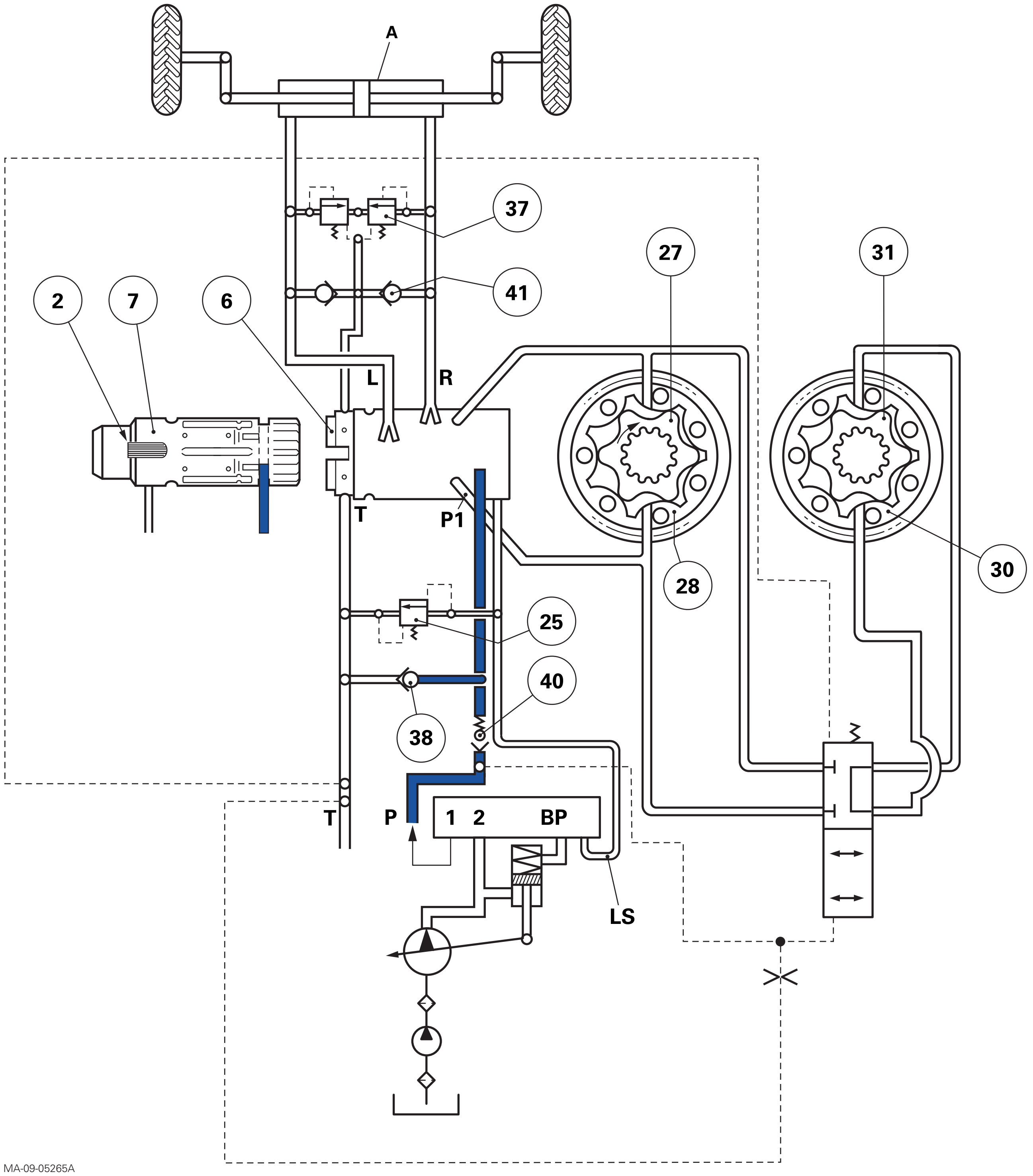


Fig. 7

F . Steering on lock position (engine running)

Action on the steering wheel (to the left or right) (Fig. 8) produces an angular displacement of the spool valve (7) in relation to the sleeve (6) and the opening of the closed Orbitrol circuit.

A pilot pressure coming from the Orbitrol arrives in channel (4) and allows the passing into channel (1) of the flow necessary to the integrated spool (18) and the stator metering devices (stators (28) (30) and rotors (27) (31)).

The rotors (27) (31) are driven in rotation and force towards the ram a quantity of oil that is proportional to the degree of rotation. The rotation of rotors (27) (31) is equal to that of the steering wheel.

Example: Let us suppose that the steering wheel is turned by 5°. An angular displacement of 5° of the spool valve (7) is produced in relation to the sleeve (6).

The rotors (27) (31) are driven in rotation as long as they are supplied with pressurised oil. They drive with them the link shaft (9) (Fig. 3, Fig. 4) and the sleeve (6).

When the latter have turned 5°, the spool valve (7) and the sleeve (6) are once again centred by the springs (2) (Fig. 8). The rotors cease to be supplied and stop.

This same reasoning applies to greater angles. The quantity of oil delivered by the steering unit to the steering ram A is therefore proportional to the rotational angle of the steering wheel.

Depending on whether a left-hand or right-hand lock is applied, the spool valve (7) directs the oil discharged by the metering devices (stator (28) (30) and rotor (27) (31)) towards the L or R port.

During rotation, the sleeve (6) ensures the synchronous communication of the cavities in the metering device with the circuit from the pump, on the one-hand, and the circuit to the steering rams, on the other hand.

A non-return valve (40) is screwed into the supply port of the steering unit (Fig. 4). This valve is one-way. It prevents excessive pressure exerted to the front wheels from being transmitted to the pump when the steering lock is applied.

If the pressure in the steering circuit is too high, the relief valve (25), located in the steering unit, opens and the excess pressure is released to channel T.

Legend (Fig. 8)

A	Double acting steering ram
BP	Priority block(s)
L	LH hydraulic port of the steering ram
LS	Signal
P	Pressure
R	RH hydraulic port of the steering ram
T	Return

- Inlet channel
- Delivery channel
- Return channel
- Pilot flow channel

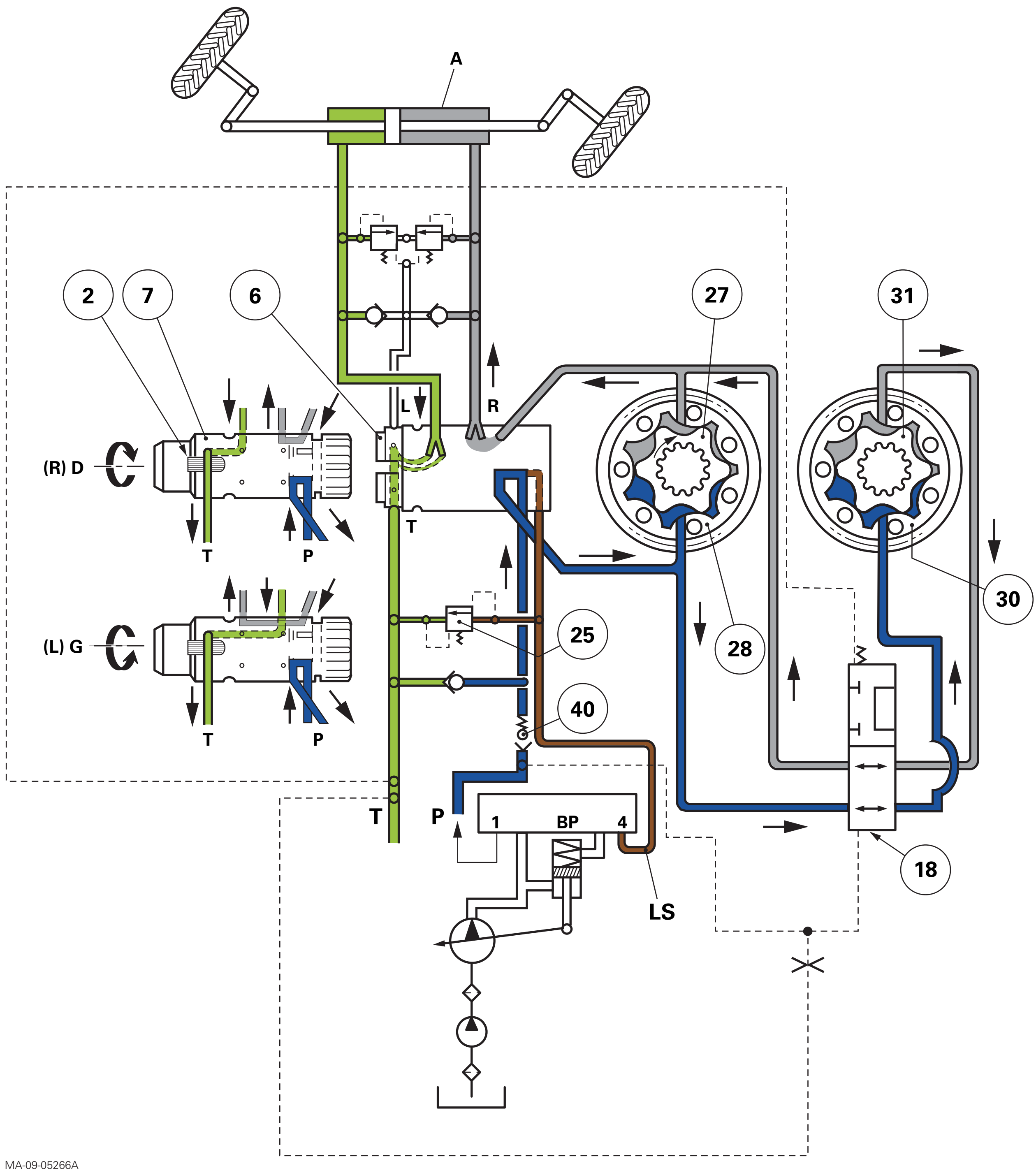


Fig. 8

G . Manual steering (engine stopped)

When the pump is no longer providing pressure or when the pressure is too low (Fig. 9), the rotors (27) (31) are no longer hydraulically driven. It is no longer power assisted.

In this case, action on the steering wheel compresses the centring springs (2). The angular clearance between pin (5) (Fig. 3, Fig. 4) and sleeve (6) is caught up and there is a mechanical driving of the metering device (stator (28) and rotor (27) only). The steering unit then operates in the same way as a hand pump.

The oil returning from steering ram A passes through the non-return valve (38) and supplies the metering device.

The pressure generated is proportional to the torque applied to the steering wheel. A great effort is therefore required to turn the wheel in order to steer the tractor.

Legend (Fig. 9)

A	Double acting steering ram
BP	Priority block(s)
L	LH hydraulic port of the steering ram
LS	Signal
P	Pressure
R	RH hydraulic port of the steering ram
T	Return

Inlet channel

Delivery channel

Return channel

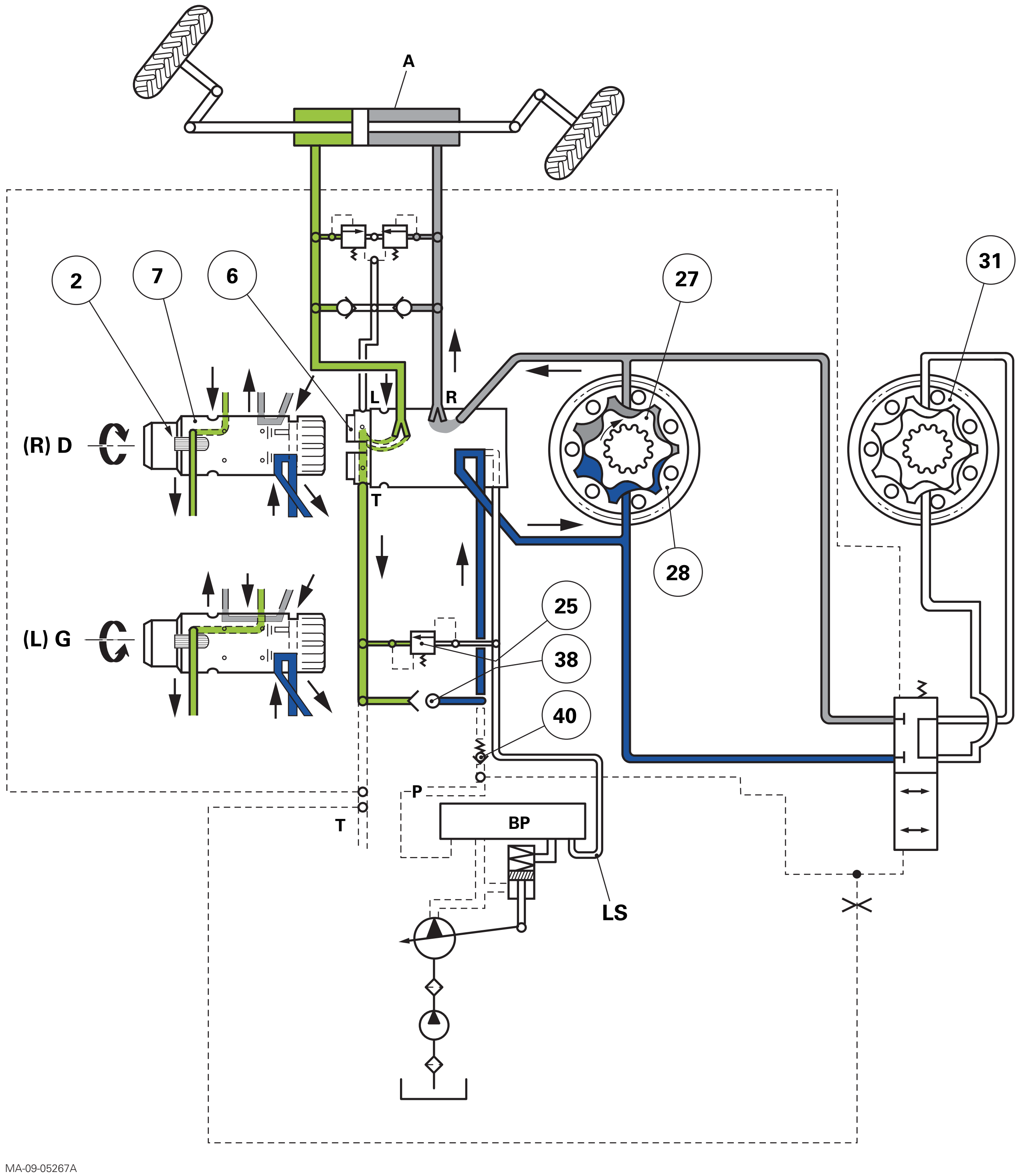


Fig. 9

H . Disassembling - reassembling the Orbitrol steering unit

IMPORTANT: *If the Orbitrol steering unit cannot be repaired, it must be replaced by a new unit with the same properties.*

Disassembly

1. Remove the steering unit from the tractor.

2. Place the steering unit in a vice fitted with plastic jaws.

3. Mark the location of the screws (36) and remove them. Remove seals (20).

4. Take off the closing plate (35), the O'ring (34), the body (19), the integrated spool (18) and spring (33).

5. Remove the O'ring (17). Locate the position of plate (32) and remove it.

6. Remove the O'ring (16). Remove stator (30) and rotor (31). Remove the O'ring (14).

7. Locate the position of plate (13) and remove it.

8. Remove spacer (15), stator (28), rotor (27). Locate the position of plate (11) and remove it. Remove the O'ring (10).

9. Take out the splined link shaft (9).

10. Unscrew the threaded bush and recover the ball from the non-return valve (38).

11. Take out the two axle pins and the balls from the suction valves (41) of the steering unit.

12. Extract the sleeve (6) and spool valve (7) assembly by pushing it out while checking that the pin (5) lies along the horizontal axis.

13. Remove the washers (22) (24), the needle bearing (23) and the bush (3) from the sleeve and spool valve assembly.

Remove the pin (5), and the centring springs (2) by pressing on their ends.

Separate the sleeve (6) from the spool valve (7).

14. Unscrew the plug from the relief valve (25). Using an 8 mm Allen wrench, disassemble the threaded bush and remove the seal, the spring and the valve (the crimped seat cannot be removed).

15. Unscrew the two plugs from the shock valves (37) and remove the seals.

Using a 6 mm Allen wrench, remove the threaded bushes and take out the springs, the valve balls and their seats (the crimped seats cannot be removed).

16. Extract the seal (1) and O'ring (21).

17. Disassemble the non-return valve (40).

Reassembly

18. Check and clean all components. Replace any defective parts. Lubricate the components with clean transmission oil.

19. Reassemble the non-return valve (40).

20. Fit the seal (1) and O'ring (21).

21. Place the valve balls and springs in the recesses of the shock valve (37). Screw in the threaded bushes, fit the seals and tighten the plugs.

22. Fit the valve and spring in the recesses of the relief-valve (25), screw in the threaded bush. Fit the seal and tighten the plug to a torque of 40 - 60 Nm.

23. Insert the spool valve (6) into the sleeve (7).

Position the centring springs (2) according to Fig. 10 and insert the pin (5).

24. Position the bush (3) on the sleeve and spool valve assembly so that the chamfer facilitates assembly in the steering unit.

25. Place the washers (22) (24), the chamfer of washer (24) towards the centring springs (2), by inserting the needle bearing (23) between them.

26. Fit the sleeve and spool valve assembly in the steering unit by oscillating it slightly. Check that the pin (5) is held horizontally.

27. Fit the two valve balls and the two pins in the recesses of the suction valves (41).

28. Fit the valve ball in the recess of the non-return valve (38) and screw in the threaded bush.

29. Position the splined link shaft (9).

30. Fit the O'ring (10) and the distributor plate (11).

31. Fit the rotor (27) so that the two concave depressions C lie along the axis of the slot in the splined link shaft (9) (Fig. 11).

32. Place the O'rings (12)(29) on the stator (28).

33. Align the stator (28) fitting holes with those of the spool valve. Refit the stator on the spool valve without moving the rotor (27).

NOTE: *The rotor (27) and the pin (5) must be in the position shown in Fig. 12.*

34. Fit rotor (31) on the spacer (15) so that the two depressions C lie in the axis of the slot of splined shaft (9) (Fig. 11).

35. Place the O'rings (14)(16) on the stator (30).

Fit and move the stator (30) with an angular movement so that the fixing holes align with those provided in the steering unit.

NOTE: *The rotor (31) and the pin (5) must be in the position shown in Figure Fig. 12.*

36. Refit plate (32) in the position marked at disassembly.

37. Check that there are no scratches on the bore of the body (19) or on the spool rim (18).

38. Check that the spool moves normally in the body.

39. Slide the spool fitted with its oil tightness components into the body. Fit O'rings (17)(34) and spring (33).

40. Refit the cover plate (35).

41. Refit the new seals (20) and screws (36) as marked at disassembly. Alternately tighten the screws to a torque of 30 - 35 Nm.

42. Using a test-bench or a suitable fixture, check the adjustment and correct operation of the steering unit.

43. Refit the steering unit on the tractor.

44. Check the oil tightness of the hydraulic unions.

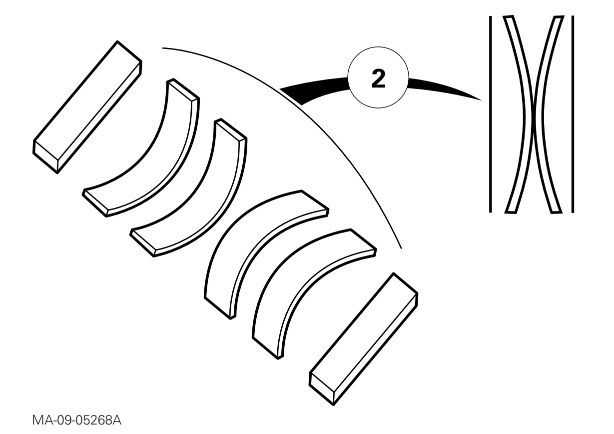


Fig. 10

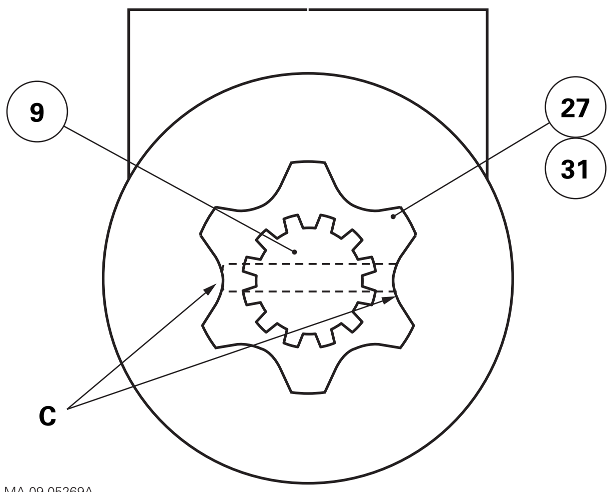


Fig. 11

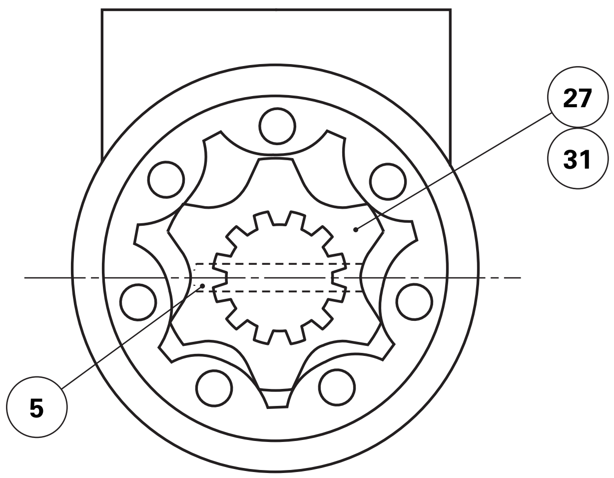


Fig. 12

9L10 - Steering rams

CONTENTS

A . Removing - refitting the 2 WD steering ram

Preliminary operation

1. Immobilise the tractor. Chock the rear wheels. Apply the handbrake.

Removal (Fig. 1)

2. If necessary, remove the front wheel(s). Place one or more safety stand(s).

3. Disconnect and block off the left- and right-hand ram supply hoses, carefully identifying their positions.

4. Drive out the ball joints (1) from the steering arms using a suitable extractor.

5. Loosen the screws (2) (Fig. 1).

6. Remove the ram with its link rods (3) and ball joints (7).

If necessary, split the link rods and O'rings from the ram.

Refitting (Fig. 1)

7. If removed, assemble onto the ram:
- the ball joints (7);
- the link rods (3).

8. Refit the complete ram.

9. Lightly smear the thread of the screws (2) with Loctite 270 or equivalent. Fit and tighten these screws, with their washers, to a torque of 120 Nm.

10. Attach the steering ball joints (1). Fit and tighten their locknut (4) to a torque of 115 - 130 Nm.

11. Reconnect the left- and right-hand ram supply hoses, in their initial positions.

12. If removed, refit the wheel(s). Remove the safety stand(s). Tighten the wheel studs to a torque of 200 - 260 Nm.

Final operation

13. Remove the chocks from the rear wheels.

Carry out a road test on the steering system.

Check the oil tightness of the hydraulic unions.

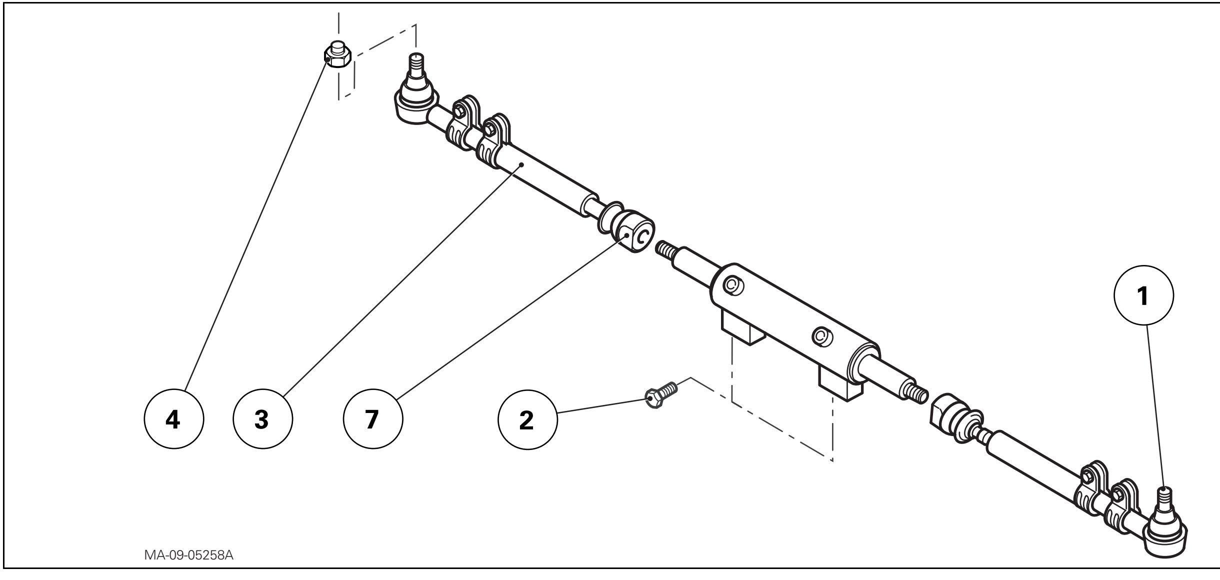


Fig. 1

B . Removing - refitting and disassembling - reassembling the CARRARO 4 WD steering ram

Preliminary operation

14. Immobilise the tractor. Chock the rear wheels. Apply the handbrake.

Removal (Fig. 2)

15. Take off the front left-hand mudguard and wheel. Position a safety stand.

Note: *Removal of the front left-hand mudguard and wheel is recommended to make the extraction of the steering ram easier.*

16. Disconnect and block off the left and right-hand ram supply hoses, carefully identifying their positions.

17. Drive out the ball joints (1) from the steering arms using a suitable extractor.

18. Loosen the screws (2) (Fig. 2).

19. Remove the ram with its link rods (3) and ball joints (7).

If necessary, split the link rods and O'rings from the ram.

Refitting (Fig. 2)

20. If removed, assemble onto the ram:
- the ball joints (7);
- the link rods (3).

21. Refit the complete ram.

22. Lightly smear the thread of the screws (2) with Loctite 270 or equivalent. Insert and tighten these screws, with their washers, to a torque of 120 Nm.

23. Fix the steering ball joints (1). Insert and tighten their locknut (4) to a torque of 220 Nm.

24. Reconnect the left and right-hand ram supply hoses, in their initial positions.

25. If removed, refit the mudguard and wheel. Remove the safety stand. Tighten the wheel nuts to a torque of 640 - 680 Nm.

Disassembly (Fig. 3)

26. Remove the steering ram (see previous operations).

27. Loosen and remove the ball joints (7) using a suitable wrench (Fig. 2).

28. Separate the cover (7) from the cylinder (4).

29. Take out the piston/rod (6) from cylinder.

30. Systematically discard all the sealing rings, seals and dust guards.

Reassembly (Fig. 3)

31. Clean the components. Replace any defective parts.

Important:

Check the surface condition:
- *of the inner cylinder bore;*
- *of the rod/piston functional parts.*

Systematically *discard scratched parts that may lead to steering ram leaks.*

32. Lubricate with clean transmission oil:
- the new rings and joints;
- the inner cylinder bore;
- the rod/piston.

33. Carefully fit the joints on:
- the rod/piston (6);
- the cylinder (4);
- the cover (7).

34. Reassemble the steering ram without damaging the oil tight seals. For this purpose:
- slide the rod/piston, with its seals, into the cylinder;
- put the cover back on the cylinder, with the pressure inlet facing the right direction.

35. Screw on the ball joints (7) (Fig. 2). Tighten to a torque of 300 Nm.

36. Refit the steering ram.

37. If necessary, check the pressure at the ram hydraulic ports (see chapter 9).

Final operations

38. Carry out a road test on the steering system.

39. Check the oil tightness of the ram and hydraulic unions.

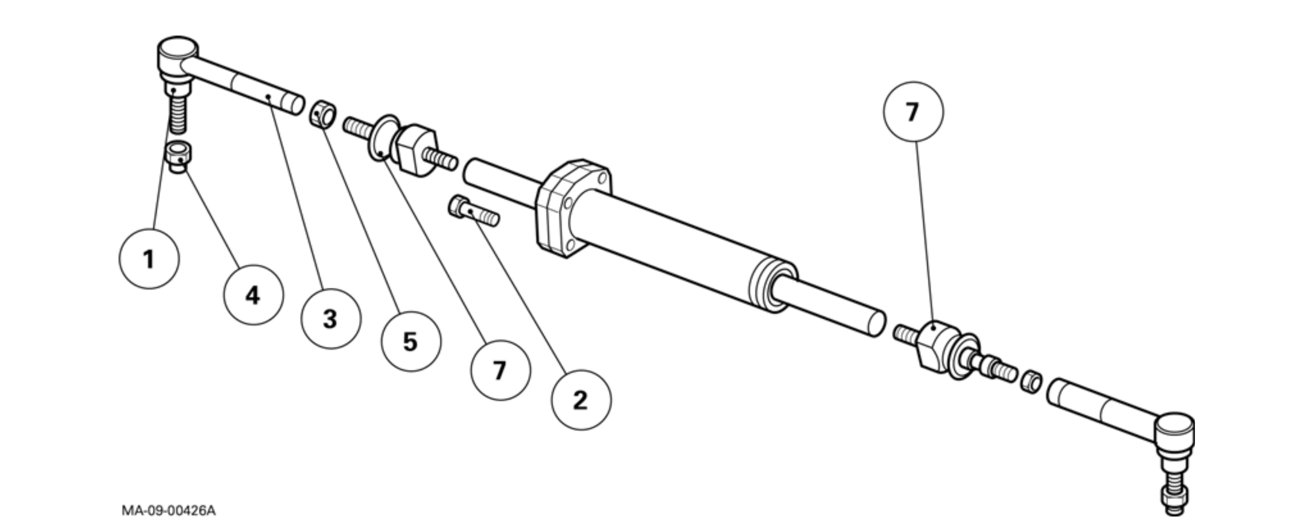


Fig. 2

Parts list (Fig. 3)

(1) Ram assembly
(2) Pack of seals
(4) Cylinder
(6) Rod/piston
(7) Cover

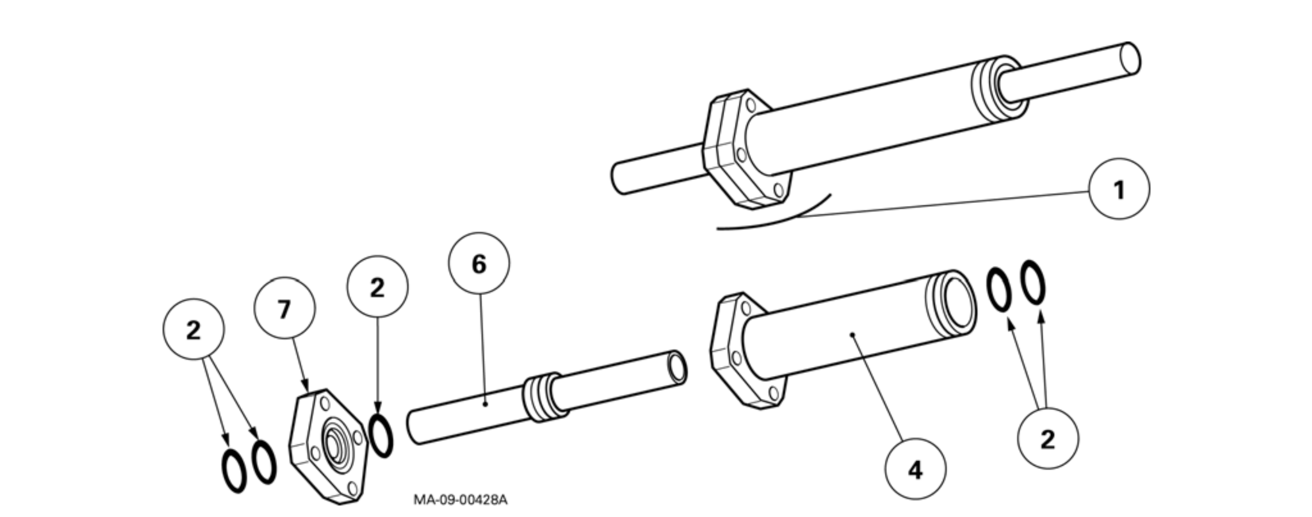


Fig. 3

C . Removing - refitting and disassembling - reassembling the DANA 4 WD steering ram

Preliminary operations

40. Immobilise the tractor. Chock the rear wheels. Apply the handbrake.

41. If access to steering ram fixing screws (2) seems difficult (Fig. 5):
- raise the front of the tractor with a trolley jack placed in the centre of the front axle;
- remove the front wheels;
- place a suitable axle stand beneath the lower engine housing;
- swing the front axle at maximum to high and low positions in order to access the screws.

Removal (Fig. 5)

42. Disconnect and block off the steering ram feed hoses, carefully identifying their positions.

43. Drive out the ball joints (1) from the steering arms using a suitable extractor.

44. Loosen the screws (2) (Fig. 5).

45. Remove the ram.

Refitting (Fig. 5)

46. Refit the ram.

47. Lightly smear the thread of the screws (2) with Loctite 270 or equivalent. Tighten these screws to a torque of 180 - 200 Nm.

48. Fix the steering ball joints (1). Tighten their locknut (4) to a torque of 115 - 130 Nm. Lock the nuts (4) using new pins.

49. Reconnect the steering ram supply hoses, in their initial positions.

50. If removed, refit the wheels. Tighten the wheel nuts to a torque of 400 - 450 Nm.

Disassembly (Fig. 4)

Note: *DANA front axles are fitted with a double acting steering ram. It receives pressure from the steering unit as a function of the rotation of the steering wheel.*

When one side of the ram is fed, the other is connected to the return pipes and vice versa.

Each component can be replaced and is listed in the spare parts catalogue.

A pack provides all the seals necessary for carrying out service operations.

51. Remove the steering ram (see previous operations).

52. Release and remove the ball joints (7) (Fig. 5).

53. Take off the lock rings (5) using a suitable locally made tool, while simultaneously turning the guide rings (3).

54. Take out the piston rod (6) from cylinder (4).

55. Discard all the seals (sealing ring, O'rings, dust guards and lock rings).

Reassembly (Fig. 4)

56. Clean the components. Replace any defective parts.

Important:

Check the surface condition:
- *of the inner cylinder bore;*
- *of the rod/piston functional parts.*

Systematically *discard scratched parts that may lead to steering ram leaks.*

57. Lubricate with clean transmission oil:
- the O'rings;
- the rings;
- the inner cylinder bore.

58. Fit the concerned seals on:
- the rod/piston (6);
- the guide rings (3).

59. Slide the piston rod fitted with its seals in the cylinder bore.

60. Fit the guide rings at each end of the cylinder, taking care not to damage the lip of the sealing rings.

61. Position the machined groove of each guide ring opposite the cylinder groove. Turn the guide rings while simultaneously slipping in the lock rings.

62. Tighten and lock the ball joints (7) (Fig. 5) to a torque of 120 - 150 Nm, the threads previously smeared with Loctite 270 or equivalent.

63. Refit the steering ram on the tractor.

64. Check the ram supply and tightness.

Final operation

65. Carry out a road test on the steering system.

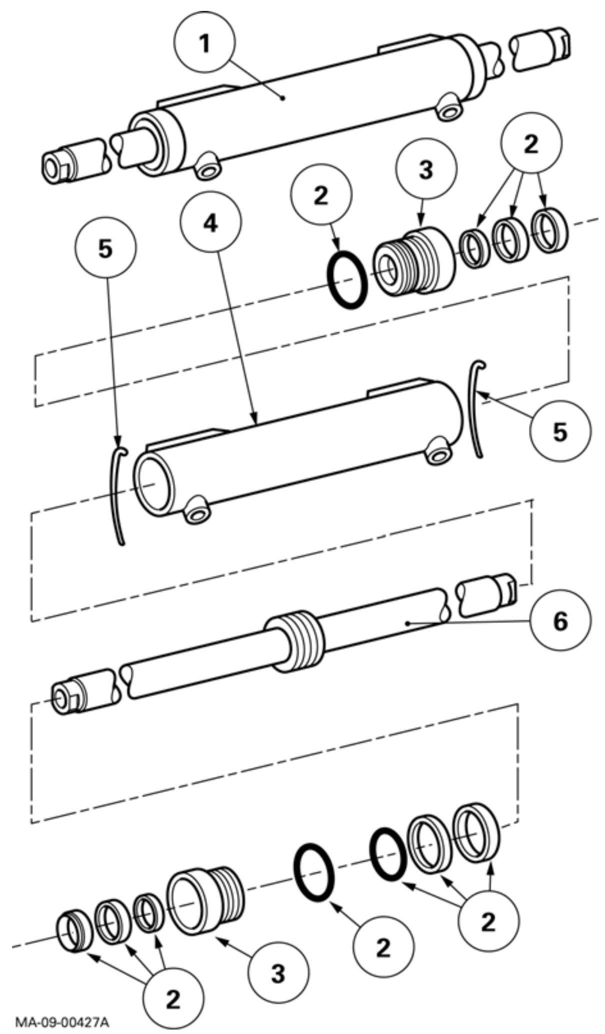


Fig. 4

Parts list (Fig. 4)

(1) Ram assembly
(2) Pack of seals
(3) Guide rings
(4) Cylinder
(5) Lock rings

(6) Rod/piston

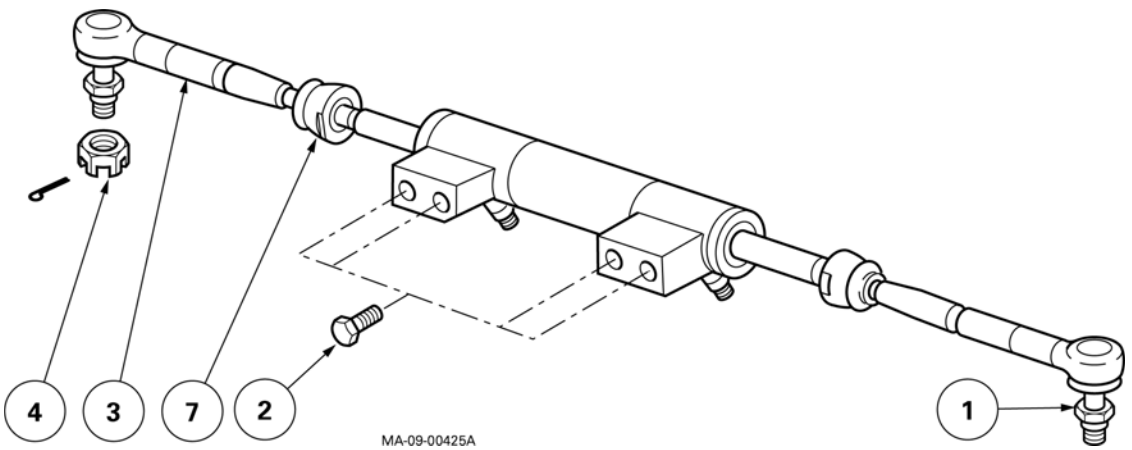


Fig. 5

9M10 - 17 bar valve - Open Centre

CONTENTS

A . General

The 17 bar valve (2) (Fig. 1) is screwed onto the left-hand hydraulic cover. It performs the following functions:

- it supplies oil and maintains pressure in the 17 bar low pressure circuit
- it supplies the cooling system (5 bar) and lubricating system (1.5 bar).

Parts list

(2) 17 bar valve
(3) O'ring
(4) Plug
(5) Spring
(6) Ball
(7) Spool
(8) Shim(s)
(9) Spring
(10) O'ring
(11) Seal
(12) Plug
(13) Valve sleeve

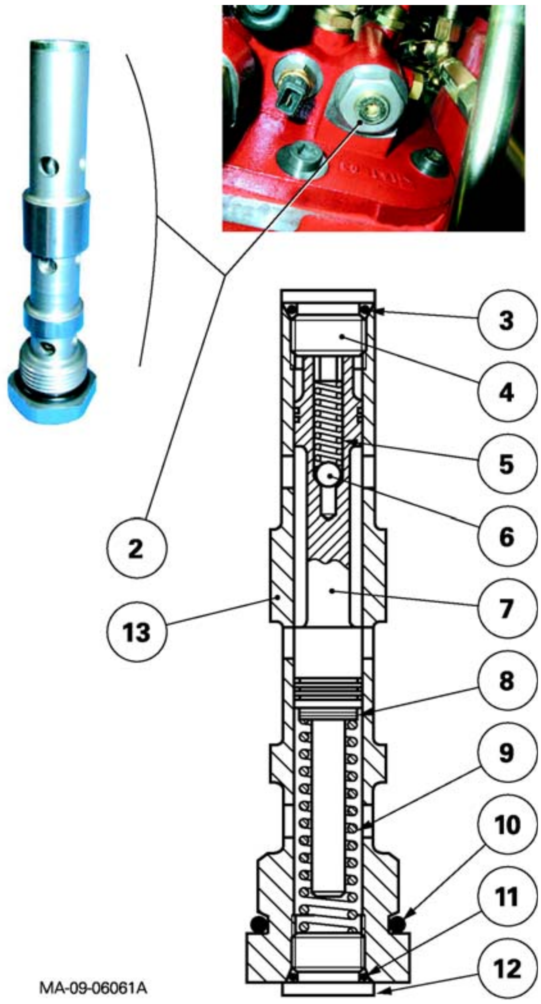


Fig. 1

17 bar valve - Open Centre

Identification of ports (Fig. 2)

G Brake master cylinder booster (excluding Meritor type)
O Valve supply via the steering spool valve return (Orbitrol)
P Outlet to low pressure parts
R1 Return (1.5 bar valve)
BV Lubrication to 1.5 bar valve (cold oil)
RR Lubrication - cooling system return
VR Lubrication to cooling system
PDF Lubricating line to rear PTO

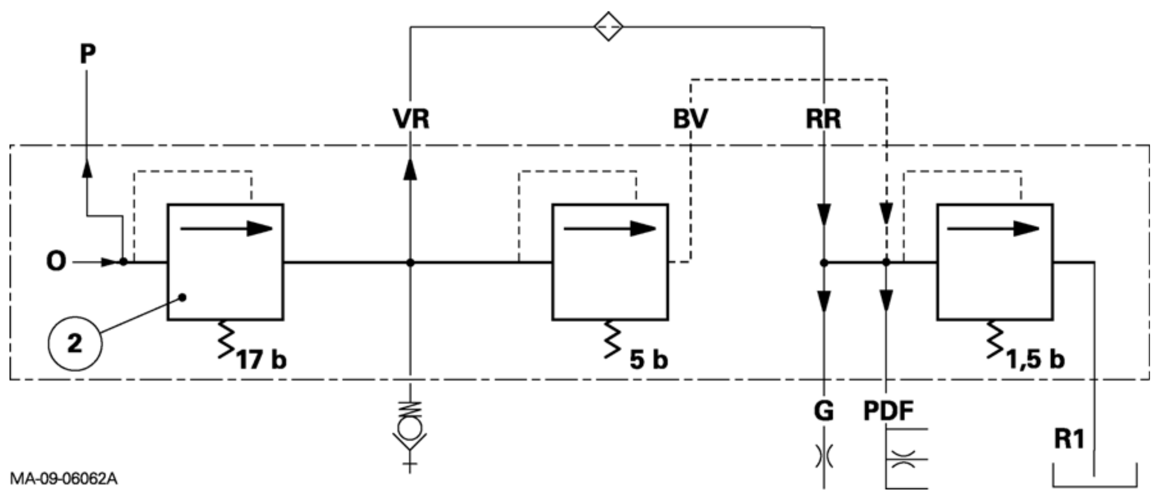


Fig. 2

B . Description of the 17 bar low pressure valve

Supply (Fig. 3)

As soon as the engine is started, the return oil from the steering unit (Orbitrol) enters port O and exits by port P of the left-hand cover; then it is directed towards the low pressure circuit of the right-hand hydraulic cover in order to supply:

- power shuttle (if fitted)
- dynashift unit
- changing between Hare / Tortoise range
- 4WD clutch
- front and rear differential locks
- rear PTO brake and clutch
- front power take off (if fitted).

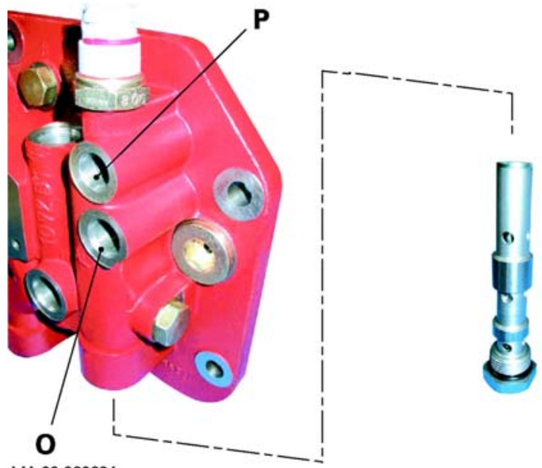


Fig. 3

Operation (Fig. 4)

A back pressure is generated in the low pressure circuit, forcing the ball (6) from its seating and thereby compressing the spring (5). The oil passes into the rear of the spool (7), creating a pressure which progressively moves it downwards by compressing the spring (9) which thrusts against the shims (8).

When one of the low pressure functions is activated, the momentary drop in pressure returns the ball (6) to its seating through the action of the spring (5). The oil contained in the chamber at the front of the plug (4) flows through a drain port located at the end of the spool (7).

Leaks return to the housing via port R in the cover (Fig. 5).

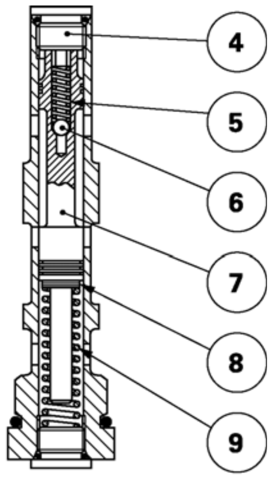


Fig. 4

Identification of components and ports (Fig. 5)

(1) 17 bar low pressure switch
(2) Plug (provision for outlet).
O Valve supply via the steering spool valve return (Orbitrol)
P Outlet to low pressure parts of the right-hand hydraulic cover
R Return port

Legend

17 bar low pressure

C . Removing - refitting and disassembling - reassembling the 17 bar valve

Remark

It is not necessary to remove the left-hand hydraulic cover to carry out work on the valve.

Removal

1. Remove any parts around the valve that may obstruct work.
2. Remove and separate the valve (2) from the left-hand hydraulic cover (Fig. 1).

Refitting

3. Check the condition of the O'ring (10) and replace if necessary.
4. Screw the valve back onto the cover and tighten to 40 - 55 Nm.

Disassembly (Fig. 6)

Reminder

The valve comprises several hydraulic parts (spool, springs and ball) which cannot be replaced separately.

5. Remove the O'ring (10).
6. Tighten the hexagonal head of the valve in a vice with protective jaws.
7. Gradually unscrew the plug (12) and discard the O'ring (11).
8. Recover:
   - spring (9),
   - shim(s) (8).
9. Gradually unscrew the plug (4) and discard the O'ring (3).
10. Recover:
    - spring (5)
    - ball (6).
11. Remove the spool (7) by carefully tapping the shaft (13) against a wooden shim.

Reassembly

Remark

The hydraulic parts must be reassembled on a clean work surface clear of filings and dirt.

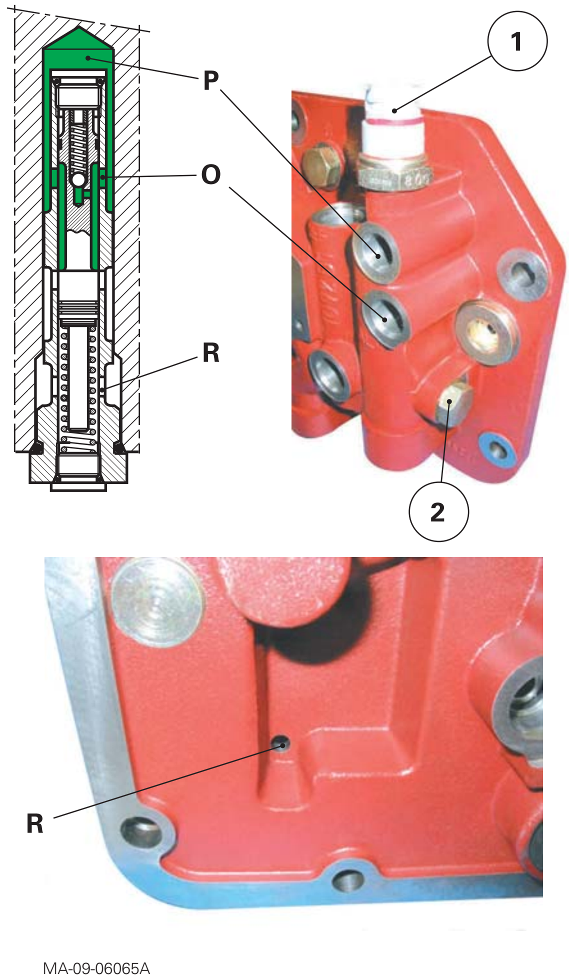


Fig. 5

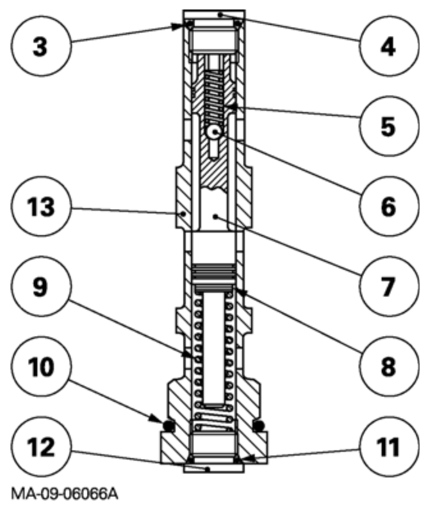


Fig. 6

12. Check:
- the condition of the springs and O'rings
- the absence of scratches or seizing on the moving parts of the valve
- the sliding of the spool in its sleeve
- the cleanliness of the ports.

Conclusion

If the valve is defective, replace it. If not, reassemble it by carrying out the disassembly operations in reverse order.

D . Adjusting the 17 bar valve

Remarks

- It is not necessary to remove the left-hand hydraulic cover to adjust the valve.
- When the valve is removed, it can be adjusted inserting shims (8) between the spool (7) and the spring (9).

E . Operation of the cooling system

The pressure acting on the back of the spool (7) pushes it towards the bottom of the valve, pressing in the spring (9) (Fig. 4). It then allows oil to pas to port VR (Fig. 7) and the cooler. When it leaves the cooler, the oil is directed to the transmission lubricating system via the 1.5 bar valve.

5 bar valve

When the oil is cold, the 5 bar valve (1) (2) (3) (Fig. 7) opens partially. It then allows some oil to pass directly to port BV of the left-hand cover (Fig. 7), and to supply the transmission lubricating system, without really entering the cooler.

Legend

17 bar low pressure

Return to the housing via the cover

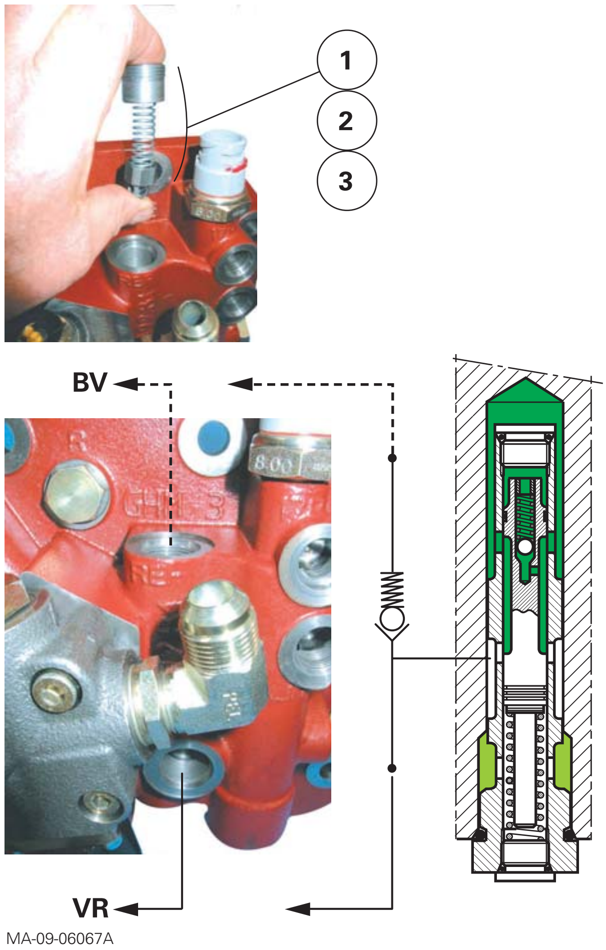


Fig. 7

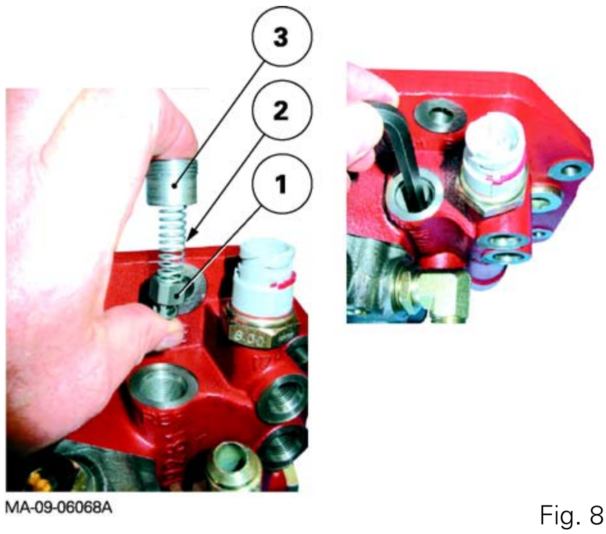


Fig. 8

F . Assembling the 5 bar valve

Remark

It is not necessary to remove the left-hand hydraulic cover to carry out work on the valve.

13. Remove the pipe and union.
14. Place the valve (1), spring (2) and threaded ring (3) in the cover (Fig. 8).
15. Compress the spring, tightening the threaded bush until it reaches a "hard point" (Fig. 8 - the bush has reached the cover shoulder).
16. After assembly, check that free movement of the valve and the compression of the spring, entering a screwdriver through the port provided for screwing in the temperature switch, located on the lower part of the cover.

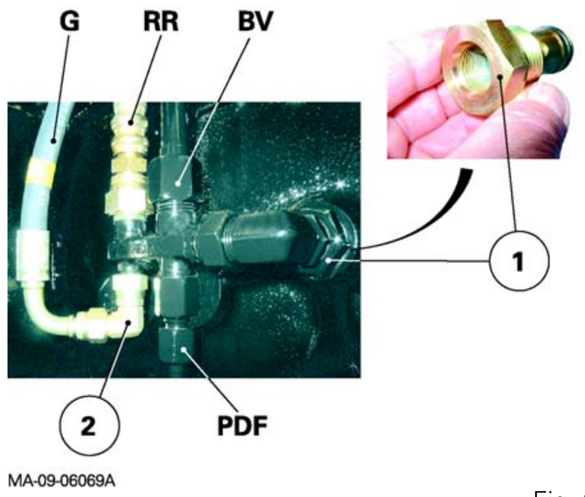


Fig. 9

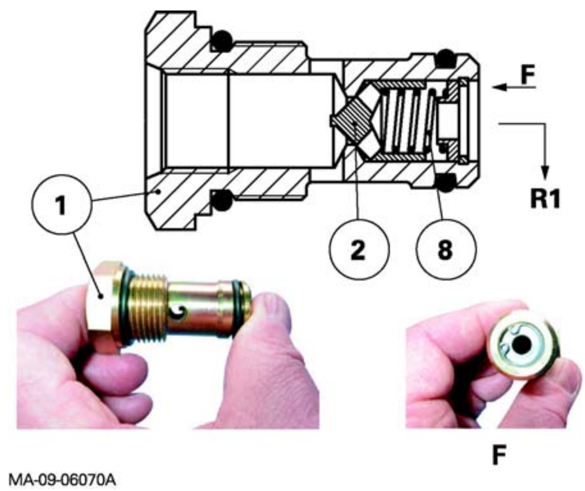


Fig. 10

G . Description of the 1.5 bar lubricating valve

Location

The 1.5 bar valve (1) is hidden behind the fuel tank, and is located at the front left-hand side of the gearbox (Fig. 9).

Operation

It controls the oil coming from the cooling circuit, and maintains a lubricating pressure of approximately 1.5 bar in the circuit, due to the valve setting. If the pressure exceeds 1.5 bar, the spring (8) compresses, the valve (2) moves and oil flows to the return R1 (Fig. 10).

Reminder

For identification of pipes and hoses (see § A).

Remarks

- When the requirements of the low pressure circuit are met, oil is channelled towards the booster port of the brake master cylinders in order to ensure a constant oil level.
- Considering the available hydraulic options, other assemblies can be carried out on the union (2) (Fig. 9). Example: Front PTO - Meritor brake master cylinders)

H . Removing - refitting and disassembling - reassembling the 1.5 bar valve

Removal (Fig. 11)

17. Remove the part(s) that may obstruct work on the valve (1).
18. Mark and disconnect the pipes (5) (6), hoses (7) (8) and unions (2) (3) (4).
19. Remove the housing valve from the gearbox.

Refitting

20. Replace the O'rings if necessary.
21. Refit the valve, unions, hoses and pipes.
22. Replace any part(s) removed at operation 17.

Disassembly

23. Take off circlip (5). Remove the bush (2), spring (3) and valve (4) from the valve body (6).

Reassembly

Reminder (Fig. 12)

The valve (1) consists of several hydraulic parts (valve, spring) listed in the spare parts catalogue.

24. Check that the hydraulic parts are clean.
25. Reassemble the valve, carrying out operation 23 in reverse order.
26. Manually check the free movement of the valve.

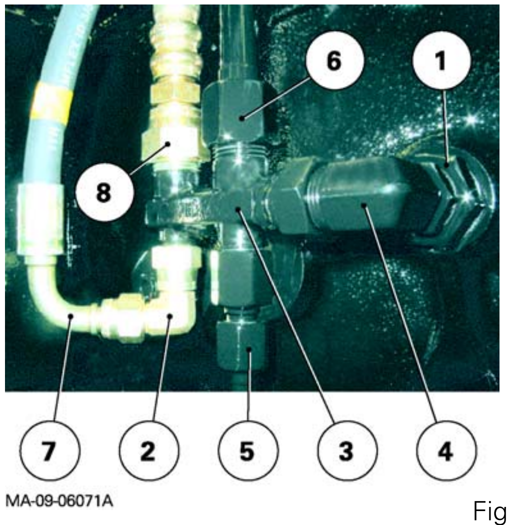


Fig. 11

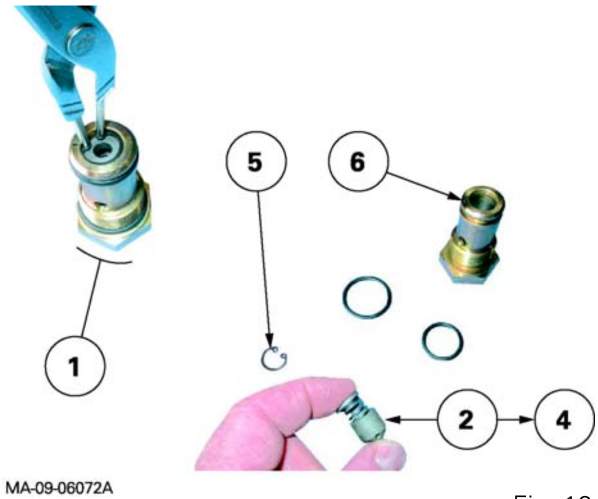


Fig. 12

9M20 - 17 bar twin flow load sensing valve

CONTENTS

A . General

The left-hand cover (1), fixed to the gearbox (Fig. 1), distributes the low pressure supply (17 bar (B), 5 bar (A)) to the appropriate functions on the tractor.

In this section, the description is limited to one function of the left-hand cover, namely the oil supply and the keeping under pressure of the 17 bar valve.

For the other functions, such as lubrication, cooling and topping up the brake and clutch master cylinders (if fitted), see chapter 9.

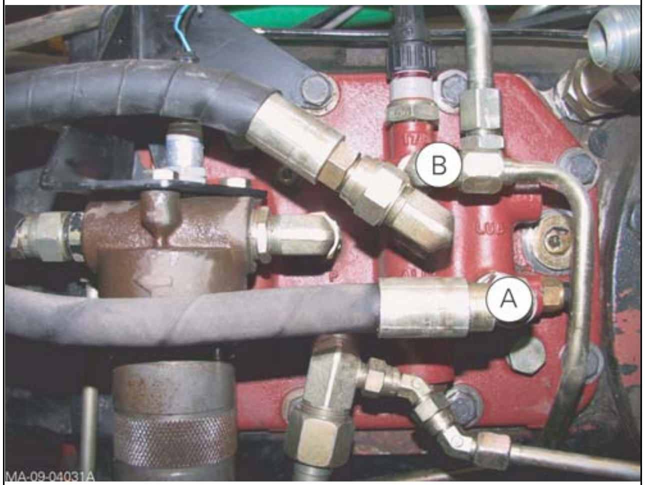
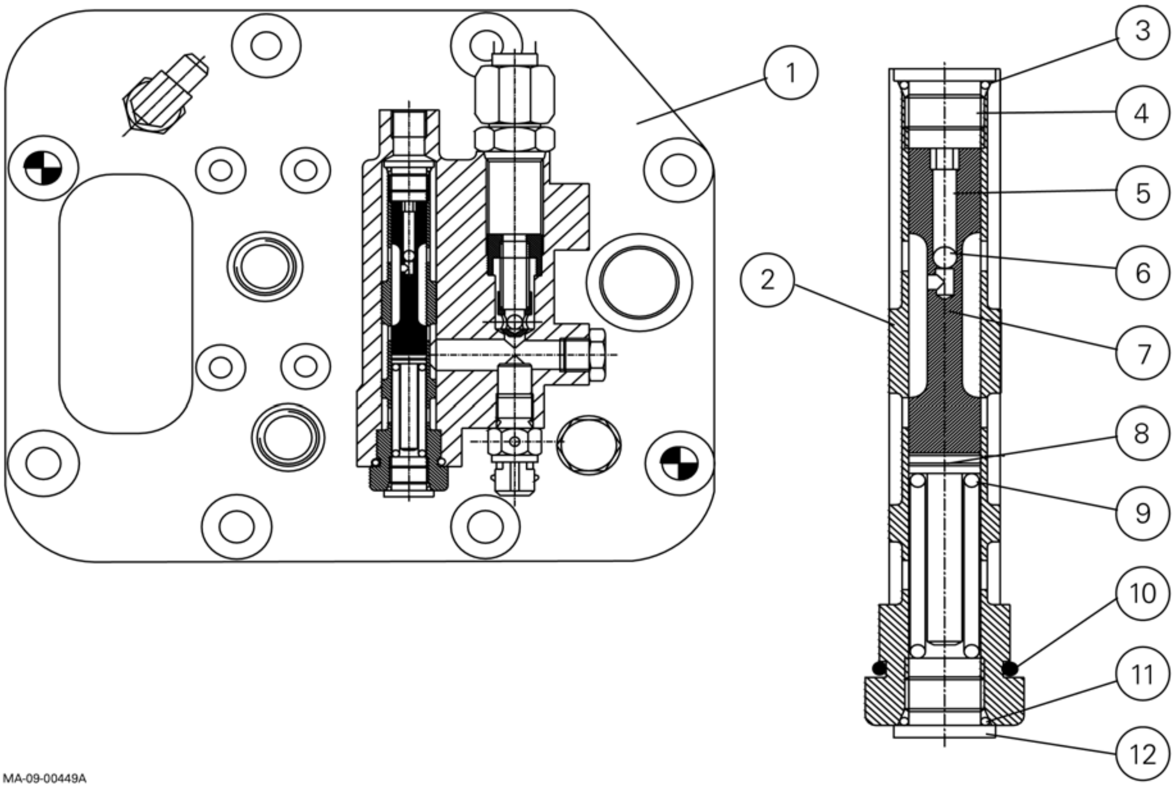


Fig. 1



Parts list

(1) Left-hand cover
(2) 17 bar valve
(3) O'ring
(4) Plug
(5) Spring
(6) Ball
(7) Spool
(8) Shim(s)
(9) Spring
(10) O'ring
(11) Seal
(12) Plug

Fig. 2

B . Identification of ports

Parts list

O : Supply from Orbitrol

P : 17 bar outlet to the right-hand hydraulic cover and low pressure components

R : Return (plug or union depending on options)

VR : Lubrication (to oil cooler, see chapter 9)

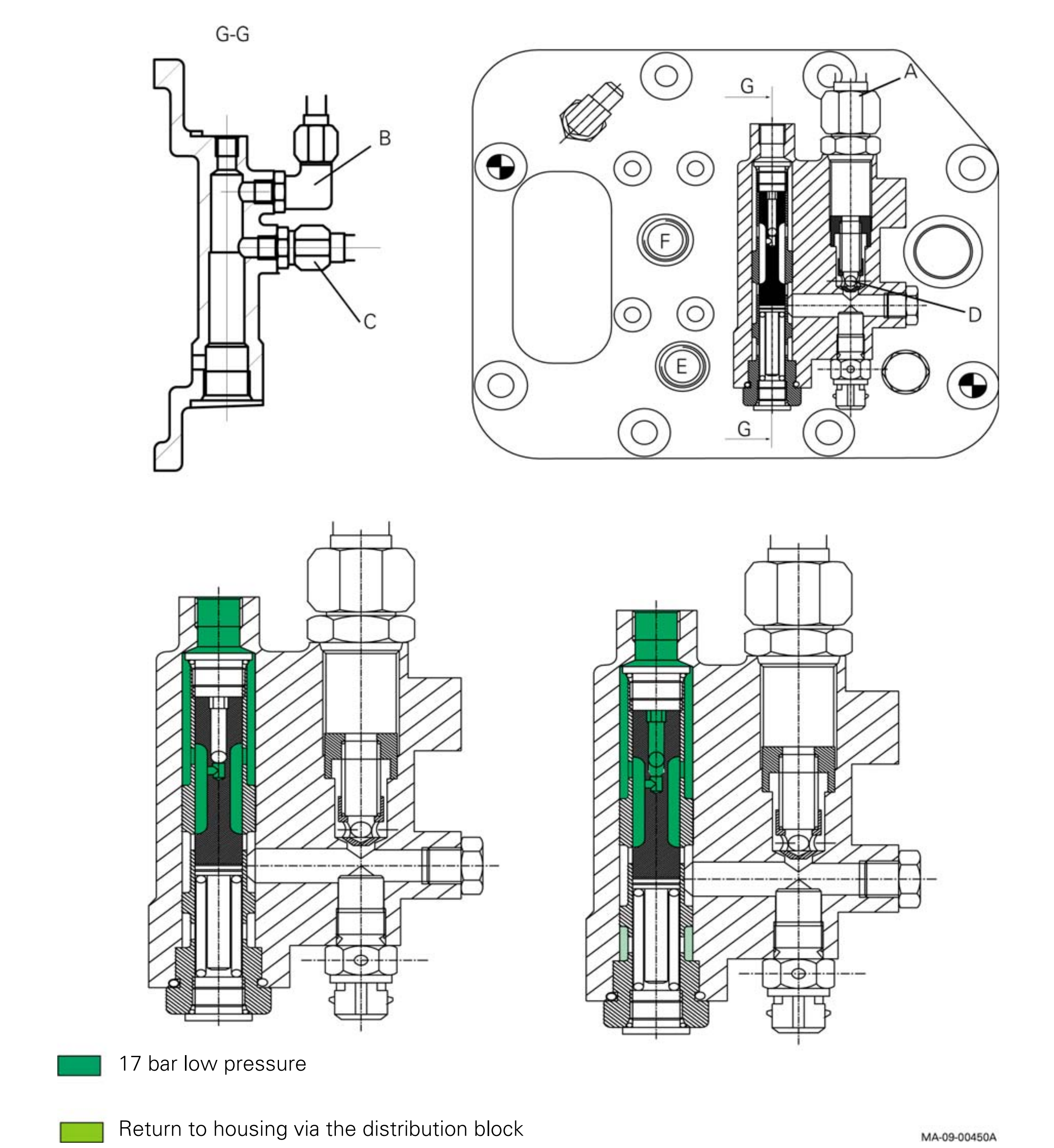


Fig. 3

C . Operation (Fig. 2 to Fig. 3)

As soon as the engine is started, the return oil from the steering unit (Orbitrol) enters port C and exits by port B towards the low pressure circuit of the right-hand hydraulic cover in order to supply:

- power shuttle (if fitted)
- Dynashift gearbox (depending on version)
- pressure loaded clutch or the spring loaded clutch pedal servo assistance (depending on version)
- changing between Hare / Tortoise range
- 4WD clutch
- front and rear differential lock
- PTO clutch
- PTO brake
- front PTO (if fitted).

A back pressure is generated in the circuit, forcing the ball (6) from its seating and thereby compressing the spring (5). The oil passes into the rear of the spool (7), creating a pressure which progressively moves it downwards by compressing the spring (9) which thrusts against the shims (8).

When one of the low pressure functions is activated, the momentary drop in pressure returns the ball (6) to its seating through the action of the spring (5). The oil contained in the chamber at the front of the plug (4) flows through a drain port located at the end of the spool (7).

The leaks return to the gearbox housing via channel D.

D . Removing and refitting the 17 bar valve

Removal (Fig. 1 - Fig. 2)

As the valve is incorporated into the cover, several precautions must be taken when removing it:

1. Handle the parts in a clean environment free of iron filings, and make a visual note of the position of components at disassembly.

   Special points

   - The correct adjustment of the valve is obtained using shims (8) which are fitted between the spool (7) and the spring (9).

Refitting (Fig. 1 - Fig. 2)

2. Check that both the spool (7) and its bore are free from scratches that could prevent it from functioning correctly.
3. Check that the spool (7) slides freely in the valve body and that the ball (6) is correctly seated. Also check the condition of the springs.
4. Refit the O'ring (10).
5. Tighten valve (2) to a torque of 40 - 55 Nm.

E . Final operation

6. Carry out the hydraulic tests relevant to the low pressure circuit (see section 9L03).

9N10 - GBA20 Power Shuttle control unit

CONTENTS

A . General

The unit (1) fixed to the right-hand side and front of the gearbox (Fig. 1) carries out two hydraulic functions quite separate to the input unit.

It controls:

- the power shuttle,
- the Dynashift.

The channels and ducts machined in the unit allow oil under pressure to be directed to the reverse shuttle proportional solenoid valves and the Dynashift solenoid valves EV1 and EV2.

All solenoid valves are controlled respectively by the tractor electronic system.

A 60 micron filter element (8) (Fig. 1) is located under the right-hand hydraulic cover, upstream from the control unit. This additional filter supplies clean oil to the spool of each solenoid valve.

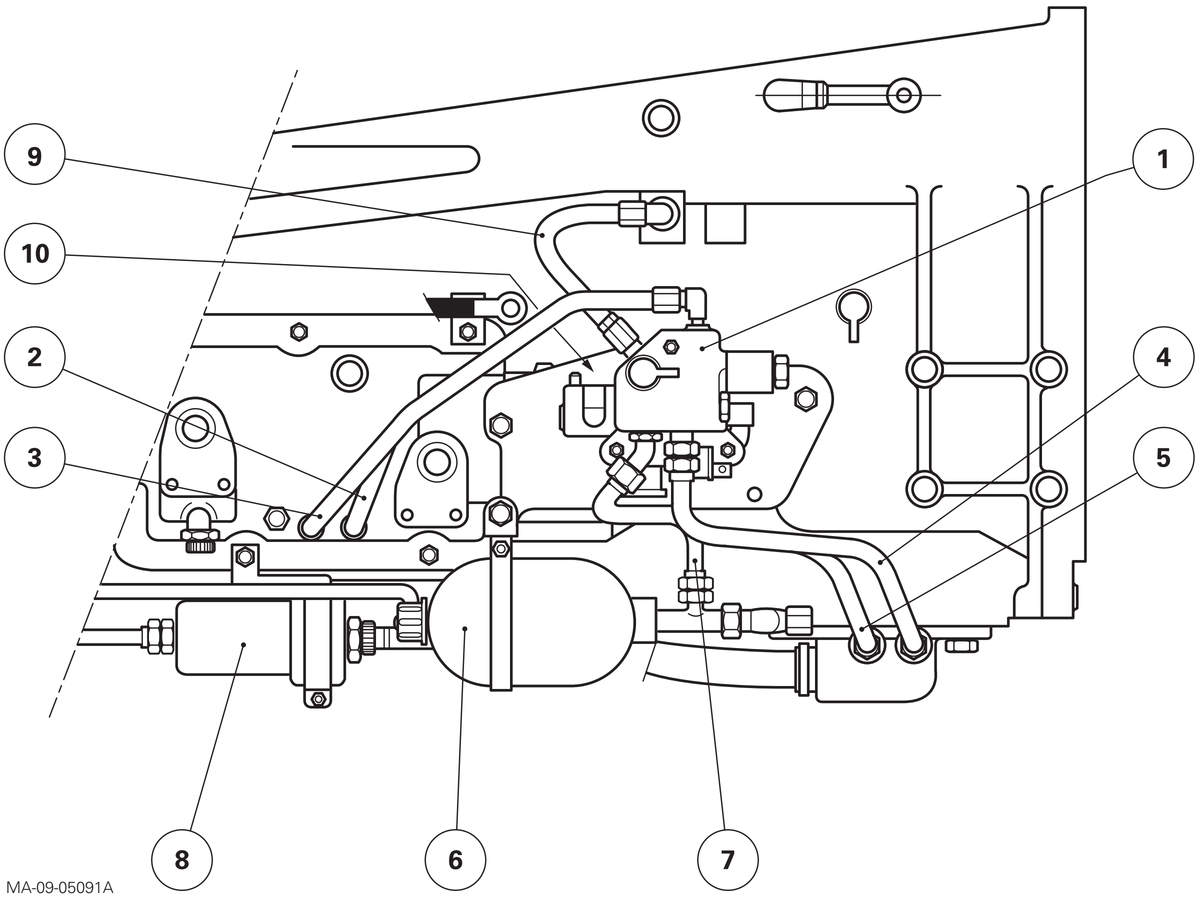


Fig. 1

B . Presentation of control unit and hydraulic lines

Parts list (Fig. 2)

(1) Control unit
(2) Return to reverse clutch housing
(3) Return to forward clutch housing
(4) Reverse shuttle: 17 bar supply line to forward clutch
(5) Reverse shuttle: 17 bar supply line to reverse clutch
(6) Accumulator (Nitrogen)
(7) Main 17 bar supply line
(8) 60 micron filter element
(9) Dynashift: to internal forward clutch line (17 bar)
(10) Dynashift: to internal reverse clutch line (17 bar)

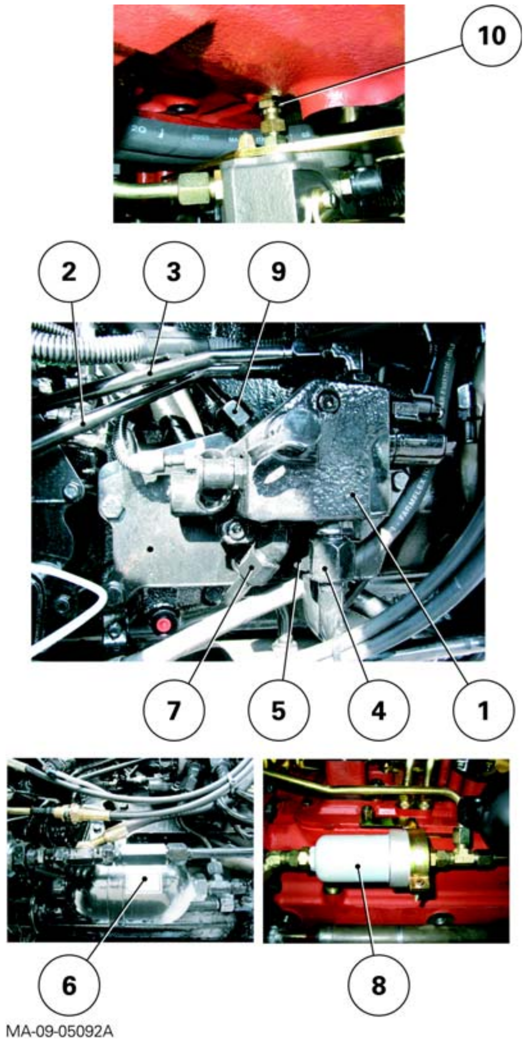


Fig. 2

C . Control of the Power Shuttle

Identification of ports on control unit (Fig. 3).

(1) Control unit
(2) Return to reverse clutch housing
(3) Return to forward clutch housing
(4) Pressure outlet to forward clutch
(5) Pressure outlet to reverse clutch
(7) Control unit main supply (17 bar)
(13) Control unit pressure connector
(14) Reverse clutch pressure connector
(15) Forward clutch pressure connector

Remark

Each of the hydraulic return lines of the proportional solenoid valves (11) and (12) (Fig. 3) has separate channels. This design avoids any back pressure from one solenoid valve to another.

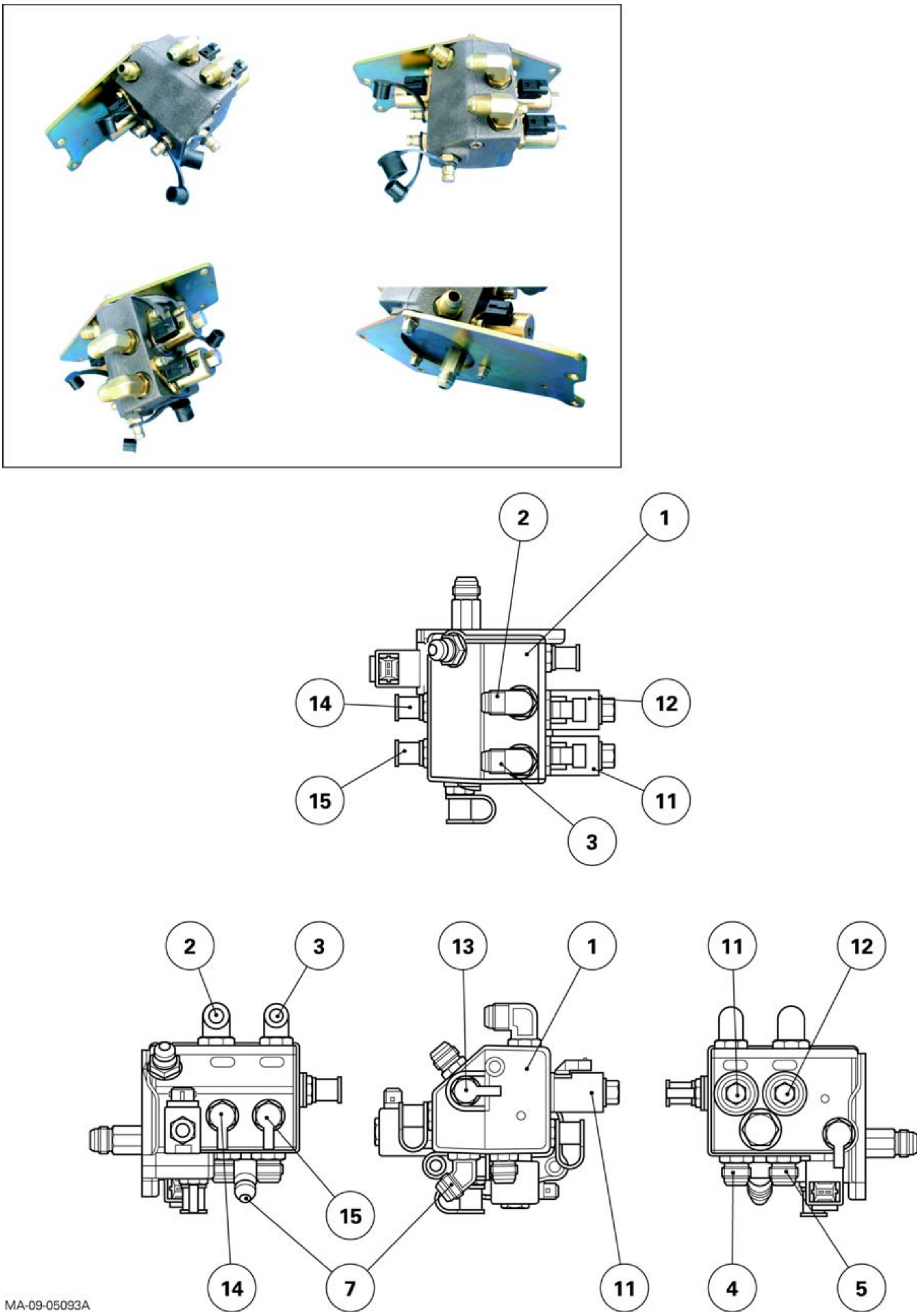


Fig. 3

Proportional solenoid valve

Removal (Fig. 4)

1. Remove flange (1).
2. Drive off the solenoid valve (11) or (12) by gently applying pressure with a screwdriver between the valve and the unit.

Refitting

3. Check the condition and cleanliness of the O’rings fitted on the solenoid valve.
4. Position and manually drive the solenoid valve into its housing, beyond the point of resistance (O’rings squeezing).
5. Position the flange.
   Tighten the screw from 8 to 11 Nm.

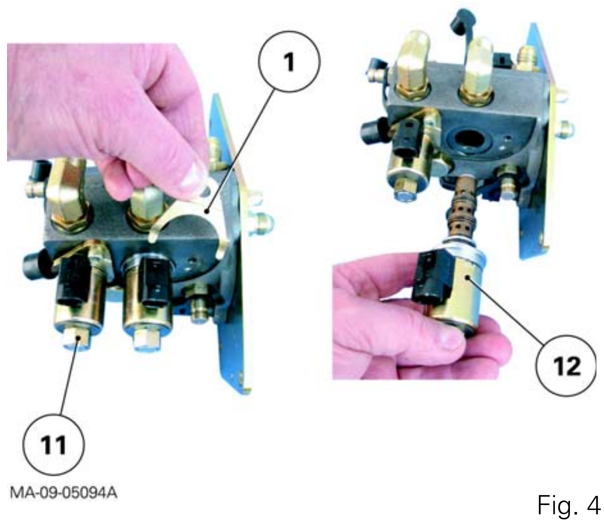


Fig. 4

Identification of ports on a proportional solenoid valve (Fig. 5)

A: Clutch supply ports
B: Clutch return ports
P: 17 bar pressure

Electrical connection (Fig. 5)

C: Solenoid supply

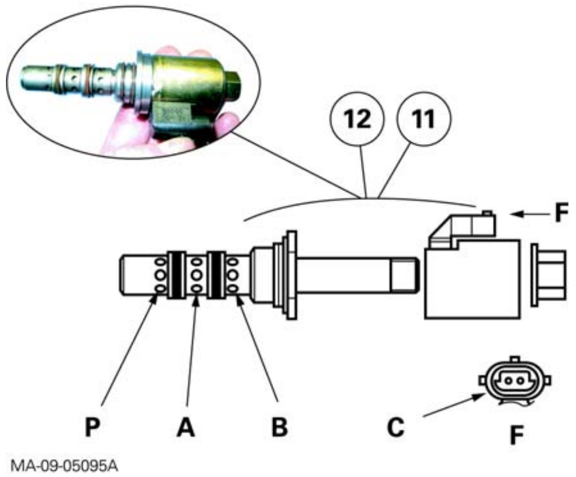


Fig. 5

D . Dynashift **control**

Identification of ports on control unit (Fig. 7 and Fig. 8)

(1) Control unit
(9) Pressure outlet to forward clutch
(10) Pressure outlet to reverse clutch
(16) Forward clutch pressure connector
(17) Reverse clutch pressure connector

Reminder

In the control unit, the Dynashift part includes two internal channels A and B (Fig. 6) which allow oil to circulate from one solenoid valve to the other.

The four Dynashift ratios are managed by two solenoid valves.

Characteristics of the solenoid valves (Fig. 9)

Solenoid valve	Characteristics
Low EV1 (4 x 2) solenoid valve	4 ports 2 positions
High EV2 (3 x 2) solenoid valve	3 ports 2 positions

Identification of ports (Fig. 9)

C: To port F
D: Non-return valve
E: Port to front piston
F: Port to rear piston
P: 17 bar pressure
R Return

Remark

The removal and refitting procedure for solenoid valves EV1 and EV2 is the same as that for a proportional solenoid valve (see § C).

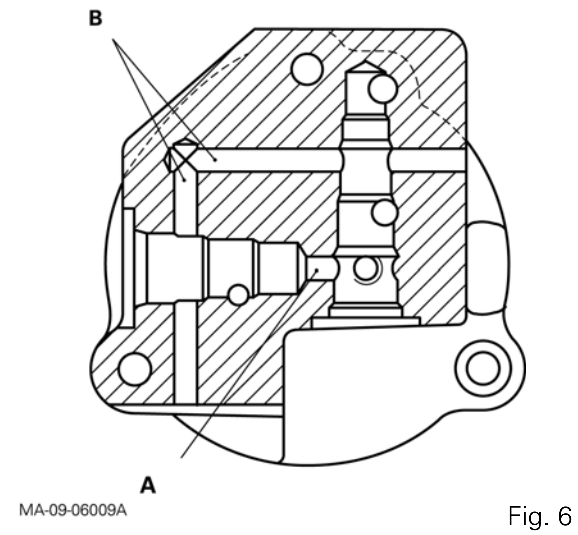


Fig. 6

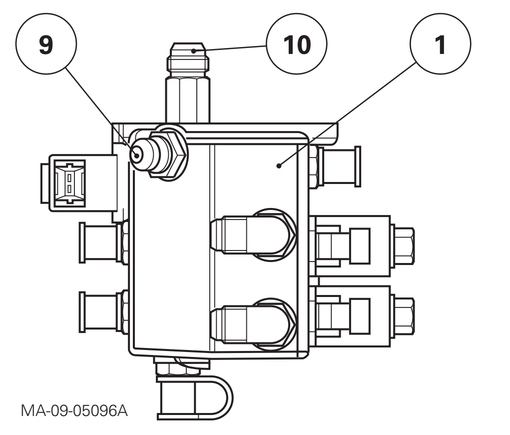


Fig. 7

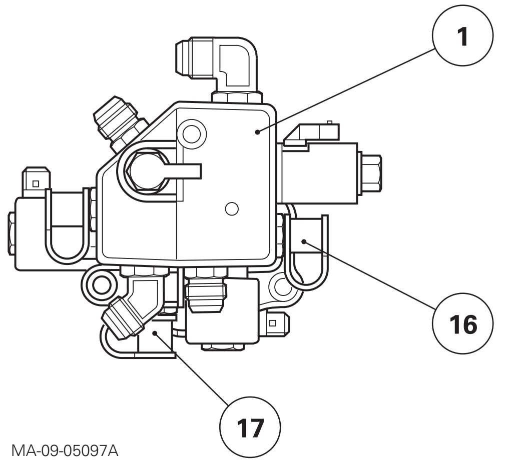


Fig. 8

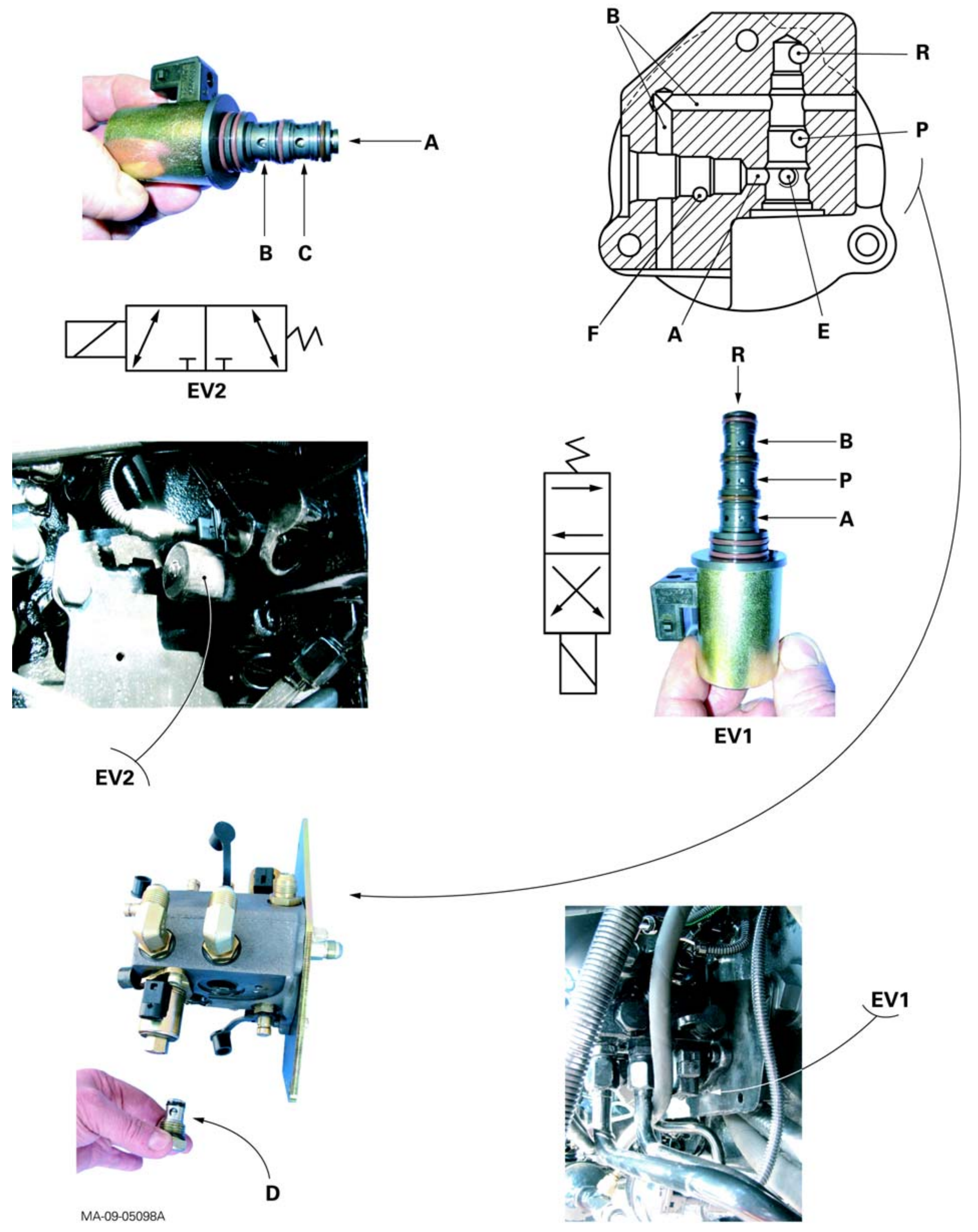


Fig. 9

E . Explanation of Dynashift ratios

Reminder

For design operation and mechanical explanation of ratios, see chapter 5.

Ratio A (Fig. 10)

Ratio A is obtained when solenoid valve EV1 is supplied. Oil under pressure can also reach channel A. Channel A directs the oil to the front piston via port E and to solenoid valve EV2. As this is in neutral position, the oil can pass through the spool and port F to the chamber of the rear piston. The two pistons are therefore under pressure.

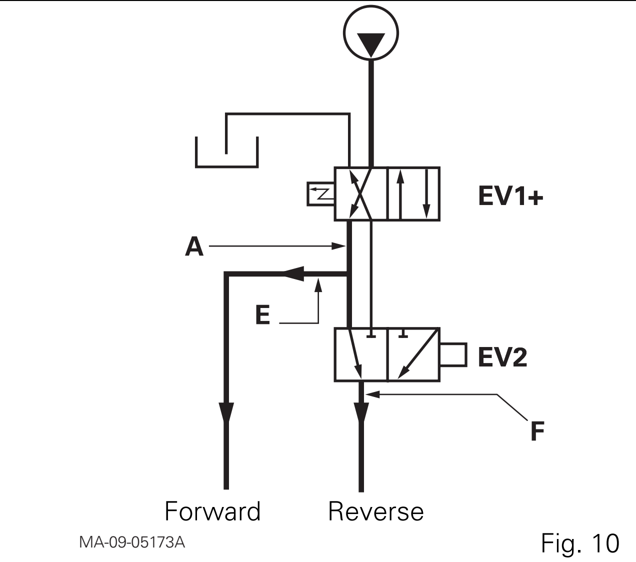


Fig. 10

Ratio B (Fig. 11)

Ratio B is obtained when the two solenoid valves are supplied. Therefore the flow of oil to the rear piston is interrupted. The rear piston is pushed out by springs which send the oil into channel B. This channel is joined to the housing by solenoid valve EV1.

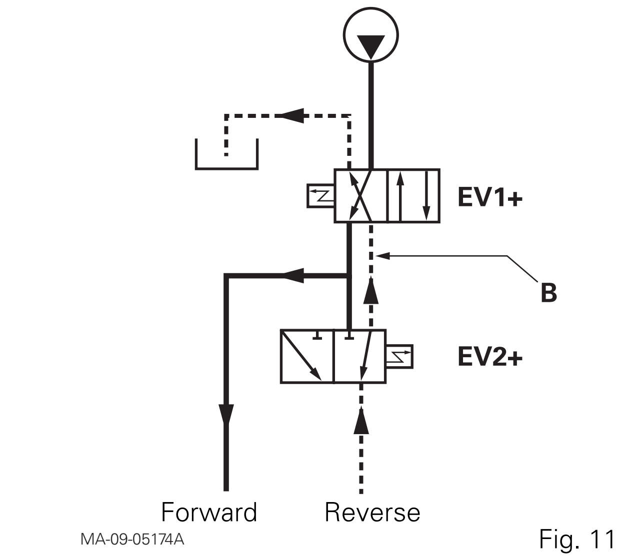


Fig. 11

Ratio C (Fig. 12)

Ratio C is obtained by switching off solenoid valve EV1, while maintaining solenoid valve EV2 under voltage. Channel A is no longer pressurised but is connected to the housing. As a result, the front piston can return to neutral position. Channel B is under pressure. The oil flows to the rear piston via solenoid valve EV2.

Ratio D (Fig. 13)

Ratio D is obtained by switching off EV2. The two solenoid valves are at rest. The two pistons are connected to the housing via channel A.

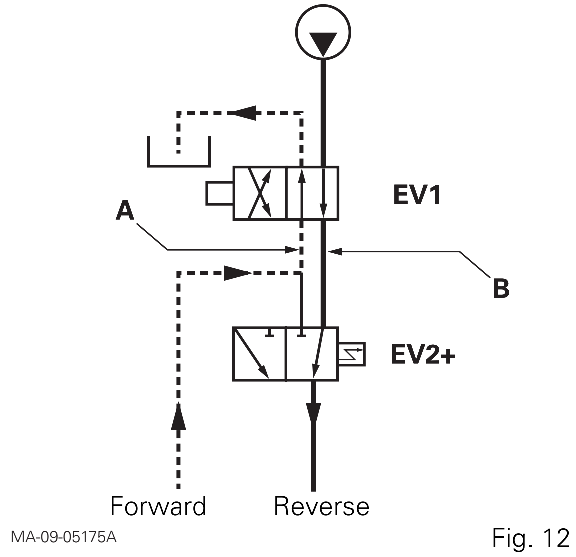


Fig. 12

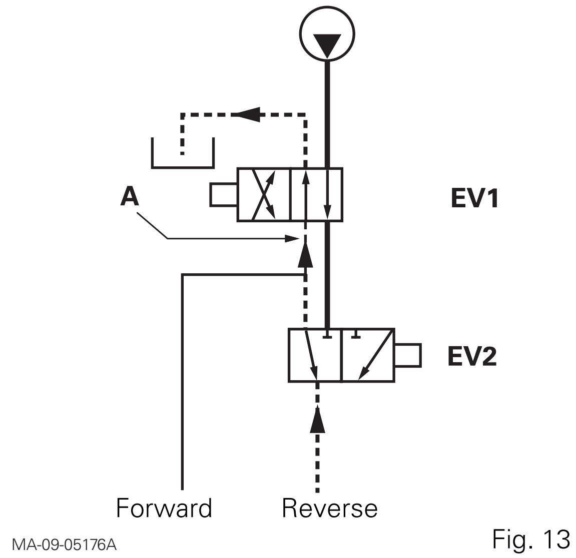


Fig. 13

F . Removing - Refitting the control unit

If you work on the 17 bar hydraulic circuit immediately after stopping the engine, release the pressure stored in the accumulator or wait a while before working on the circuit.

Removal

6. Mark and disconnect the connectors on solenoid valves EV1 and EV2 of the Dynashift (Fig. 9) as well as those of the proportional solenoid valves (12) (11) of the power shuttle forward and reverse clutches (Fig. 3).

7. Disconnect and remove pipes (2), (3), (4), (5), (7) and (9) (Fig. 14).

Remark

To prevent oil flowing from the gearbox, it is advised to disconnect the return pipes (2) and (3) at their higher connections.

8. Unscrew the support (1) from the gearbox. Remove the "support and unit" assembly by gradually unscrewing the union (10) (Dynashift reverse clutch supply) (Fig. 14).

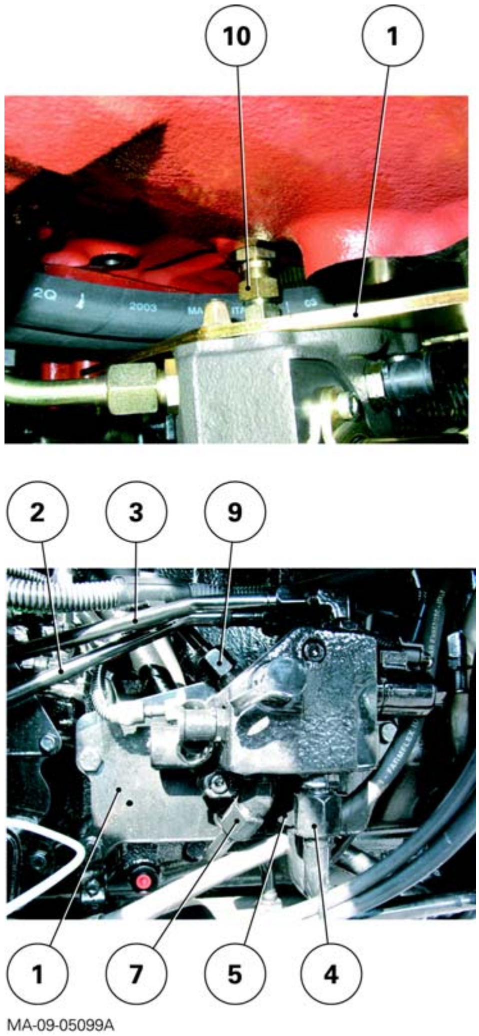


Fig. 14

Refitting

9. Refit the "support and unit" assembly.

Tighten:

- the screws fixing the support to the gearbox to 50 - 70 Nm,
- the screws fixing the unit to the support to 25 - 35 Nm.

10. Reconnect the pipes and connectors.

Reminder

If it was necessary to replace the control unit or proportional solenoid valves, test:

- the 17 bar pressure of the unit,
- the Dynashift clutch pressures,
- the pressure of the reverse shuttle forward and reverse clutches.

  Special point

  When pressurised, the reverse shuttle clutches must be calibrated using Wintest.

Final operations

11. Carry out a road test of the hydraulic functions affected by the repair work.

12. Check the oil tightness of the hydraulic unions.

9N20 - GBA10 PowerShuttle control unit

CONTENTS

A . General

The control unit (1) fixed to the right-hand side and front of the gearbox (Fig. 1) carries out two hydraulic functions quite distinct from the input unit.

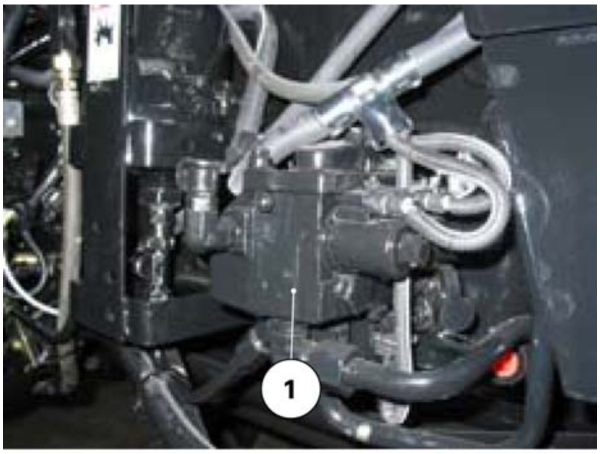
It controls:

- the PowerShuttle;
- Dynashift.

The channels and ducts machined in the unit allow oil under pressure to be directed to the PowerShuttle proportional solenoid valves and the Dynashift solenoid valves EV1 and EV2.

All solenoid valves are controlled respectively by the tractor electronic system. A 60 micron filter element (7) (Fig. 2) is located under the right-hand hydraulic cover, upstream from the control unit.

The extra filter mechanism ensures maximum purity of the oil entering the spool of each solenoid valve.



MA-09-06001A

Fig. 1

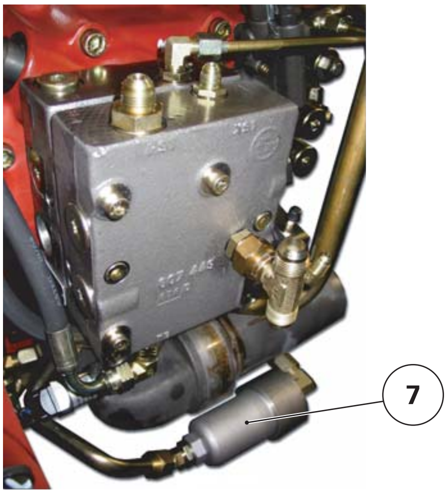


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Fig. 2

B . Presentation of control unit and surrounding parts

Parts list (Fig. 3)

(1) Control unit
(2) 17 bar supply line to PowerShuttle forward clutch
(3) 17 bar supply line to PowerShuttle reverse clutch
(4) Accumulator (Nitrogen)
(6) Main 17 bar supply line
(7) 60 µ filter element
(8) 17 bar internal line to Dynashift front clutch (Fig. 5)
(9) 17 bar internal line to Dynashift rear clutch (Fig. 5)
(12) Cover for separate return to gearbox for oil coming from pipes (2) (3) (Fig. 5)

Legend

17 bar low pressure

Gas

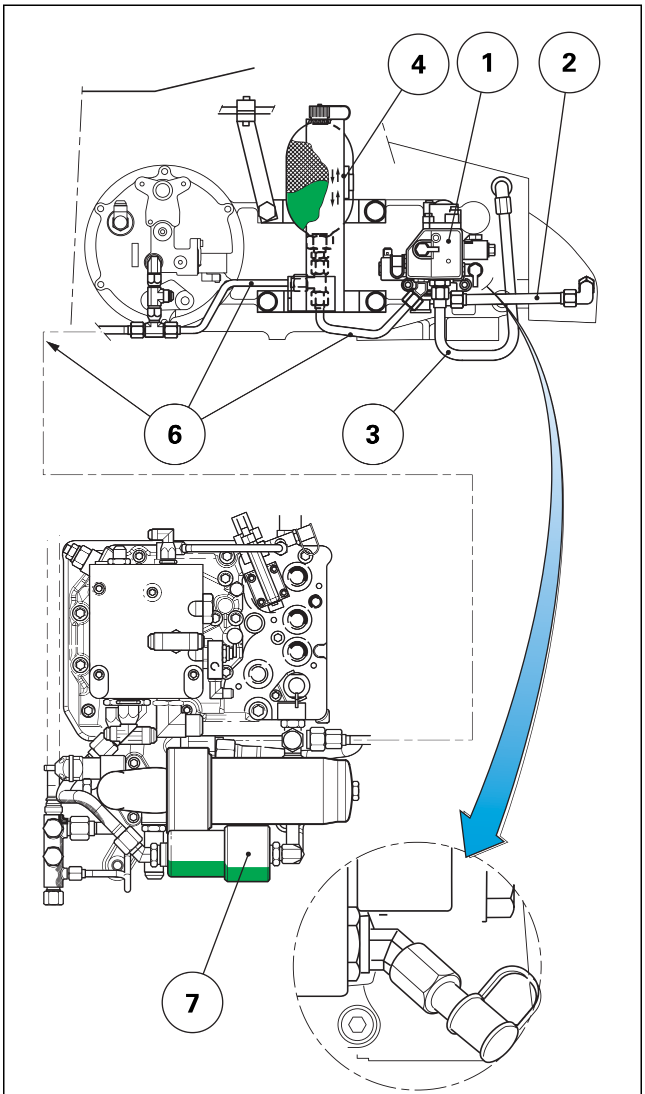

Fig. 3

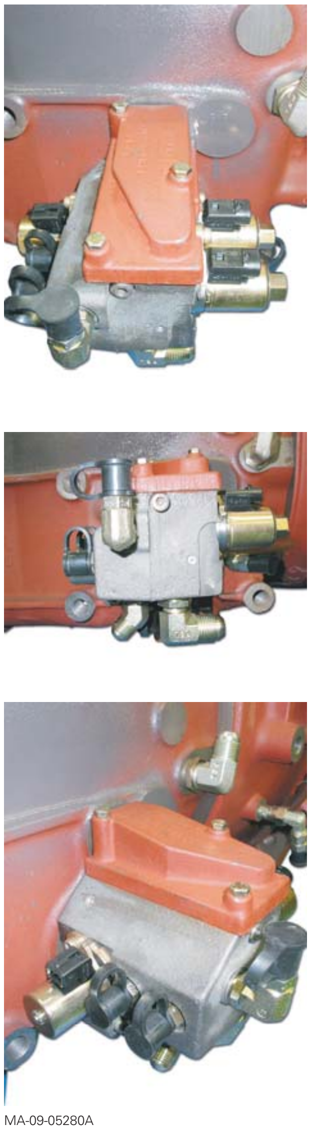

Fig. 4

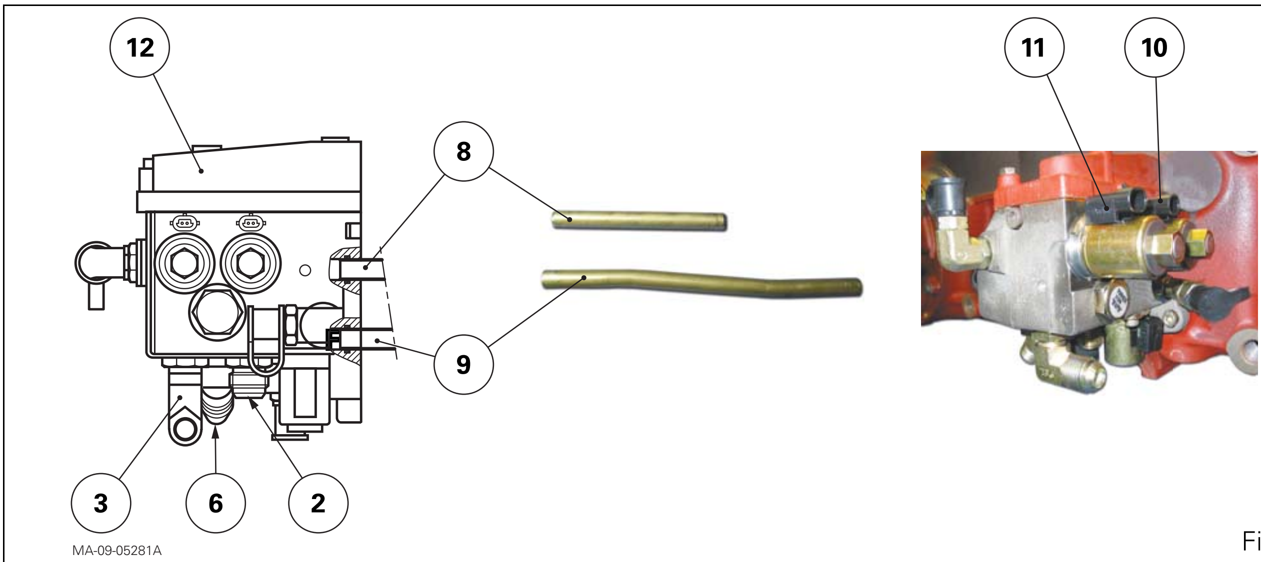

Fig. 5

C . PowerShuttle control

Identification of ports on control unit (Fig. 8).

(2) Return to reverse clutch housing
(3) Pressure outlet to forward clutch
(4) Pressure outlet to reverse clutch
(5) Main 17 bar supply
(6) Forward clutch pressure connector
(7) Reverse clutch pressure connector
(8) Return to forward clutch housing
(9) 17 bar pressure take-off
(12) Return cover
(13) O'ring

NOTE: *Each of the hydraulic return lines of the proportional solenoid valves has separate channels. This design avoids any back pressure from one solenoid valve to another.*

Removing a proportional solenoid valve (Fig. 6)

1. Remove flange (1).
2. Drive off the solenoid valve (10) or (11) by gently applying pressure with a screwdriver between the valve and the control unit.

Refitting

3. Check the condition and cleanliness of the O'rings fitted on the solenoid valve.
4. Position and manually drive the solenoid valve into its housing, beyond the point of resistance (O'rings squeezing).
5. Place the flange on the solenoid valve base. Tighten the screw to a torque of 8 - 11 Nm.
If necessary, tighten the solenoid valve nut to a torque of 5.4 - 8.1 Nm.

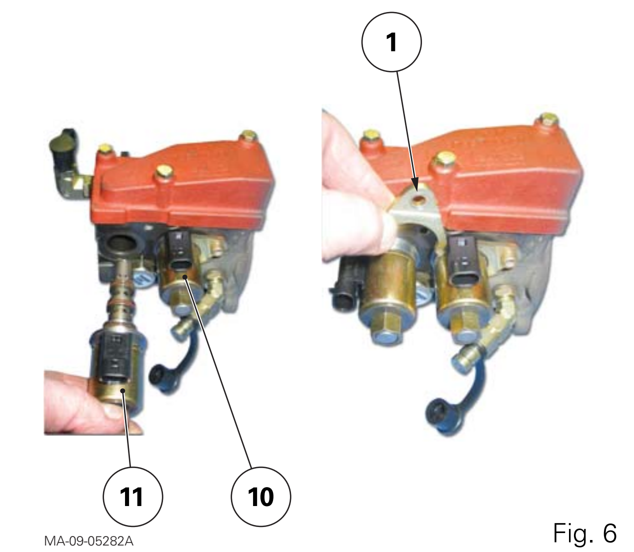

Fig. 6

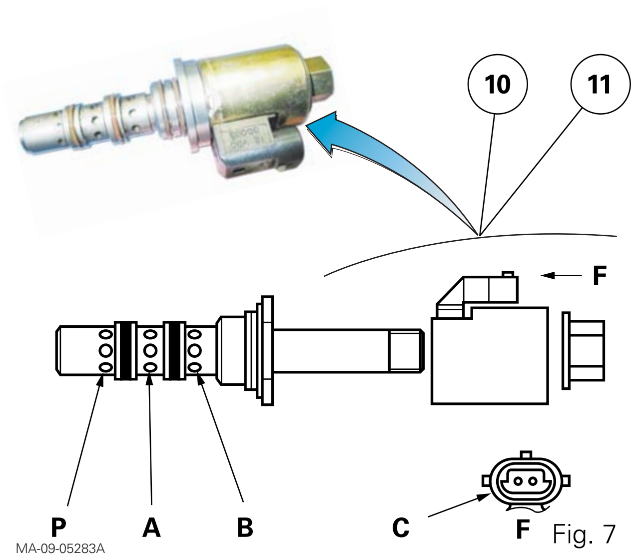

Fig. 7

Identification of ports on a proportional solenoid valve (Fig. 7)

A Forward or reverse clutch supply ports
A Forward or reverse clutch return ports
P 17 bar pressure

Electrical connection (Fig. 7)

C Solenoid supply

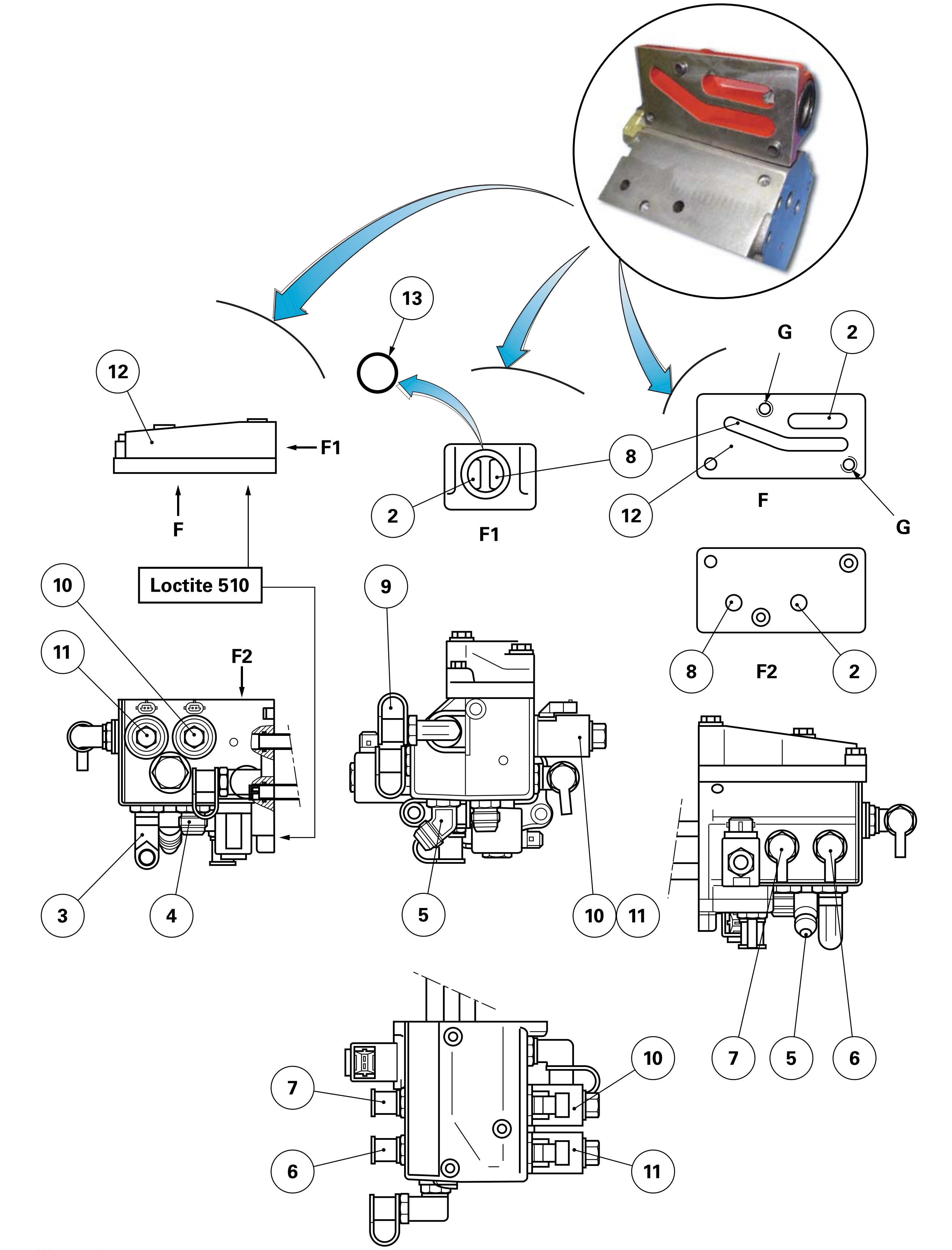
13
12
F1
F
Loctite 510
2
8
F1
G
2
12
F
G
10
11
F2
9
8
F2
2
3
4
5
10
11
7
5
6
7
6
10
11
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Fig. 8

D . Dynashiftcontrol

In the control unit, the Dynashift part includes two internal channels A and B (Fig. 9), which allow oil to circulate from one solenoid valve to the other.

The four Dynashift ratios are controlled by two solenoid valves.

The removal and refitting procedure for a solenoid valve is the same as that for a proportional solenoid valve (see § C).

Solenoid valve characteristics

- **EV1 lower solenoid valve** (Fig. 10 and Fig. 12)
  4x2 solenoid valve: four ports and two positions

- **EV2 upper solenoid valve** (Fig. 11 and Fig. 12)
  3x2 solenoid valve: three ports and two positions

Identification of ports (Fig. 12)

C To port F
D Non-return valve
E Port to front piston
F Port to rear piston
P 17 bar pressure
R Return

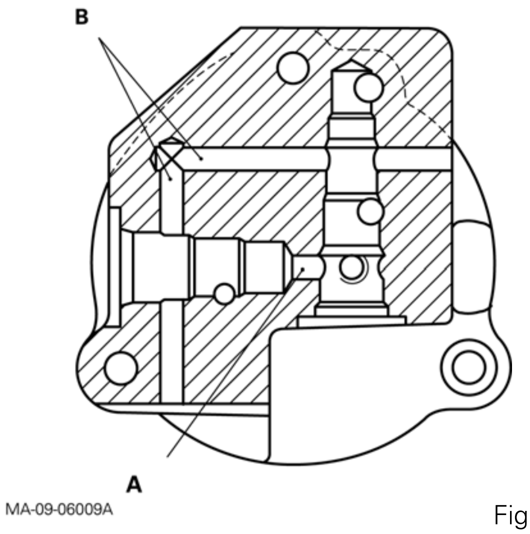

Fig. 9

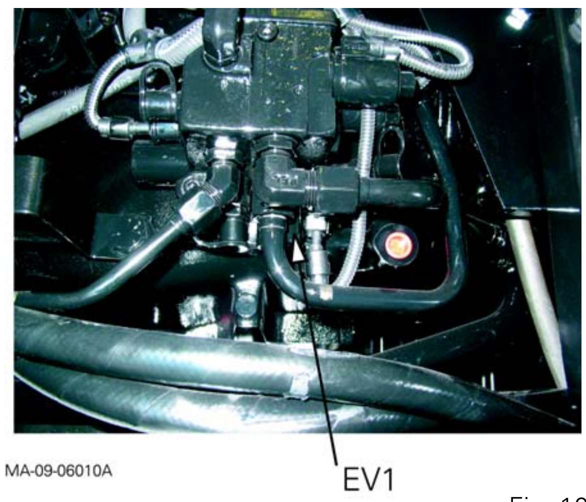

Fig. 10

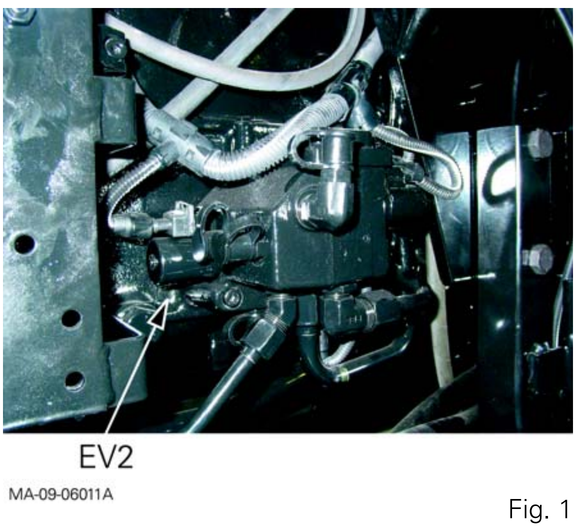

Fig. 11

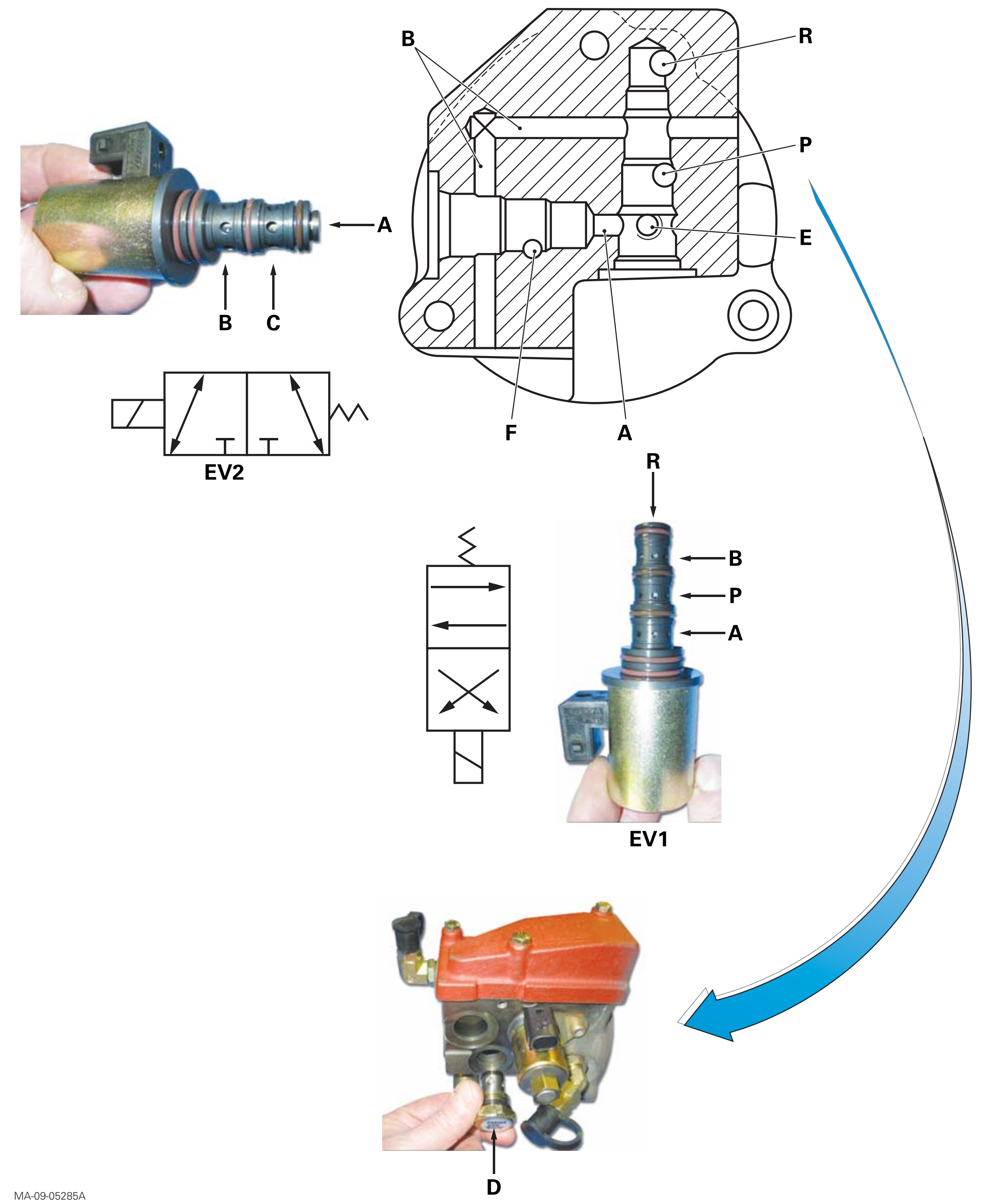

Fig. 12

E . Explanation of Dynashift ratios

For design operation and mechanical explanation of ratios, see chapter 5.

Ratio A (Fig. 13)

Ratio A is obtained when solenoid valve EV1 is powered. The pressurised oil reaches channel a. This channel directs the oil to the front piston through port E and also to the EV2 solenoid valve. As this is in neutral position, the oil can pass through the spool and port F to the chamber of the rear piston. The two pistons are therefore under pressure.

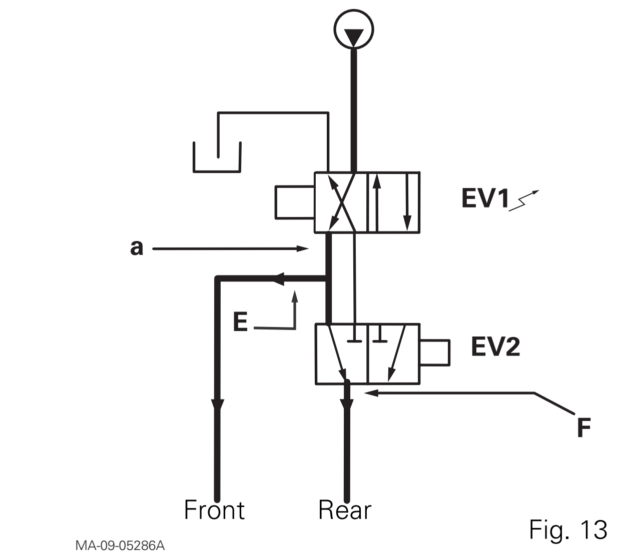

Fig. 13

Ratio B (Fig. 14)

Ratio B is obtained when the two solenoid valves are powered. Therefore the flow of oil to the rear piston is interrupted. The rear piston is pushed out by springs which send the oil into channel b. This channel is joined to the housing by solenoid valve EV1.

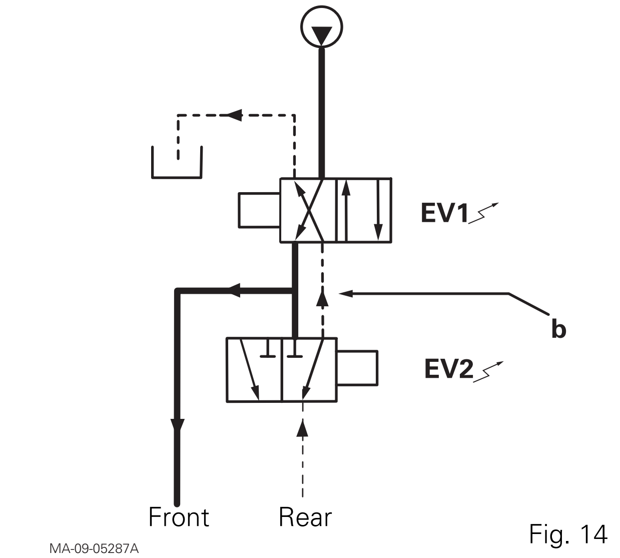

Fig. 14

Ratio C (Fig. 15)

Ratio C is obtained by switching off solenoid valve EV1, while maintaining solenoid valve EV2 under voltage. Channel a is no longer pressurised but is connected to the housing. As a result, the front piston can return to neutral position. Channel b is under pressure. The oil flows to the rear piston via solenoid valve EV2.

Ratio D (Fig. 16)

Ratio D is obtained by switching off EV2. The two solenoid valves are at rest. The two pistons are connected to the housing via channel a.

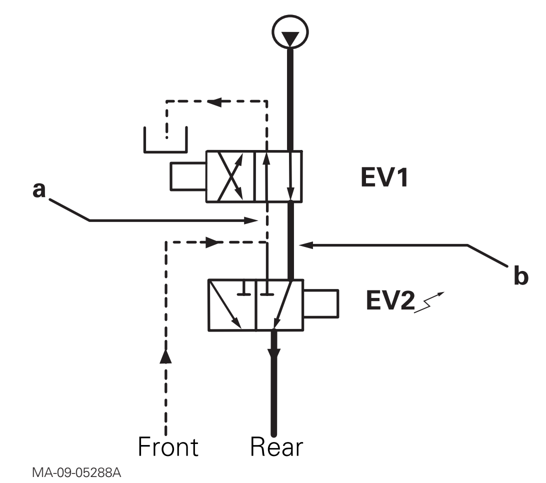

Fig. 15

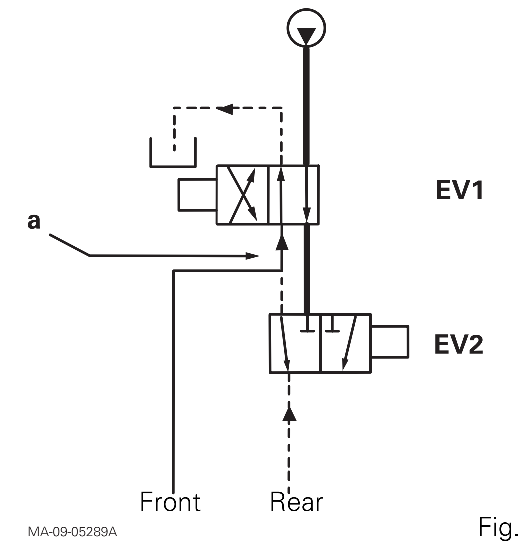

Fig. 16

F . Removing - Refitting the control unit

Preliminary operation

6. Drain the gearbox.

Removal

7. Mark and disconnect the connectors on solenoid valves EV1 and EV2 of the Dynashift (Fig. 10 and Fig. 11) as well as those of the proportional solenoid valves (10) (11) of the forward and reverse clutches of the PowerShuttle (Fig. 5).

8. ***DANGER: Before working on the circuit, wait for the pressure stored in the accumulator to drop naturally. Opening the pressurised hydraulic circuit can lead to splashing of hot oil and cause serious burns.***

If you need to perform servicing immediately, ensure you are wearing appropriate protective clothing (goggles and gloves) and progressively loosen a union on the concerned hydraulic line (17 bar).

Disconnect and remove pipes (2) (3) (6) connected respectively to the gearbox and accumulator (Fig. 3).

9. Remove solenoid valve EV1.

10. Unscrew, release and take off cover (12) and the control unit. Discard the O'ring (13) (Fig. 8).

11. If necessary, detach from the input unit the internal pipes (8) (9) supplying the Dynashift clutches (Fig. 5).

NOTE: *The cranked lower pipe (9) (Fig. 17) supplies the clutch piston located at the back of the Dynashift.*

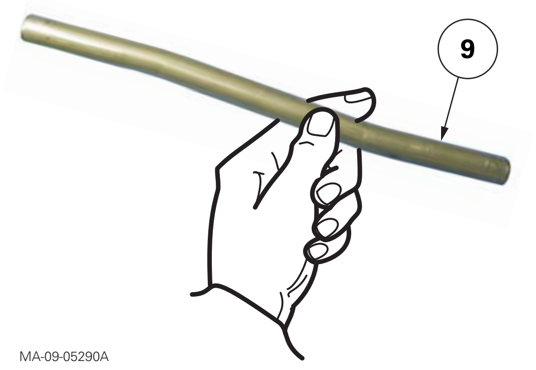

Fig. 17

Refitting

12. Remove all traces of Loctite from the mating surfaces of the control unit and gearbox housing.

13. If removed, position the internal pipes of the Dynashift clutches in the ports of the input unit.

14. On the control unit, replace the O'rings of the above-mentioned pipes.

15. Lightly smear the mating face of the control unit with the housing with Loctite 510 or equivalent.

16. Turn the internal pipes of the Dynashift in such a way that they correctly enter the ports of the control unit.

17. Fit the control unit onto the gearbox.

Lightly smear the thread of each screw with Loctite 542 or equivalent. Fit and tighten these screws to a torque of 42 - 46 Nm.

Note: *The cover (12) is positioned on the hydraulic unit by the two G cotter pins (Fig. 8).*

Oil tightness is ensured by:

- *application of a seal (Loctite 510 or equivalent) on the surface in contact with the control unit;*
- *an O'ring (13) fitted between the gearbox housing and the cover (12).*

18. Reconnect the pipes and electrical connectors that were marked during removal.

Final operations

19. Top up the transmission oil.

20. If the control unit or one or more solenoid valves needed to be replaced:

- check the 17 bar pressure of the control unit, along with the Dynashift clutch pressure (see chapter 9) then
- calibrate the forward and reverse PowerShuttle clutches using Wintest (see chapter 11).

21. Carry out a road test of hydraulic functions.

22. Check the oil tightness of the hydraulic unions.

9O10 - CARRARO suspended front axle control unit

CONTENTS

A . Technical characteristics

Description	Values
Nominal pressure	250 bar
Hydraulic oil type	DIN 51524
Ambient temperature	Min -30 °C / Max +90 °C
Hydraulic fluid temperature	Min -30 °C / Max +70 °C
Type of hydraulic unions to ports P, T, A, B	M18 x 1.5 (ISO6149-1)
Type of hydraulic unions to LS port	M14 x 1.5 (ISO6149-1)
Filtration: maximum pollution level allowed in service fluid	NAS 1638 class 10
Solenoid valve	25 Nm
Accumulator tightening torque	200 Nm
Nominal voltage	12 VDC

CARRARO suspended front axle control unit

Parts list (Fig. 1 and Fig. 2)

(1) LS pilot flow
(2) KSP1 accumulator
(3) KSP2 accumulator
(4) RSP1 accumulator
(5) Bleed screw
(6) Solenoid valve WV1
(7) Solenoid valve WV2
(8) Return
(9) Supply from pump
(10) Top ram supply
(11) Bottom ram supply

Accumulator capacity and pressure

Axle type	RSP1	KSP1	KSP2
20.19	0.75 l 140 bar	1.4 l 40 bar	0.75 l 40 bar
20.22	0.75 l 140 bar	1.4 l 40 bar	0.75 l 40 bar
20.29	0.75 l 140 bar	1.4 l 40 bar	1.4 l 40 bar
20.43	0.75 l 140 bar	1.4 l 40 bar	1.4 l 40 bar
20.48 S	0.75 l 140 bar	1.4 l 40 bar	1.4 l 40 bar

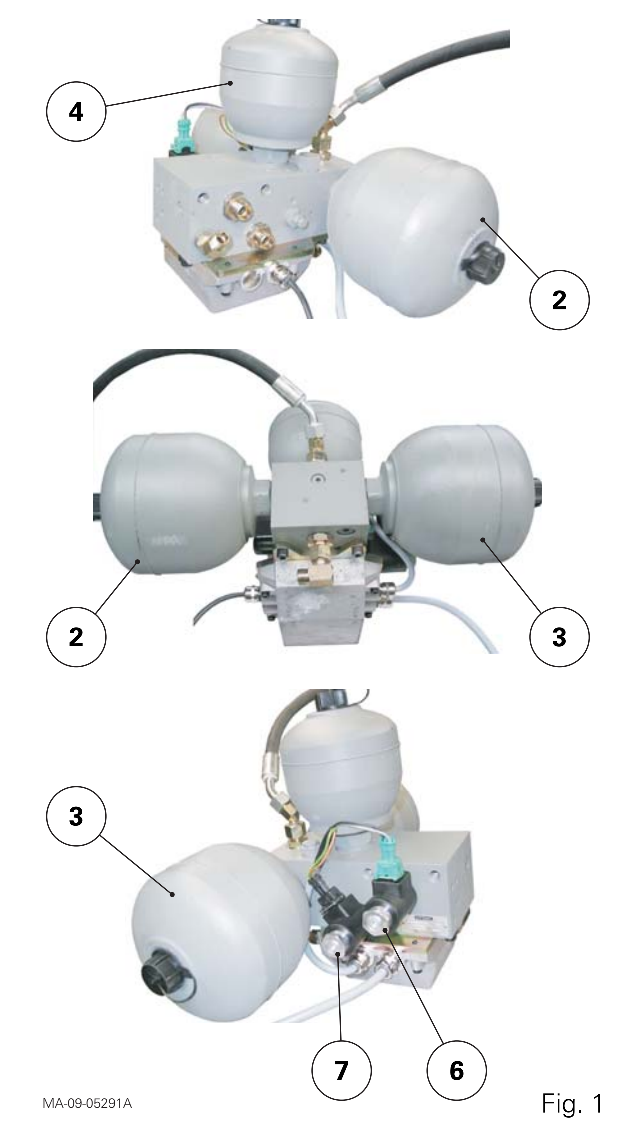

Fig. 1

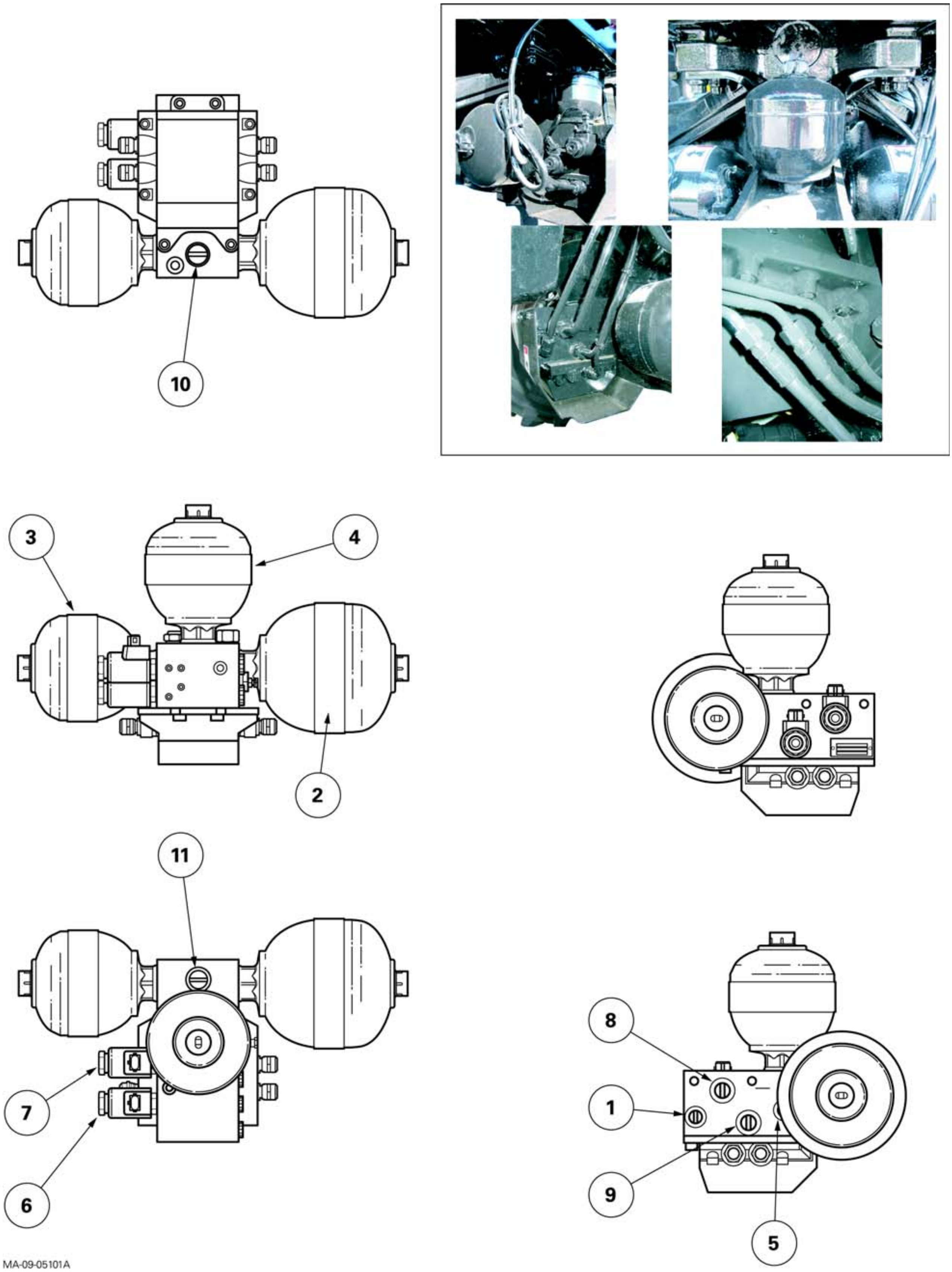

Fig. 2

B . Hydraulic description of the control unit with Open Centre hydraulics

Parts list (Fig. 3, Fig. 4 and Fig. 5)

(1) Front axle suspension ram
(2) KSP1 accumulator
(3) KSP2 accumulator
(4) RSP1 accumulator
(5) Bleed screw
(6) Solenoid valve WV1
(7) Solenoid valve WV2
(8) Control unit
(9) Filter
(10) Proportional valve
(11) Controlled non-return valve
(12) 250 + 20 bar pressure relief valve
(13) 170 bar pressure relief valve
(14) High pressure inlet
(15) To auxiliary spool valves

Legend

A Upper ram chamber
B Lower ram chamber
C Hydraulic channel
D Hydraulic channel
E Hydraulic channel
F LS pilot line
G Hydraulic channel
LS Load Sensing pilot flow
R Return to housing

Neutral position

In low position, chamber A of the ram (1) is empty. The suspension is in contact with two mechanical central beam stops.

In high position (Fig. 3), the ram is balanced by accumulators (2), (3) and (4).

If the pressure in the ram is too high (shocks received by the front axle), the pressure relief valve (12) opens and the excess pressure is directed to the return.

If the ram position has changed, the position sensor value has also changed. If after 3 seconds the sensor value does not match to the calibration value, the calculator supplies the solenoid relevant valve(s) (WV1 (6), WV2 (7)) to make the two values correspond.

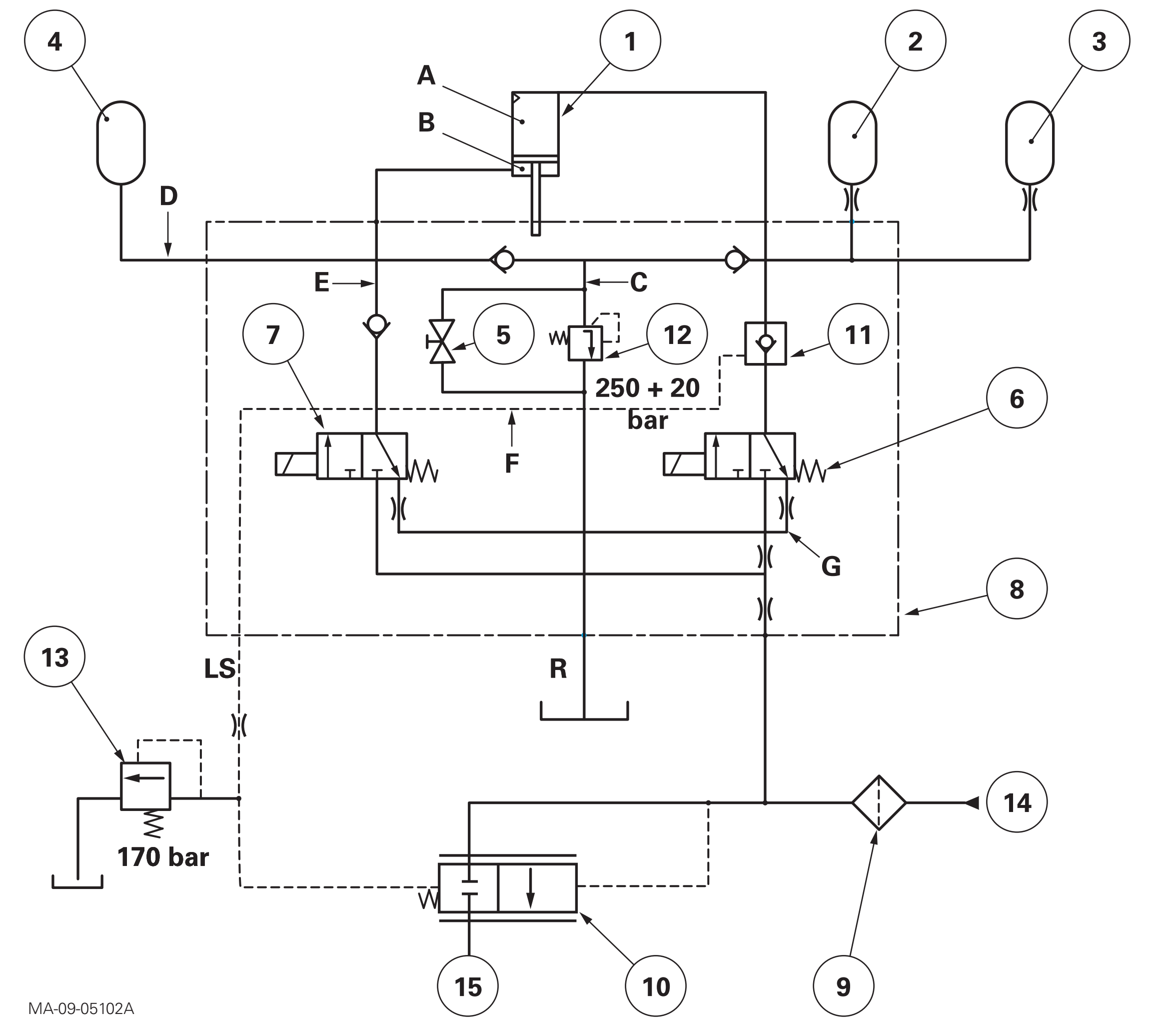

Fig. 3

Lifting position (Fig. 4)

When lifting, the two solenoid valves WV1 (6) and WV2 (7) are activated.

The WV1 solenoid valve (6) allows oil to reach the accumulators (2) and (3) and chamber A of the ram (1).

When the pressure in chamber B reaches 250 bar, the oil returns to the tank via channel C. Channel D also supplies accumulator (4).

Solenoid valve WV2 (7) allows priority for the suspended front axle in pilot flow line F.

The proportional valve (10) stops the supply to the auxiliary spool valve and linkage.

When the pressure in the circuit reaches 180 bar, the circuit resumes its course via the proportional valve (10) and supplies the linkage and auxiliary valves.

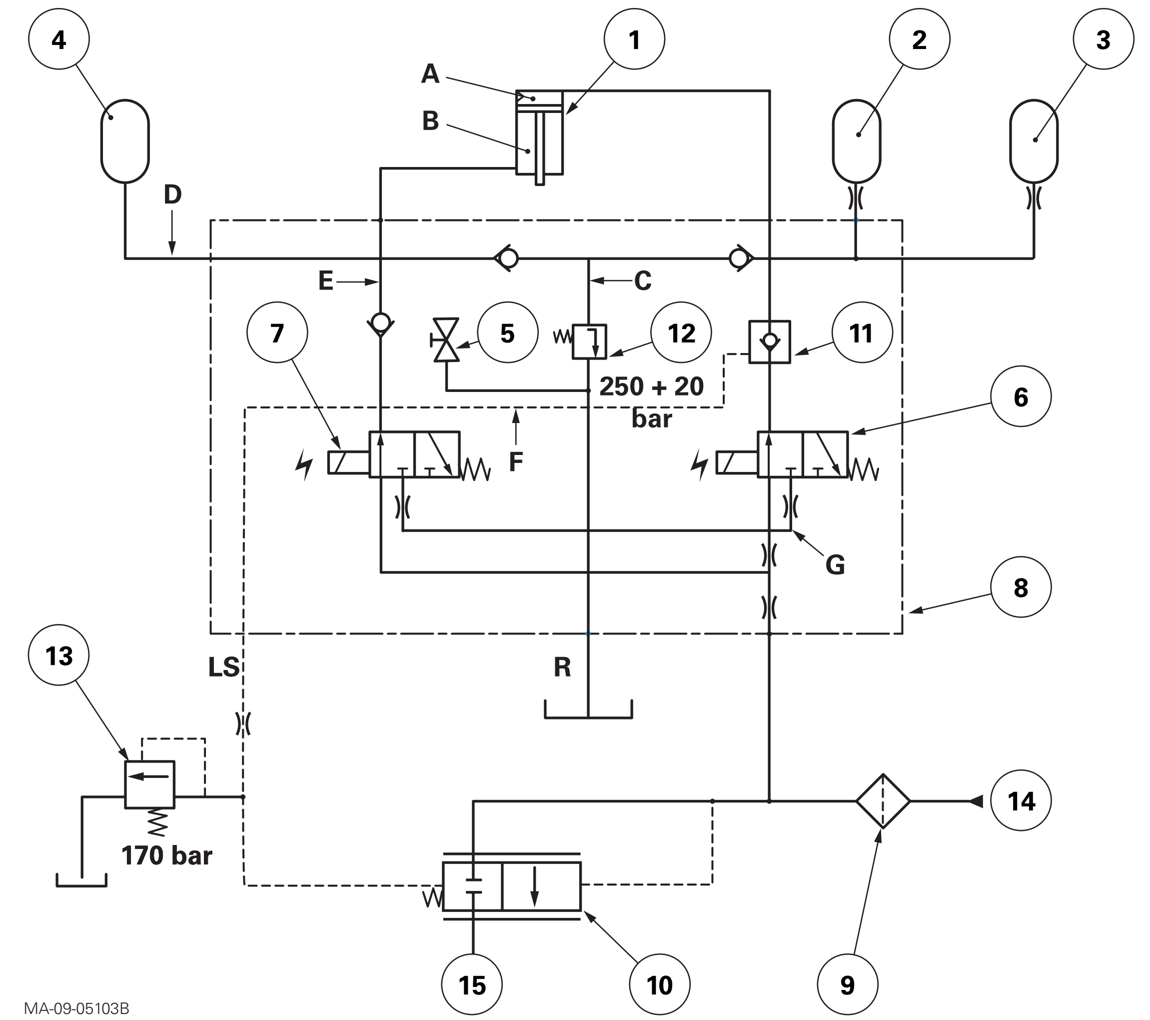

Fig. 4

Lowering position (Fig. 5)

When lowering, only solenoid valve WV2 (7) is supplied.

The oil supplies chamber B of the ram (1) via channel E. The pressure created in the pilot flow line F allows priority for the suspended front axle.

The proportional valve (10) stops the supply to the auxiliary spool valve and linkage.

When the pressure in the circuit reaches 180 bar, the circuit resumes its course via the proportional valve (10) and supplies the linkage and auxiliary valves (15).

The pressure in pilot flow line F also allows the non-return valve (11) to open so that the oil in chamber A returns to the tank via channel G.

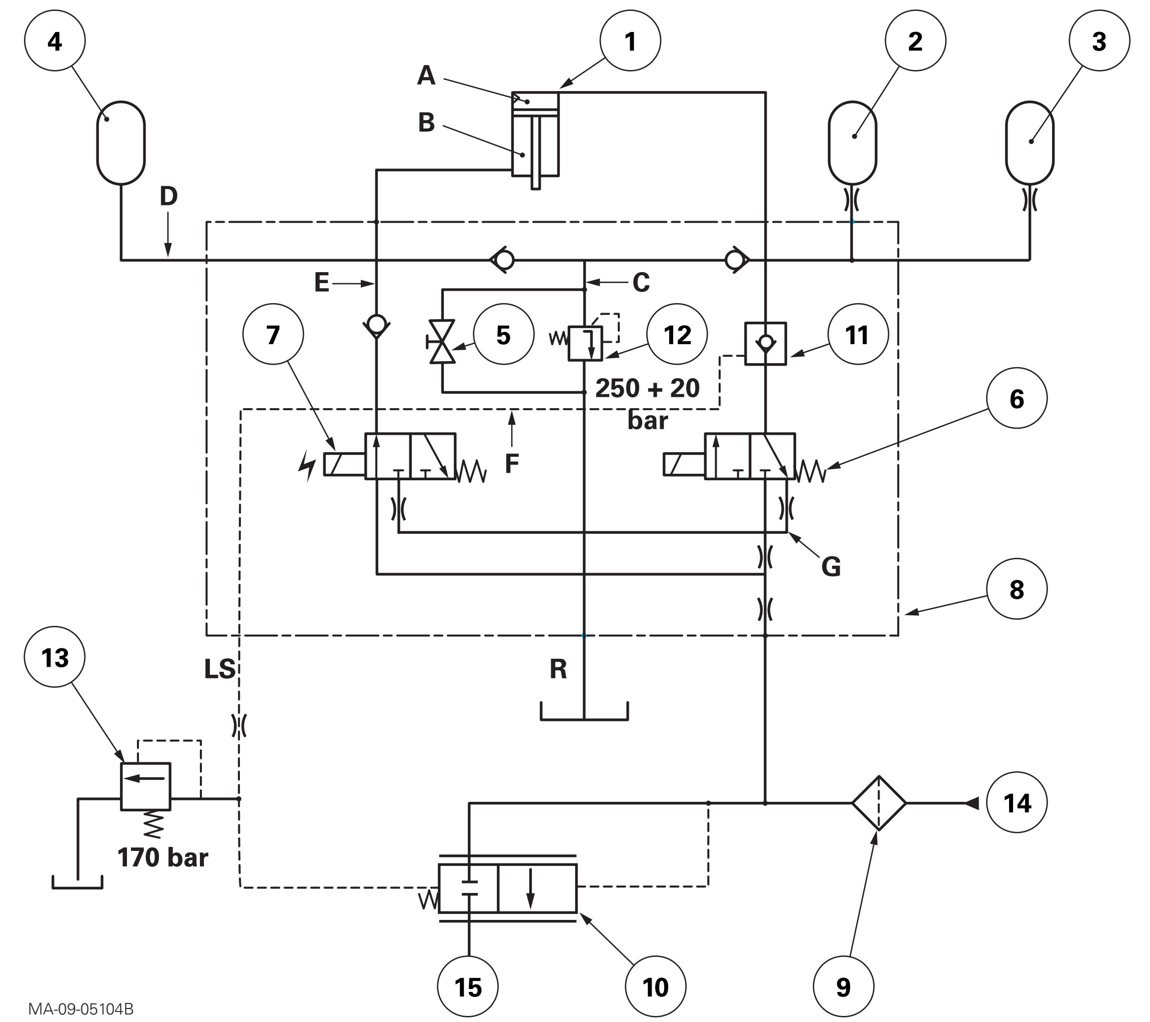

Fig. 5

C . Hydraulic description of the control unit with Closed Centre hydraulics

Parts list (Fig. 6, Fig. 7 and Fig. 8)

1) Front axle suspension ram
(2) KSP1 accumulator
(3) KSP2 accumulator
(4) RSP1 accumulator
(5) Bleed screw
(6) Solenoid valve WV1
(7) Solenoid valve WV2
(8) Control unit
(11) Controlled non-return valve
(12) 250 + 20 bar pressure relief valve
(14) High pressure inlet

Legend

A Upper ram chamber
B Lower ram chamber
C Hydraulic channel
D Hydraulic channel
E Hydraulic channel
F LS pilot line
G Hydraulic channel
LS Load Sensing pilot flow
R Return to housing

Neutral position

In low position, chamber A of the ram (1) is empty. The suspension is in contact with two mechanical central beam stops.

In high position (Fig. 6), the ram is balanced by accumulators (2), (3) and (4).

If the pressure in the ram is too high (shocks received by the front axle), the pressure relief valve (12) opens and the excess pressure is directed to the return.

If the ram position has changed, the position sensor value has also changed. If after 3 seconds the sensor value does not match to the calibration value, the calculator supplies the solenoid relevant valve(s) (WV1 (6), WV2 (7)) to make the two values correspond.

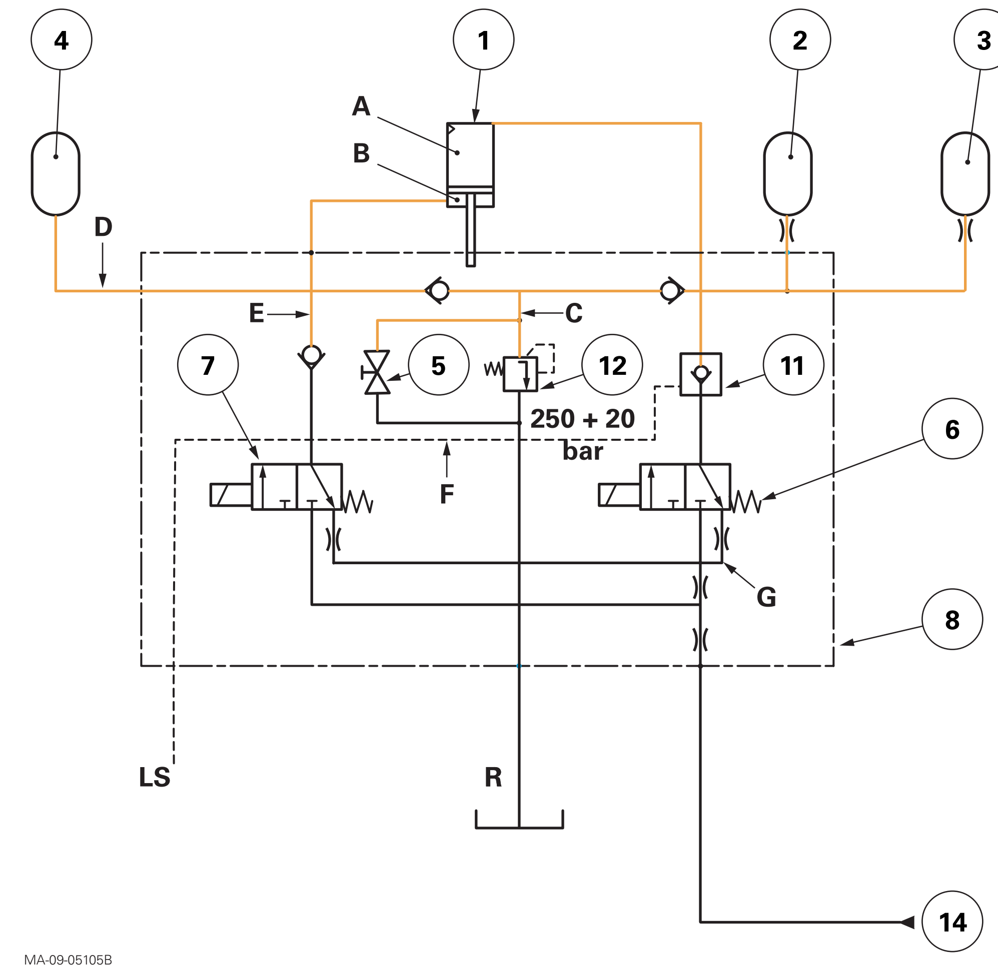

Fig. 6

CARRARO suspended front axle control unit

Lifting position (Fig. 7)

When lifting, the two solenoid valves WV1 (6) and WV2 (7) are activated.

The WV1 solenoid valve (6) allows oil to reach the accumulators (2) and (3) and chamber A of the ram (1).

When the pressure in chamber B reaches 250 bar, the oil returns to the tank via channel C. Channel D also supplies accumulator (4).

Solenoid valve WV2 (7) allows priority for the suspended front axle in pilot flow line F.

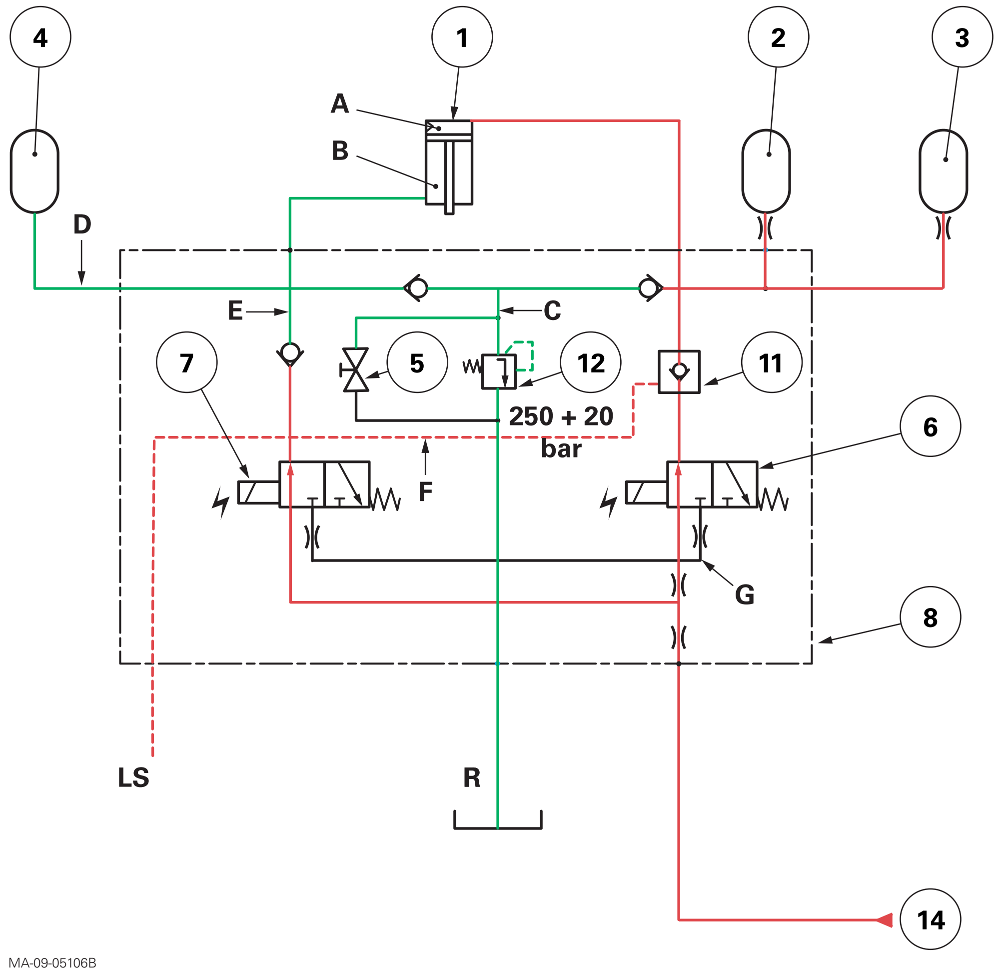

Fig. 7

Lowering position (Fig. 8)

When lowering, only solenoid valve WV2 (7) is supplied.

The oil supplies chamber B of the ram (1) via channel E. The pressure created in the pilot flow line F allows priority for the suspended front axle.

The pressure in pilot flow line F also allows the non-return valve (11) to open so that the oil in chamber A returns to the tank via channel G.

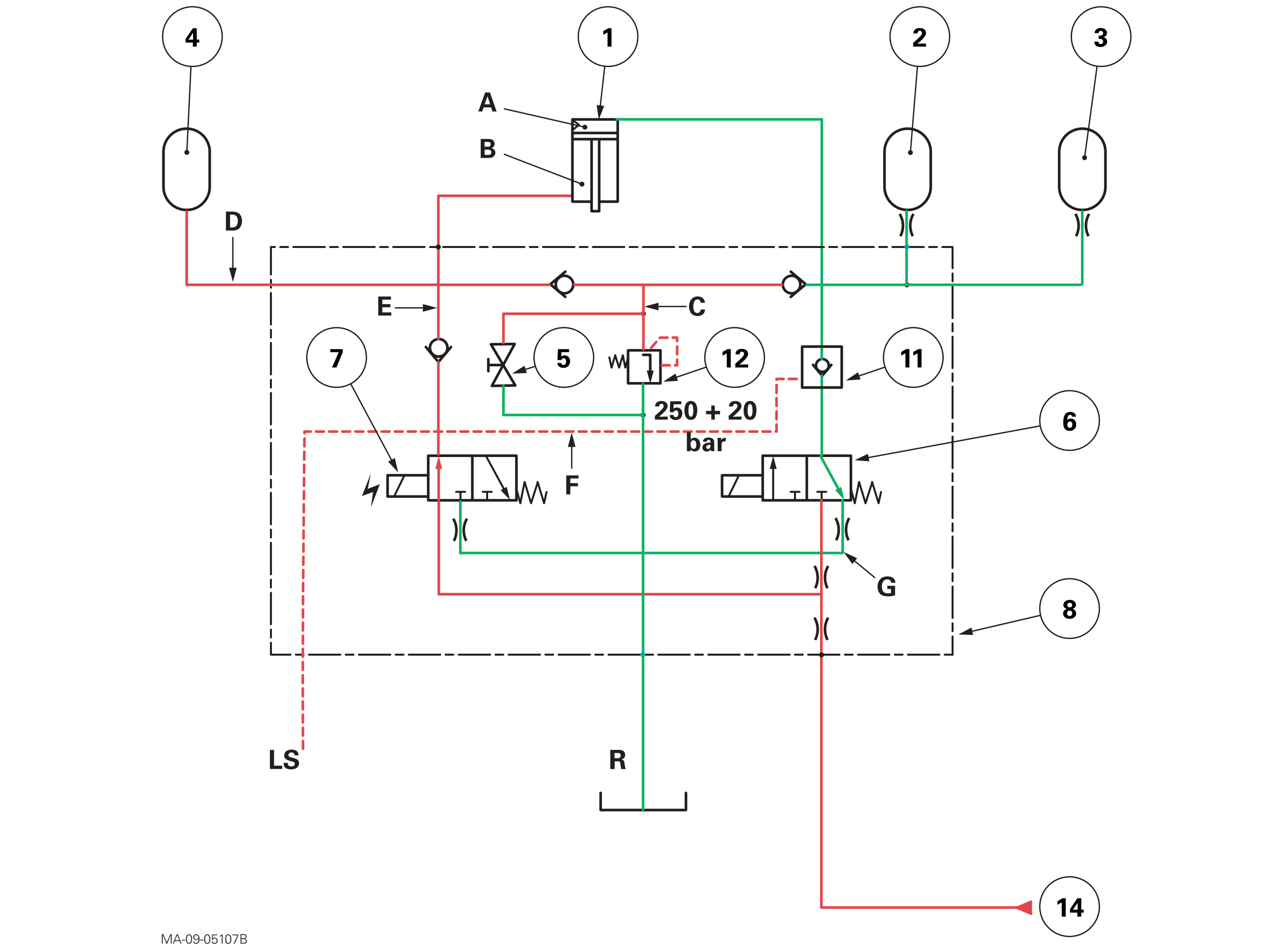

Fig. 8

D . Hydraulic description of the control unit with Twin Flow Load Sensing hydraulics

The operation of the different positions (neutral, lifting and lowering) of the hydraulic unit with Twin Flow hydraulics is similar to that described in § C. The only difference is that the hoses (pressure and LS) are connected at different places.

Location of hoses

Hoses	Location
P and LS	On the right-hand hydraulic cover
R	- GBA10: on the selector cover - GBA20: on the front left-hand side of the gearbox

Neutral position (Fig. 9)

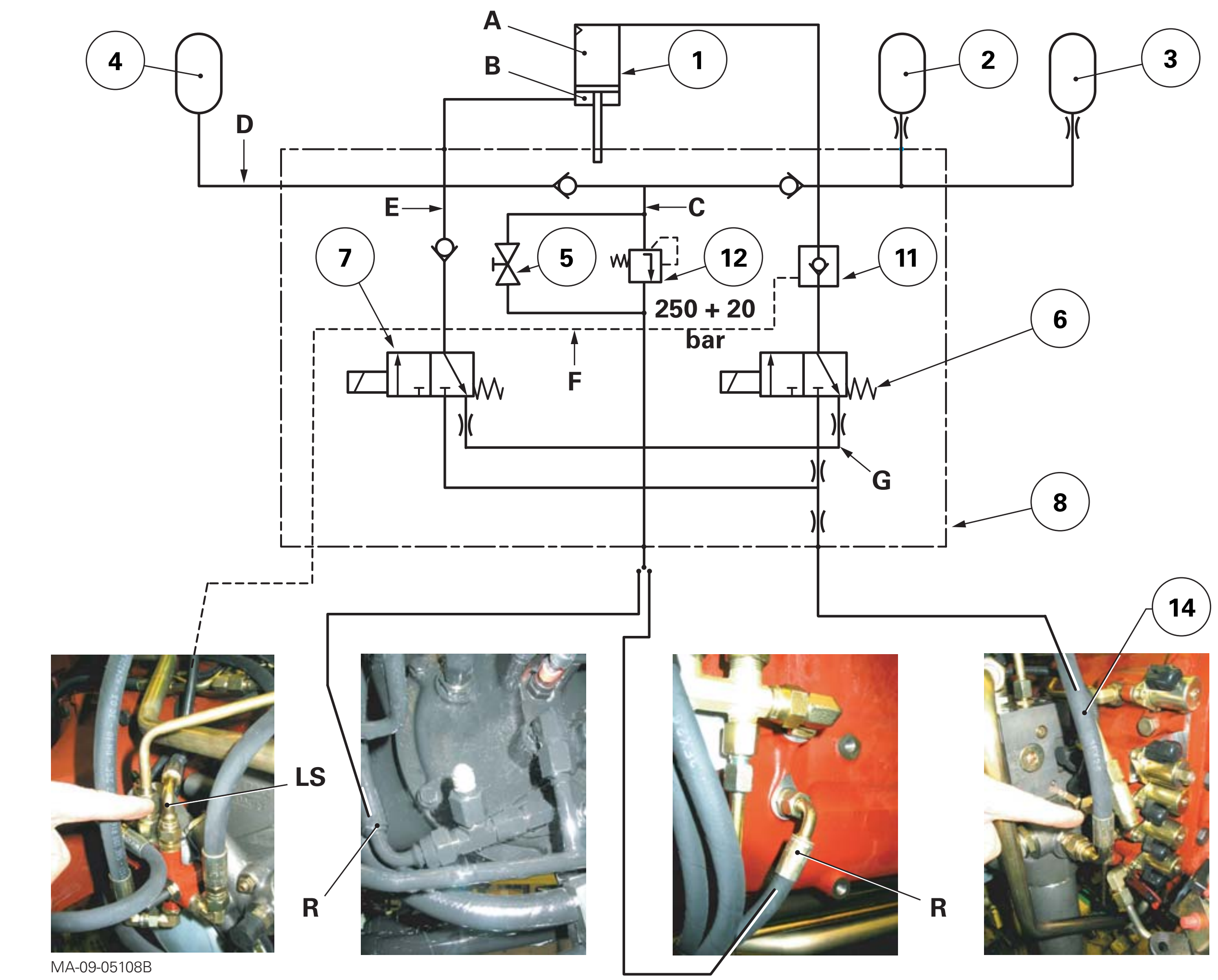

Fig. 9

Lifting position (Fig. 10)

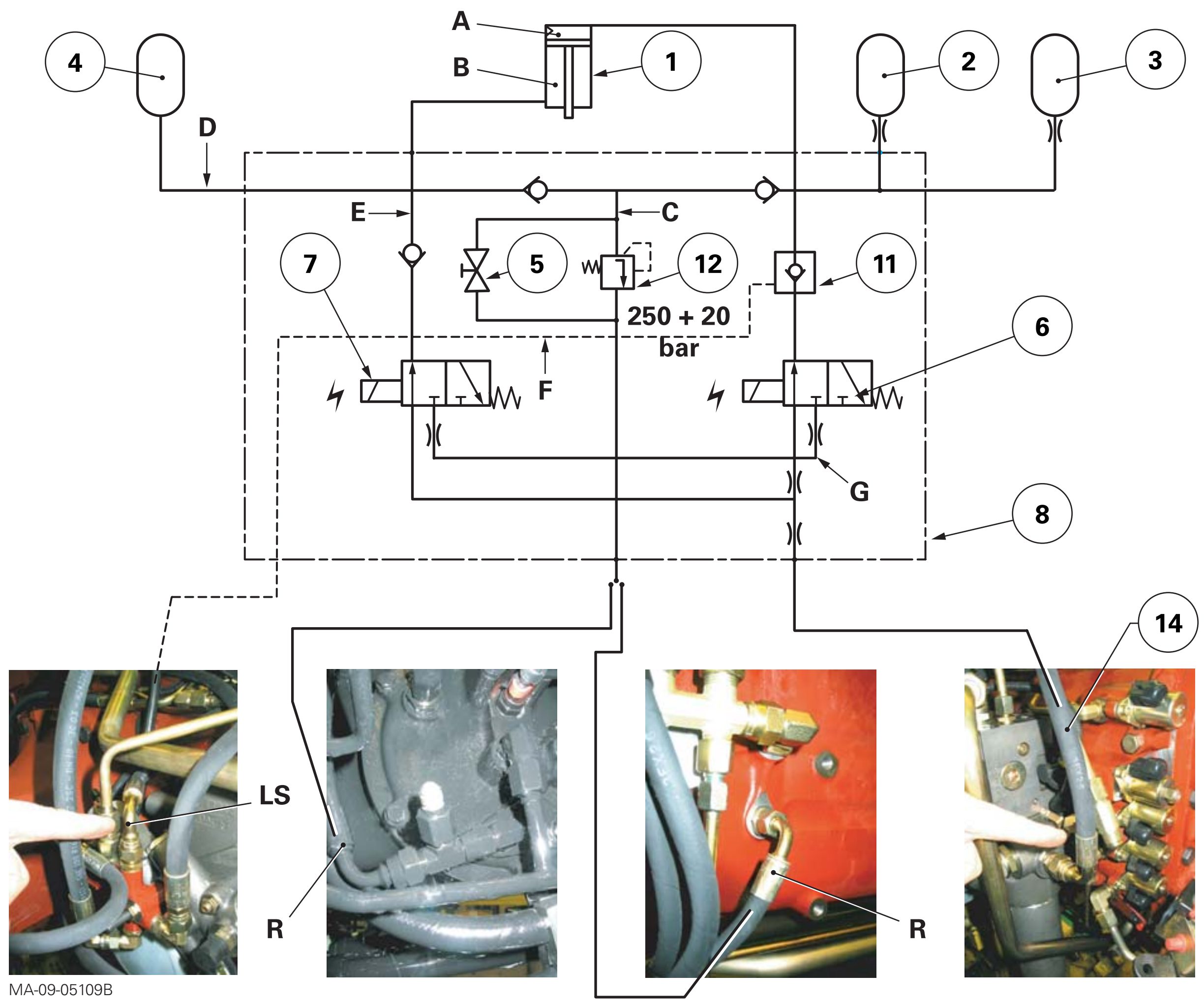

Fig. 10

Lowering position (Fig. 11)

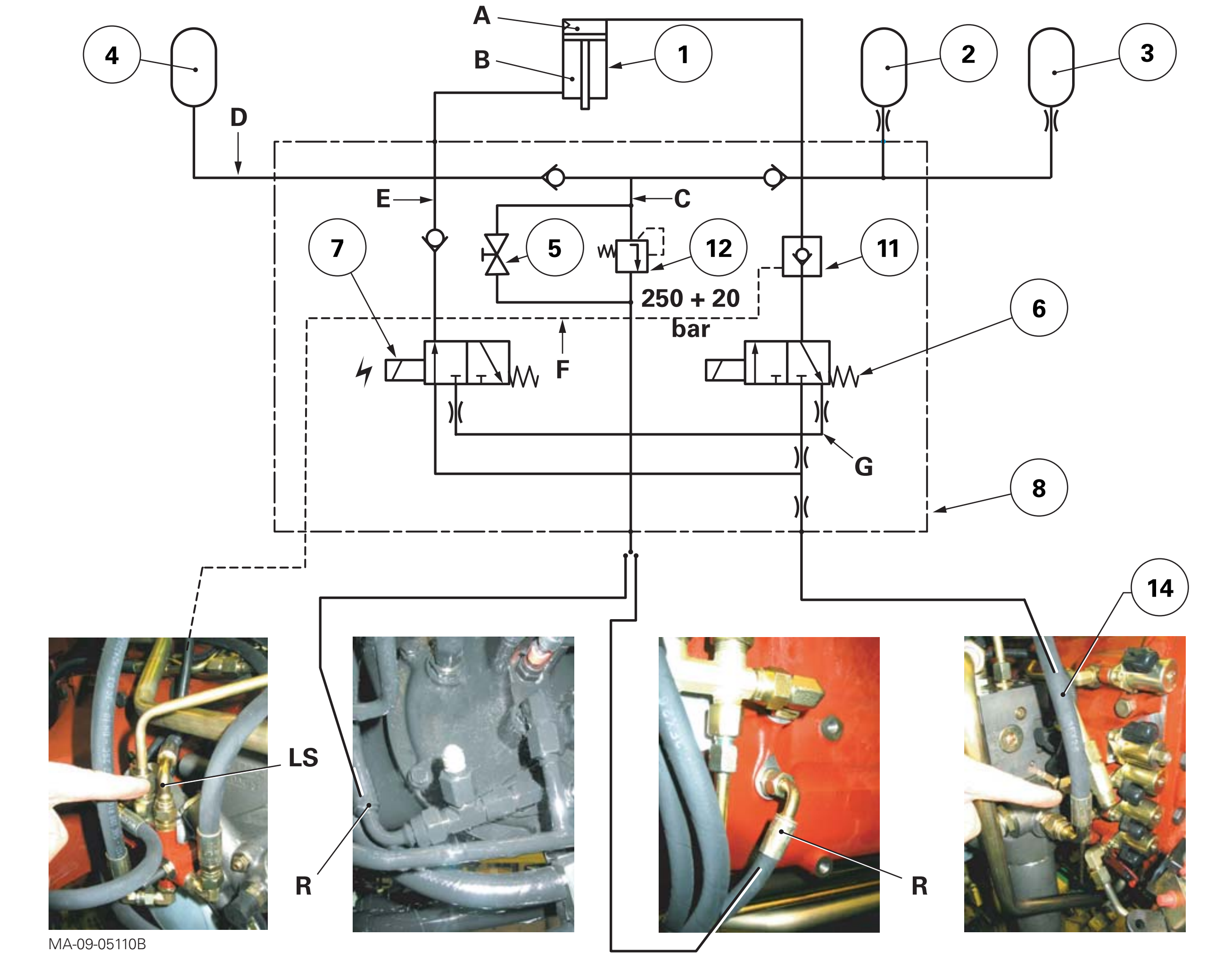

Fig. 11

E . Identification of ports…

… on the control unit (Fig. 12)

A Supply (hydraulic chamber with a large section)
B Supply (hydraulic chamber with a small section)
LS Load Sensing pilot flow
P High pressure
T Return

… on the tractor (Fig. 13)

LS Load Sensing pilot flow
P High pressure
T Return

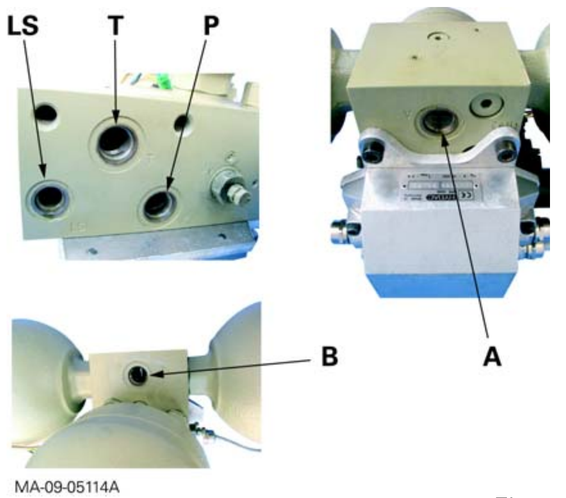

Fig. 12

F . Disassembling - reassembling the control unit

Some of the following pictures may not show your exact hydraulic control unit, but the procedure is the same.

Preliminary operations

DANGER: Before working on the circuit, progressively loosen the AV bleed screw (atmospheric pressure equilibration) on the control unit to release the hydraulic pressure of the circuit and accumulators (Fig. 14).

1. Remove any components that could hinder control unit removal.
2. If necessary, remove the tractor complete control unit.

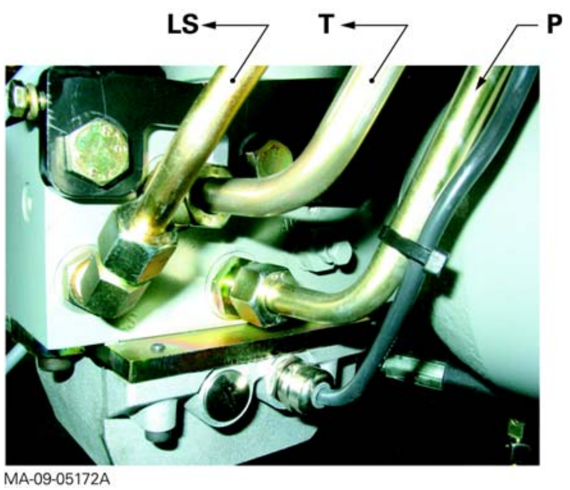

Fig. 13

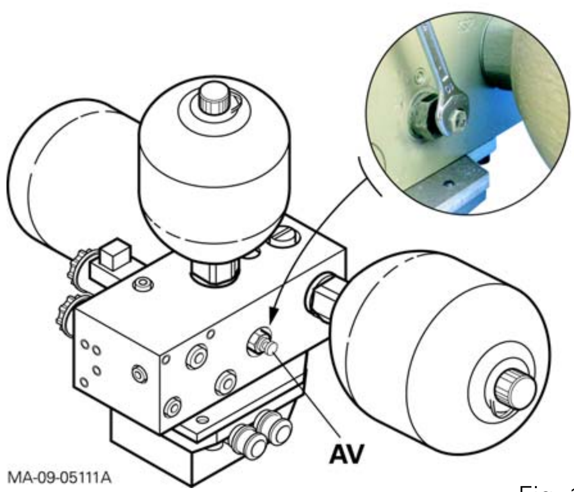

Fig. 14

Disassembly

3. Mark the position of accumulators (2) (3) (4) on the control unit (Fig. 15). Remove them.

   IMPORTANT: *The accumulators may be of different capacity depending on their position and on the front axle model.*
4. Loosen the A screw of each solenoid valve (Fig. 16).
5. Split the B solenoids from C spools (Fig. 16).
6. Unscrew the C spools from the control unit (Fig. 16). Gather the components.

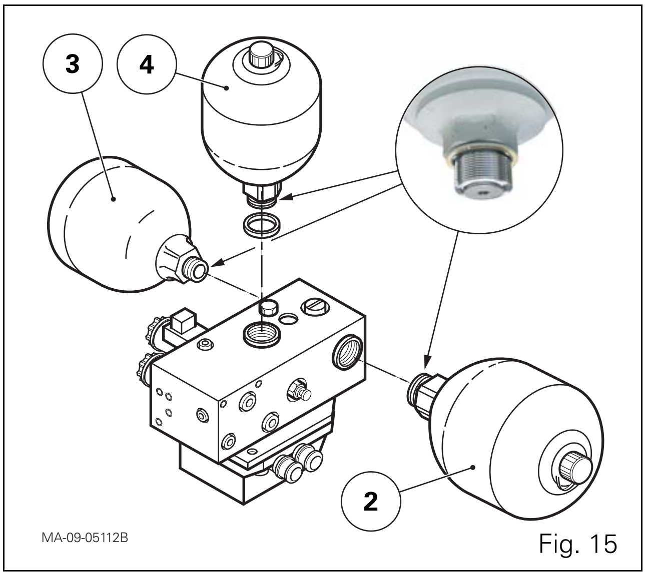

Fig. 15

Reassembly

7. Check the components. Replace any defective parts.
8. Screw the C spools on the control unit (Fig. 16). Tighten to a torque of 25 Nm.
9. Assemble the B solenoids on C spools (Fig. 16).
10. Tighten the A nuts moderately (Fig. 16).
11. If necessary, fit new seals on each accumulator.
12. Refit the accumulators using the marks made during removal. Tighten to a torque of 200 Nm.

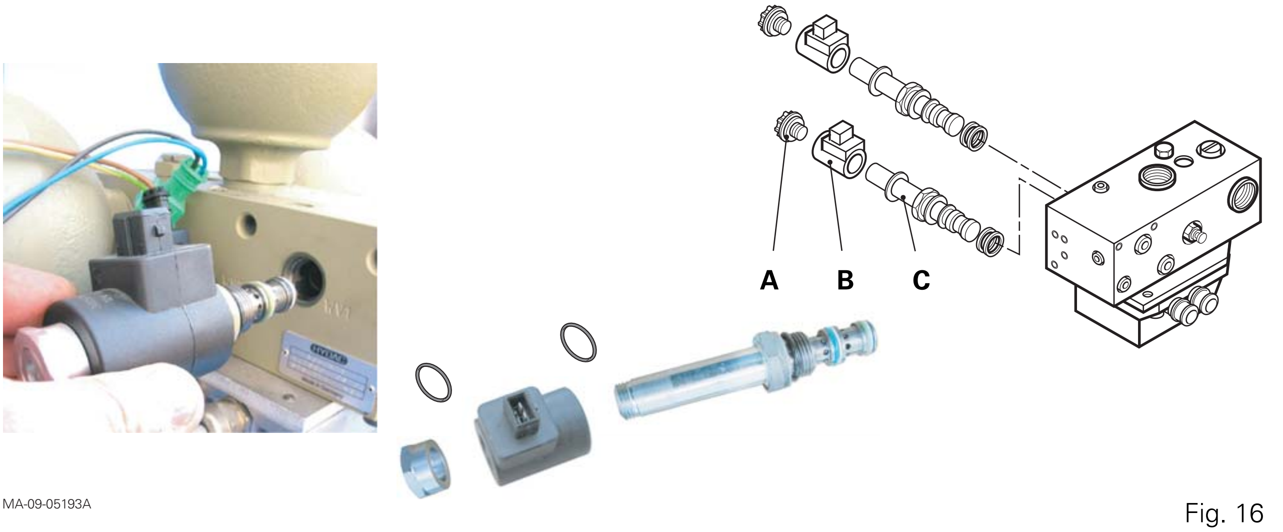

Fig. 16

Final operations

13. If removed, refit the control unit on the tractor.

14. Refit any removed components around the control unit.

15. Screw the control unit AV bleed screw.

16. If the control unit and/or one or more solenoid valves needed to be replaced:
- check P and LS pressure at the control unit ports (see chapter 9);
- calibrate the front axle (see chapter 11).