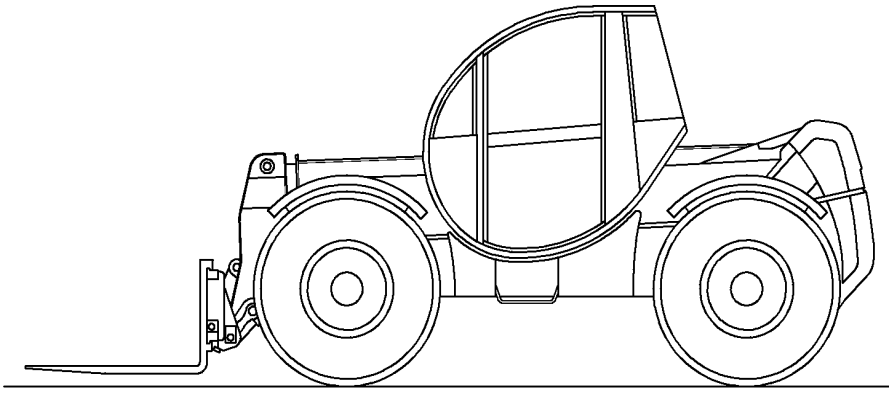
HYDRAULICS
ELECTRICS
TECHNICAL DATA

CLAAS



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CLAAS TARGO K50 K60 K70

The machines in this handbook are designed essentially for agricultural and associated applications. This is their intended use.

Any modifications made to the machine without prior written approval from CLAAS or if the machine is used in any way contrary to the intended use or if the machine is not properly driven or maintained then the Company will not accept any liability whatsoever for any damage or injury (whether direct or consequential).

The method of operation and maintenance specified in this handbook should be strictly adhered to.

For your parts requirements, it is essential that only genuine CLAAS parts are fitted. Any resultant damage from non-genuine parts will invalidate your machine warranty.

CLAAS operates a policy of continuous improvement to its products and reserve the right to change specifications and equipment without notice. Therefore some information within this handbook may differ from your machine.

This manual is designed to service machines:

from Serial No. 51200011
up to Serial No. 51200727.

from Serial No. K5D00100
from Serial No. K6D00100
from Serial No. K7D00100

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SECTION 3

TECHNICAL DATA

INTRODUCTION

General

The contents of this Repair Manual, although correct at the time of publication, may be subject to alteration by the manufacturer without notice.

This manual assumes that maintenance personnel have a sound knowledge of workshop practices and safety procedures associated with the repairs of this type of machine. This manual is designed to assist with the more specialised information required for removal and strip-down of major components.

It is recommended that the relevant part of this Repair Manual is studied carefully before proceeding with any maintenance.

Machine identification

To make sure that the correct parts are obtained, always quote the machine Serial Number when ordering parts.

Health and Safety

To prevent injury to personnel and damage to equipment and machinery, care must be taken to operate in a safe manner. Read the Safety Warnings that follow and always work in a safe manner and obey the relevant Warnings.

Throughout this manual and on the machine there are safety notes. Each note starts with a single word. The meaning of these single words is as follows:

WARNING 

Identifies a hazard exists. If proper precautions are not taken, it is highly probable that the operator (or others) could be killed or seriously injured.

CAUTION 

Identifies a reminder of safety practices. Failure to observe these safety practices could result in injury to the operator (or others) or damage to the machine.

In general these notes are used to indicate that the procedures being described in the manual must be followed to avoid serious injury or death to yourself or others. The notes are also used to protect the machine from unsafe maintenance practices.

NOTE: An identification number in bold type, after an item, refers to the number of that item in the main hydraulic schematic illustration.

WARNING *Always wear correct fitting protective clothing. Loose or baggy clothing can be extremely dangerous when operating or maintaining a machine.*

WARNING *Where possible, only work on or close to engines or machinery when they are stopped. If this is not practical, remember to keep tools, test equipment and all parts of your body well away from moving parts.*

WARNING *Avoid contact with exhaust pipes and exhaust manifolds when the engine is running; these can be very hot.*

WARNING *Many liquids used on this machine are harmful if taken internally or splashed into the eyes. In the event of accidentally swallowing oil, diesel fuel, anti-freeze, battery acid etc., DO NOT induce vomiting, but OBTAIN QUALIFIED MEDICAL ASSISTANCE IMMEDIATELY.*

WARNING *Always obtain advice before mixing oils; some are incompatible.*

WARNING *Never run an engine in an enclosed space unless an exhaust extraction system is used.*

WARNING *Always Disconnect battery cables before using an external charger to prevent damage to electrical system components.*

WARNING *Always Disconnect battery cables before working on the electrical system to prevent injury caused by electric shock.*

WARNING *When it is necessary to work on the electrical system with power on, for fault diagnosis, always have a safety man in attendance*

WARNING *Any dust found on the machine or produced during work on the machine should be removed by extraction, not by blowing. Dust waste should be dampened, placed in a sealed container and marked for safe disposal.*

WARNING *Always dump pressure from the hydraulic system before carrying out any maintenance or adjustment* ***(refer to page 1.1)***.

WARNING *Never leave the machine unattended with pressure in the system.*

WARNING *Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. If hydraulic fluid penetrates your skin OBTAIN QUALIFIED MEDICAL ASSISTANCE IMMEDIATELY. Never allow unqualified personnel to attempt to remove or replace any part of the machine.*

WARNING *Always use the correct lifting equipment to remove large or heavy components.*

WARNING *Never attempt to lift or hold up the machine using the lash-down points.*

SECTION 1

HYDRAULICS

DESCRIPTION AND OPERATION

DESCRIPTION

General

The hydraulic system supplies the power for boom manipulation, attachments, brakes and steering.

A hydraulic oil reservoir has a filter breather cap and supplies the main and auxiliary hydraulic pumps.

The reservoir is also fitted with a sight gauge. With the boom in the lower position, retracted and with the carriage tilted forward, the oil level will be visible in the gauge above the red line.

The main hydraulic pump is driven from the engine gearbox and is of the variable displacement type. Pressurized oil from the hydraulic pump is directed to the hydraulic control valve assembly (PVG). The control valve is modular in construction and combines individual sections (slices), each with a different use. At one end of the control valve is the priority module (PVSP), which controls the supply of hydraulic oil to the steering and brake systems. The remaining oil is supplied to those sections of the control valve that control each boom service.

The brakes, steering and boom services each supply a load-sensing signal, hydraulically, to the main hydraulic pump. This maintains the optimum supply of oil to those services.

The auxiliary hydraulic pump is driven by the engine timing case gears and supplies pressurized oil to the motor of the engine cooling fan. It also supplies oil to the front axle parking brake units, to keep the parking brake off. When this hydraulic pressure is released, spring pressure applies the parking brake.

The hydraulic tank is divided into clean and dirty sides by a mesh filter. A low-pressure filter is installed in the oil supply to the cooling fan system. This filter constantly filters the hydraulic fluid and a blockage indicator, installed in the filter, operates a warning light in the cab when servicing is required.

Modifications, such as the introduction of a reverse cooling fan or different brake servo valves, will change the basic layout of the system. To obtain the correct component layout you must refer to the applicable schematic illustration, which can be located using the batch Serial Number (S/No.) for the particular machine.

Dumping (dissipation) of hydraulic pressure

WARNING *Always dump all hydraulic pressure from the system before servicing any hydraulic component.*

WARNING *Ensure there is sufficient space and headroom around machine before operating any hydraulic control.*

To dump brake system pressure

1. Stop the engine.

2. Make sure the machine is parked on firm and level ground and chock the wheels.

3. Turn the ignition switch to position **(1)**.

4. Set the parking brake switch, if necessary, to the parking brake applied position.

5. Press the brake pedal repeatedly until the brake charge warning lamp illuminates.

6. Press the brake pedal a further twenty times to ensure that residual pressure in the brake system is fully dissipated.

7. Turn the ignition switch to off.

To dump a system pressure

NOTE: This procedure applies to all machine hydraulic systems, except brakes.

1. Stop the engine.

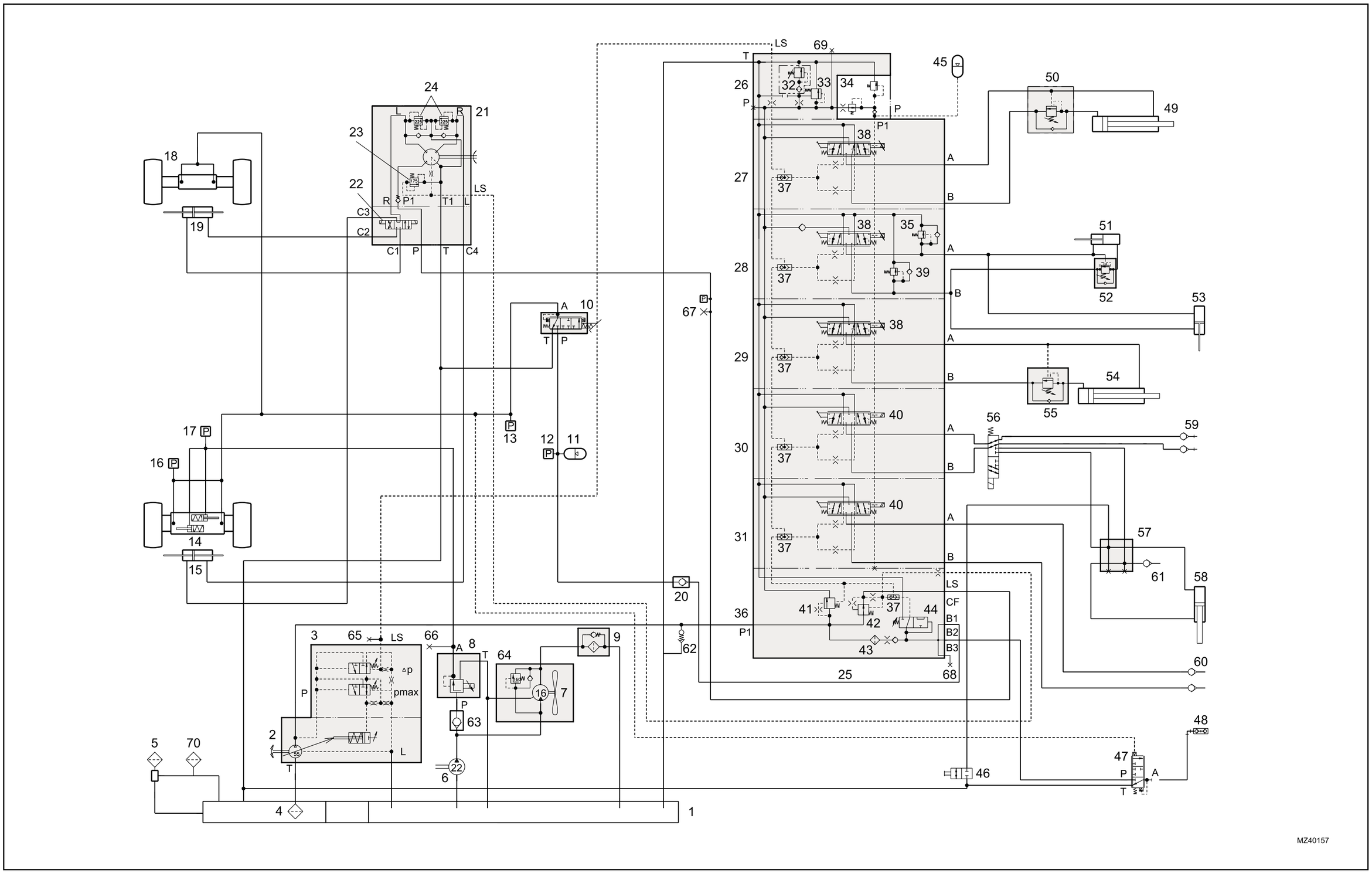
2. Make sure the machine is parked on firm and level ground and chock the wheels.

3. Turn the ignition switch to position ‘I’.

3. Operate the applicable system until all hydraulic pressure has been dissipated.

4. Turn the ignition switch to off.

HYDRAULIC CIRCUIT - SINGLE CIRCUIT BRAKING (up to Machine S/No.51200317)



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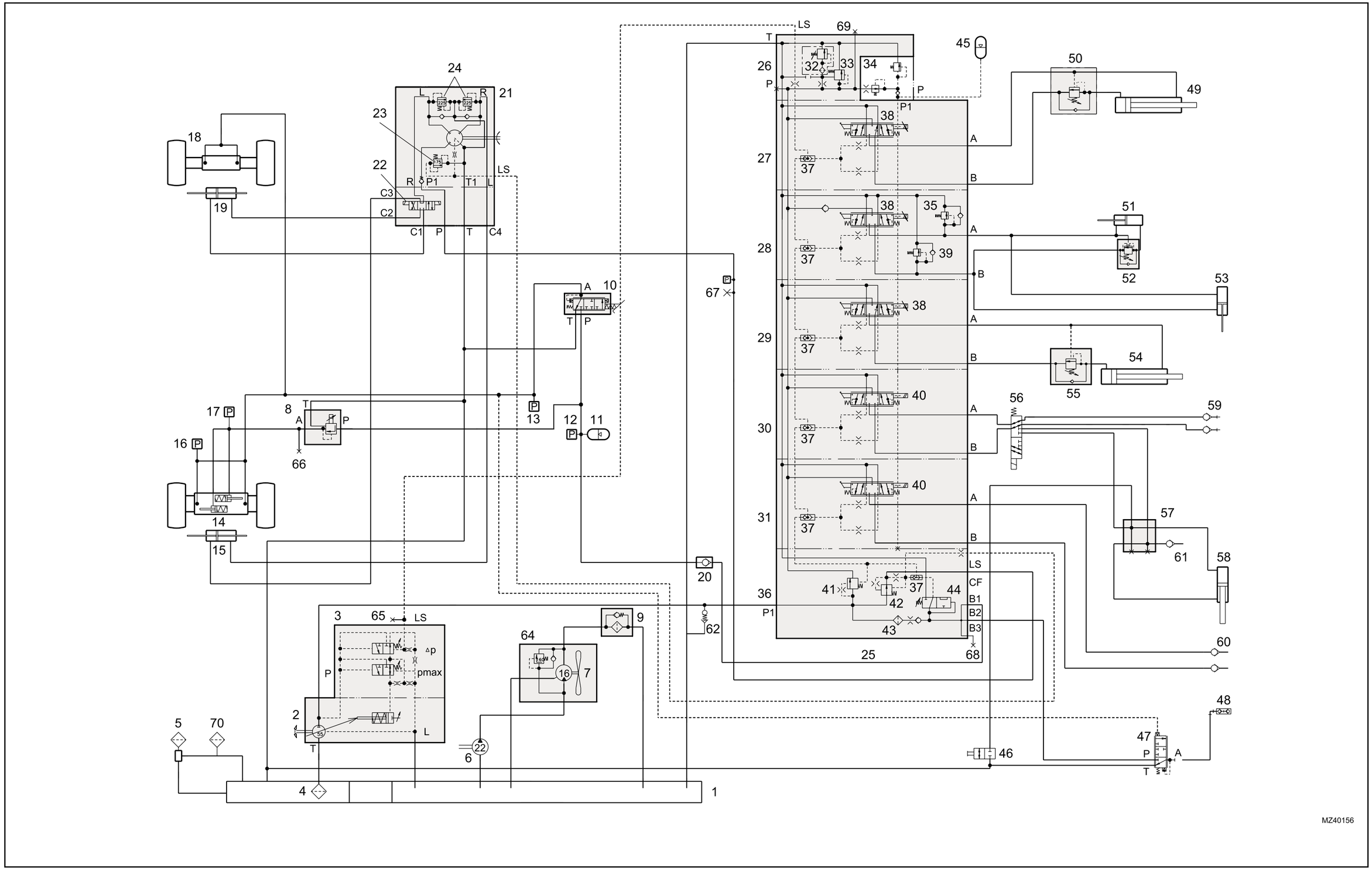
Key to hydraulic circuit - single circuit braking (up to Machine S/No.51200317)

1. Hydraulic tank (reservoir)
2. Hydraulic pump, load sensing (LS)
3. LS pump compensator
4. Gauze filter (Not Serviceable)
5. Filler/breather
6. Auxiliary hydraulic pump
7. Fan motor
8. Pressure reducing valve (parking brake control)
9. Pressure filter
10. Brake servo valve
11. Accumulator
12. Pressure switch (116 bar)
13. Pressure switch (15 bar)
14. Front axle (park brake actuators)
15. Steering cylinder (front)
16. Pressure switch (5 bar)
17. Pressure switch (16 bar)
18. Rear axle
19. Steering cylinder (rear)
20. Non-return valve
21. Steering control valve (Danfoss OSPF)
22. Steering selector valve (attached to OSPF valve)
23. Pressure relief valve (175 bar)
24. Shock valve (225 - 245 bar)
25. Hydraulics control valve (PVG 32)
26. Outlet section (PVP)
27. Extension section
28. Crowd/compensator section
29. Lift section
30. 1st auxiliary section (carriage/autohitch)
31. 2nd auxiliary section
32. Pressure relief valve (290 bar)
33. Pressure raising spool
34. Pilot valve
35. Shock valve (175 bar)
36. Inlet section (PVSP)
37. LS shuttle valve
38. Proportional controller
39. Shock valve (265 bar)
40. Controller (not proportional)
41. Priority valve (brakes and steering)
42. Priority valve (steering)
43. Filter
44. Brake accumulator charge valve (BAC)
45. Accumulator
46. Tap
47. Trailer brake valve
48. Trailer brake coupling
49. Extension cylinder
50. Load control valve
51. Crowd cylinder
52. Load control valve
53. Compensator cylinder
54. Lift cylinder
55. Load control valve
56. Diverter valve
57. Manifold
58. Cylinder, autohitch
59. 1st service couplings
60. 2nd service couplings
61. Trailer tipping coupling
62. Start-up valve
63. Non-return valve
64. Pressure relief valve (160 bar)
65. Test point 1 (main system pressure LS)
66. Test point 2 (parking brake release pressure)
67. Test point 3 (steering system pressure)
68. Test point 4 (brake circuit)
69. Test point 5 (main circuit pressure P)
70. Auxiliary breather

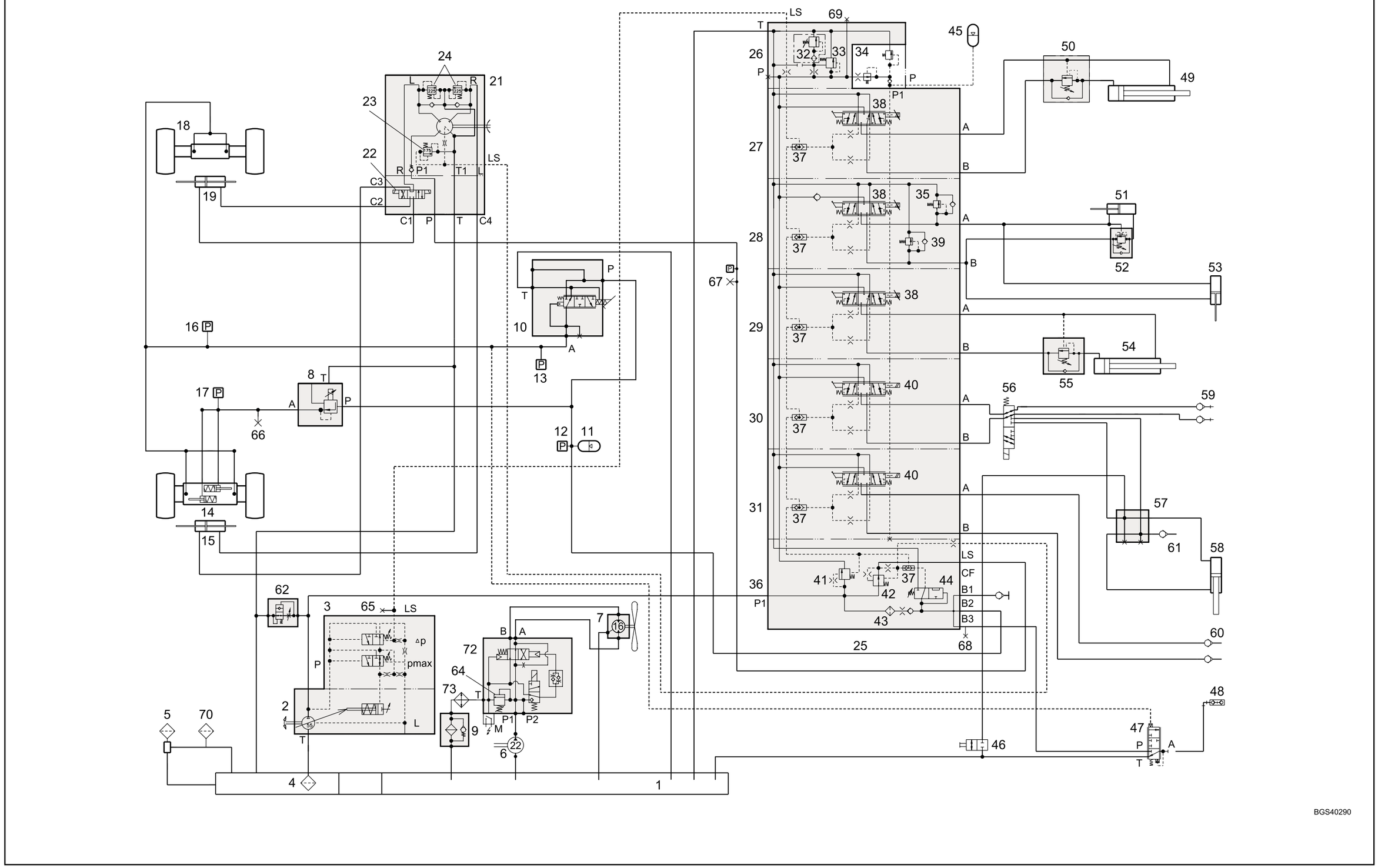
HYDRAULIC CIRCUIT - SINGLE CIRCUIT BRAKING (from Machine S/No.51200318 to 51200471)



Key to hydraulic circuit - single circuit braking (from Machine S/No.51200318 to 51200471)

1. Hydraulic tank
2. Hydraulic pump, load sensing (LS)
3. LS pump compensator
4. Gauze filter (Not Serviceable)
5. Filler/breather
6. Auxiliary hydraulic pump
7. Fan motor
8. Pressure reducing valve (parking brake control)
9. Pressure filter
10. Brake valve
11. Accumulator
12. Pressure switch (116 bar)
13. Pressure switch (15 bar)
14. Front axle (park brake actuators)
15. Steering cylinder (front)
16. Pressure switch (5 bar)
17. Pressure switch (16 bar)
18. Rear axle
19. Steering cylinder (rear)
20. Non-return valve
21. Steering control valve (Danfoss OSPF)
22. Steering selector valve (attached to OSPF valve)
23. Pressure relief valve (175 bar)
24. Shock valve (225 - 245 bar)
25. Hydraulic control valve (PVG 32)
26. Outlet section (PVP)
27. Extension section
28. Crowd/compensator section
29. Lift section
30. 1st auxiliary section (carriage/autohitch)
31. 2nd auxiliary section
32. Pressure relief valve (290 bar)
33. Pressure raising spool
34. Pilot valve
35. Shock valve (175 bar)
36. Inlet section (PVSP)
37. LS shuttle valve
38. Proportional controller
39. Shock valve (265 bar)
40. Controller (not proportional)
41. Priority valve (brakes and steering)
42. Priority valve (steering)
43. Filter
44. Brake accumulator charge valve (BAC)
45. Accumulator
46. Tap
47. Trailer brake valve
48. Trailer brake coupling
49. Extension cylinder
50. Load control valve
51. Crowd cylinder
52. Load control valve
53. Compensator cylinder
54. Lift cylinder
55. Load control valve
56. Diverter valve
57. Manifold
58. Cylinder (autohitch)
59. 1st service couplings
60. 2nd service couplings
61. Trailer tipping coupling
62. Start-up valve
63. NOT FITTED
64. Pressure relief valve (160 bar)
65. Test point 1 (main system pressure LS)
66. Test point 2 (parking brake release pressure)
67. Test point 3 (steering system pressure)
68. Test point 4 (brake circuit)
69. Test point 5 (main circuit pressure P)
70. Auxiliary breather

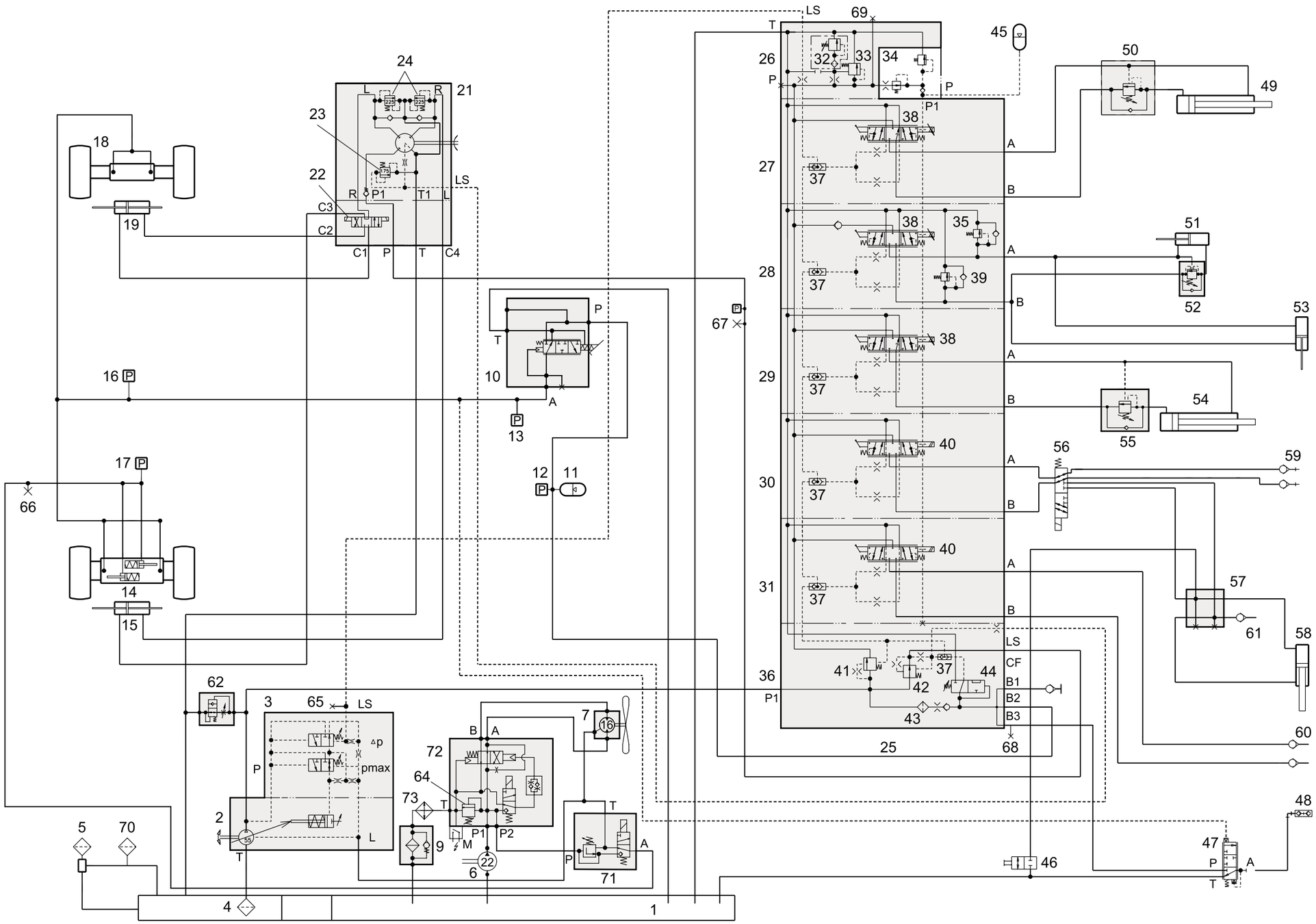
HYDRAULIC CIRCUIT - SINGLE CIRCUIT BRAKING (from Machine S/No. 51200472 to 51200551)



Key to hydraulic circuit - single circuit braking (from Machine S/No.51200472 to 51200551)

1. Hydraulic tank
2. Hydraulic pump, load sensing (LS)
3. LS pump compensator
4. Gauze filter (Not Serviceable)
5. Filler/breather
6. Auxiliary hydraulic pump
7. Fan motor
8. Pressure reducing valve (parking brake control)
9. Pressure filter
10. Brake valve (Safim type)
11. Accumulator
12. Pressure switch (116 bar)
13. Pressure switch (15 bar)
14. Front axle (park brake actuators)
15. Steering cylinder (front)
16. Pressure switch (5 bar)
17. Pressure switch (16 bar)
18. Rear axle
19. Steering cylinder (rear)
20. NOT FITTED
21. Steering control valve (Danfoss OSPF)
22. Steering selector valve (attached to OSPF valve)
23. Pressure relief valve (175 bar)
24. Shock valve (225 - 245 bar)
25. Hydraulic control valve (PVG 32)
26. Outlet section (PVP)
27. Extension section
28. Crowd/compensator section
29. Lift section
30. 1st auxiliary section (carriage/autohitch)
31. 2nd auxiliary section
32. Pressure relief valve (290 bar)
33. Pressure raising spool
34. Pilot valve
35. Shock valve (175 bar)
36. Inlet section (PVSP)
37. LS shuttle valve
38. Proportional controller
39. Shock valve (265 bar)
40. Controller (not proportional)
41. Priority valve (brakes and steering)
42. Priority valve (steering)
43. Filter
44. Brake accumulator charge valve (BAC)
45. Accumulator
46. Tap
47. Trailer brake valve
48. Trailer brake coupling
49. Extension cylinder
50. Load control valve
51. Crowd cylinder
52. Load control valve
53. Compensator cylinder
54. Lift cylinder
55. Load control valve
56. Diverter valve
57. Manifold
58. Cylinder, autohitch
59. 1st service couplings
60. 2nd service couplings
61. Trailer tipping coupling
62. Start-up valve
63. NOT FITTED
64. Pressure regulator, 120 bar
65. Test point 1 (main system pressure LS)
66. Test point 2 (parking brake release pressure)
67. Test point 3 (steering system pressure)
68. Test point 4 (brake circuit)
69. Test point 5 (main circuit pressure P)
70. Auxiliary breather
71. NOT FITTED
72. Fan reverse valve
73. Oil cooler

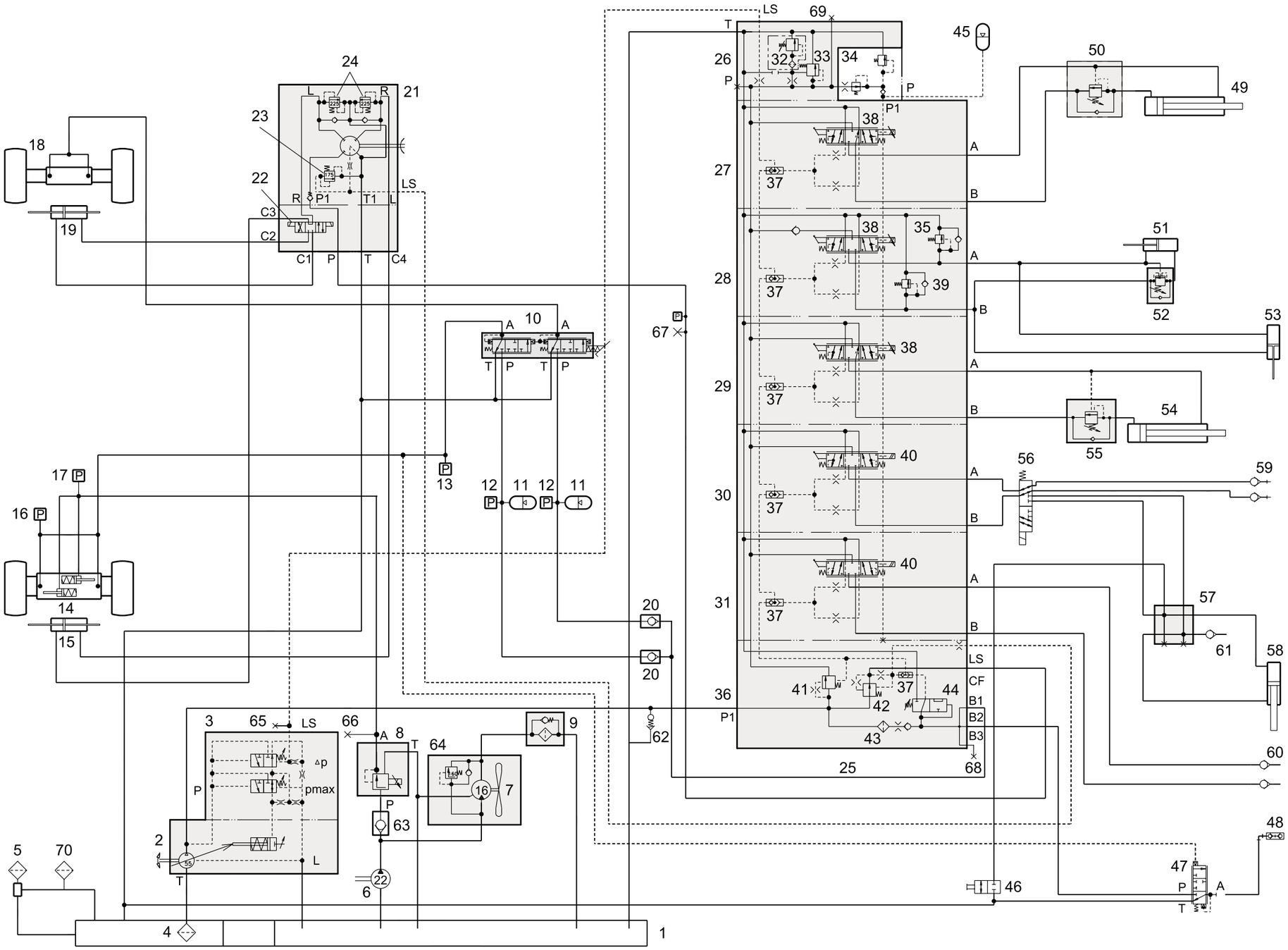
HYDRAULIC CIRCUIT - SINGLE CIRCUIT BRAKING (from Machine S/No. 51200552 to 51200727)



Key to hydraulic circuit - single circuit braking (from Machine S/No.51200552 to 51200727)

1. Hydraulic tank
2. Hydraulic pump, load sensing (LS)
3. LS pump compensator
4. Gauze filter (Not Serviceable)
5. Filler/breather
6. Auxiliary hydraulic pump
7. Fan motor
8. NOT FITTED
9. Pressure filter
10. Brake valve (Safim type)
11. Accumulator
12. Pressure switch (116 bar)
13. Pressure switch (15 bar)
14. Front axle (park brake actuators)
15. Steering cylinder (front)
16. Pressure switch (5 bar)
17. Pressure switch (16 bar)
18. Rear axle
19. Steering cylinder (rear)
20. NOT FITTED
21. Steering control valve (Danfoss OSPF)
22. Steering selector valve (attached to OSPF valve)
23. Pressure relief valve (175 bar)
24. Shock valve (225 - 245 bar)
25. Hydraulic control valve (PVG 32)
26. Outlet section (PVP)
27. Extension section
28. Crowd/compensator section
29. Lift section
30. 1st auxiliary section (carriage/autohitch)
31. 2nd auxiliary section
32. Pressure relief valve (290 bar)
33. Pressure raising spool
34. Pilot valve
35. Shock valve (175 bar)
36. Inlet section (PVSP)
37. LS shuttle valve
38. Proportional controller
39. Shock valve (265 bar)
40. Controller (not proportional)
41. Priority valve (brakes and steering)
42. Priority valve (steering)
43. Filter
44. Brake accumulator charge valve (BAC)
45. Accumulator
46. Tap
47. Trailer brake valve
48. Trailer brake coupling
49. Extension cylinder
50. Load control valve
51. Crowd cylinder
52. Load control valve
53. Compensator cylinder
54. Lift cylinder
55. Load control valve
56. Diverter valve
57. Manifold
58. Cylinder, autohitch
59. 1st service couplings
60. 2nd service couplings
61. Trailer tipping coupling
62. Start-up valve
63. NOT FITTED
64. Pressure regulator, 120 bar
65. Test point 1 (main system pressure LS)
66. Test point 2 (parking brake release pressure)
67. Test point 3 (steering system pressure)
68. Test point 4 (brake circuit)
69. Test point 5 (main circuit pressure P)
70. Auxiliary breather
71. Parking brake valve
72. Fan reverse valve
73. Oil cooler

HYDRAULIC CIRCUIT - DUAL CIRCUIT BRAKING (up to Machine S/No.51200317)



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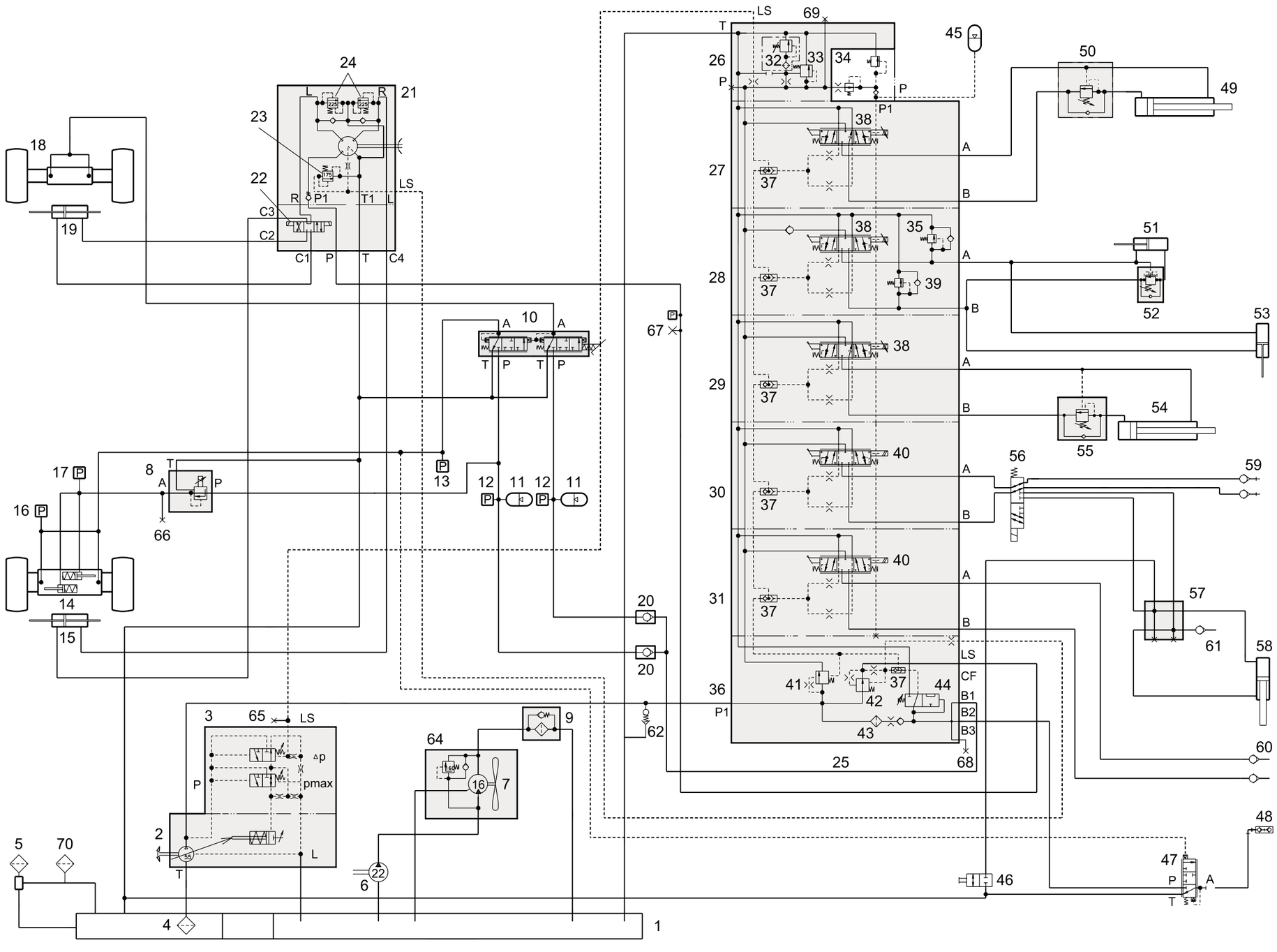
Key to hydraulic circuit - dual circuit braking (up to Machine S/No.51200317)

1. Hydraulic tank
2. Hydraulic pump, load sensing (LS)
3. LS pump compensator
4. Gauze filter (Not Serviceable)
5. Filler/breather
6. Auxiliary hydraulic pump
7. Fan motor
8. Pressure reducing valve (parking brake control)
9. Pressure filter
10. Brake valve
11. Accumulator
12. Pressure switch (116 bar)
13. Pressure switch (15 bar)
14. Front axle (park brake actuators)
15. Steering cylinder (front)
16. Pressure switch (5 bar)
17. Pressure switch (16 bar)
18. Rear axle
19. Steering cylinder (rear)
20. Non-return valve
21. Steering control valve (Danfoss OSPF)
22. Steering selector valve (attached to OSPF valve)
23. Pressure relief valve (175 bar)
24. Shock valve (225 - 245 bar)
25. Hydraulic control valve (PVG 32)
26. Outlet section (PVP)
27. Extension section
28. Crowd/compensator section
29. Lift section
30. 1st auxiliary section (carriage/autohitch)
31. 2nd auxiliary section
32. Pressure relief valve (290 bar)
33. Pressure raising spool
34. Pilot valve
35. Shock valve (175 bar)
36. Inlet section (PVSP)
37. LS shuttle valve
38. Proportional controller
39. Shock valve (265 bar)
40. Controller, (not proportional)
41. Priority valve (brakes and steering)
42. Priority valve (steering)
43. Filter
44. Brake accumulator charge valve (BAC)
45. Accumulator
46. Tap
47. Trailer brake valve
48. Trailer brake coupling
49. Extension cylinder
50. Load control valve
51. Crowd cylinder
52. Load control valve
53. Compensator cylinder
54. Lift cylinder
55. Load control valve
56. Diverter valve
57. Manifold
58. Cylinder, autohitch
59. 1st service couplings
60. 2nd service couplings
61. Trailer tipping coupling
62. Start-up valve
63. Non-return valve
64. Pressure relief valve (160 bar)
65. Test point 1 (main system pressure LS)
66. Test point 2 (parking brake release pressure)
67. Test point 3 (steering system pressure)
68. Test point 4 (brake circuit)
69. Test point 5 (main circuit pressure P)
70. Auxiliary breather

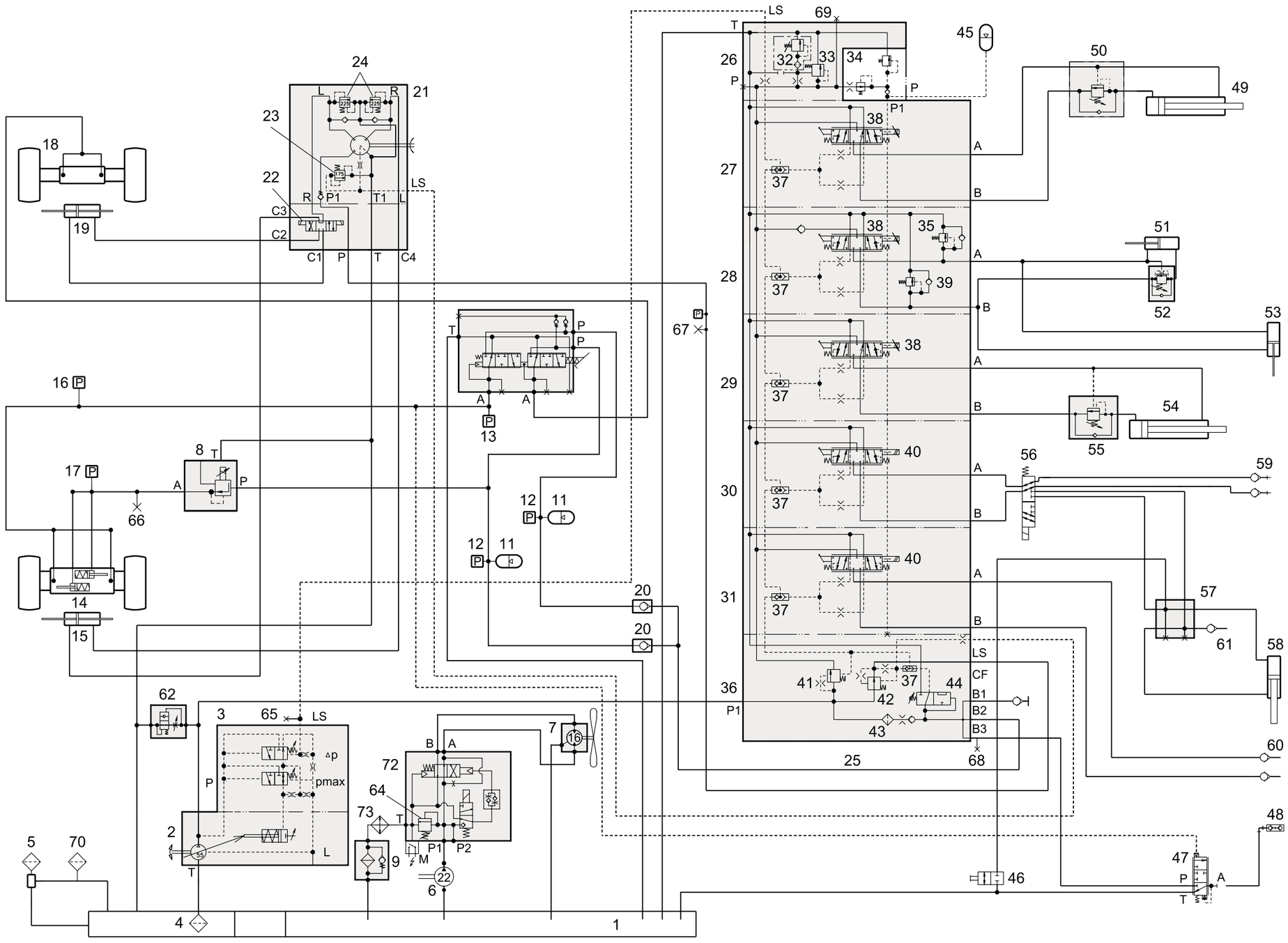
HYDRAULIC CIRCUIT - DUAL CIRCUIT BRAKING (from Machine S/No.51200318 to 51200471)



Key to hydraulic circuit - dual circuit braking (from Machine S/No.51200318 TO 512471)

1. Hydraulic tank
2. Hydraulic pump, load sensing (LS)
3. LS pump compensator
4. Gauze filter (Not Serviceable)
5. Filler/breather
6. Auxiliary hydraulic pump
7. Fan motor
8. Pressure reducing valve (parking brake control)
9. Pressure filter
10. Brake valve
11. Accumulator
12. Pressure switch (116 bar)
13. Pressure switch (15 bar)
14. Front axle (park brake actuators)
15. Steering cylinder (front)
16. Pressure switch (5 bar)
17. Pressure switch (16 bar)
18. Rear axle
19. Steering cylinder (rear)
20. Non-return valve
21. Steering control valve (Danfoss OSPF)
22. Steering selector valve (attached to OSPF valve)
23. Pressure relief valve (175 bar)
24. Shock valve (225 - 245 bar)
25. Hydraulic control valve (PVG 32)
26. Outlet section (PVP)
27. Extension section
28. Crowd/compensator section
29. Lift section
30. 1st auxiliary section (carriage/autohitch)
31. 2nd auxiliary section
32. Pressure relief valve, 290 bar
33. Pressure raising spool
34. Pilot valve
35. Shock valve (175 bar)
36. Inlet section (PVSP)
37. LS shuttle valve
38. Proportional controller
39. Shock valve (265 bar)
40. Controller (not proportional)
41. Priority valve (brakes and steering)
42. Priority valve, steering
43. Filter
44. Brake accumulator charge valve (BAC)
45. Accumulator
46. Tap
47. Trailer brake valve
48. Trailer brake coupling
49. Extension cylinder
50. Load control valve
51. Crowd cylinder
52. Load control valve
53. Compensator cylinder
54. Lift cylinder
55. Load control valve
56. Diverter valve
57. Manifold
58. Cylinder, autohitch
59. 1st service couplings
60. 2nd service couplings
61. Trailer tipping coupling
62. Start-up valve
63. NOT FITTED
64. Pressure relief valve (160 bar)
65. Test point 1 (main system pressure LS)
66. Test point 2 (Park brake release pressure)
67. Test point 3 (steering system pressure)
68. Test point 4 (brake circuit)
69. Test point 5 (main circuit pressure P)
70 Auxiliary breather

HYDRAULIC CIRCUIT - DUAL CIRCUIT BRAKING (from Machine S/No.51200472 to 51200551)



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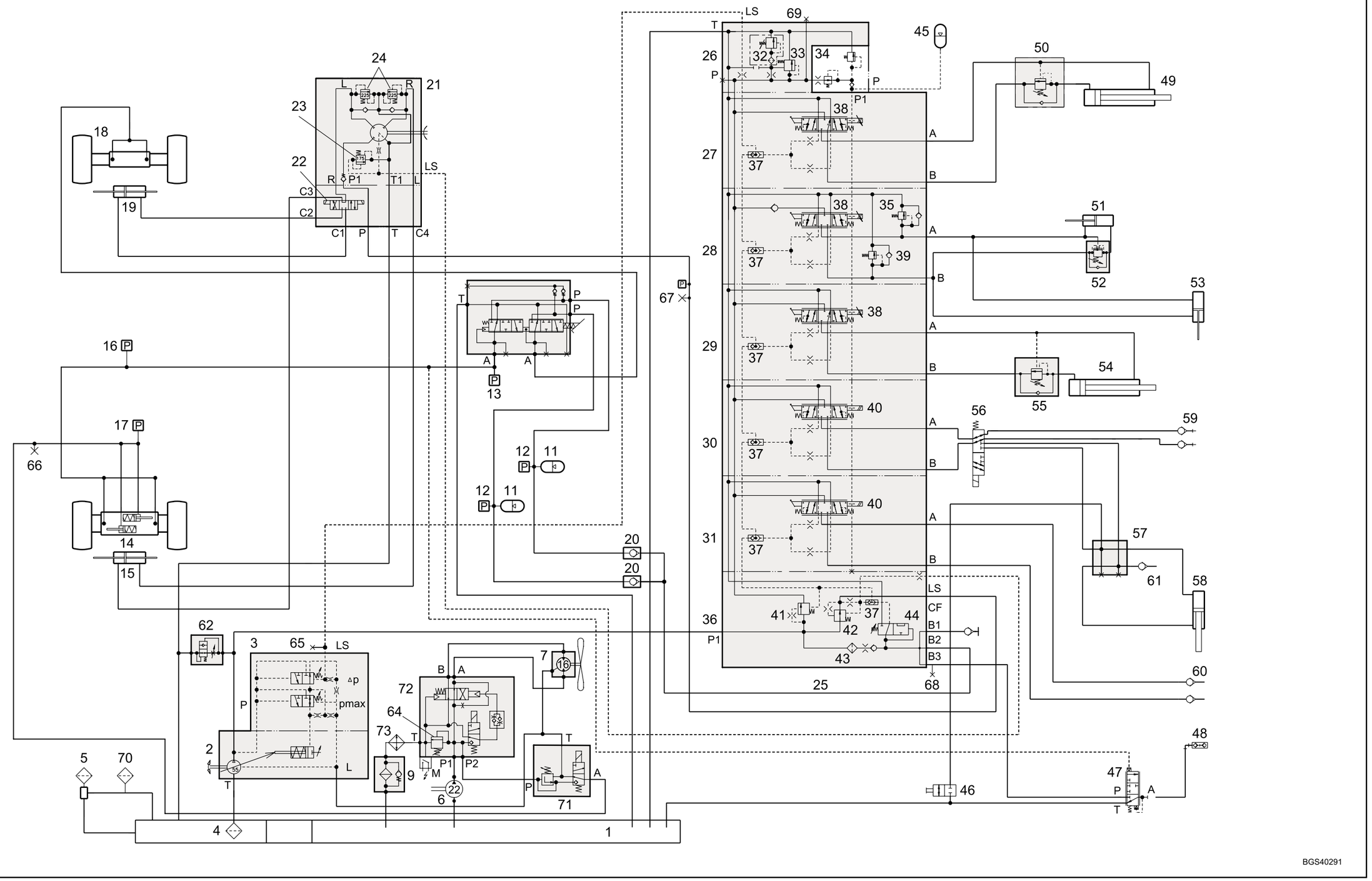
Key to hydraulic circuit - dual circuit braking

(from Machine S/No.51200472 TO 512551)

1. Hydraulic tank
2. Hydraulic pump, load sensing (LS)
3. LS pump compensator
4. Gauze filter (Not Serviceable)
5. Filler/breather
6. Auxiliary hydraulic pump
7. Fan motor
8. Pressure reducing valve (parking brake control)
9. Pressure filter
10. Brake valve
11. Accumulator
12. Pressure switch (116 bar)
13. Pressure switch (15 bar)
14. Front axle (park brake actuators)
15. Steering cylinder (front)
16. Pressure switch (5 bar)
17. Pressure switch (16 bar)
18. Rear axle
19. Steering cylinder (rear)
20. Non-return valve
21. Steering control valve (Danfoss OSPF)
22. Steering selector valve (attached to OSPF valve)
23. Pressure relief valve (175 bar)
24. Shock valve (225 - 245 bar)
25. Hydraulic control valve (PVG 32)
26. Outlet section (PVP)
27. Extension section
28. Crowd/compensator section
29. Lift section
30. 1st auxiliary section (carriage/autohitch)
31. 2nd auxiliary section
32. Pressure relief valve, 290 bar
33. Pressure raising spool
34. Pilot valve
35. Shock valve (175 bar)
36. Inlet section (PVSP)
37. LS shuttle valve
38. Proportional controller
39. Shock valve (265 bar)
40. Controller (not proportional)
41. Priority valve (brakes and steering)
42. Priority valve, steering
43. Filter
44. Brake accumulator charge valve (BAC)
45. Accumulator
46. Tap
47. Trailer brake valve
48. Trailer brake coupling
49. Extension cylinder
50. Load control valve
51. Crowd cylinder
52. Load control valve
53. Compensator cylinder
54. Lift cylinder
55. Load control valve
56. Diverter valve
57. Manifold
58. Cylinder, autohitch
59. 1st service couplings
60. 2nd service couplings
61. Trailer tipping coupling
62. Start-up valve
63. NOT FITTED
64. Pressure regulator, 120 bar
65. Test point 1 (main system pressure LS)
66. Test point 2 (Park brake release pressure)
67. Test point 3 (steering system pressure)
68. Test point 4 (brake circuit)
69. Test point 5 (main circuit pressure P)
70 Auxiliary breather
71. NOT FITTED
72. Fan reverse valve
73. Oil cooler

HYDRAULIC CIRCUIT - DUAL CIRCUIT BRAKING (from Machine S/No.51200552 to 51200727)



BGS40291

Key to hydraulic circuit - dual circuit braking (from Machine S/No.51200552 TO 512727)

1. Hydraulic tank
2. Hydraulic pump, load sensing (LS)
3. LS pump compensator
4. Gauze filter (Not Serviceable)
5. Filler/breather
6. Auxiliary hydraulic pump
7. Fan motor
8. NOT FITTED
9. Pressure filter
10. Brake valve (Safim type)
11. Accumulator
12. Pressure switch (116 bar)
13. Pressure switch (15 bar)
14. Front axle (park brake actuators)
15. Steering cylinder (front)
16. Pressure switch (5 bar)
17. Pressure switch (16 bar)
18. Rear axle
19. Steering cylinder (rear)
20. Non-return valve
21. Steering control valve (Danfoss OSPF)
22. Steering selector valve (attached to OSPF valve)
23. Pressure relief valve (175 bar)
24. Shock valve (225 - 245 bar)
25. Hydraulic control valve (PVG 32)
26. Outlet section (PVP)
27. Extension section
28. Crowd/compensator section
29. Lift section
30. 1st auxiliary section (carriage/autohitch)
31. 2nd auxiliary section
32. Pressure relief valve, 290 bar
33. Pressure raising spool
34. Pilot valve
35. Shock valve (175 bar)
36. Inlet section (PVSP)
37. LS shuttle valve
38. Proportional controller
39. Shock valve (265 bar)
40. Controller (not proportional)
41. Priority valve (brakes and steering)
42. Priority valve, steering
43. Filter
44. Brake accumulator charge valve (BAC)
45. Accumulator
46. Tap
47. Trailer brake valve
48. Trailer brake coupling
49. Extension cylinder
50. Load control valve
51. Crowd cylinder
52. Load control valve
53. Compensator cylinder
54. Lift cylinder
55. Load control valve
56. Diverter valve
57. Manifold
58. Cylinder, autohitch
59. 1st service couplings
60. 2nd service couplings
61. Trailer tipping coupling
62. Start-up valve
63. NOT FITTED
64. Pressure regulator, 120 bar
65. Test point 1 (main system pressure LS)
66. Test point 2 (Park brake release pressure)
67. Test point 3 (steering system pressure)
68. Test point 4 (brake circuit)
69. Test point 5 (main circuit pressure P)
70 Auxiliary breather
71. Parking brake valve
72. Fan reverse valve
73. Oil cooler

COMPONENTS

General

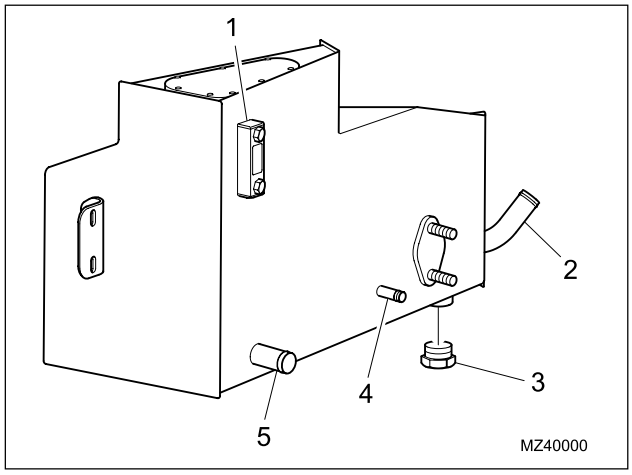
NOTE: An identification number in bold type, after an item, refers to the number of that item in the main hydraulic schematic illustration.

Hydraulic tank (1)

A single hydraulic reservoir feeds the main and auxiliary systems of the machine. A sight glass is fitted to check system contents. An internal 40 µm mesh filter (pre-filtration) separates the clean and dirty sides of the tank. Both system suction lines are taken from the clean side of the mesh filter. All return lines go to a manifold and return fluid to dirty side of tank for pre filtration.

Specifications:

Nominal tank capacity	67 litres
Total system capacity (oil)	128 litres

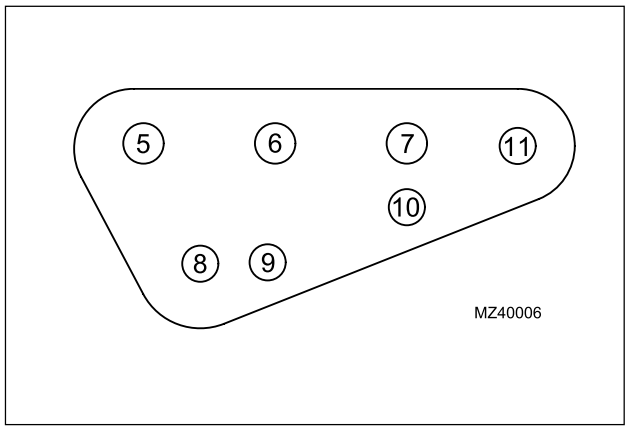


Suction line connections to hydraulic tank

1. Sight glass
2. Suction - Main Pump
3. Drain plug
4. Suction - Auxiliary Pump
5. Filler

Return hose connections to hydraulic tank
(up to Machine S/No.51200471)

5. Return from PVG (Main Control Valve)
6. Return from LS Pump and Filter
7. From LS Pump Case Drain
8. Breather (connected to Filler)
9. Return from Brake and Steering circuits
10. From Trailer Brake (optional)
11. Return from Parking Brake PRV



Return hose connections to hydraulic tank
(from Machine S/No.51200472)

5. Return from PVG (Main Control Valve)
6. Return from LS Pump and Filter
7. (Blank fitted)
8. Breather (connected to Filler)
9. Return from Brake circuit
10. From Trailer Brake (optional)
11. Return from Brake and Parking Brake circuit

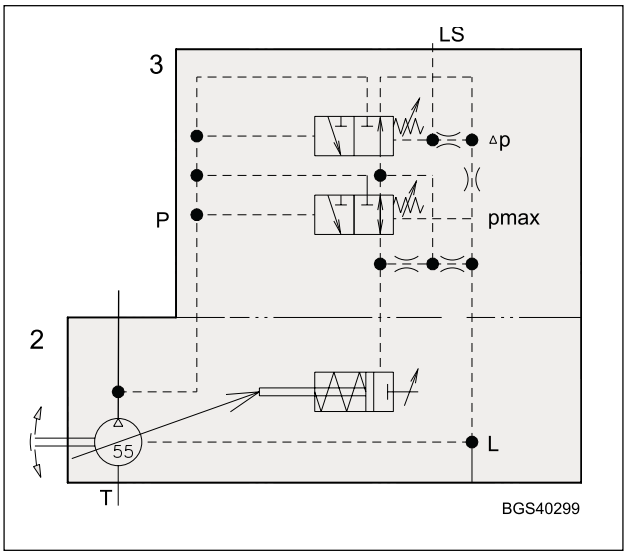
Hydraulic Pump (load sensing) (2)

The load sensing hydraulic pump supplies pressure to operate all services, except the fan motor and parking brake circuits.

Specifications

Pressure	(P)	250 bar (3625 psi)
Pressure	(load sensing)	14 bar (200 psi)
Pressure	(stand-by)	20 bar (290 psi)

Capacity (flow)
(up to Machine S/No.51200471)
122 l/min @ 2300 rpm
(from Machine S/No.51200472)
122 l/min @ 2200 rpm



Pump compensator (load sensing) (3)

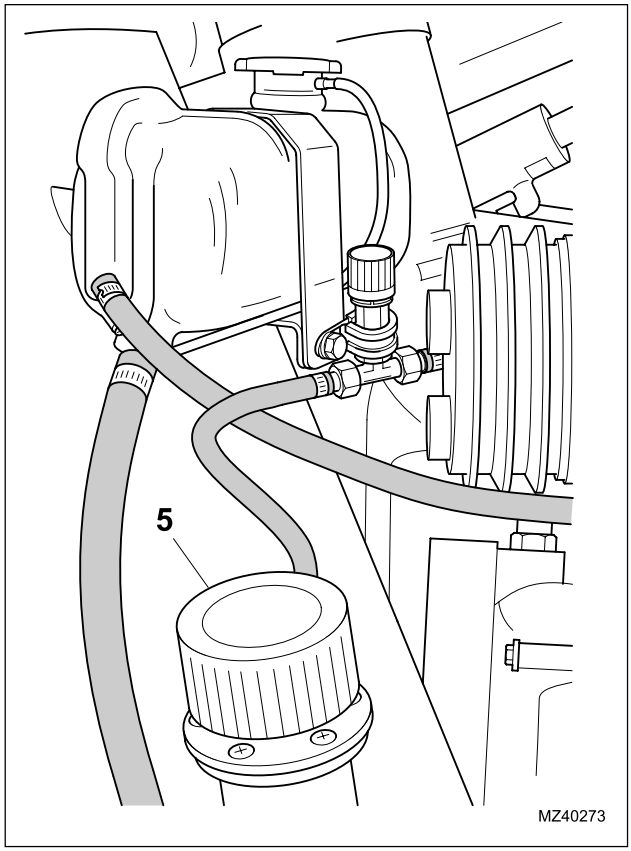
The LS pump compensator controls the stand-by pressure of the pump when services are not demanding oil, then causes the pump to swash and deliver full pressure when a service is operated. The valve also contains a pressure relief valve.

Tank filter (4)

The filter (not illustrated) is in the hydraulic tank and separates the return side from the clean side of the tank and is rated at 40 mm.

Filler/breather (5)

The hydraulic tank is replenished through the filler/ breather (5) which contains a filter rated at 7µm. The filler breather maintains a positive pressure of 0.3 bar (4 psi) in the hydraulic tank.



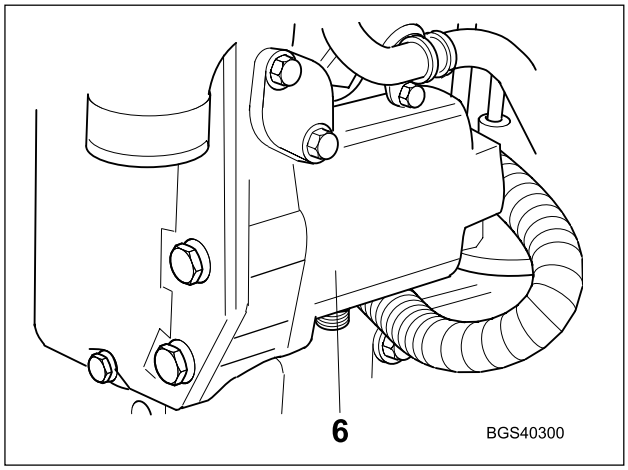
Auxiliary hydraulic pump (6)

The auxiliary pump supplies pressure to operate the engine cooling fan motor and keep the parking brake off while the engine is running.

Specifications

Pressure (Max allowable in circuit)	160 bar (2320 psi)
Capacity (flow)	50 l/min @ 2300 rpm

NOTE: On Machines up to S/No.51200317, a non-return valve **(63)**, between the auxiliary pump (6) and the PRV **(8)** maintains line pressure security from any fluctuation in the auxiliary circuit. This prevents any immediate application of the parking brake in the event of engine or hydraulic failure.



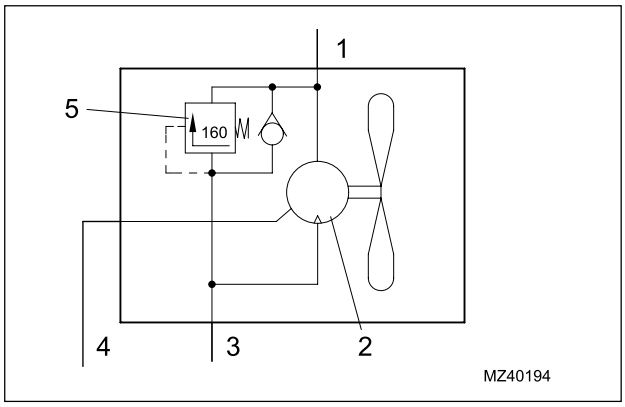
Fan motor (7)

NOTE: Fitted to machines up to S/No.51200471only.

This type of fan motor is hydraulically operated from the auxiliary circuit and is fitted as part of the engine cooling system. The fan is secured to the drive shaft with a woodruff key, nut and tab washer. A cartridge pressure relief valve (64) is attached to the fan motor.

Specifications:

Pressure relief valve	160 bar (2320 psi)

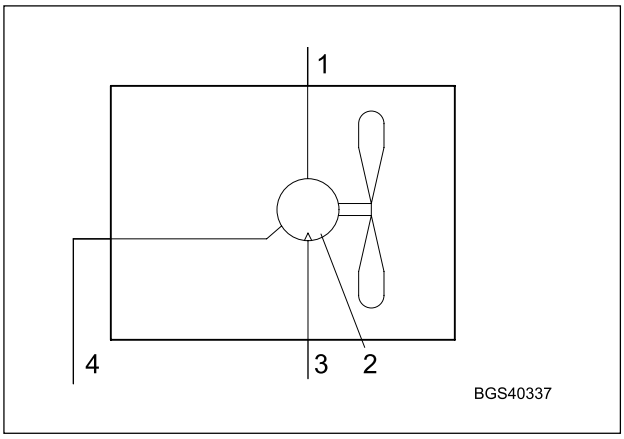


1. To pressure filter (9)
2. Fan motor (7)
3. Pressure - auxiliary pump (6)
4. Return to tank (1)
5. Pressure relief valve (64)

Fan reverse motor (7)

NOTE: Fitted to machines from S/No.51200472 only.

This type of fan motor is hydraulically operated from the auxiliary circuit and is fitted as part of the Reverse Fan engine cooling system. The fan is secured to the drive shaft with a woodruff key, nut and tab washer.



1. Fan reverse valve (72)
2. Fan motor (7)
3. Fan reverse valve (72)
4. Return to tank (1)

Pressure Reducing Valve (PRV) - for the parking brake (8)

NOTE: (Fitted to Machines up to S/No.51200551 only

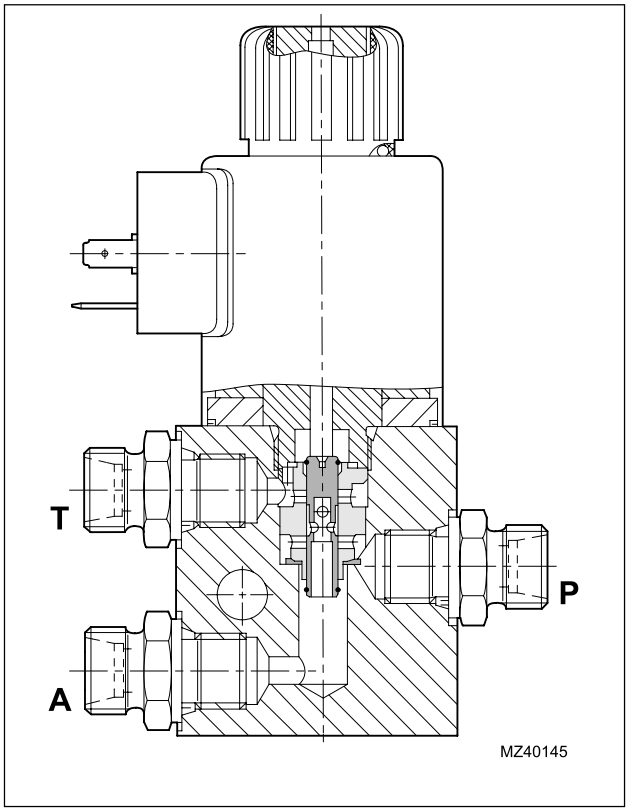
The Pressure Reducing Valve (PRV) (8) for the parking brake is electrically controlled from a switch in the cab (refer to electrical section). The PRV is located in the engine pod for Machines up to S/No.51200317 and adjacent to the front axle for Machine S/No's.51200318 to 51200551. The switch operates a solenoid on the valve to give proportional operation. The pressure can be tested using test point 2 (66 - Refer to Page 1.30), which is in the output from connection A.

NOTE: The voltage to the solenoid is supplied through a voltage transformer, to achieve the proportionality required.

CAUTION *Under no circumstances should battery voltage be applied to this solenoid.*

Specifications:

Operating pressure	16 bar (230 psi)
Maximum pressure	20 bar (290 psi)
Solenoid	3mm/12vdc/100% prop



T. Return to hydraulic tank (1)
P. Supply from Auxiliary pump (6)
A. Supply to Parking Brake actuators (14)

Pressure filter (9)

NOTE: (Fitted to Machines up to S/No.51200471 only)

The oil pressure filter (9) is installed in the return line, between the fan motor (7) and the hydraulic tank (1).

NOTE: (Fitted to Machines from S/No.51200472 only)

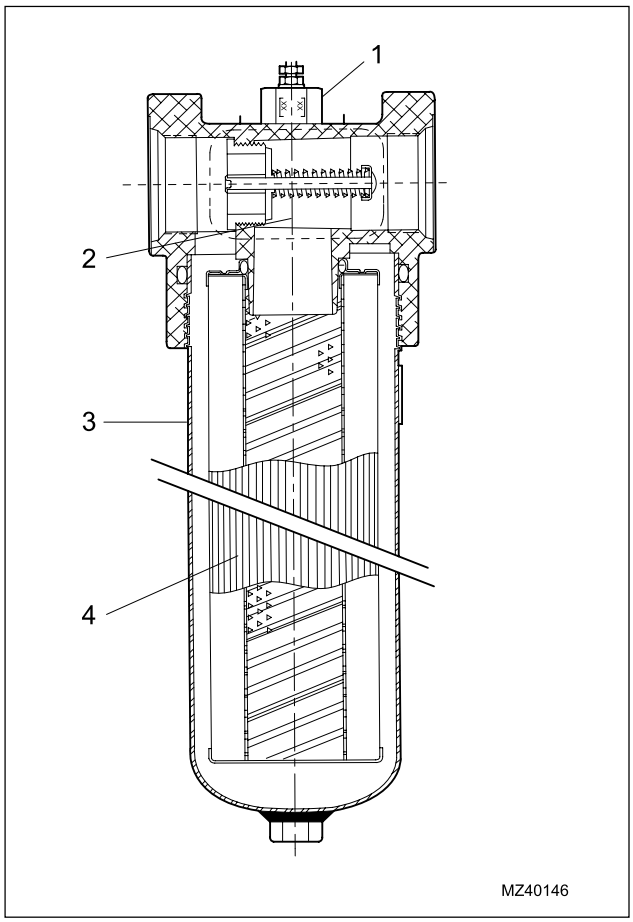
The oil pressure filter (9) is installed in the return line, between the reverse fan valve (72) and the hydraulic tank (1).

If the filter becomes blocked, a filter blockage warning light in the cab illuminates and a bypass will open at 3.5 bar (50 psi).

CAUTION *When the warning light is illuminated NO filtration is taking place. Always change the filter IMMEDIATELY.*

Specifications

Filtration 10µm



1. Pressure switch
2. Bypass valve
3. Filter bowl
4. Filter media

Single circuit brake pressure servo valve (MICO) (10)

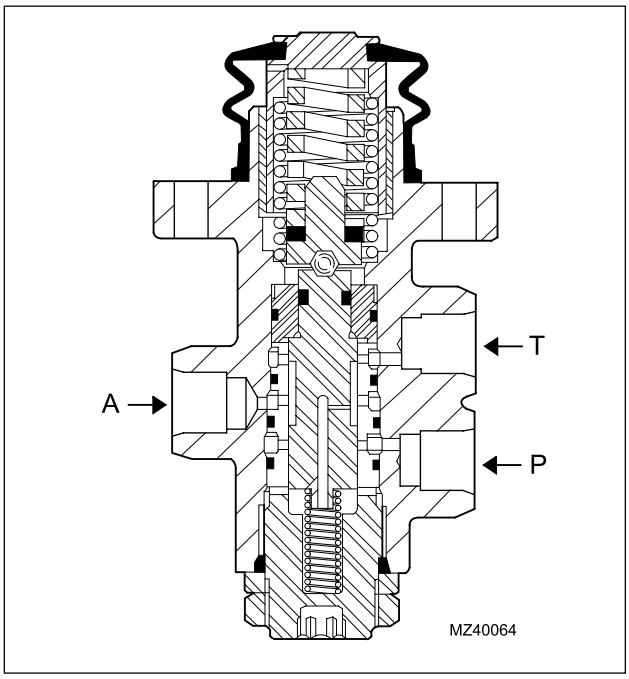
NOTE: Fitted to Machines up to S/No.51200471 only.

The brake pressure servo valve can be either single or dual depending on the model of the machine.

The operation of the servo valve is proportional to brake pedal movement. When the brake pedal is pressed, the valve (10) allows pressure in the accumulator (11) to apply the brakes. When the brake pedal is released, the valve (10) closes the pressure line from the accumulator (11) and diverts brake pressure from the brake units to the hydraulic tank (1), releasing the brakes.

Specification

Brake pressure at A	44 bar (640 psi)



Servo Valve - Single circuit brake pedal

P Pressure supply from Accumulator (11)

T Return to Hydraulic Tank (1)

A Supply to Brakes on Front (14) and Rear (18) Axles

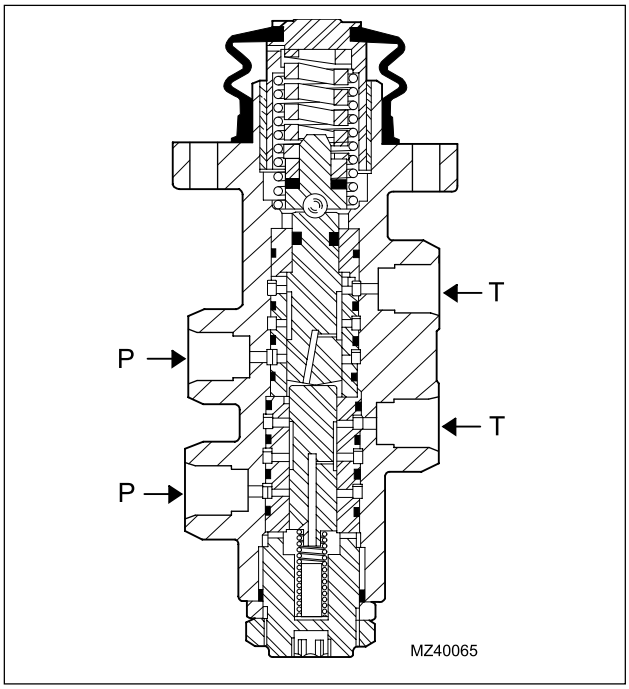
Dual circuit brake pressure servo valve (MICO) (10)

NOTE: Fitted to Machines up to S/No.51200471 only.

With a dual brake servo valve (10), the front and rear brakes are operated independently of each other by separate feed and return lines from the servo valve.

Specification

Brake pressure at A (not shown)	44 bar (640 psi)



Servo Valve - Dual circuit brake pedal

P Pressure supplies from Accumulators (11)

T Return from Hydraulic Tank (1)

A (not shown) - Supply to Brakes on Front (14) and Rear (18) Axles

Single circuit brake pressure servo valve (SAFIM) (10)

NOTE: Fitted from Machines Serial No.51200472 only

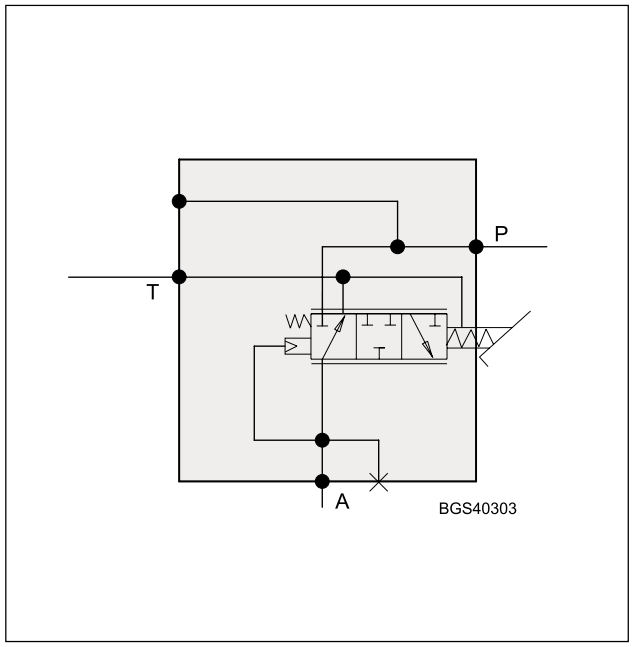
The brake pressure servo valve can be either single or dual depending on the model of the machine. The valve is constructed from 3 separate modules, the master cylinder, valve body and end plate. Brake pedal travel and braking pressure are set using an adjusting screw, located on the base on the brake valve.

The operation of the servo valve (1) is proportional to brake pedal movement. When the brake pedal is pressed, a pivoted lever moves a master cylinder, which positions an associated sprung loaded plunger. The plunger is in contact with the main shuttle valve in the valve body Refer to Page 1.84). The shuttle valve controls the flow of the pressure oil supply from the brake accumulator. The accumulator is supplied from the inlet (PVSP) section of the main hydraulic control valve. When the shuttle valve is moved, the oil supply from the accumulator is allowed to flow to the outlet connection in the end plate, which supplies the front and rear brakes units.

When the brake pedal is released, spring pressure in the master valve releases pressure on the shuttle valve and repositions the brake pedal. The shuttle valve moves under spring pressure to close the oil supply from the accumulator and divert residual oil pressure from the brake system to the hydraulic tank, releasing the brakes.

Specification:

Brake pressure at A 44 bar (640 psi)

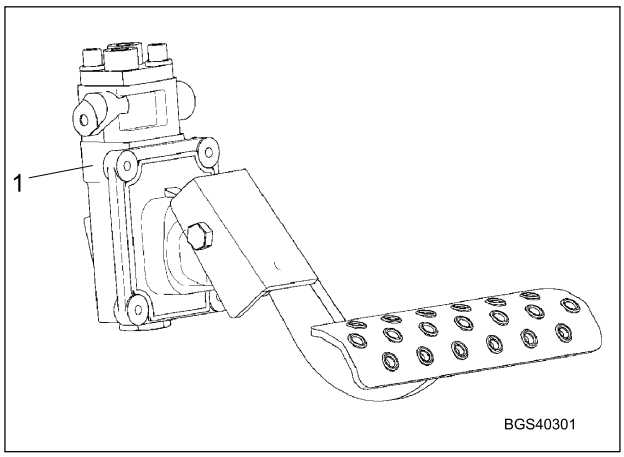


Servo Valve - Single circuit brake pedal

P Pressure supply from Accumulator (11)

T Return to Hydraulic Tank (1)

A Supply to Brakes on Front (14) and Rear (18) Axles



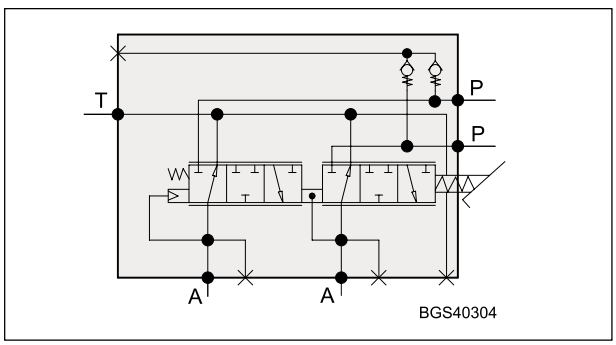
Dual circuit Brake pressure servo valve (SAFIM) (10)

NOTE: Fitted from Machines Serial No.51200472 only

The construction and operation of the dual brake servo valve is similar to the single servo valve. The primary difference is that the front and rear brakes are operated independently of each other by separate feed and return lines from the servo valve.

Specification:

Brake pressure at A 44 bar (640 psi)



Servo Valve - Dual circuit brake pedal

P Pressure supply from Accumulators (11)

T Return to Hydraulic Tank (1)

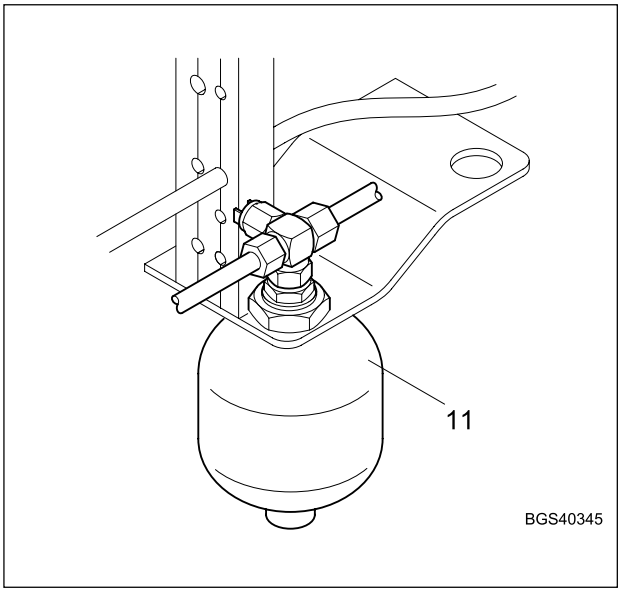
A Supply to Brakes on Front (14) and Rear (18) Axles

Accumulator(s) (11)

The nitrogen charged accumulator(s) provide hydraulic pressure for efficient operation of the brakes under all pump load conditions. One accumulator is fitted for the single brake system and two are fitted for the dual brake system. The accumulator(s) are located in the chassis behind the cab assembly.

Specifications

Pre-charge pressure	41 bar (595 psi)
Oil capacity	0.75 litre

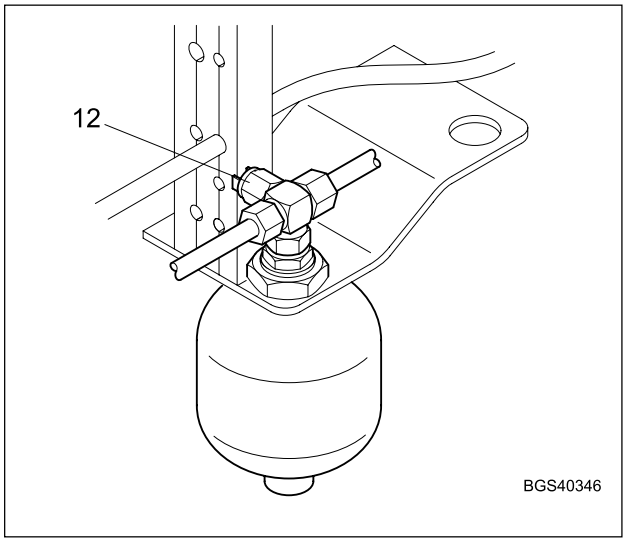


Pressure switch (12)

The pressure switch illuminates a warning light in the cab when brake pressure drops to a critical level. The pressure switch is located adjacent to the accumulator(s) (11) behind of the cab structure, forward of the rear axle.

Specification

Operating pressure 116 bar (1682 psi) falling

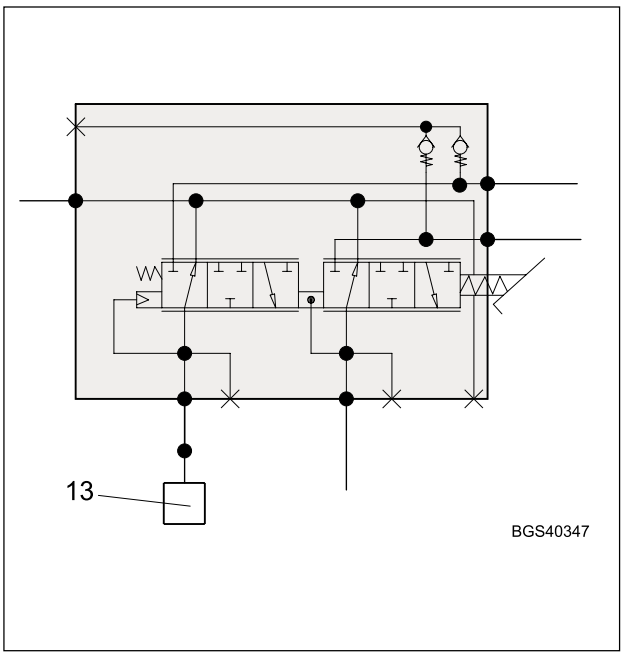


Pressure switch (transmission dump) (13)

When the transmission dump selector switch in the cab is operated the pressure switch will disconnect transmission when the brakes are applied. The pressure switch is located adjacent to the transmission drop box, above the drive shaft.

Specification

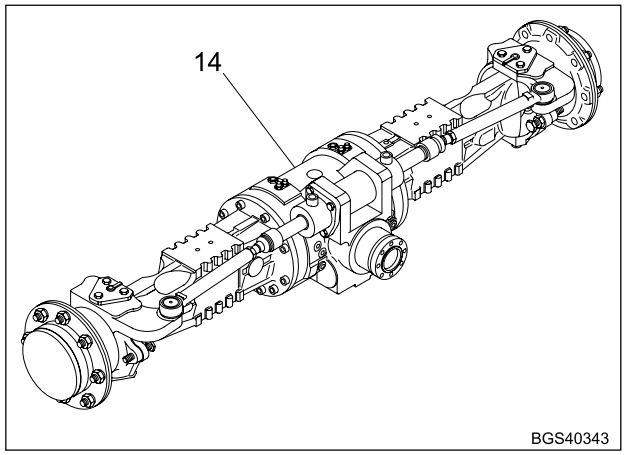
Operating pressure	15 bar (217 psi) rising



Front axle (14)

The front axle contains double reduction bevel and planetary hub reduction gears and a limited slip differential. Braking is by inboard multi-disc units, the axle also contains a parking brake.

The outboard wheel hubs are steerable, operated by a steering cylinder **(15)** attached to the axle.

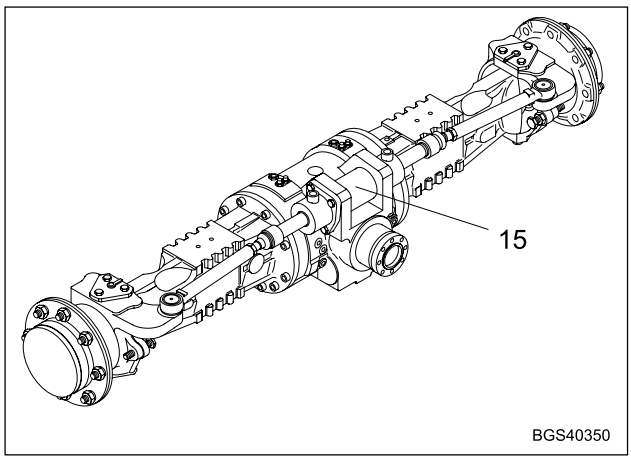


Steering cylinder (front) (15)

The front steering cylinder is a double acting hydraulic cylinder, supplied with pressure operating oil from the Steering Control Valve (21). The two cylinder rams have a ball joint end fitting, which connect to the swivel hubs for the front wheels. The front steering cylinder is attached to the rear of the front axle, above the drive shaft housing.

Specification

Stroke (lock to lock) 200 mm
Bore 85 mm

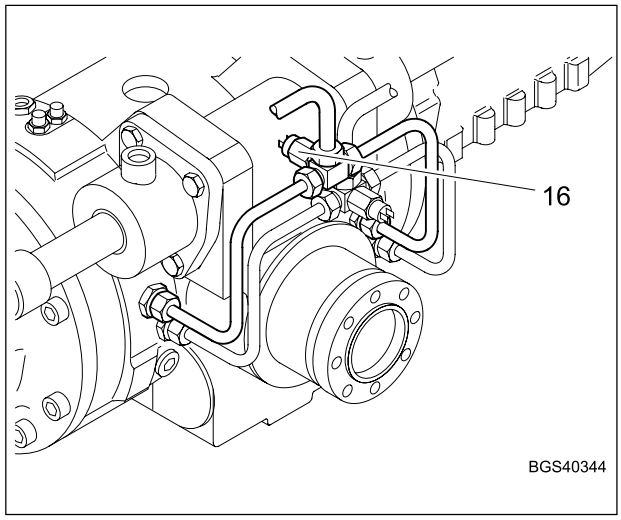


Pressure switch (brake light) (16)

When the brake pedal is depressed the pressure switch operates and illuminates the brake stoplights at the rear light clusters. The switch is located in the brake pipes on the right side of the front axle.

Specification

Operating pressure 5 bar (72 psi) rising



Pressure switch (parking brake) (17)

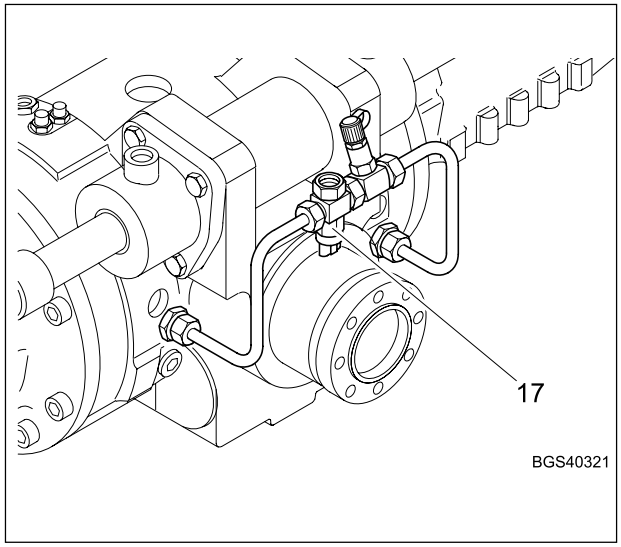
When the parking brake pressure (17) falls below 16 bar (232 psi) the pressure switch illuminates a warning light in the cab. The switch is located in the brake pipes on the right side of the front axle.

If light is on, parking brake has been applied.

CAUTION *If light comes on when parking brake is not applied, stop vehicle and investigate fault.*

Specification

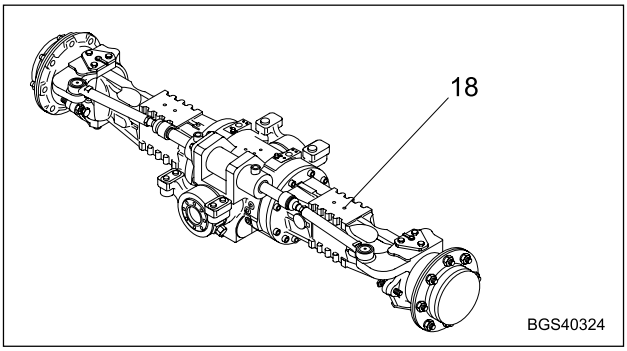
Operating pressure 16 bar (232 psi) rising



Rear axle (18)

The rear axle (18) contains double reduction bevel and planetary hub reduction gears and a limited slip differential. Braking is by inboard multi-disc units (when taken as an option).

The outboard wheel hubs are steerable, operated by a steering cylinder (19) attached to the axle.

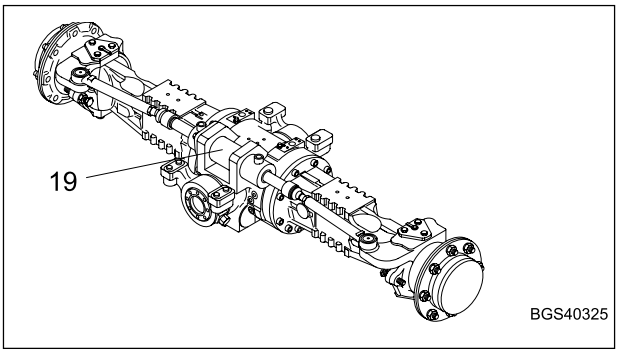


Steering cylinder (rear) (19)

The rear steering cylinder (19) is a double acting hydraulic cylinder, supplied with pressure operating oil from the Steering Control Valve. The two cylinder rams have a ball joint end fitting, which connect to the swivel hubs for the front wheels. The rear steering cylinder is attached to the front of the rear axle, above the drive shaft housing.

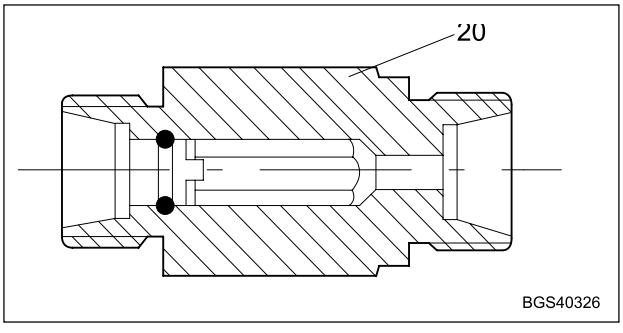
Specification

Stroke (lock to lock) 200 mm
Bore 85 mm



Non-return valve (20)

The non-return valve (NRV) allows pressure supply oil to be supplied from the main hydraulic control valve to the Brake Servo valve. The NRV (20) prevents oil from the brake servo valve returning into the main control valve. This valve is fitted to Machines for certain markets only.



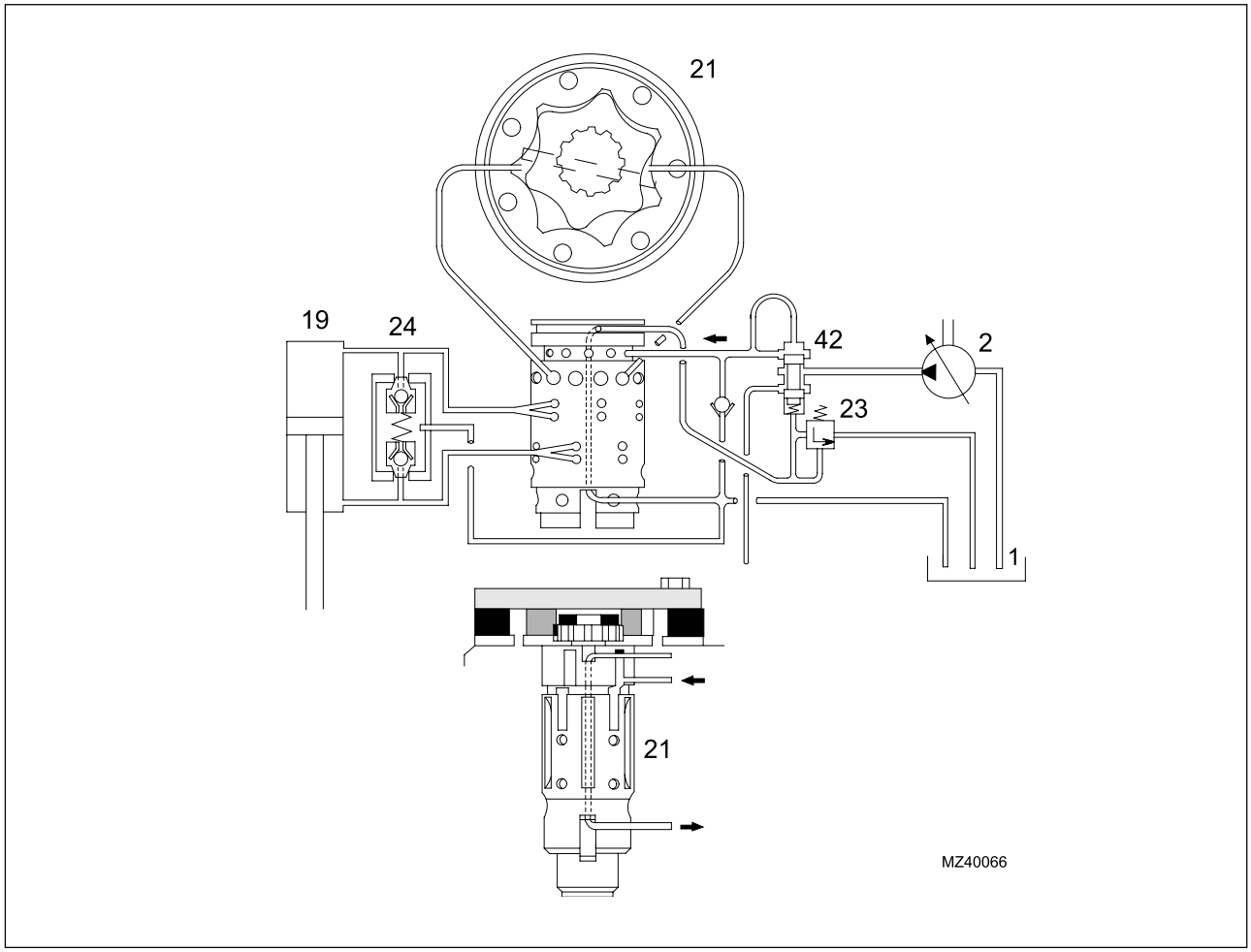
Steering valve (21)

The steering system is dynamic and fully load sensing and is supplied with pressure operating oil from the load sensing (LS) output of the inlet section (PVSP) (36) on the main hydraulic control valve (25). The valve contains a PRV (23) and two shock valves (24).

Steering in Neutral position

When the steering valve is in the neutral position, the spring in the priority valve (42) moves the valve to allow the oil to pass freely, from the load sensing line, through the priority valve (42) and the steering control valve (21) to the hydraulic tank (1). The oil supply from the hydraulic pump (2) is locked.

As back pressure increases at the spool of the priority valve (42), the valve spring is compressed and the spool moves to allow oil to flow to the working hydraulics.



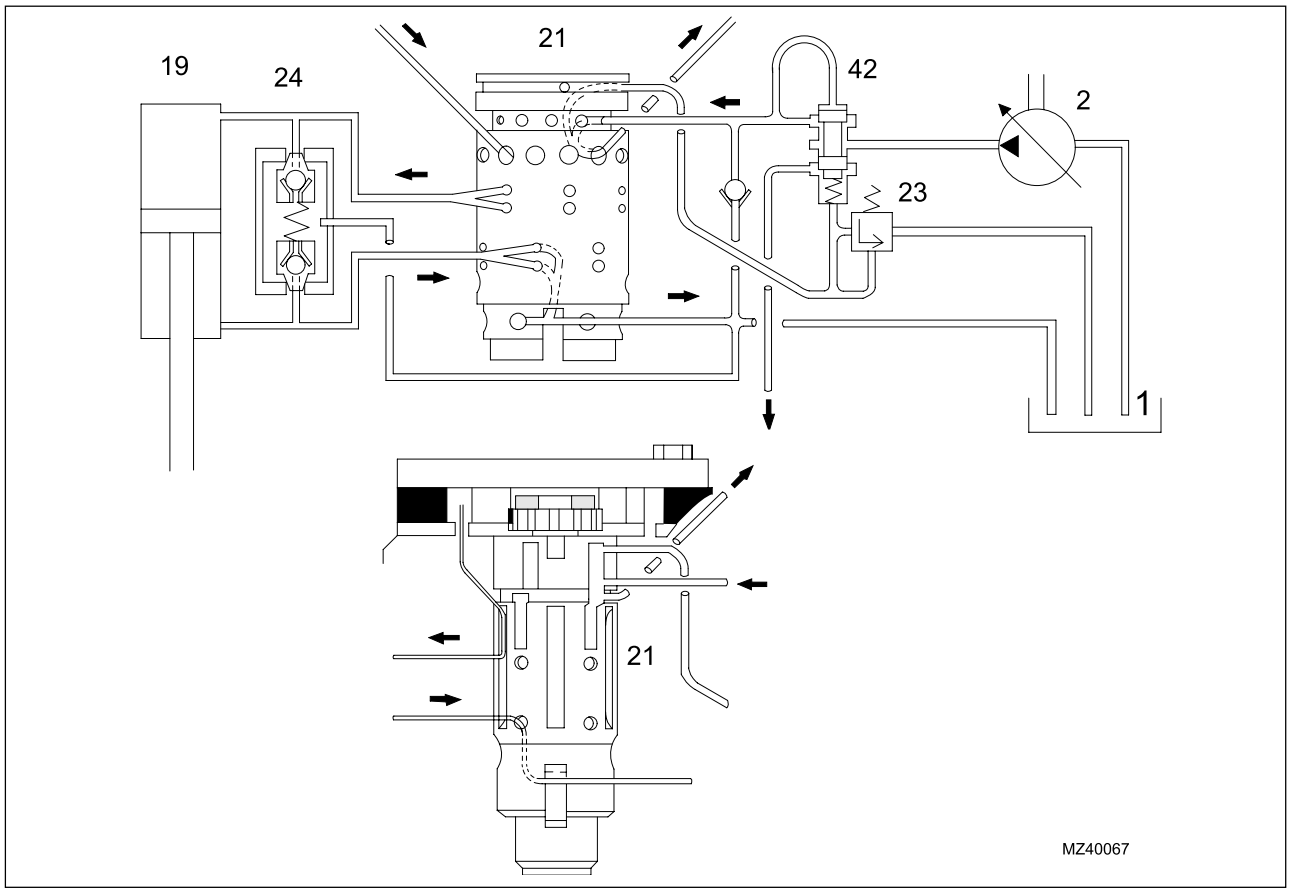
STEERING - NEUTRAL POSITION

Steering in Operation

As the steering wheel is turned, the rotary valve proportionally directs the oil flow from the LS line of the inlet section (PVSP) (36) to the steering selector valve (21) (not shown). The LS line is not fully closed until the rotary valve is fully open. When the steering input is stopped, the rotor passages close, steering input stops and the system returns to the load-sensing mode.

Specification

Type	OSPF250LS
PRV	170-175 bar (2465-2537 psi)
Shock valve	225-245 bar (3262-3552 psi)



STEERING - RIGHT TURN OPERATION

Pressure relief valve (23)

If an overpressure condition exists, a pressure relief valve (PRV) will bypass pressure oil from the spring side of the priority valve (42) to the hydraulic tank (1). The upstream oil pressure is greater and moves the spool valve, against the spring, allowing oil to be supplied to the working hydaulics.

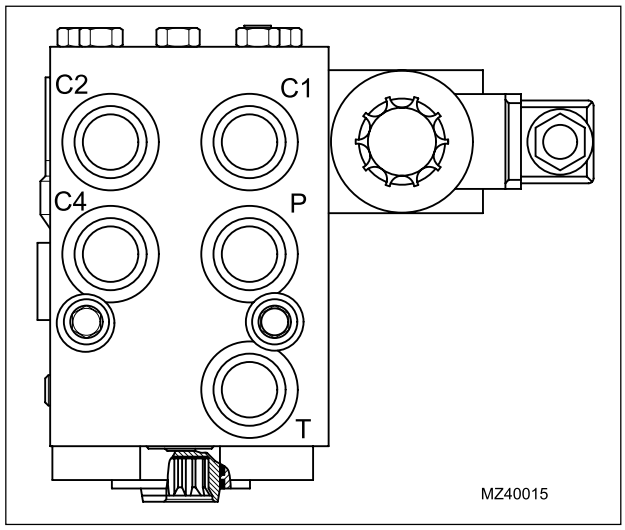
Specification:

Operating pressure	175 bar (254 psi)

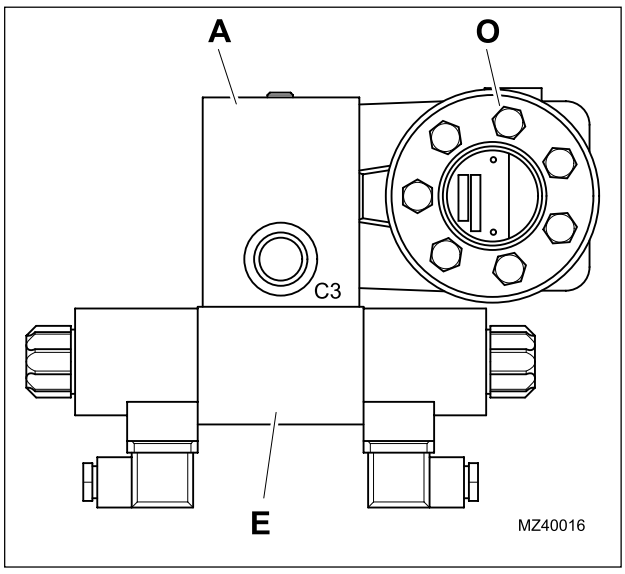
Steering selector valve (22)

The steering selector valve is solenoid operated and diverts oil to the respective ports of the steering cylinders. Three modes of steering are available by selecting the steering mode switch in the cab to give either two-wheel steering (front wheels), four-wheel steering or 'crab' steering.

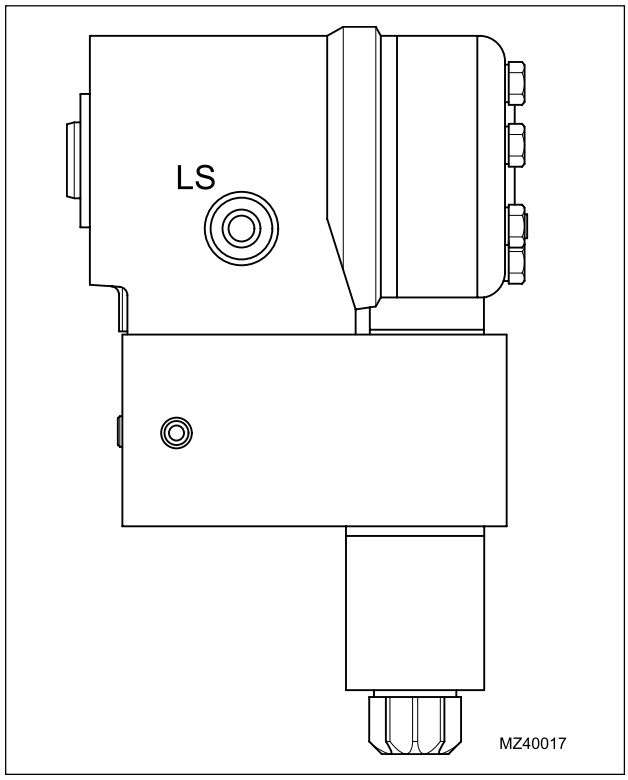
WARNING *The machine must always be stationary before changing steering modes.*



C1 To rear steering cylinder (19)
C2 To rear steering cylinder (19)
C4 To front steering cylinder (15)
T Return to hydraulic tank (1)
P From inlet section (36) CF - Line



C3 To front steering cylinder (15)
O OSPF250 valve
A Adapter
E Selector valve



LS From inlet section (36) LS – Line

Control valve (25)

The control valve consists of up to five individual spool valves, with common pressure and return lines, linked together by an inlet and outlet cover. The inlet (PVSP) (36) contains a priority valve (43) (steering) module and brake accumulator charge valve (44). The spools, outlet cover and PSVP are secured together with tie bolts. The individual components of the valve described are (26) to (44).

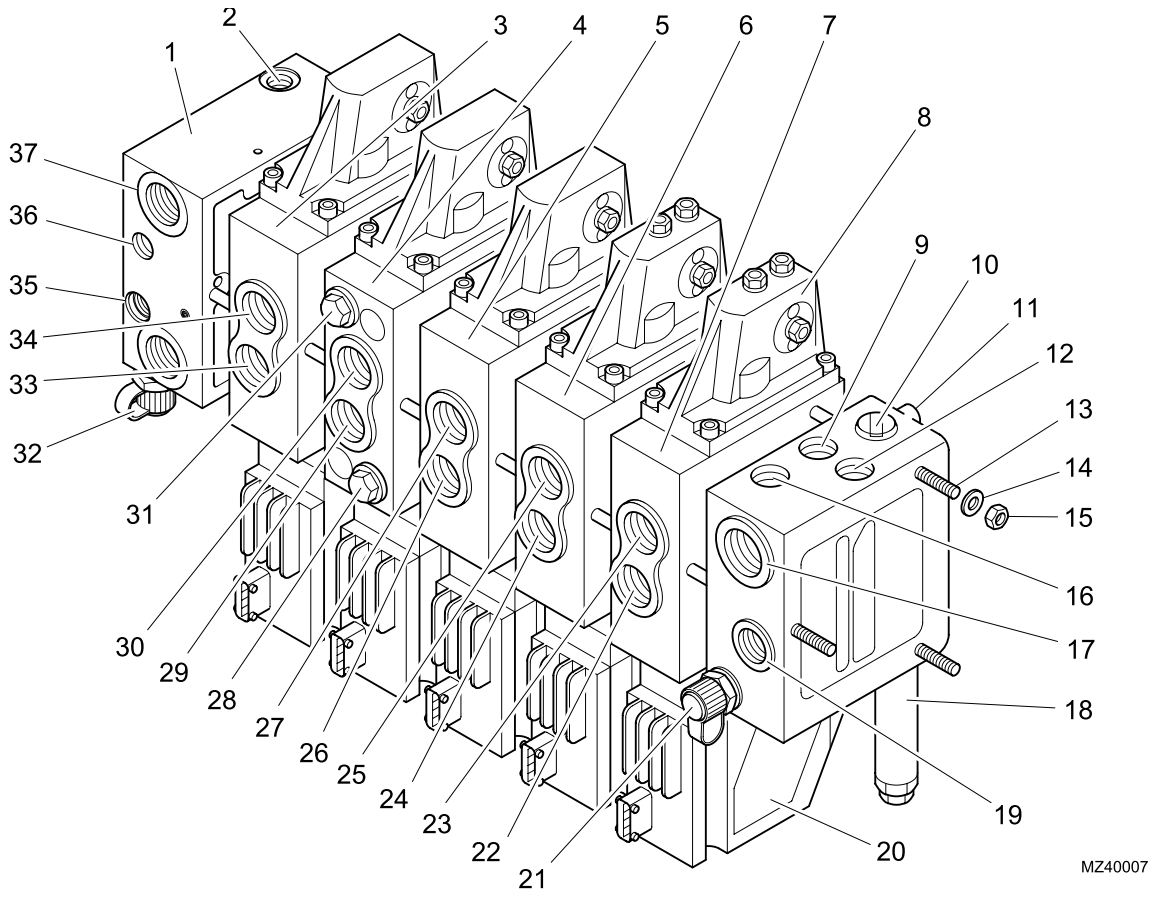
Key to control valve

NOTE: Numbers in bold type refer to identification numbers on main hydraulic schematic.

1 Outlet section (PVP) (26)
2 Test Point 1 (65)
3 Boom extend/retract section (27)
4 Crowd/compensator section (28)
5 Boom lift/lower section (29)
6 1st auxiliary section (30)
7 2nd auxiliary section (31)
8 Manual operation module
9 Brake and Accumulator Charge valve (BAC) (44)
10 Steering Priority Valve (42)
11 Inlet Section (PVSP) (36)
12 Brakes/Steering Priority Valve (12)

Key to control valve (continued)

13 Tie bolt
14 Washer
15 Nut
16 LS Shuttle Valve (37)
17 Pressure supply (36)
18 Brake and Accumulator Charge valve (BAC) (44)
19 Steering Valve (22)
20 Electric module (38, 40)
21 Test Point 4 (68)
22 2nd Service Couplings (60)
23 2nd Service Couplings (60)
24 Diverter Valve (56)
25 Diverter Valve (56)
26 Load Control Valve (55)
27 Lift Cylinder (54)
28 Relief valve, crowd back (39)
29 Load Control Valve (52)
30 Crowd Cylinder (51)
31 Relief valve, crowd forward (36)
32 Test {Point 5 (69)
33 Extension Cylinder (49)
34 Load Control Valve (50)
35 Relief valve, main system (32)
36 Pilot pressure regulator (34)
37 Hydraulic Tank (1)



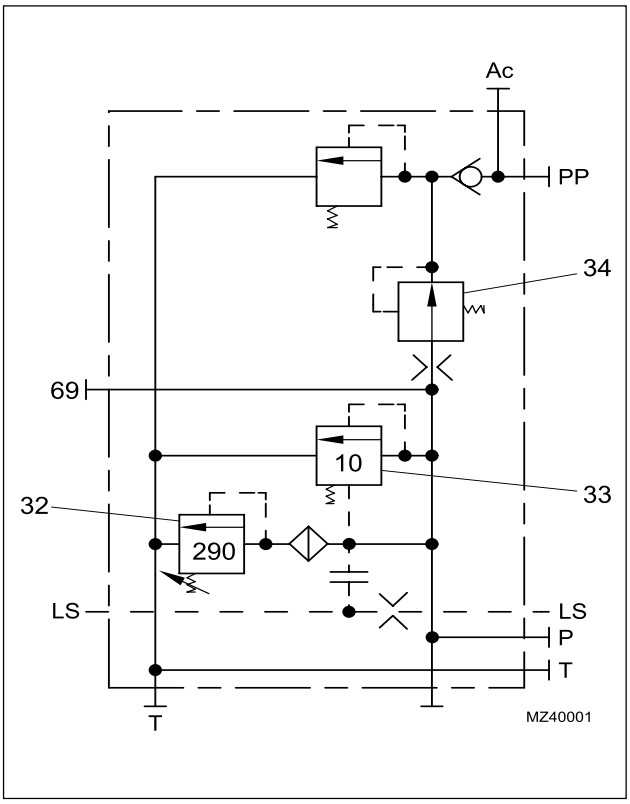
Outlet section (PVP) (26)

Ac Accumulator
PP Pilot pressure
LS Load sensing
T Return to tank
P Pressure

32 Main pressure relief valve (RV1-290 bar)
34 Pilot pressure regulator (14 bar)
33 Compensator (pressure raising spool) (10 bar)
69 Test point

Function

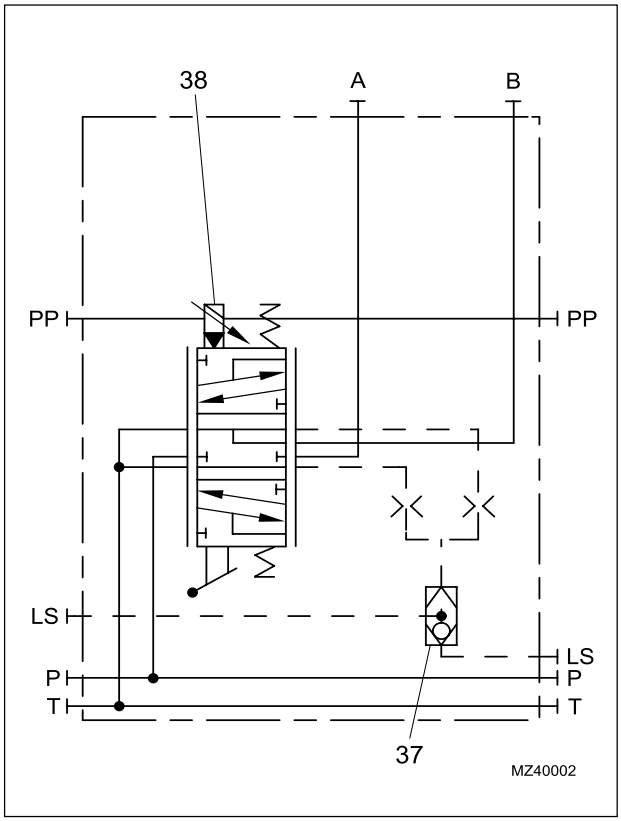
The closed centre provides for ultimate system protection and the provision of pilot pressure for the operation of the spools.



Extension section (27)

A Port A - connection to service
B Port B - connection to service
PP Pilot pressure
LS Load sensing
T Return to tank
P Pressure

(37) LS shuttle valve
(38) Controller, proportional



Function

Extension service is fully proportional and operated electrically to provide oil flow to the extension circuit.

When the spool is moved from the neutral position, oil at P (standby pressure 20 bar (290 psi)) is delivered to the consumer (service). The oil at the consumer meets a resistance (i.e. to move the piston) and the pressure at P rises to overcome this force. The P line is connected permanently to the LS line; therefore the pump receives a signal to swash to the required position to provide the pressure required to overcome the resistance. The pressure at P will therefore be the LS pressure plus the standby pressure of 20 bar (290 psi).

The pump will always react to the highest pressure requested when more than one service is operated by virtue of the LS shuttle valve in each section.

When the valve returns to neutral the pressure at P drops and therefore the pressure in the LS line also drops.

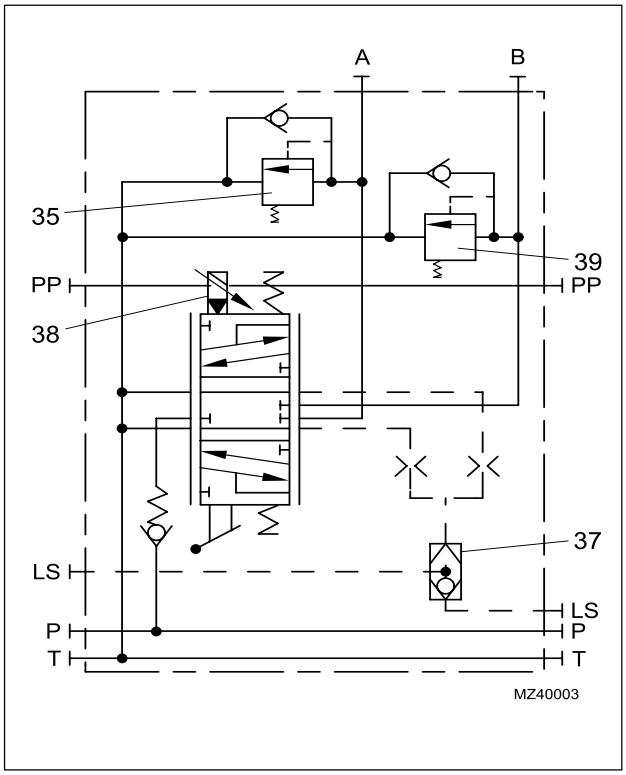
The spool is operated by pilot oil pressure delivered by the electrical actuator under the command of the ‘Solo’ joystick and is fully proportional.

In neutral the spool is ‘half-motored’, connecting port B to the T line.

Crowd section (28)

A Port A - connection to service
B Port B - connection to service
PP Pilot pressure
LS Load sensing
T Return to tank
P Pressure

(35) Shock and anti-cavitation valve - Port A (RV2-175 bar)
(37) LS shuttle valve
(38) Controller, proportional
(39) Shock and anti-cavitation valve - Port B (RV3-265 bar)



Function

Crowd service is fully proportional and operated electrically to provide oil flow to the crowd circuit.

When the spool is moved from the neutral position, oil at P (standby pressure 20 bar (290 psi)) is delivered to the consumer (service). The oil at the consumer meets a resistance (i.e. to move the piston) and the pressure at P rises to overcome this force. The P line is connected permanently to the LS line; therefore the pump receives a signal to swash to the required position to provide the pressure required to overcome the resistance. The pressure at P will therefore be the LS pressure plus the standby pressure of 20 bar (290 psi).

The pump will always react to the highest pressure requested when more than one service is operated by virtue of the LS shuttle valve in each section.

When the valve returns to neutral the pressure at P drops and therefore the pressure in the LS line also drops.

The spool is operated by pilot oil pressure delivered by the electrical actuator under the command of the 'Solo' joystick and is fully proportional.

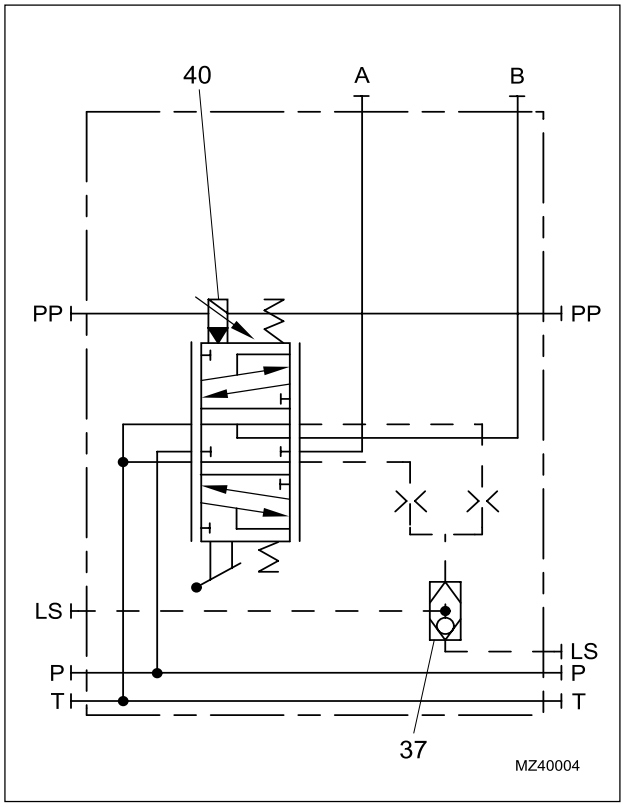
In neutral the spool is closed', neither of the consumer ports A or B are connected to the T line. This enables self-levelling operation from the compensator cylinder.

To protect the circuit, shock valves are provided in both A and B ports.

Lift section (29)

A Port A - connection to service
B Port B - connection to service
PP Pilot pressure
LS Load sensing
T Return to tank
P Pressure

(37) LS shuttle valve
(40) Controller, proportional



Function

Lift service is fully proportional and operated electrically to provide oil flow to the lift circuit.

When the spool is moved from the neutral position, oil at P (standby pressure 20 bar (290 psi)) is delivered to the consumer (service). The oil at the consumer meets a resistance (i.e. to move the piston) and the pressure at P rises to overcome this force. The P line is connected permanently to the LS line; therefore the pump receives a signal to swash to the required position to provide the pressure required to overcome the resistance. The pressure at P will therefore be the LS pressure plus the standby pressure of 20 bar (290 psi).

The pump will always react to the highest pressure requested when more than one service is operated by virtue of the LS shuttle valve in each section.

When the valve returns to neutral the pressure at P drops and therefore the pressure in the LS line also drops.

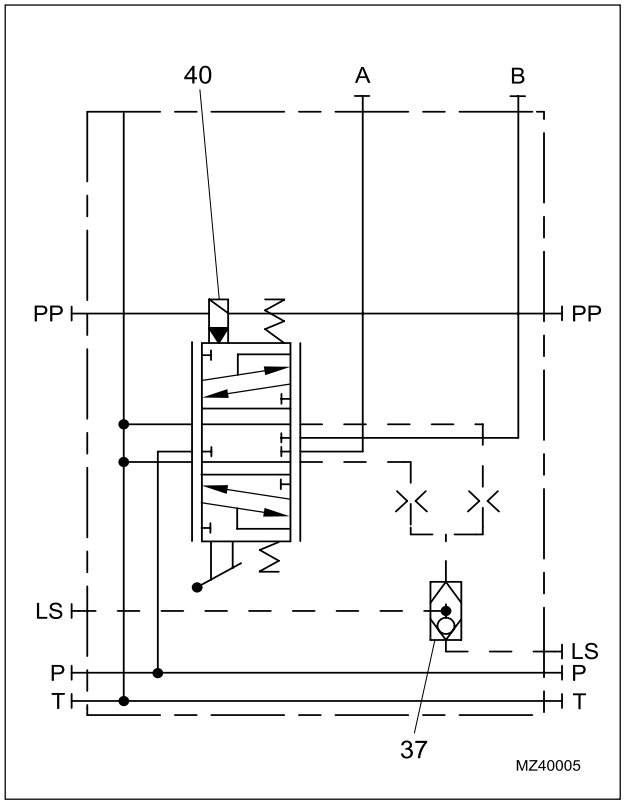
The spool is operated by pilot oil pressure delivered by the electrical actuator under the command of the ‘Solo’ joystick and is fully proportional.

In neutral the spool is ‘half-motored’, connecting port B to the T line.

1st service (30)/2nd service (31) section

A Port A - connection to service
B Port B - connection to service
PP Pilot pressure
LS Load sensing
T Return to tank
P Pressure

(37) LS shuttle valve
(40) Controller, non-proportional



Function

1st service/2nd service is non-proportional and operated electrically to provide oil flow to the 1st service/2nd service circuit.

When the spool is moved from the neutral position, oil at P [standby pressure 20 bar (290 psi)] is delivered to the consumer (service). The oil at the consumer meets a resistance (i.e. to move the piston) and the pressure at P rises to overcome this force. The P line is connected permanently to the LS line; therefore the pump receives a signal to swash to the required position to provide the pressure required to overcome the resistance. The pressure at P will therefore be the LS pressure plus the standby pressure of 20 bar (290 psi).

The pump will always react to the highest pressure requested when more than one service is operated by virtue of the LS shuttle valve in each section.

When the valve returns to neutral the pressure at P drops and therefore the pressure in the LS line also drops.

The spool is operated by pilot oil pressure delivered by the electrical actuator under the command of the 'Solo' joystick.

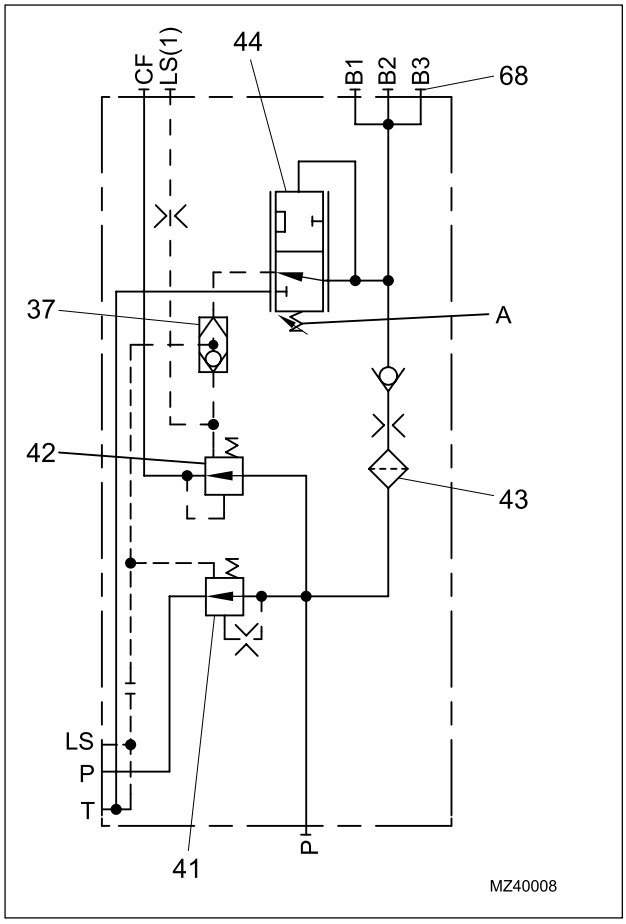
These sections, although electrically controlled, are non-proportional. Operation of the buttons on the 'Solo' joystick operate these sections as an on-off switch.

In neutral the spool is closed, neither of the consumer ports A and B are connected to the T line.

Inlet section (PVSP) (36)

LS (1) Load sensing (to steering valve)
CF Steering valve
B1 Main brake
B2 Trailer brake (optional)
B3 Pressure test point **(67)**
LS Load sensing
T Return to tank
P Pressure
A BAC valve spring

(37) LS shuttle valve
(41) Priority valve
(42) Steering priority valve (compensator)
(43) Filter
(44) Brake accumulator charge (BAC)
(68) Test point



Function

The inlet section (PVSP) provides oil to:

(a) The brake circuit through the BAC valve **(44)**, this gives a charge of between 138-159 bar (2000-2300 psi) and operates in preference to all other services. Brake charge pressure can be tested at test point B3 **(68)**.

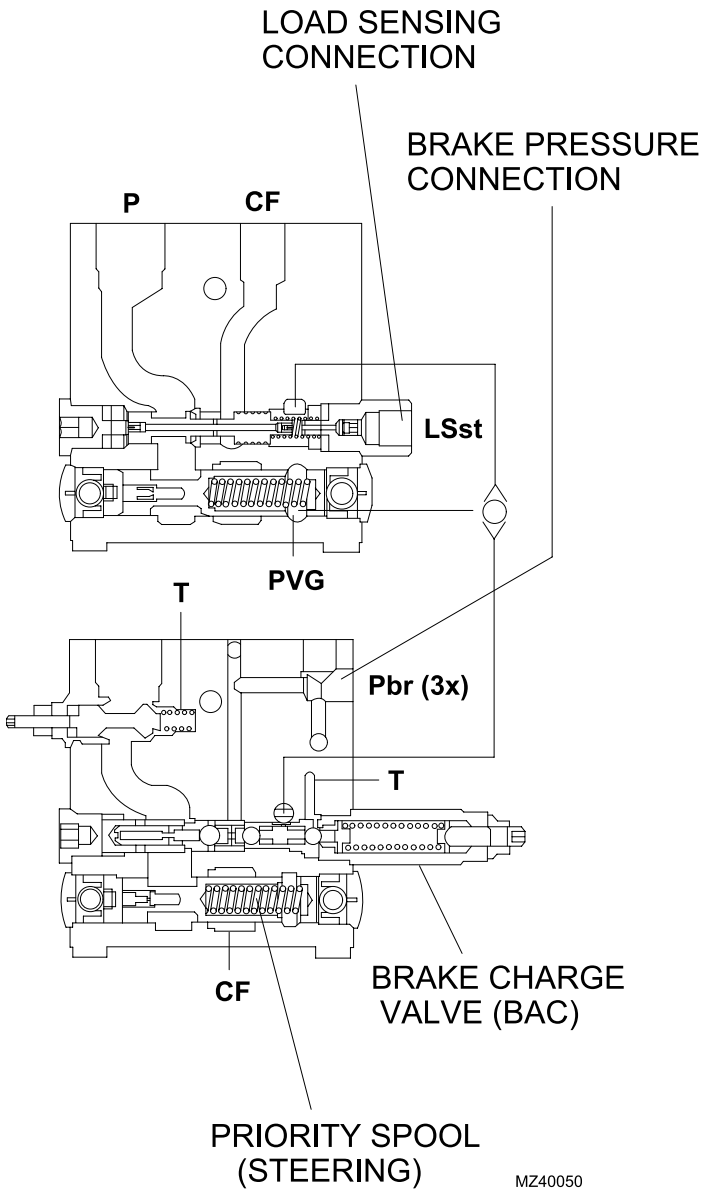
(b) The steering circuit with oil on demand by the steering priority valve **(42)**.

The oil arriving at P is delivered to the BAC valve and onto the accumulators, the resistance to charging the accumulator causes the pressure to rise at P which, as it is connected to the LS line via the BAC valve, signals to the pump. The pump responds by delivering oil at the required pressure.

The system charges at 138 bar and stops charging at 159 bar. At the upper limit 159 bar, the oil pressure at P overcomes the force of the BAC valve spring (A) and closes the connection between P and LS; the pump therefore goes to standby. When the pressure in P falls below 138 bar, the spring force opens the valve and the system recharges.

At the same time, pump pressure is supplied to the steering unit via the CF port. If the steering is not being used, the pump at standby pressure overcomes the spring force in the priority valve **(41)** and supplies oil to the other consumers.

When the steering wheel is moved, the resistance to oil from the steering cylinders builds in the CF line. This is also sensed by the LS line, which, as it is linked to the steering priority valve **(42)**. makes sure steering is given priority as well as signalling the pressure requirement to the pump.

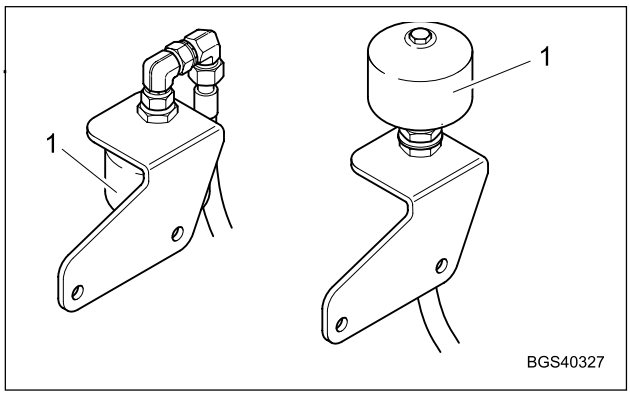

LOAD SENSING
CONNECTION
BRAKE PRESSURE
CONNECTION
P
CF
LSst
PVG
T
Pbr (3x)
T
CF
BRAKE CHARGE
VALVE (BAC)
PRIORITY SPOOL
(STEERING)
MZ40050

Accumulator (45)

The nitrogen charged accumulators (1) provide hydraulic pressure for operation of spools when engine is switched off. The accumulators are attached to brackets, located adjacent to the main hydraulic control valve (25).

Specifications

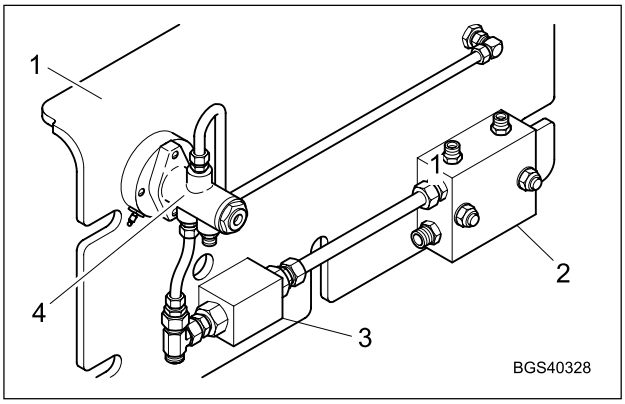
Pre-charge pressure	7 bar (100 psi)
Oil capacity	0.75 litre



1 Accumulators

Tap (46)

The tap valve (3) **(46)** is located on the rear service plate (1) and connects the return line from the autohitch manifold (2) to the hydraulic tank. When operated, the tap valve (3) allows return oil from the autohitch manifold(2) to flow to the hydraulic tank. The return line downstream from the tap valve (3) connects to the return line from the trailer brake valve (4). The tap valve (3) is used to convert the dual acting service for the autohitch to single acting service for trailer tipping.



1 Service plate 3 Tap valve **(46)**

2 Manifold 4 Trailer valve

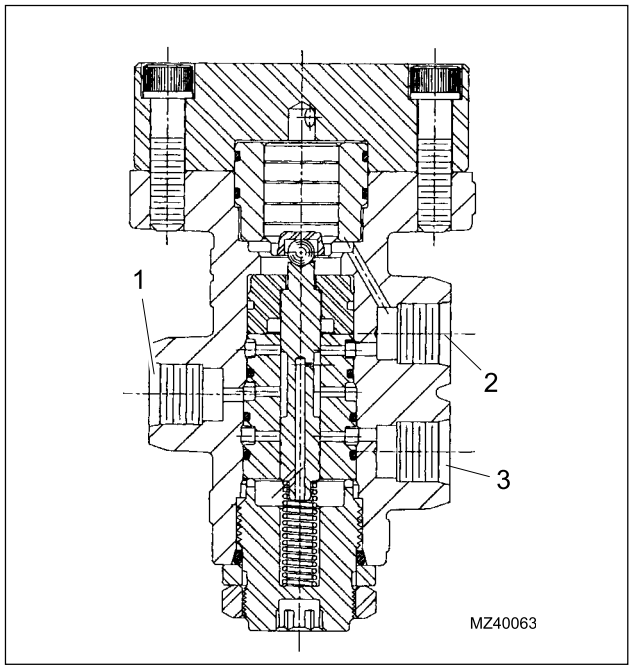
Trailer brake valve (47)

The trailer brake valve, if fitted, is located on the rear service plate and is connected to the inlet section (36) of the main hydraulic control valve (25), the hydraulic tank (1) and the trailer coupling (48). When a trailer brake is connected to the trailer brake coupling and the brakes are applied, the porting of the valve applies proportional pressure to the trailer brake. When the brakes are released, the valve diverts the hydraulic oil to the hydraulic tank (1).

The valve is pilot operated by a signal taken from the operation of the service brakes.

Key to Trailer Brake Valve

1 Outlet to Trailer Brake Coupling (48)
2 Inlet from Tap (46)
3 Pressure supply (B2)

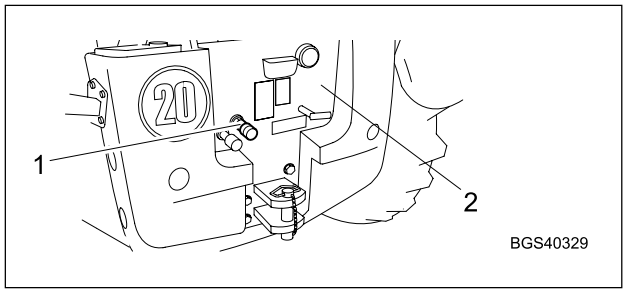


Trailer brake coupling (48)

The trailer brake coupling (1) is a self-sealing, quick release coupling, located on the rear service plate (2). The coupling is used to connect a trailer braking system to the trailer brake valve (47), if fitted.

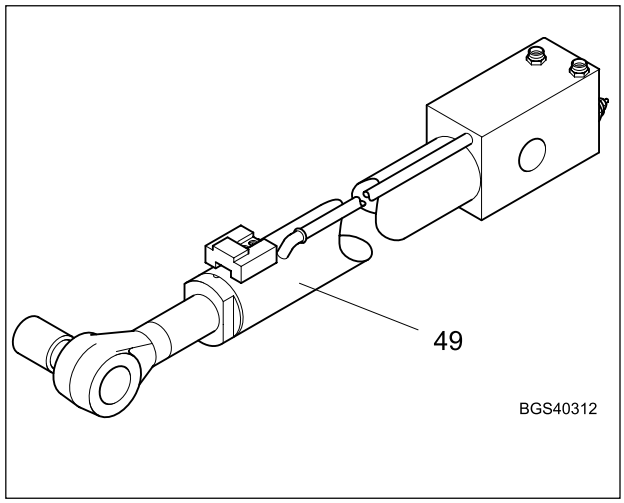
Key to Trailer Brake Coupling

1 Trailer brake coupling
2 Rear service plate



Extension cylinder (49)

The boom extension cylinder is fitted inside the boom of the machine and is supplied with operating pressure oil from a load control valve (50).

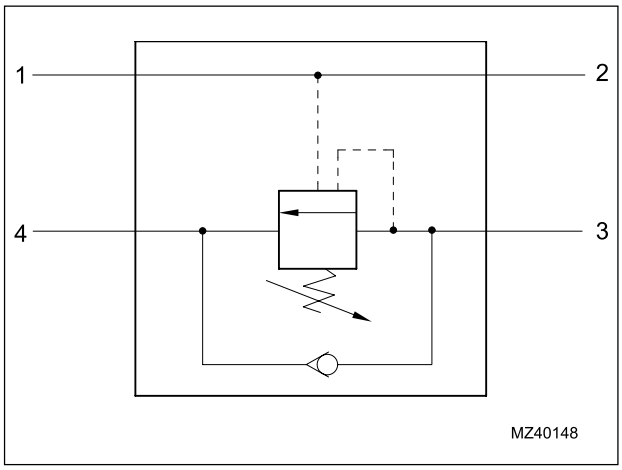


Specification:

Type K 50	Stroke	1971 mm
	Bore	80 mm
Type K 60	Stroke	2111 mm
	Bore	80 mm
Type K 70	Stroke	2917 mm
	Bore	80 mm

Load control valve (50)

The load control valve for the extension cylinder is fitted in the pressure oil supply lines, between the extension section (27) and the boom extension cylinder (49). The valve prevents any load movement in the event of hose bursts or leakage. If the valve is defective, a complete new cartridge must be fitted.

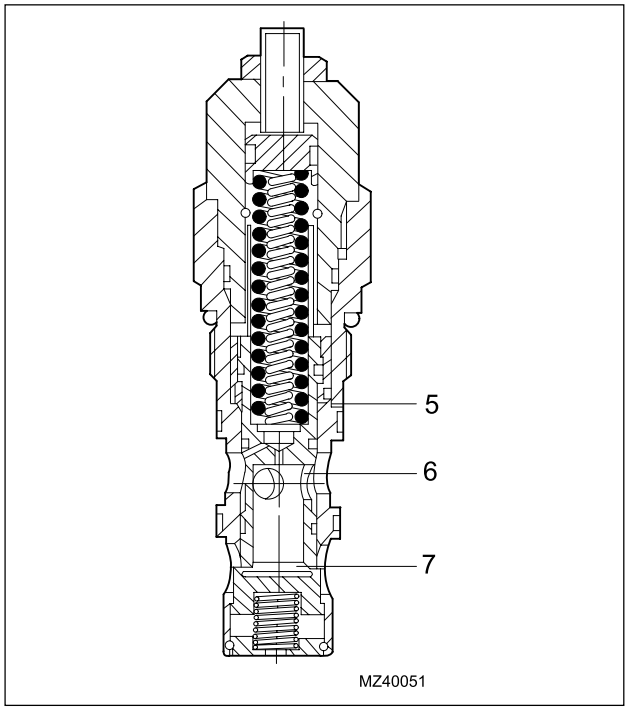


WARNING

The load control valve is factory set and should never be dismantled or adjusted except for resealing.

Key to Load Control Valve

1. From the extension section (27)
2. Extension cylinder (rod side)
3. Extension cylinder (full bore side)
4. From the extension section (27)
5. Pilot pressure
6. Supply pressure
7. Pressure relief

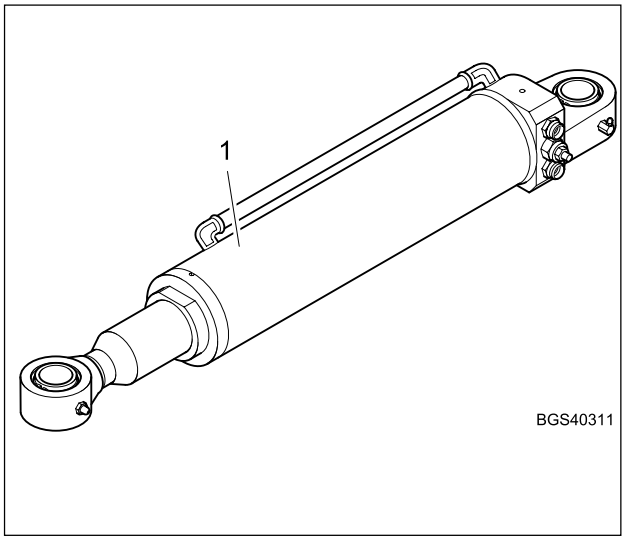


Crowd cylinder (51)

The crowd cylinder is fitted inside the head of the boom and controls the operation of the head attachments. The crowd cylinder is supplied with operating pressure oil from the crowd/compensator section (28) and a load control valve (52).

Specification:

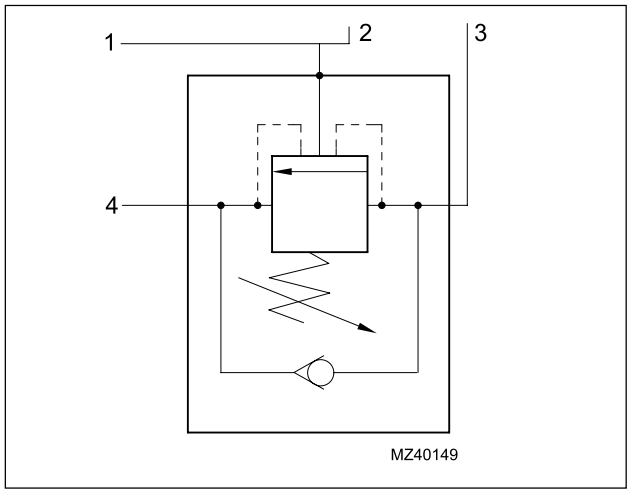
Stroke	350 mm
Bore	125 mm



Load control valve (52)

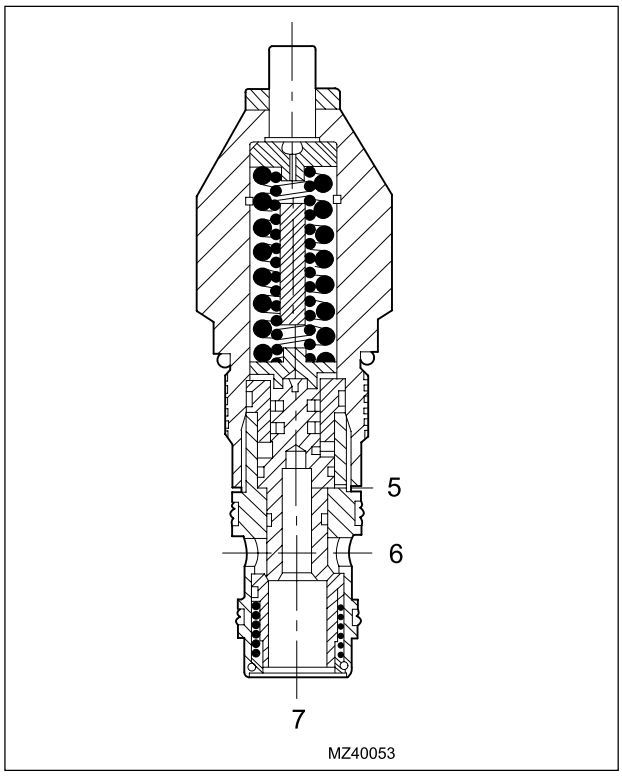
The load control valve for the crowd cylinder is fitted between the crowd cylinder (51) and the crowd/compensator section (28). The valve prevents any load movement in the event of hose bursts or leakage. If the valve is defective, a complete new cartridge must be fitted.

WARNING *The load control valve is factory set and should never be dismantled or adjusted except for resealing.*



Key to Load Control Valve

1. From the crowd/compensator section (28)
2. Crowd/compensator cylinder (rod side)
3. Crowd/compensator cylinder (full bore side)
4. From the crowd/compensator section (28)
5. Pilot pressure
6. Supply pressure
7. Pressure relief

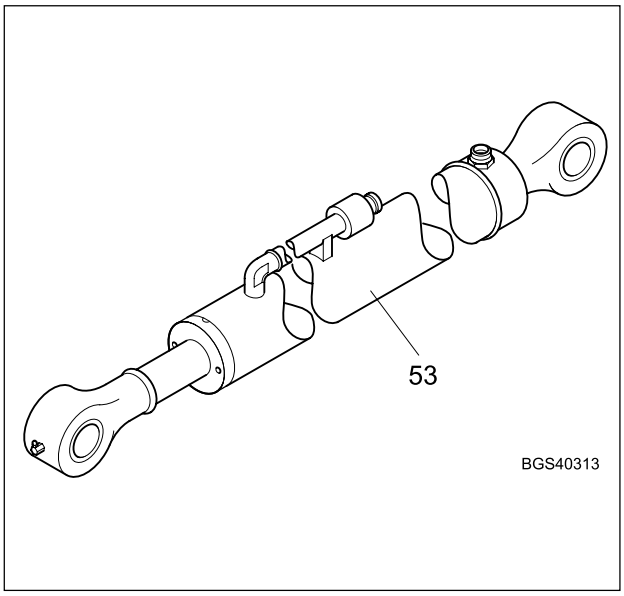


Compensator cylinder (53)

The compensator extension cylinder is fitted below and to the rear of the extension boom and is connected to the load control valve (52) and the crowd/compensator section (28).

Specification

Stroke	750 mm
Bore	63 mm

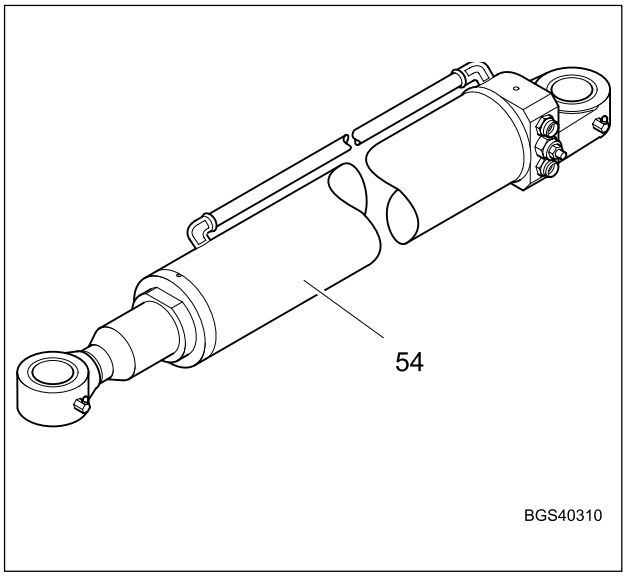


Lift cylinder (54)

The lift cylinder is fitted below and forward of the extension boom. The lift cylinder is supplied with operating pressure oil from the lift section (29) and a load control valve (55).

Specification

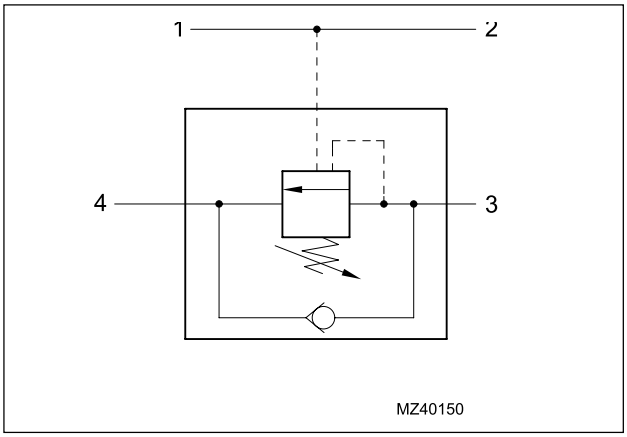
Type K50	Stroke	1325 mm
	Bore	125 mm
Type K60	Stroke	1325 mm
	Bore	125 mm
Type K70	Stroke	1400 mm
	Bore	125 mm



Load control valve (55)

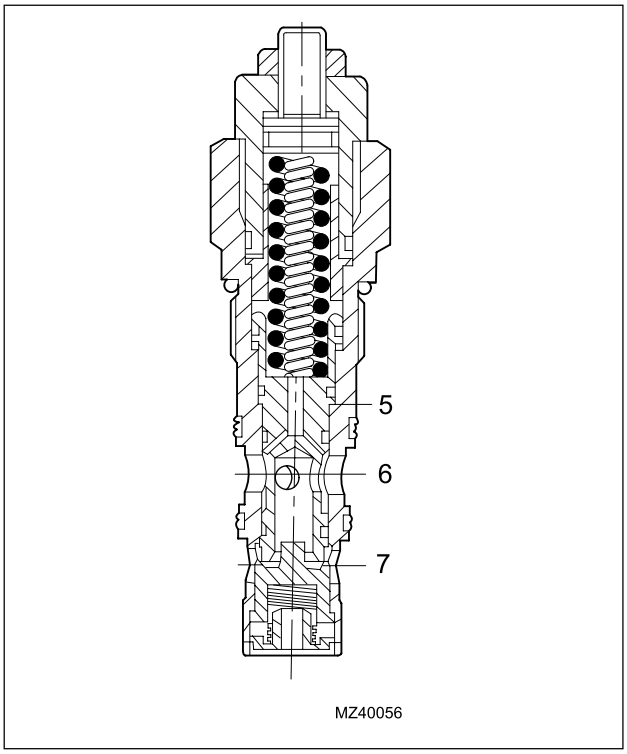
The load control valve for the lift cylinder is fitted in the pressure oil supply lines, between the lift section (29) and the lift extension cylinder (54). The valve prevents any load movement in the event of hose bursts or leakage. If the valve is defective, a complete new cartridge must be fitted.

WARNING *The load control valve is factory set and should never be dismantled or adjusted except for resealing.*



Key to Load Control Valve

1. From the lift section (29)
2. Lift cylinder (rod side)
3. Lift cylinder (full bore side)
4. From the lift section (29)
5. Pilot pressure
6. Supply pressure
7. Pressure relief



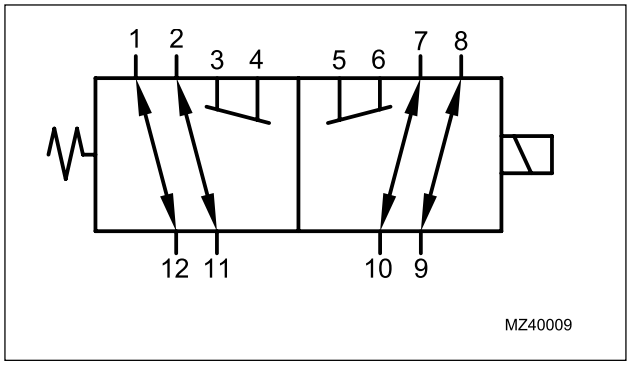
Diverter valve (56)

The diverter valve, if fitted, is attached to a bracket, which is fitted to the rear service plate, to the left side of the chassis member. The valve is connected between the 1st auxiliary section (30) and the 1st service couplings (59) and autohitch manifold (57).

The valve is solenoid operated and selected by a rocker switch in the cab. When selected, the valve diverts oil from the 1st auxiliary service to the rear of the machine where it can be utilized to operate trailer tipping or autohitch.

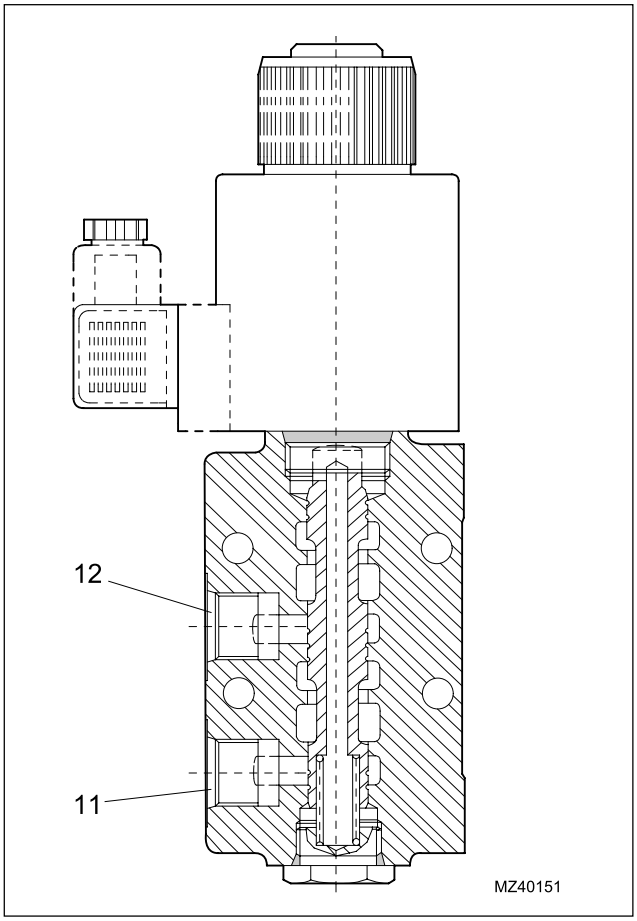
Specification:

Solenoid Operating voltage 12V DC



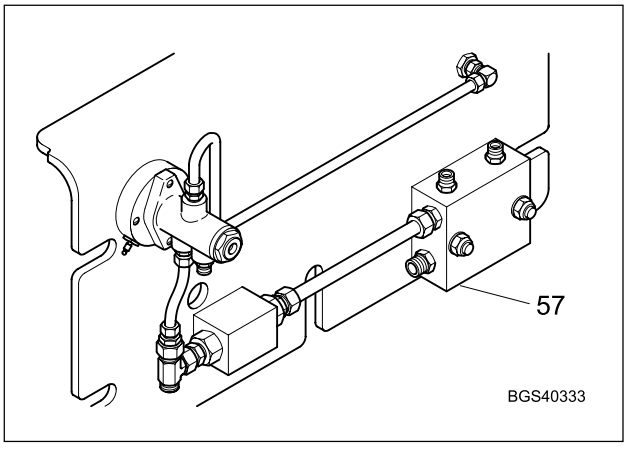
Key to Diverter Valve

1 To the 1st service coupling (59)
2 To the 1st service coupling (59)
3 Autohitch manifold (57)
4. Autohitch manifold (57)
5-10. Not used
11. To the 1st auxiliary section (30)
12. To the 1st auxiliary section (30)



Manifold (57)

The manifold is attached to the rear service plate and is located between the autohitch cylinder (58) and the diverter valve (56). The manifold is used to deliver oil to the autohitch or trailer tipping services.

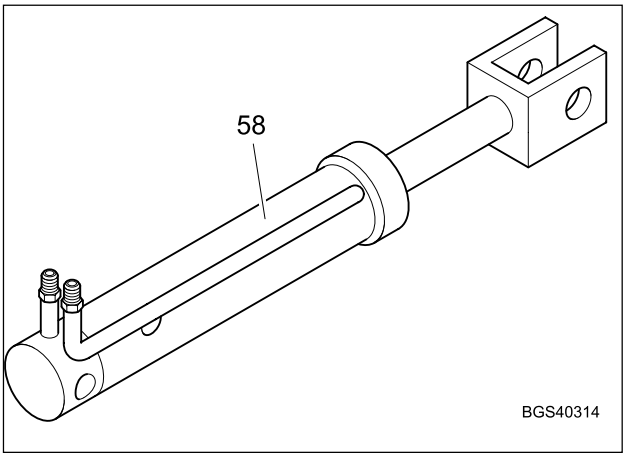


Autohitch cylinder (58)

The autohitch cylinder, if fitted, is located on the rear of the machine and is used to automatically connect and lift a trailer onto the machine. The pressure oil supplies to the autohitch cylinder are from the autohitch manifold (57).

Specification

Stroke	325 mm
Bore	60 mm

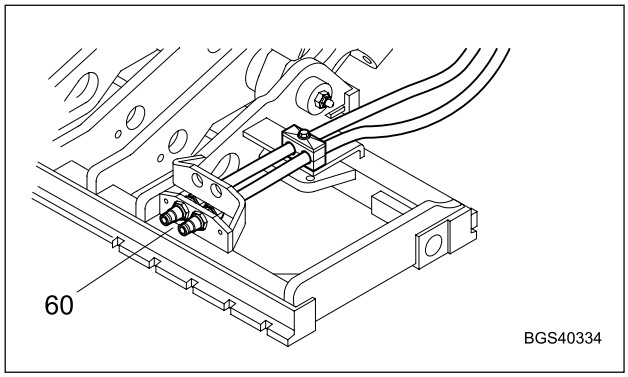


1st service couplings (59).

The 1st service couplings (not illustrated) are of the quick-release type and are used to attach hydraulic services to the front of the machine.

2nd service couplings (60)

The 2nd service couplings are of the quick-release type and, if fitted, are used to attach a second hydraulic attachment to the front of the machine.

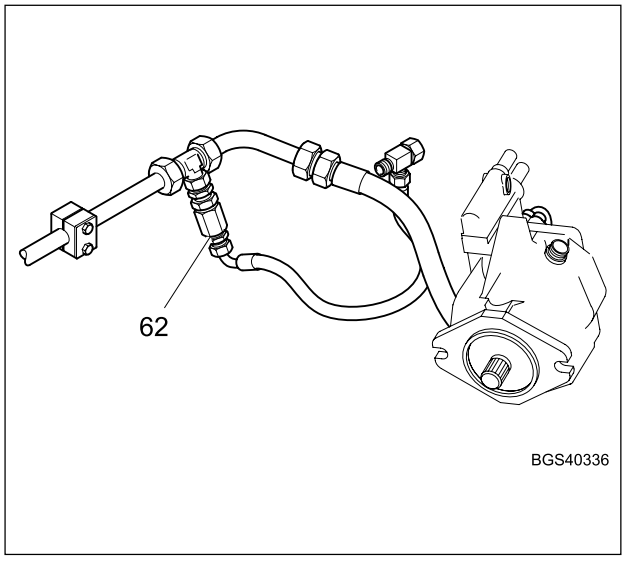


Trailer tipping connection (61)

The trailer tipping connection (not illustrated) is of the quick-release coupling type and, if fitted, connects hydraulic supplies to the trailer tipping service.

Start-up valve (62)

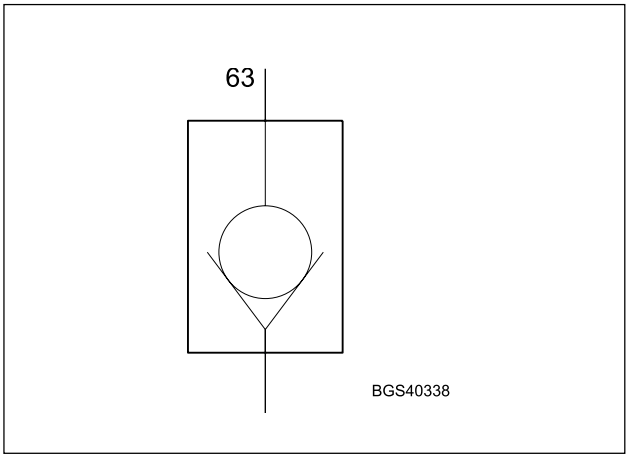
The start-up valve is fitted in the hydraulic supply line between the LS hydraulic pump (2) and the control valve PVSP inlet section (36). An internal spring valve opens the start-up valve to divert fluid to the hydraulic tank (1) when the engine is being started, offloading the build-up of pressure. When the LS hydraulic pump builds up sufficient pressure, the fluid pressure overcomes the spring valve, which closes and prevents fluid from flowing back to the hydraulic tank (1).



Non-return valve (63)

(Up to Machine S/No.51200317 only)

This is a simple non-return valve, which maintains system pressure for the parking brake circuit, in the event of hydraulic or engine failure.



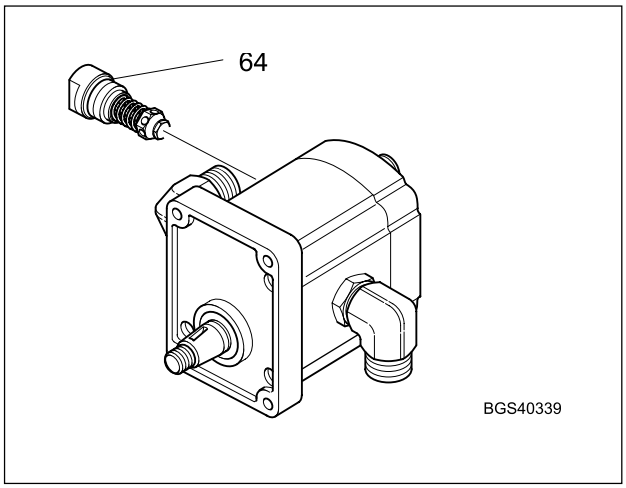
Pressure relief valve (64)

(Up to Machine S/No.51200471 only)

The cartridge pressure relief valve is attached to the cooling fan motor (7) and relieves excess pressure in the hydraulic fluid supply to the motor. The valve relieves pressure by diverting hydraulic fluid flow to the hydraulic tank (1).

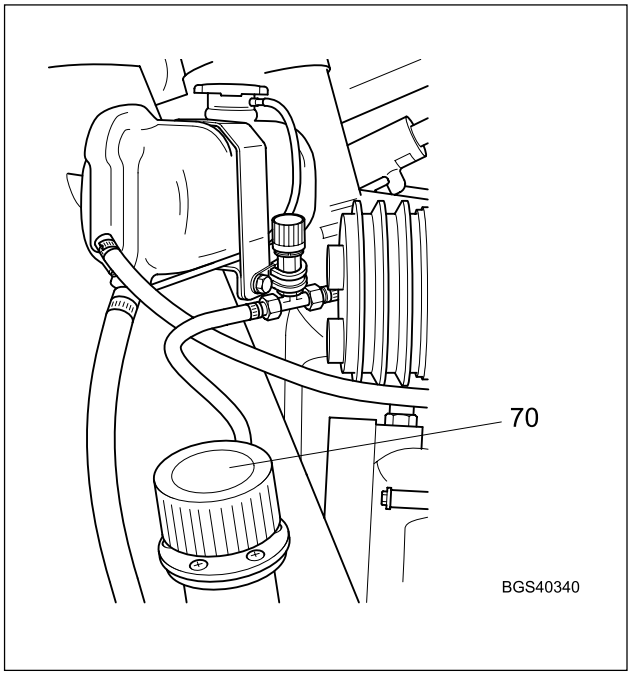
Specifications

Pressure relief valve	160 bar (2320 psi)



Breather (70)

The breather is fitted to the overflow line from the filler neck to tank return and ensures that the hydraulic tank is vented. This prevents any build up of positive or negative air pressure inside the tank, which would cause damage to the tank or restrict fluid flow.

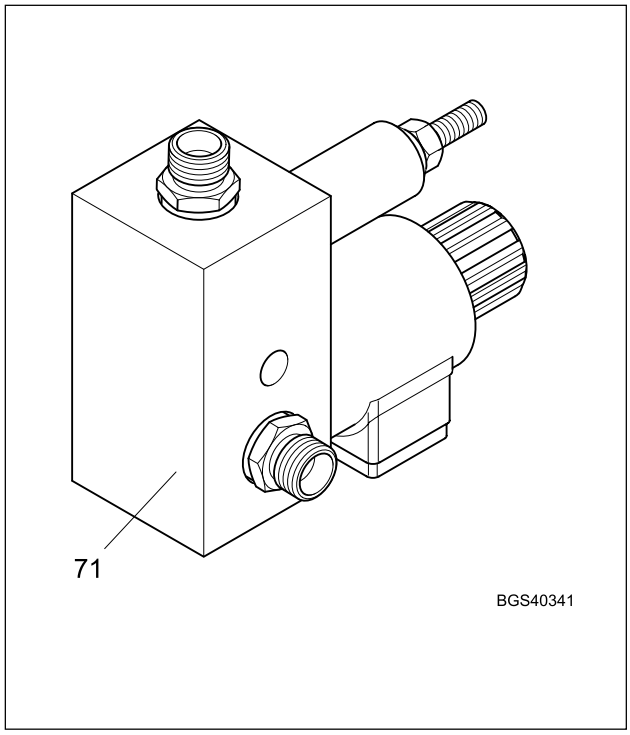


Parking brake valve (71)

(From Machine S/No.51200552 only)

The parking brake valve is fitted between the hydraulic tank (1), the cooling fan motor (7) and the fan reverse valve circuit (72). The valve is solenoid operated from a switch in the operators cab and applies the parking brake.

The valve is supplied with hydraulic fluid from the fan reverse valve (72) and has a solenoid operated valve and a pressure relief valve. When selected by the operator, the solenoid valve operates to supply hydraulic fluid to the parking brake actuators on the front axle. When de-selected, the valve releases the hydraulic fluid pressure to the parking brake and returns the fluid flow to the hydraulic tank (1).



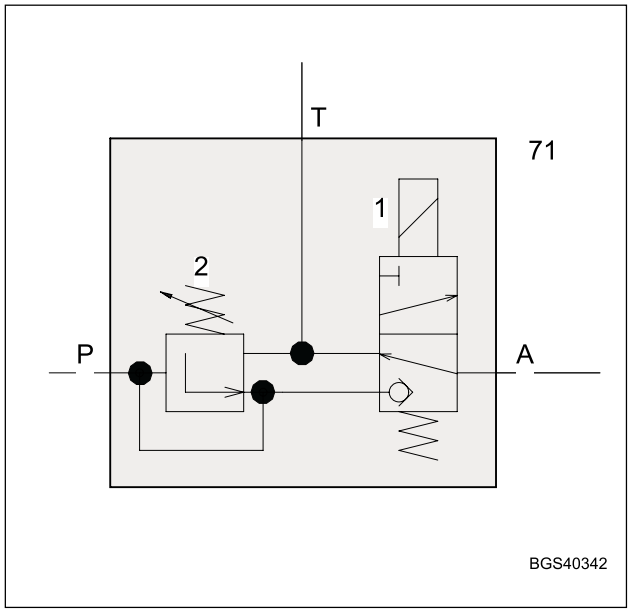
Specifications

Pressure relief valve	18 bar (261 psi) max
Solenoid voltage	12V DC

Key to Parking Brake Valve

1. Solenoid operated valve
2. Pressure relief valve

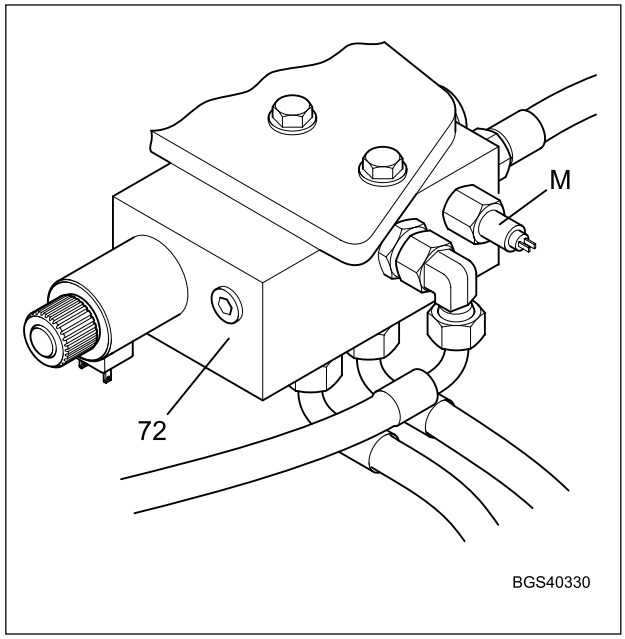
A Supply to Parking Brake actuators (14)
P Supply from Fan Reverse Valve (72)
T Return to hydraulic tank (1)



Fan reverse valve (72)

(From Machine S/No.51200472 only)

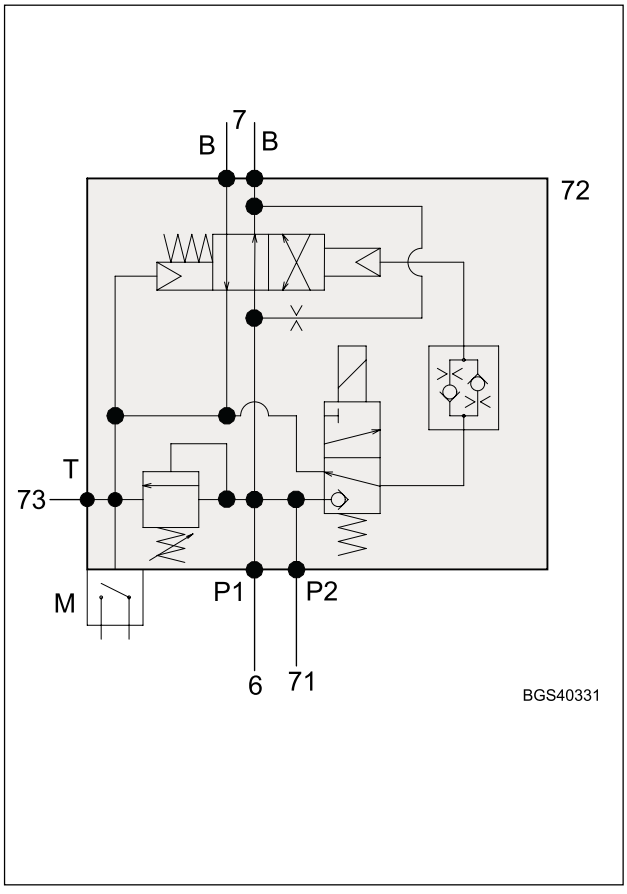
The fan reverse valve is fitted between the hydraulic tank **(1)**, the cooling fan motor **(7)** and the parking brake valve **(71)**. The valve is manually operated from a switch in the operators cab and reverses the direction of rotation of the engine cooling fan. This enables debris that is blocking the radiator to be blown clear to restore correct cooling.



The valve is supplied with hydraulic fluid from the auxiliary hydraulic pump **(6)** and has a solenoid operated valve, servo valve, pressure relief valve and a temperature operated switch. In normal operating conditions, the hydraulic fluid supply from the auxiliary pump **(6)** is directed by the solenoid valve to the fan motor **(7)**. The return fluid is directed by the solenoid valve, through the oil cooler **(73)** to the hydraulic tank **(1)**.

If the radiator becomes blocked, the temperature of the hydraulic fluid increases. When the fluid temperature reaches 100 °C, the temperature switch is operated. This illuminates a warning light in the operators cab. When the operator holds down the cab selector switch, the solenoid valve operates to reverse the flow of hydraulic fluid to the fan motor, reversing the direction of fan rotation.

A connection from the fan reverse valve supplies operating fluid to the parking brake valve **(71)**.



Specifications

Pressure relief valve	140 bar (2030 psi) max
Temperature switch	100 °C
Solenoid voltage	12V DC

Key to Fan Reverse Valve

1. Solenoid operated valve
2. Non-return valves
3. Servo valve
4. Pressure relief valve
5. Temperature switch

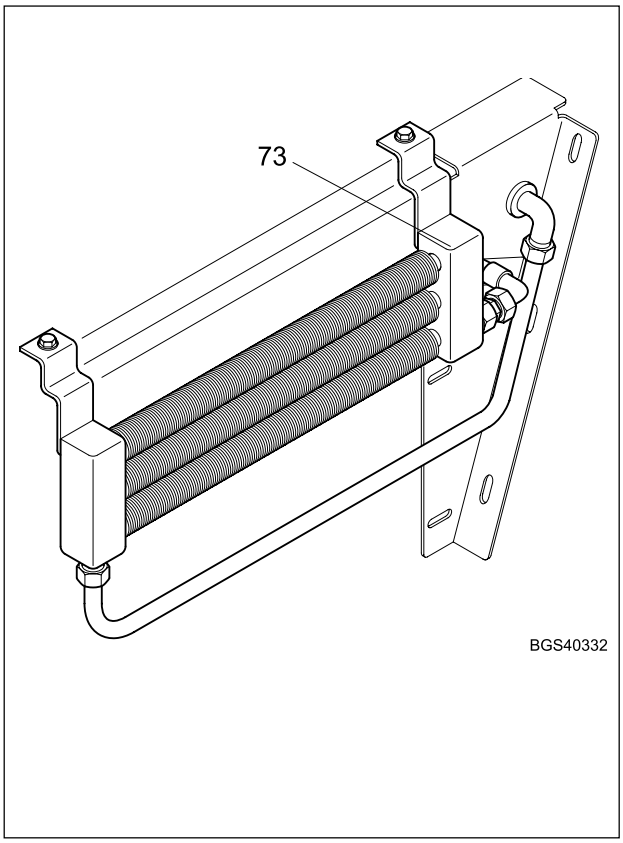
A Return from fan motor **(7)**
B Supply to fan motor **(7)**
M Temperature switch
T Return to hydraulic tank **(1)**
P1 Oil supply from auxiliary pump **(6)**
P2 Supply to Parking brake valve **(71)**

Oil cooler (73)

(From Machine S/No.51200472 only)

An oil cooler is fitted in the return line to the hydraulic tank (1), between the fan reverse valve (72) and the oil pressure filter (9). The oil cooler is attached by brackets to the machine structure with two bolts and washers.

The oil cooler has three tubular cooling elements, through which the hydraulic fluid flows on the return to the hydraulic tank. The hydraulic fluid is cooled by engine coolant flowing over the three cooling elements.



OPERATION

General

NOTE: An identification number in bold type, after an item, refers to the number of that item in the main hydraulic schematic illustration.

Hydraulic fluid reaches the control valve inlet section (PVSP) (36) from the load-sensing pump. Spools are closed centre, dead headed into a pressure adjustment spool. When a spool is actuated pressure is fed through the shuttle valve circuit to the spring chamber behind the pressure adjustment spool. This action restricts fluid return to tank and increases pump pressure to operate the selected circuit through the spool valve slice. Hydraulic pressure is now directed to the service with return flow diverted to tank.

If the control/spool is not released when the spool reaches the end of its travel, the fluid builds up pressure. This pressure is also sensed in the LS circuit, when this pressure reaches maximum of 250 bar (3625 psi) the pump de-swashes.

CAUTION *It is important that the relief valves are not allowed to remain open for more than a few seconds, otherwise extreme fluid temperatures will result and cause damage to the hydraulic seals and reduce the life of the hydraulic fluid.*

The speed of operation of the services is related to the amount of spool movement and therefore fluid flow.

If external pressure is generated by accidental contact with buildings or road surfaces, etc, the System is protected by installation of relief valves.

Relief valves

Relief valves are fitted to the control valve to control system pressure and the carriage/crowd service pressure.

The boom extend/retract, lift/lower and all auxiliary pressures are protected by the main system relief valve (RV1) (32) in the outlet section (PVP) (25) of the control valve (25). The relief valve is set at 290 bar (4205 psi). It is unlikely that this is opened, as in normal circumstances the pump de-swashes when 250 bar (3625 psi) is sensed in the LS line.

WARNING *Do not adjust the factory set relief valves in the crowd spool.*

The crowd spool contains two relief valves, one for the crowd forward or dump (RV2) (35) set at 175 bar (2538 psi) and one for the crowd back (RV3) (39) set at 265 bar (3843 psi).

Relief valves RV2 and RV3 are factory set and cannot be adjusted. The pressure setting is stamped on the valve, the spring colours do not relate to the pressure rating of the valve.

System pressure checks

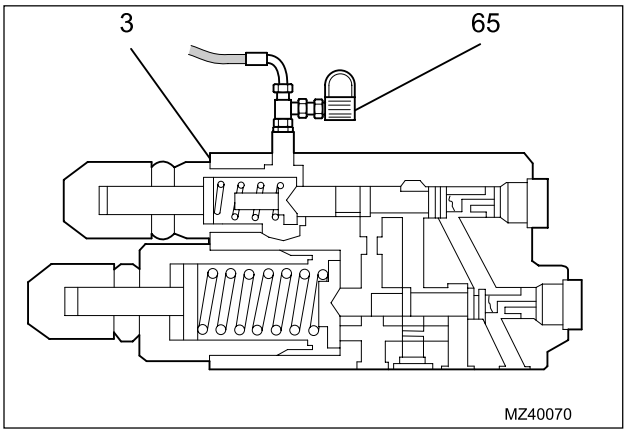
NOTE: Only check hydraulic pressure when oil is at normal working temperature (60 ± 4°C) and with engine at fast idle (1800 rpm).

Five test points are available as follows:

Test point 1 (65) (main system) - load sensing side

Located on the LS line from compensator valve of the main pump.

1. Connect pressure gauge to test point 1 (65).
2. Start engine. This gauge will indicate the load sensing signal required by any of the services being operated.
3. Operate any service. When a service is operated to its limit, the maximum pressure of 250 bar (3625 psi) will be maintained and the pump will 'de-swash'.
4. Read pressure gauge.
5. Check pressure does not exceed 250 bar (3625 psi).

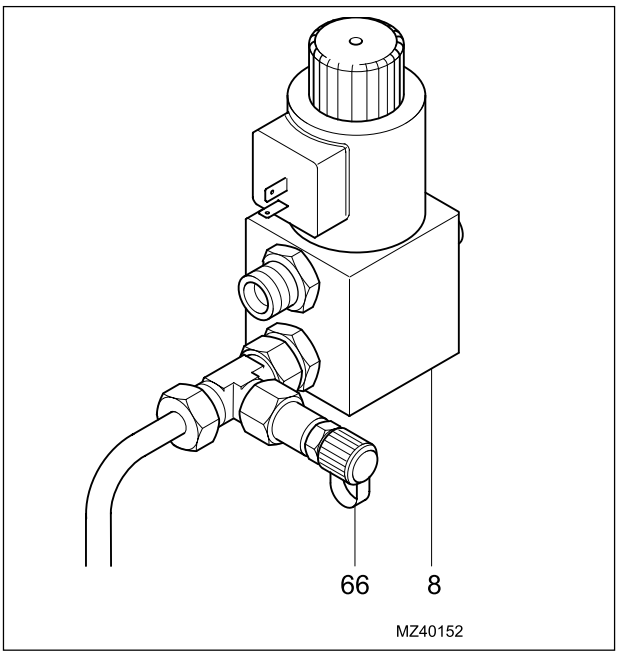


3 LS pump compensator valve
65 Test point

Test point 2 (66) (Park Brake Circuit)

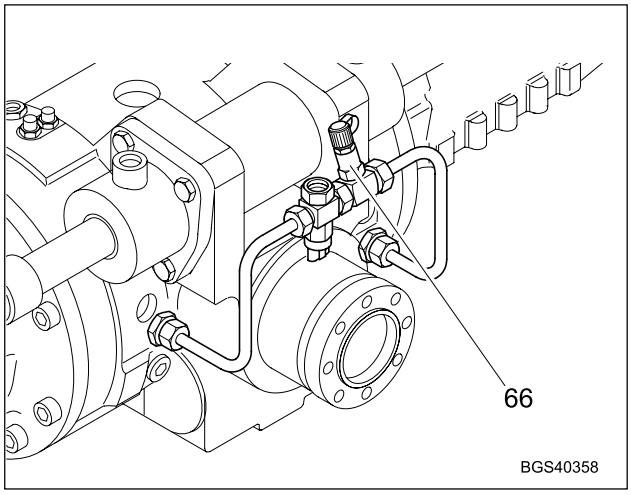
On machines up to S/No 51200317 and from S/No 51200728, the test point is located in the engine compartment, on the bulkhead above the LS pump.

1. Connect pressure gauge to test point 2 (66).
2. Start engine.
4. Read pressure gauge.
5. Check pressure is between 16 to 20 bar (232 to 290 psi).



8 Pressure reducing valve
66 Test point

On machines from S/No 51200318 to 51200727 the test point 2 (66) is located to the rear of the front axle.

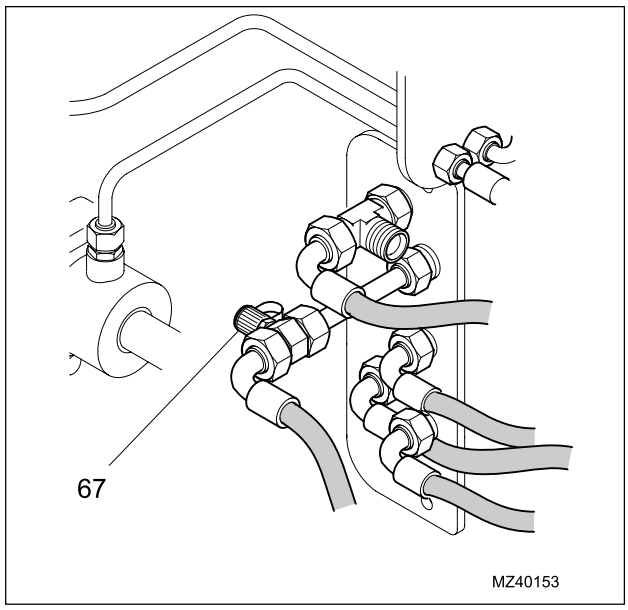


66 Test point

Test point 3 (67) (priority steering)

Located adjacent to the bulkhead plate for steering and brake hose connections at the front right of the cab.

1. Connect pressure gauge to test point 3 (67).
2. Start engine.
3. Whilst steering the wheels, the gauge will show the pressure of the oil supplied to the steering unit.
4. Read pressure gauge.
5. Check pressure - at full steering this will be 175 +/ - 10 bar (2538 +/- 145 psi).



67 Test point

Test point 4 (68). (Brake circuit)

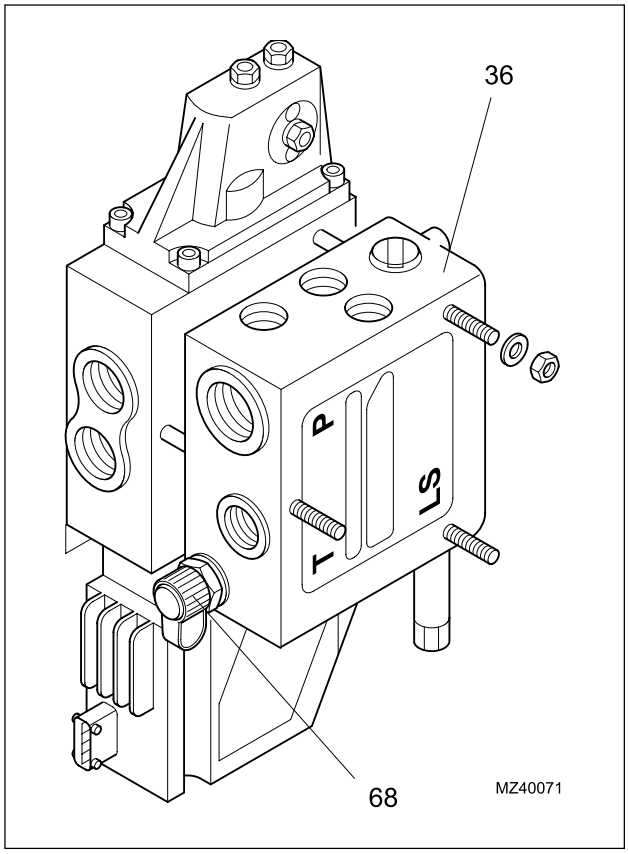
This test point is located on the inlet section (PVSP) (36) of the main valve (25), on port B3.

1. Connect pressure gauge to test point 4 (68).
2. Start engine.
3. Read pressure gauge.
4. Check pressure - when operating the gauge will read the stored pressure in the accumulator. Recharge will occur at 138 +/- 5 bar (2001 +/- 72.5 psi) and stop charging sat 160 +/- 5 bar (2321 +/- 72.5 psi).

NOTE: The test port will allow measurement of oil pressure in the brake charge circuit.

NOTE: When other services are used, the pressure seen at this Test Point will be up to a maximum of 250 bar (3625 psi).

NOTE: For dual circuit brake machines, this reading is only accurate whilst the brakes are being charged.



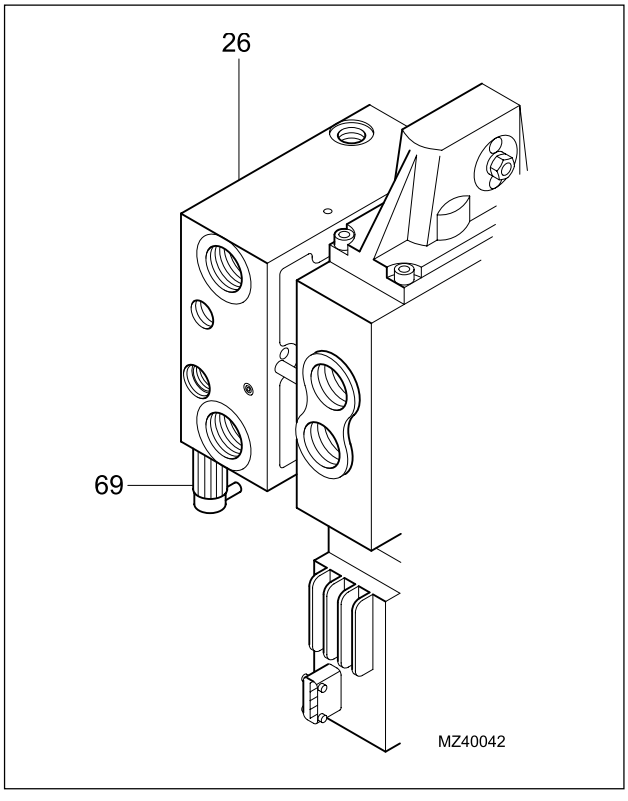
36 PVSP inlet section

68 Test point

Test point 5 (69). (Main system – pressure P)

This test point is located on the outlet section (PVP) (26) of the main valve (25).

1. Connect pressure gauge to test point 5 (69).
2. Start engine.
3. The gauge will read the pressure raised by the pump when demanded by the boom services and will be higher than the LS pressure by 20 bar (290 psi) (stand-by).
4. Read pressure gauge.
5. Check pressure is up to 270 +/- 10 bar (3916 +/- 72.5 psi).



26 PVP outlet section

69 Test point

LS pump (2)

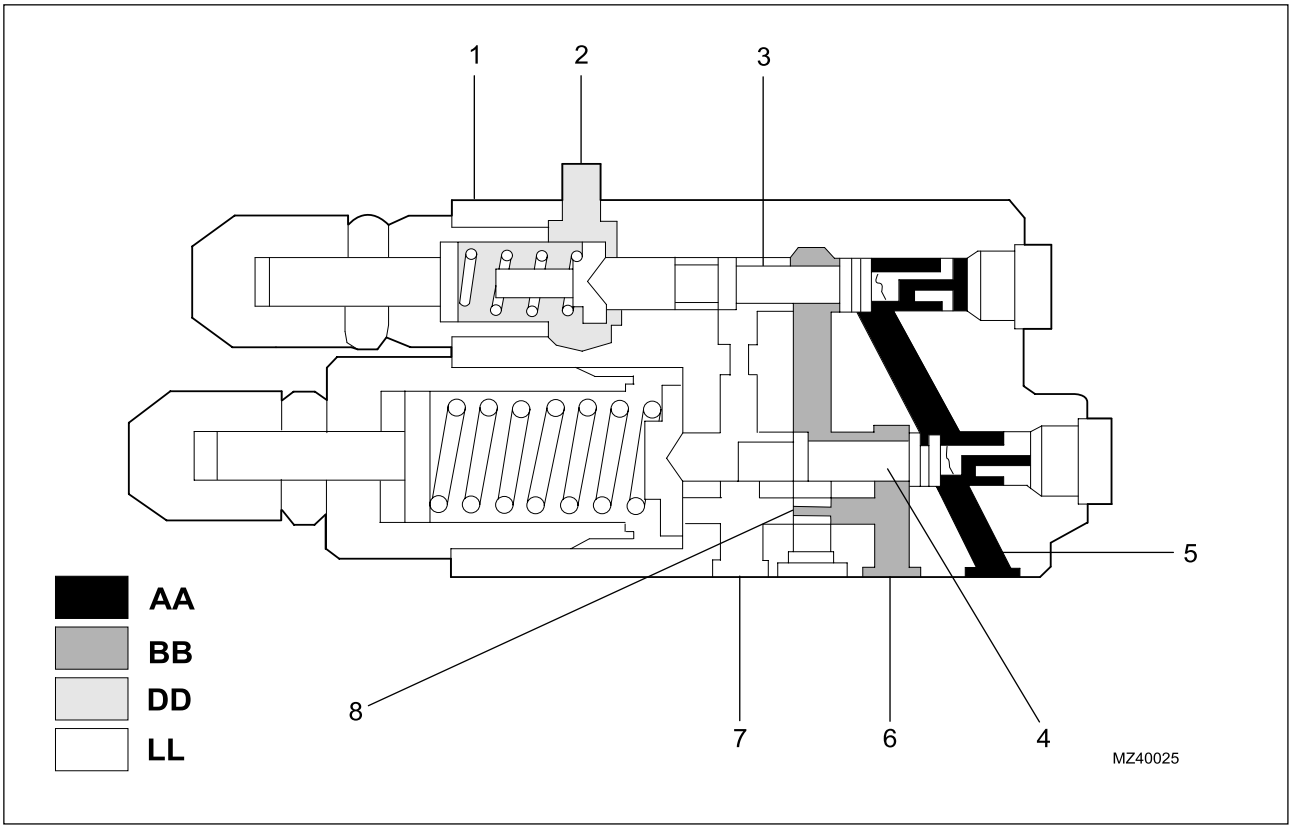
The load sensing hydraulic pump supplies pressure to operate all services, except the fan motor and hydraulic filter. The pump operation phases are as follows:

LS pump compensator (3) operation

The pressure spring of the volumetric flow controller (3) is designed so that the pump pressure acting on the face is always 20 bar (290 psi) higher than the load pressure acting via port (2).

The pressure of 20 bar (290 psi) is the stand-by pressure.

The pressure regulator (4) limits the pressure in the service hydraulic circuit to 250 ±5 bar (3625 ±70 psi) (PRV function).



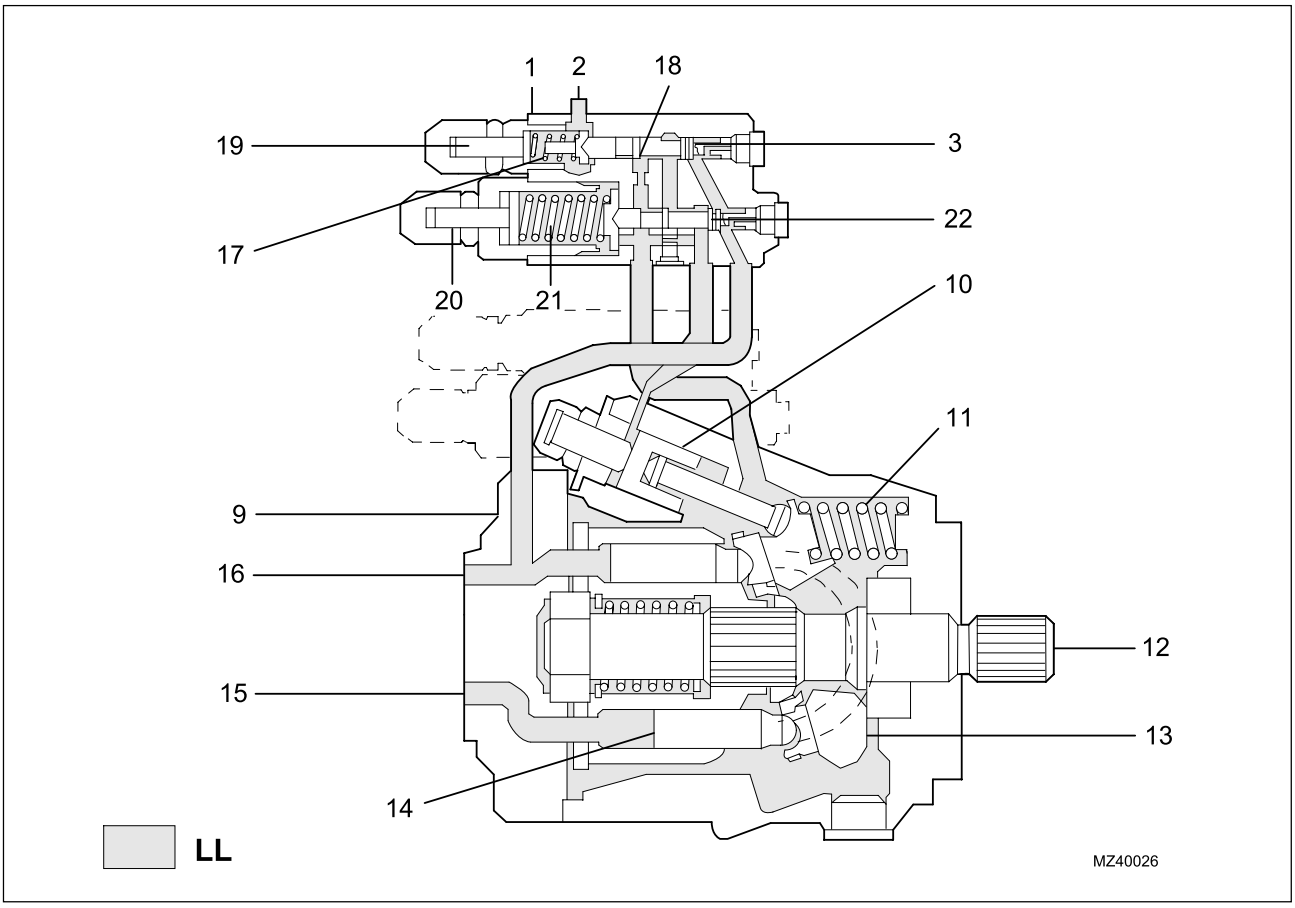
1. LS compensator **(3)**
2. Inlet port
3. Volumetric flow controller
4. Pressure regulator
5. Connection to pump
6. Connection to control plunger of pump
7. Connection to tank
8. Orifice

AA Supply oil
BB Oil at reduced pressure
DD Control oil
LL Tank

Stand-by position (engine switched off)

With the machine switched off there is no pressure in the hydraulic system. Pressure spring (17) has pushed the volumetric flow controller (3) up to the stop. In this position, the upper side of control plunger (10) is connected to the tank via the volumetric flow controller (3).

The control spring (11) has moved the swash plate (13) to maximum deflection.



9. LS pump **(2)**
1. LS compensator **(3)**
3. Volumetric flow controller
10. Control plunger
11. Control spring
12. Pump drive
13. Swash plate
14. Plunger
15. Pump inlet port
16. Pump outlet port
17. Pressure spring (stand-by pressure)
18. Control edge
19. Adjustment screw (stand-by pressure)
20. Adjustment screw (max; pump pressure)
21. Pressure spring
22. Control edge

AA Supply oil
BB Oil at reduced pressure
DD Control oil
LL Tank

Stand-by position (engine started)

All control valves are in the neutral position. The swash plate (13) is at maximum deflection.

With the machine started, the pump delivers maximum volumetric flow via pump outlet (16) to the control spool of all the control valves.

As the control spools are completely shutting off the oil flow, the pressure increases and acts on the right hand side of the volumetric flow controller (3) which is moved to the left against the pressure spring (stand-by pressure) (17). Control edge (18) is opened so that pressure acts on the upper side of control plunger (10). Swash plate (13) is now moved back against control spring (11) into the minimum delivery position. This process is completed within 10 milliseconds.

In this pump position

- Only the volumetric flow required to compensate leakage losses is generated.
- The pressure required for the initial actuation of a consumer is maintained.

Since every control valve is actuated when in the neutral position, the inlet port (2) for the load pressure is pressure free.

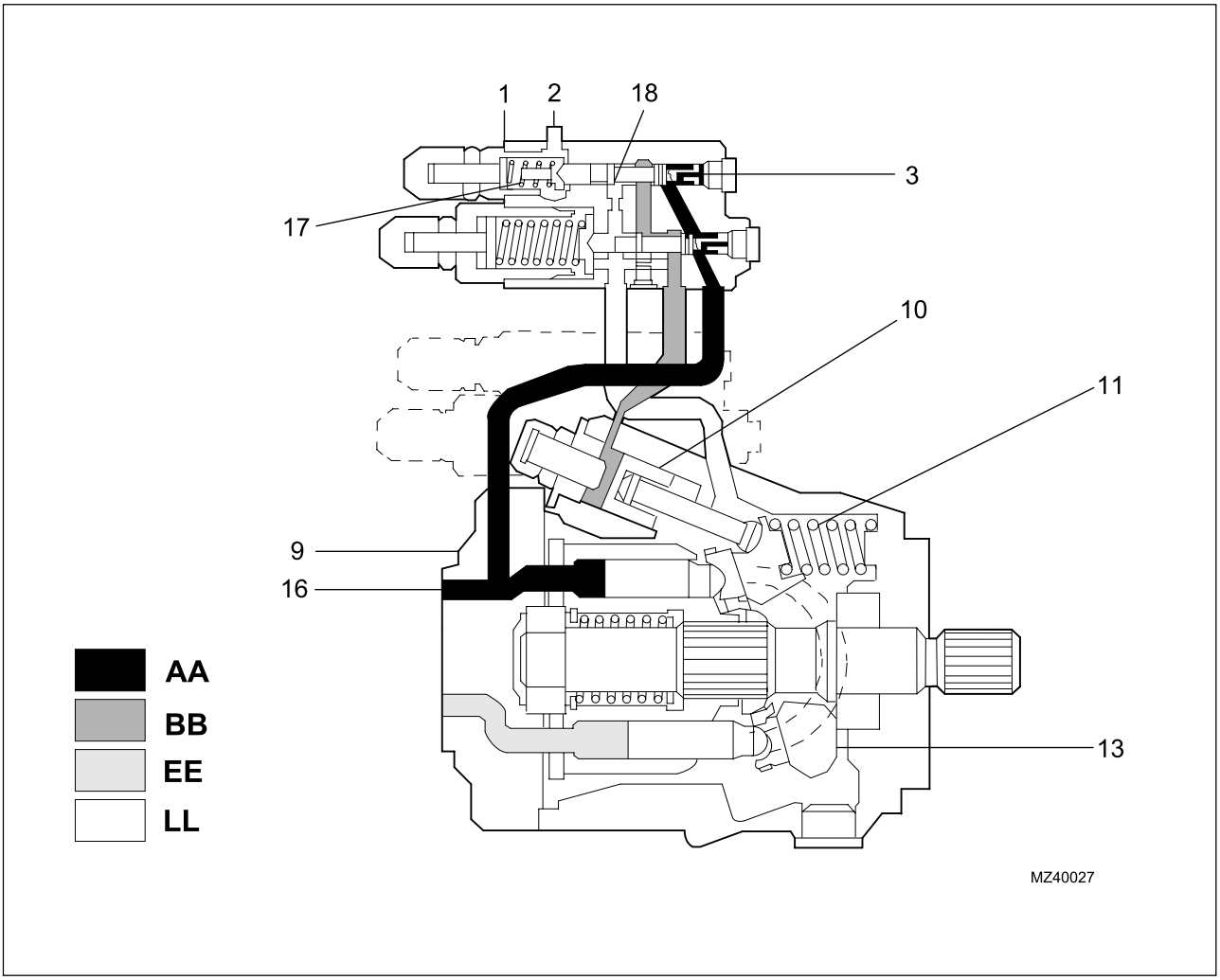
In order to move the volumetric flow controller (3); the pump pressure only has to overcome the force of the pressure spring (stand-by pressure) (17). The pressure require to do this is 22 bar (320 psi) and is referred to as the ‘low pressure stand-by pressure’.

The ‘low pressure stand-by pressure’ is slightly higher than the stand-by pressure of 20 bar (290 psi).

Depending on the setting of the volumetric flow controller (3) and the pump leakage, the ‘low pressure stand-by pressure’ and the stand-by pressure may be equal. However, the stand-by pressure can never be higher than the ‘low pressure stand-by pressure’.

The ‘low pressure stand-by pressure’ cannot be preset and may vary between machines. It changes with increasing leakage in the pump or system.

The pump remains in the ‘low pressure stand-by’ position until one of the valves is actuated. In this position, the pump requires very little drive energy.



9. LS pump **(2)**
1. LS compensator **(3)**
2. Inlet port
3. Volumetric flow controller
10. Control plunger
11. Control spring
13. Swash plate
16. Pump outlet port
17. Pressure spring (stand-by pressure)
18. Control edge

AA Supply oil
BB Oil at reduced pressure
EE Oil from charge pump
LL Tank

Pump goes into delivery

When a control valve is actuated and thus increased delivery volume is demanded from the pump, the pump pressure drops slightly.

The following conditions are created at the volumetric flow controller (3)**:**

- The pump pressure acts on the right hand face.
- The load pressure and the spring force of the pressure spring (stand-by pressure) (17) acts in the spring chamber.

As the load pressure and the spring force of the pressure spring (stand-by pressure) (17) is larger than the pump pressure acting on the right face volumetric flow controller (3) is moved to the right up to the stop.

As a result:

- The passage of the pump pressure to control plunger (10) is barred.
- Control plunger (10) is linked to the tank (no pressure on the upper side of the plunger).
- Swash plate (13) is deflected by control spring (11).

The pump now delivers a higher volumetric flow through the pump outlet (16). This process is referred to as 'upstroking'. The volumetric flow of the pump is determined by the throttling effect of the open control spool cross-section or by the setting of the flow divider of a selective control valve.

Lower volumetric flow demand

If the control valve cross-section is reduced (the volumetric flow is to be reduced), the load pressure at inlet port (2) drops.

The force conditions at volumetric flow controller (3) change as a result, so that it is pushed to the left up against the pressure spring in relation to the drop in pressure.

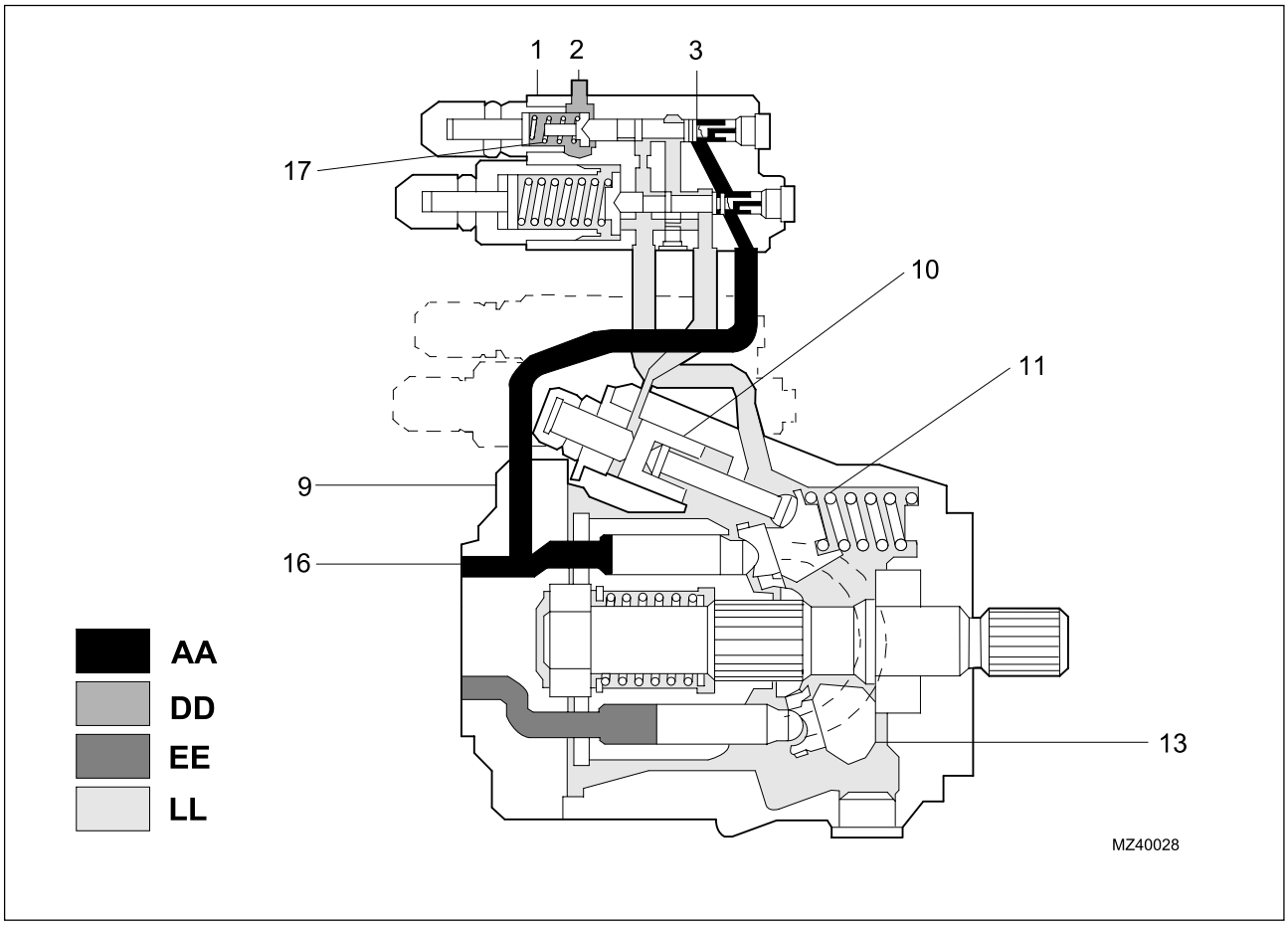
Control plunger (10) is pressurized and the angle of the swash plate (13) is reduced; the delivery of the pump is reduced until the volumetric flow demand is satisfied.

Increased volumetric flow demand.

Example:

A selective control valve is actuated. The load pressure is 140 bar (1508 psi); the pump moves to a pressure of 160 bar (1537 psi) 140 bar load pressure + 20 bar stand-by pressure).
If an additional second selective service is now actuated with a load pressure of 100 bar (1450 psi), the pump pressure drops slightly.

The pressure on the upper side of control plunger (10) is also reduced as a result and the angle of swash plate (13) is increased so that the delivery volume is increased until the additional volumetric flow demand of the second service is satisfied.



9 LS pump **(2)**
1. LS compensator **(3)**
2. Inlet port
3. Volumetric flow controller
10. Control plunger
11. Control spring
13. Swash plate
16. Pump outlet port
17. Pressure spring (stand-by pressure)

AA Supply oil
DD Control oil
EE Oil from charge pump
LL Tank

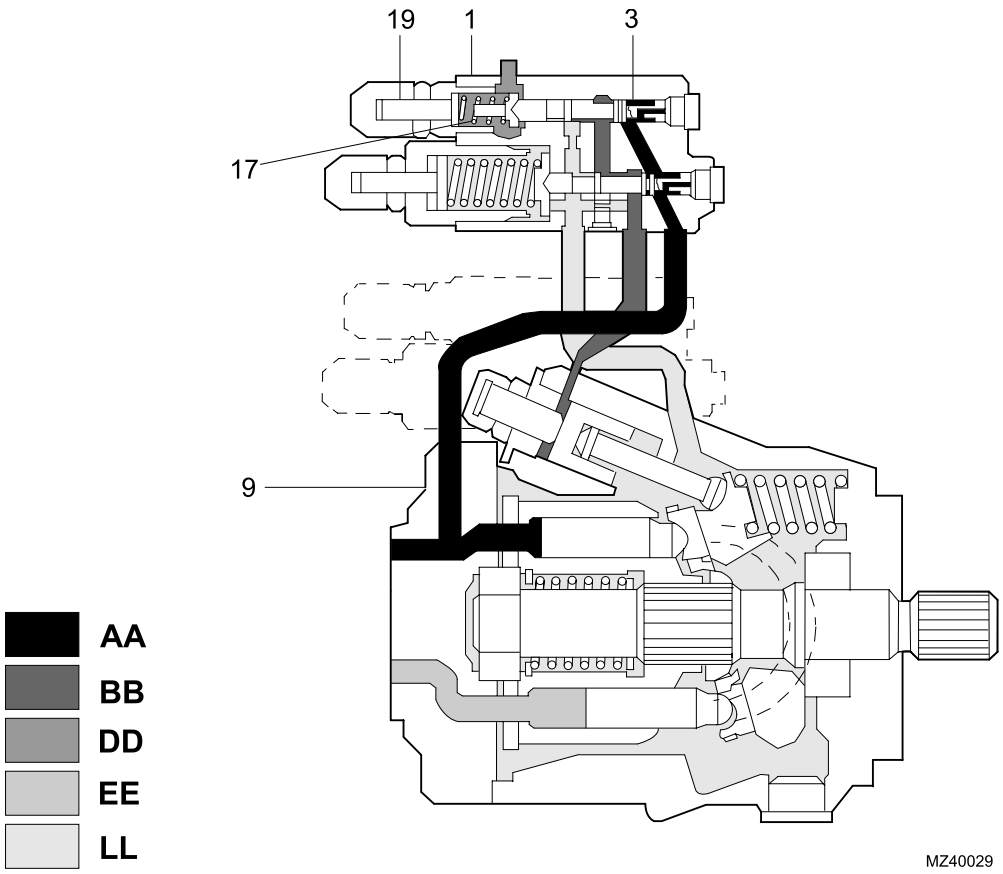
Constant volumetric flow

During operation of a consumer with a constant load (e.g. hydraulic motor), the volumetric flow controller (3) is actuated into a stable position.

The following pressure conditions then exist at the volumetric flow controller (3)**:**

- Load pressure (signal pressure) plus the spring force of stand-by pressure spring (17) act on the left-hand face.
- The pump pressure acts on the right hand side.

The difference in pressure is the stand-by pressure, which corresponds to the force of pressure spring (17). The stand-by pressure should be 20 bar (290 psi); it can be set with adjustment screw (19).



9. LS pump **(2)**
1. LS compensator **(3)**
3. Volumetric flow controller
17. Pressure spring (stand-by pressure)
19. Adjustment screw

AA Supply oil
BB Oil at reduced pressure
DD Control oil
EE Oil from charge oil
LL Tank

Downstroking of the pump

The pump is downstroked under the following conditions:

- A control valve is moved to the neutral position; no volumetric flow is required.
- During operation, one control valve is moved to the neutral position or to the precision control range. A smaller volumetric flow is required.

The pump must always be downstroked when a smaller volumetric flow is required.

The downstroking process is started when the pressure and the spring force of the pressure acting on the right face of the volumetric flow controller (3) is higher than that acting on the left hand face (in the spring chamber).

In this case the volumetric flow controller (3) is moved to the left against the pressure spring (17) and control edge (18) opens. This leads to an increased pressure on the upper side of the control plunger (10), which reduces the angle of the swash plate (13) against the control spring (11) and the volumetric flow is reduced.

If a selective control valve is moved to the precision control range (a very small volumetric flow is to be delivered to the consumer), the load pressure at inlet port (2) drops.

The force conditions at the volumetric flow controller (3) change as a result so that it is pushed to the left, up against the pressure spring (17) in relation to the drop in pressure.

The control edge (18) is opened so that control plunger (10) is pressurized. The angle of swash plate (13) is reduced; the delivery of the pump is reduced until the volumetric flow demand is satisfied.

Example

During parallel operation of two selective services, the load pressures are 140 bar (1508 psi) and 100 bar (1450 psi).

The pump moves to a pressure of 160 bar (1537 psi) (140 bar load pressure + 20 bar stand-by pressure).

The volumetric load controller (3) and swash plate (13) are in a constant position.

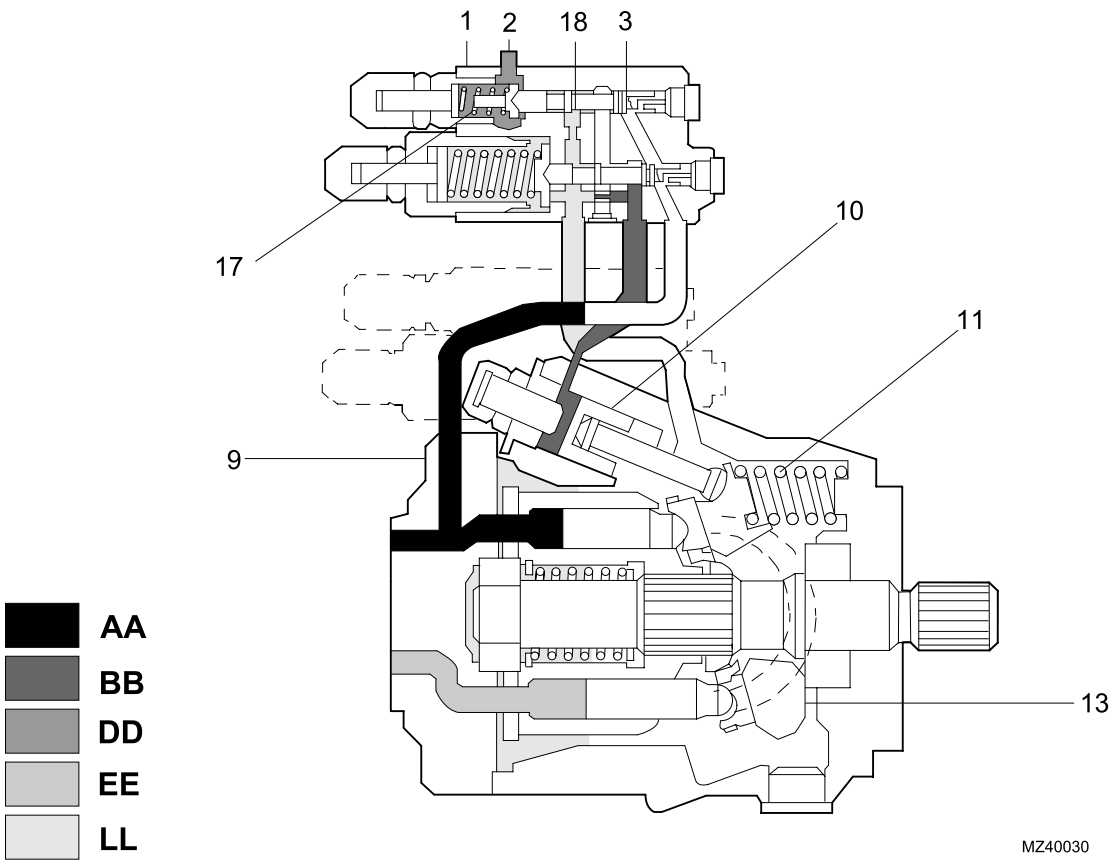
The pump delivers the volumetric flow required for the two consumers.

If the second selective control valve, 100 bar (1450 psi) load pressure, is now moved to the neutral position, the volumetric flow has to be reduced as now only the first selective service has to be supplied.

This is achieved by switching off one of the selected circuits. This causes the pump pressure to rise briefly, as the volumetric flow is now only delivered to the first selective control valve.

The volumetric flow controller (3) is moved to the left, the control edge (18) opens and the pressure on the upper side of control plunger (10) is reduced.

The angle of the swash plate (13) is decreased so that the delivery volume is reduced.



9 LS pump **(2)**
1. LS compensator **(3)**
2. Inlet port
3. Volumetric flow controller
10. Control plunger
11. Control spring
13. Swash plate
17. Pressure spring (stand-by pressure)
18. Control edge

AA Supply oil
BB Oil at reduced pressure
DD Control oil
EE Oil from charge pump
LL Tank

Maximum pressure limiting (pressure relief valve function)

The pressure in the hydraulic system is limited to 250 ±5 bar (3625 ± 70 psi) in order to prevent damage to the components. This function is performed by the pressure regulator (4).

During normal operations (working pressure < max: pressure) pressure regulator (4) is pushed to the right, up against the stop by pressure spring (21).

If for example, a selective control valve is actuated and the cylinder reaches its end position, the load pressure at inlet port (2) rises until it is equal to the pressure at pump outlet port (16).

Under these pressure conditions:

Volumetric flow controller (3) is pushed to the right against the stop by pressure spring (17).

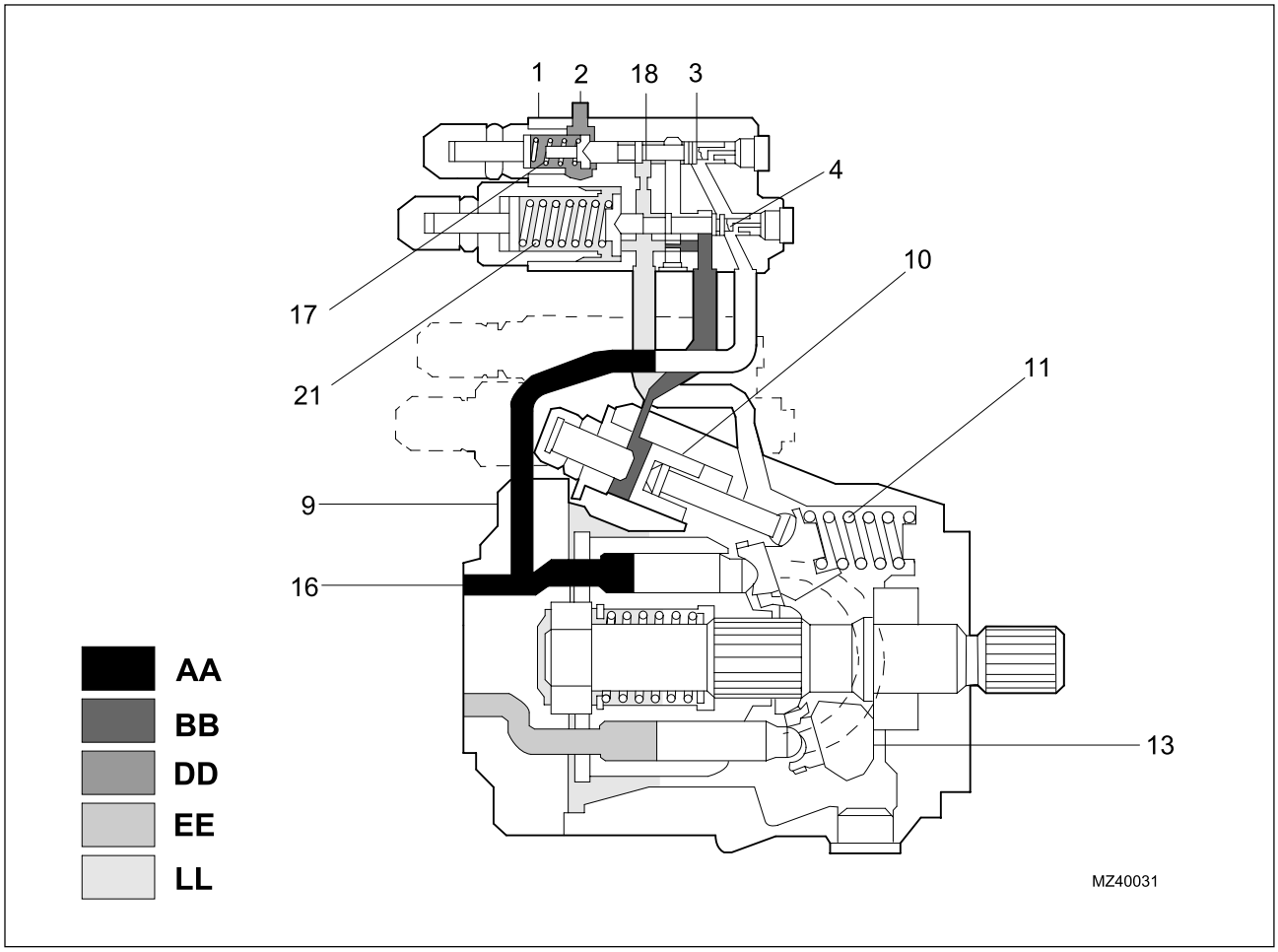
Pressure regulator (4) is pushed to the left, up to the stop against the force of pressure spring (21).

This movement takes place at a pressure of to 250 ± 5 bar (3625 ± 70 psi). Control edge (18) is opened so that the pump pressure acts on the upper side of control plunger (10).

The swash plate (13) is now moved to its ‘minimum delivery’ position against the force of control spring (11). This process takes 8-10 milliseconds.

The pump now delivers the minimum volumetric flow against the maximum pressure of to 250 ± 5 bar (3625 ± 70 psi).

The hydraulic system remains at the maximum pressure level until the selective control valve is moved to the neutral position.



9 LS pump **(2)**
1. LS compensator **(3)**
2. Inlet port
3. Volumetric flow controller
4. Pressure regulator
10. Control plunger
11. Control spring
13. Swash plate
16. Pump outlet
17. Pressure spring (standby pressure)
18. Control edge
21. Pressure spring

AA Supply oil
BB Oil at reduced pressure
DD Control oil
EE Oil from charge pump
LL Tank

Adjusting the pump

The main system pressure and the standby pressure can be adjusted using the adjusters (19 and 20) on the LS compensator valve (1). The procedure for adjusting the hydraulic pressure is as follows:

NOTE: Only check hydraulic pressure when oil is at normal working temperature (60 ± 4°C) and with engine at fast idle (1800 rpm).

Main system pressure

Connect pressure gauge to test point 1 (65).

Start engine. This gauge will indicate the load sensing signal required by any of the services being operated. Operate any service and read the pressure requirement, when a service is operated to its limit the maximum pressure of 250 bar (3625 psi) will be maintained and the pump will 'de-swash'.

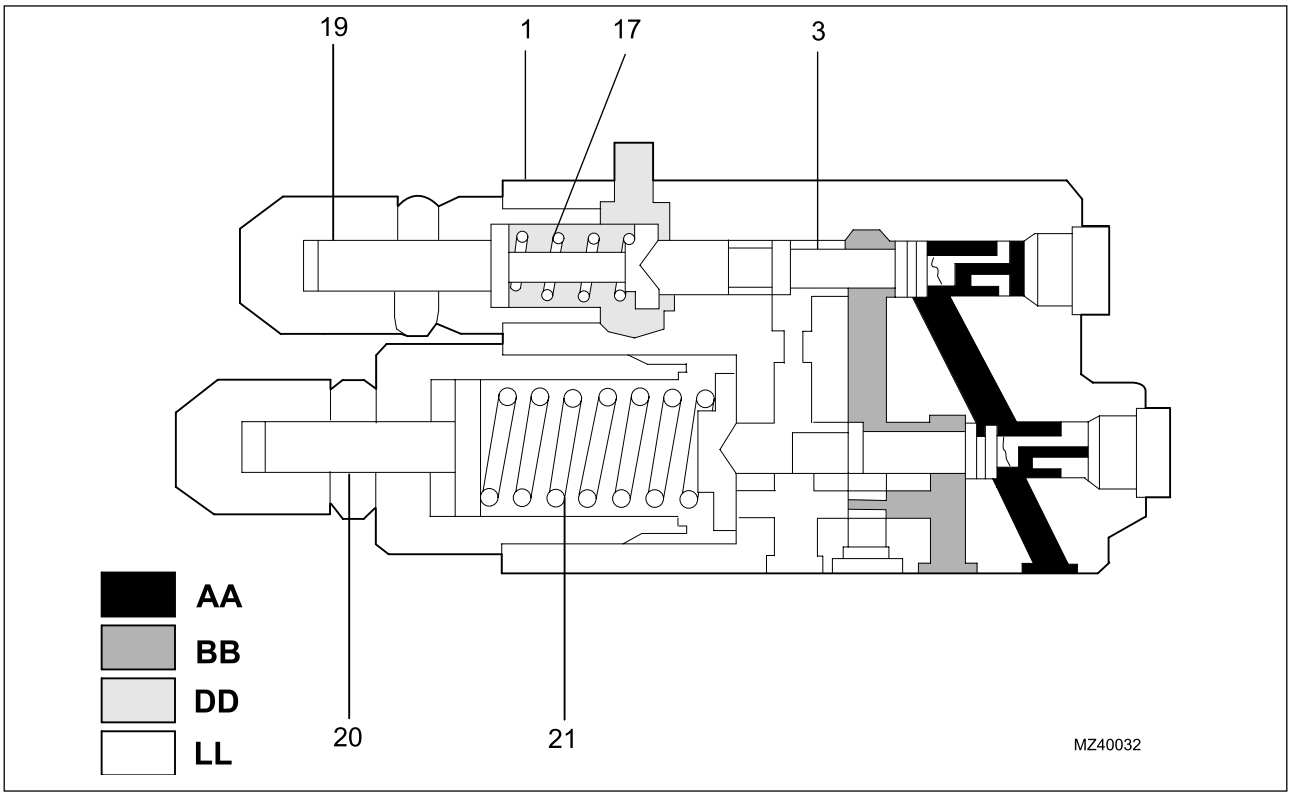
Read pressure gauge.

Adjust pressure spring (21) using adjuster screw (20) to set the pressure to 250 ± 5 bar (3625 ± 70 psi)

Standby pressure

Connect pressure gauge to test point 5 **(69)**.

Start engine. Make sure all services are in neutral then read the pressure gauge. The pressure should be 20 bar (290 psi). Adjust pressure spring (17) using adjuster screw (19) to set the standby pressure to 20 bar (290 psi).



1. LS compensator **(3)**
3. Volumetric flow controller
17. Pressure spring (standby pressure)
19. Adjuster screw (standby pressure)
20. Adjuster screw (main pressure)
21. Pressure spring (main pressure)

AA Supply oil
BB Oil at reduced pressure
DD Control oil
LL Tank

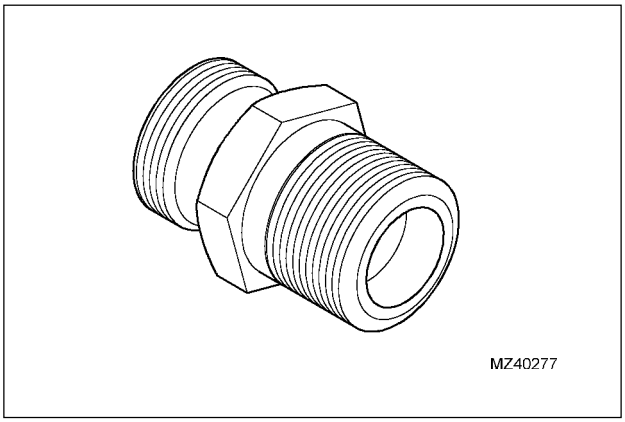
MAINTENANCE

Torque tightening

Where torque tightening figures are not given in the procedures, use the torque tightening settings in the following tables related to that fitting. The figures relate to thread sizes and are applicable to steel only and have a tolerance of 10%.

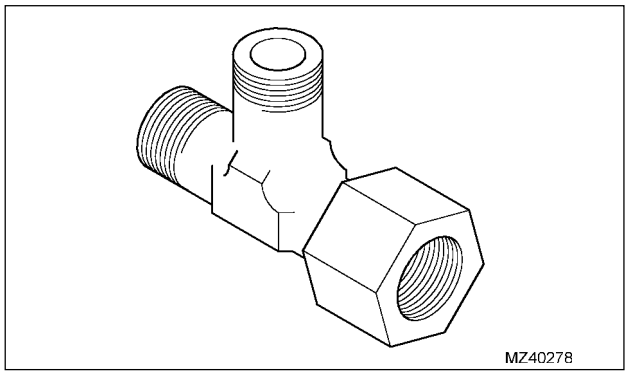
Male Union Adaptors

Tube O/D Series	Thread	Torque Nm
6L	G1/8A	16
6S	G1/4A	55
8L	G1/4A	35
8S	G1/4A	55
10L	G1/4A	35
10S	G3/8A	80
12L	G3/8A	70
12S	G3/8A	80
15L	G1/2A	90
16S	G1/2A	115
18L	G1/2A	90
20S	G3/4A	180
22L	G3/4A	180
25S	G1A	310
28L	G1A	310
30S	G1 1/4A	450
35L	G1 1/4A	450
38S	G1 1/2A	540
42L	G1 1/2A	540
6L	M 10x1	18
6S	M 12x1.5	35
8L	M 12x1.5	25
8S	M 14x1.5	55
10L	M 14x1.5	45
10S	M 16x1.5	70
12L	M 16x1.5	55
12S	M 18x1.5	90
15L	M 18x1.5	70
16S	M 22x1.5	135
18L	M 22x1.5	125
20S	M 27x2	180
22L	M 26x1.5	180
25S	M 33x2	310
28L	M 33x2	310
30S	M 42x2	450
35L	M 42x2	450
38S	M 48x2	540
42L	M 48x2	540



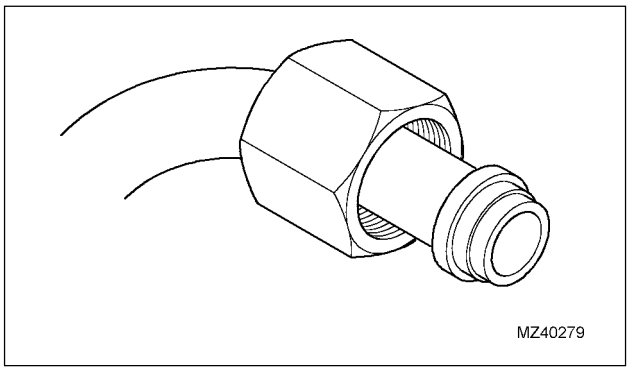
DKO Fittings

Tube Dim:	Wrench Size	Torque Nm
10L (10x1.5)	19M	45
12L (12x1.5)	22M	51
15L (15x1.5)	27M	74
18L (18x2.0)	32M	70
22L (22x2.0 or 2.5)	36M	135
28L (22x2.0 or 2.5)	41M	166



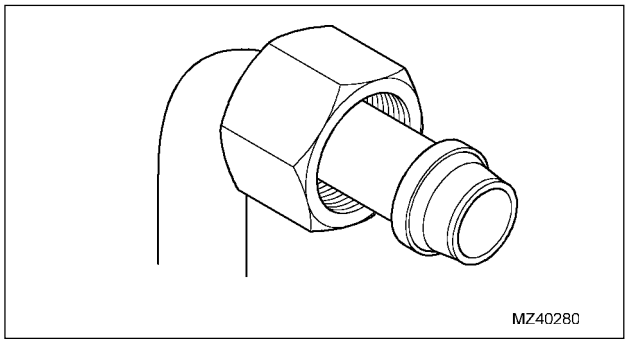
Walform Fittings

Tube Dim:	Wrench Size	Torque Nm
10L (10x1.5)	19M	50
12L (12x1.5)	22M	70
15L (15x1.5)	27M	100
18L (18x2.0)	32M	180
22L (22x2.0 or 2.5)	36M	230
28L (22x2.0 or 2.5)	41M	330



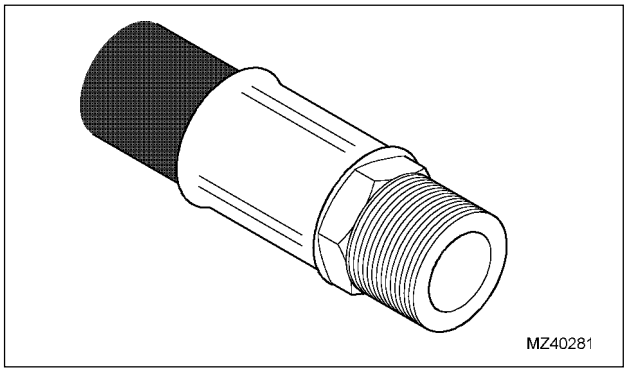
Controlled Final Assembly Fittings

Tube Dim:	Wrench Size	Torque Nm
10L (10x1.5)	19M	50
12L (12x1.5)	22M	70
15L (15x1.5)	27M	100
18L (18x2.0)	32M	115
22L (22x2.0 or 2.5)	36M	230
28L (22x2.0 or 2.5)	41M	330



Flexible Hoses

Tube Dim:	Wrench Size	Torque Nm
10L (10x1.5)	19M	45
12L (12x1.5)	22M	51
15L (15x1.5)	27M	74
18L (18x2.0)	32M	70
22L (22x2.0 or 2.5)	36M	135
28L (22x2.0 or 2.5)	41M	166



WARNING *Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. If hydaulic fluid penetrates your skin seek mecical help immediately.*

HYDRAULIC LEVEL

Check

1. Position the machine on level ground.

2. Make sure all hydraulic cylinders are fully closed.

3. Stop the engine, apply the parking brake.

4. Open the engine pod cover.

5. Check hydraulic tank sightglass (2), make sure fluid level shows in sightglass and is above the red line.

NOTE: Wait for two minutes, after engine is stopped, before checking fluid level.

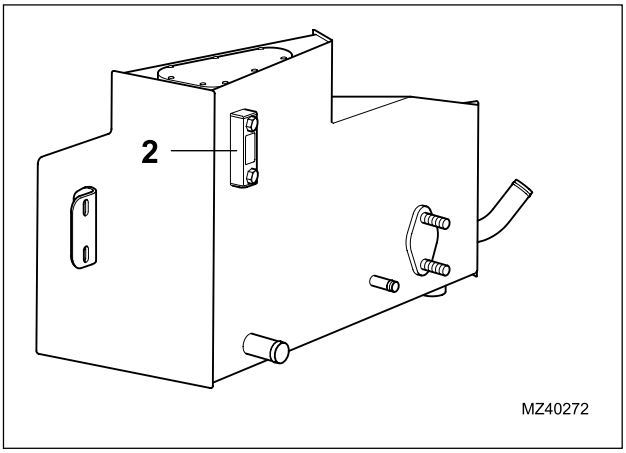
6 .Replenish fluid if necessary as follows:

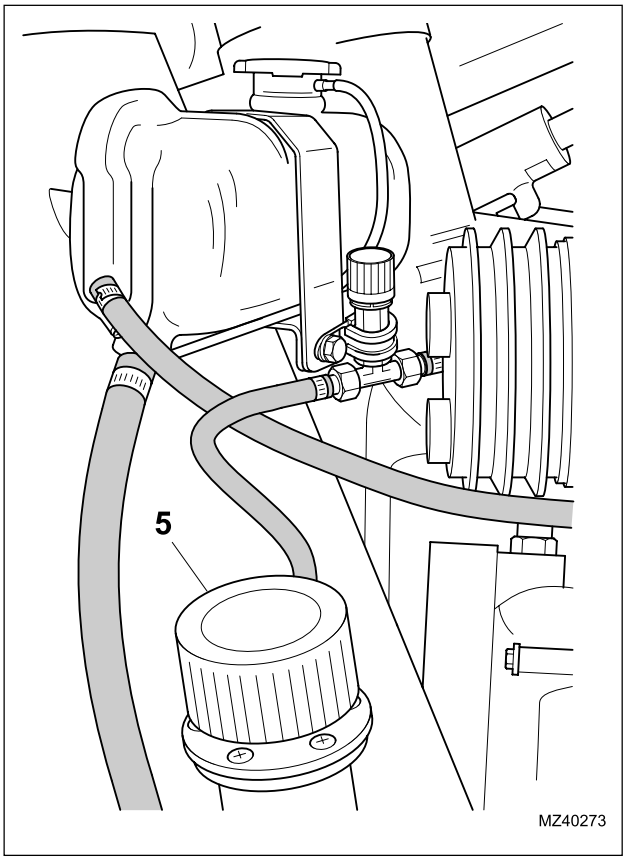
WARNING *The cap maintains an air pressure of 0.3 bar in the hydraulic tank.*

7. Clean filler cap (1) and remove.

8. Top up hydraulic tank with fluid to correct level and refit filler cap.

9. Close engine pod cover.





1. Filler cap
2. Sightglass

HYDRAULIC TANK (1)

Removal

NOTE: Removal and installation of the hydraulic tank is possible with the machine on the ground.However, increasing the ground clearance or positioning the machine over a pit will make the operation easier and quicker.

1. Position the machine over a pit, if available, or lift on axle stands.

2. Stop the engine and chock the machine, apply the parking brake**.**

3. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

NOTE: The hydraulic tank contains 67 litres (15 gal) of fluid.

4. Remove the drain plug (2) and drain the hydraulic fluid into a suitable container. Do not reuse the hydraulic fluid unless it can be specially filtered and tested.

5. Remove the hose clips (9) from the suction hoses (4 & 5) of the main and auxiliary pumps and the filler hose (3). Remove the hoses from the hydraulic tank (1).

6. Remove the two sightglass attachment bolts and remove the sightglass (6).

7. Remove the screws securing the return manifold (7) to the tank and lift the manifold to release the gasket (8).

8. Support the hydraulic tank; remove the two nuts from the studs and the two bolts securing the tank to the engine and transmission sub-assembly. Lower the tank and remove from beneath the machine.

9. Fit blanks to all openings on the tank and hoses on the machine to prevent the ingress of dirt.

Installation

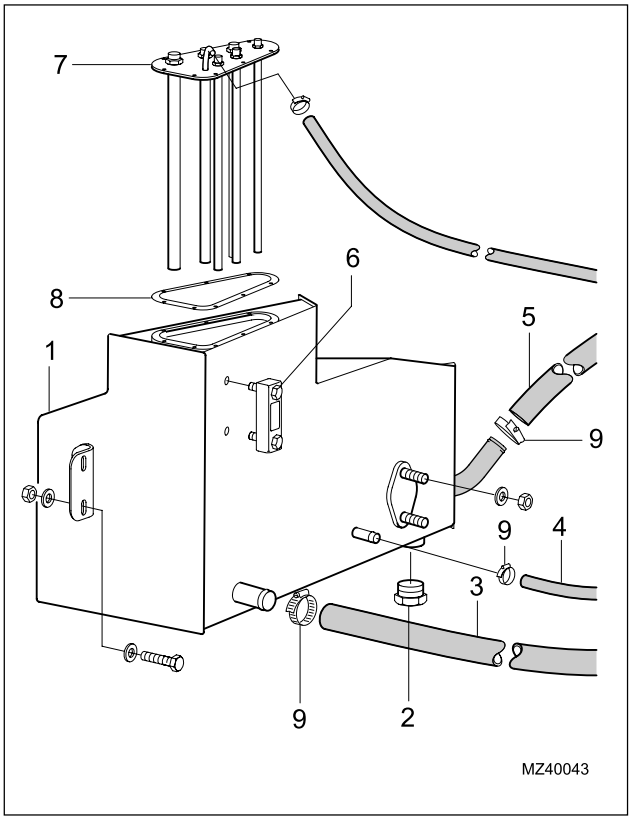
1. Installation is the reverse of removal.

2. Use new hose clips and gaskets

3. Refer to Page 1.66 and replenish the hydraulic tank before engine is started.

4. Purge the hydraulic system by starting the engine and operating all services to fully extend and retract cylinders several times.

5. Refer to Page 1.66, check the hydraulic level and replenish if necessary.



1. Hydraulic tank
2. Drain plug
3. Filler hose
4. Suction hose – auxiliary pump
5. Suction hose – main pump
6. Sightglass
7. Return manifold
8. Gasket
9. Hose clips

HYDRAULIC PUMP (LS) (2)

Removal

NOTE: The hydraulic pump (LS) is located in the engine compartment, attached to the gearbox. Remove components as necessary to get access to the pump.

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Make sure the pump is free from dirt to avoid contamination of the hydraulic system.

4. Remove the LS hose (3) from the LS compensator (2).

5. Remove the case drain hose (4) from the main body of the pump (1).

6. Remove the four cap screws (6) and washers from the pump inlet hose (5) and remove hose from pump.

7. Remove the four cap screws (8) and washers from the two half-clamps (9) on the pump outlet hose (7) and remove the half-clamps and hose from pump.

8. Remove the two attachment bolts (10) and washers securing pump to gearbox (11) and remove pump.

9. Fit blanks to all openings on the pump and hoses to prevent the ingress of dirt.

Installation

1. Installation is the reverse of removal.

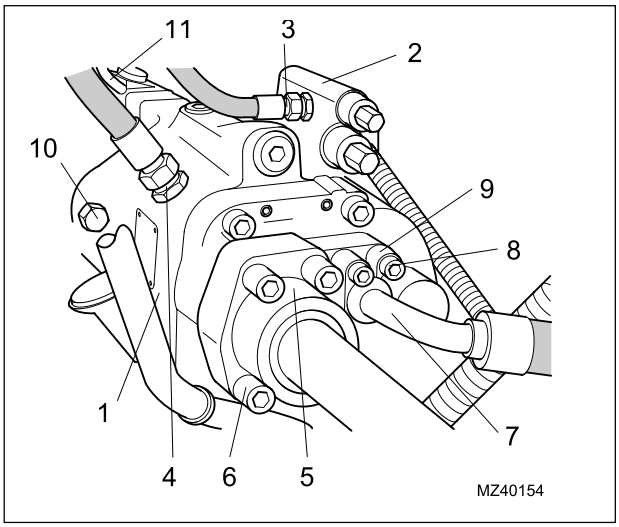
WARNING *When fitting a new LS hydraulic pump, it is vital that the case of the pump is filled with oil before the pump is fitted.*

2. Fill the pump with 0.25 litre (0.44 pt) of oil, through the case drain connection on the pump.

3. Use new O-rings when assembling the inlet and outlet hoses, lightly lubricated with clean hydraulic oil. Use new washers on the cap screws when assembling the inlet and outlet hoses.

4. Refer to Page 1.66 and replenish the hydraulic tank before the engine is started.

5. Purge the hydraulic system by starting the engine and operating all services to fully extend and retract cylinders several times. Refer to page 1.66, check the hydraulic level and replenish if necessary.



1. LS hydraulic pump
2. LS compensator
3. LS hose
4. Case drain hose
5. Inlet hose
6. Cap screw
7. Outlet hose
8. Cap screw
9. Half-clamp
10. Bolt
11. Gearbox

AUXILIARY HYDRAULIC PUMP (6)

Removal

NOTE: The auxiliary hydraulic pump is located in the engine compartment, attached to the timing case. Remove components as necessary to get access to the pump.

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Make sure the pump is free from dirt to avoid contamination of the hydraulic system.

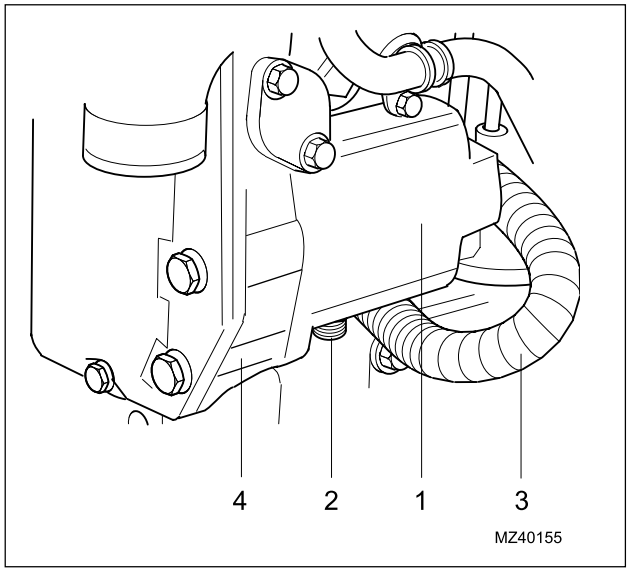
4. Remove the inlet hose (2) from the pump (1).

5. Remove the outlet hose (3) from the pump (1).

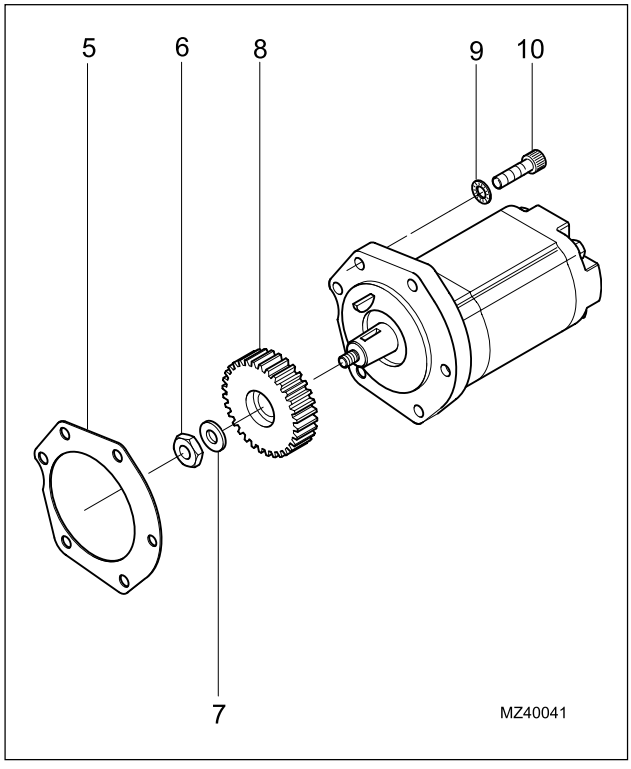
6. Remove the five cap screws and washers securing the pump to the timing case (4) and remove the pump.

7. Fit blanks to all openings on the pump and hoses to prevent the ingress of dirt.

8. When a new pump is to be installed, remove the nut (6) and washer (7) securing the drive gear (8) to the pump shaft. Remove the drive gear and woodruff key from the shaft.



1. Auxiliary pump
2. Inlet hose
3. Outlet hose
4. Timing case



5. Gasket
6. Nut
7. Washer
8. Gear
9. Washer
10. Cap screw

Installation

1. Installation is the reverse of removal.

2. Use new washers (9) on the cap screws (10) when assembling the inlet and outlet hoses.

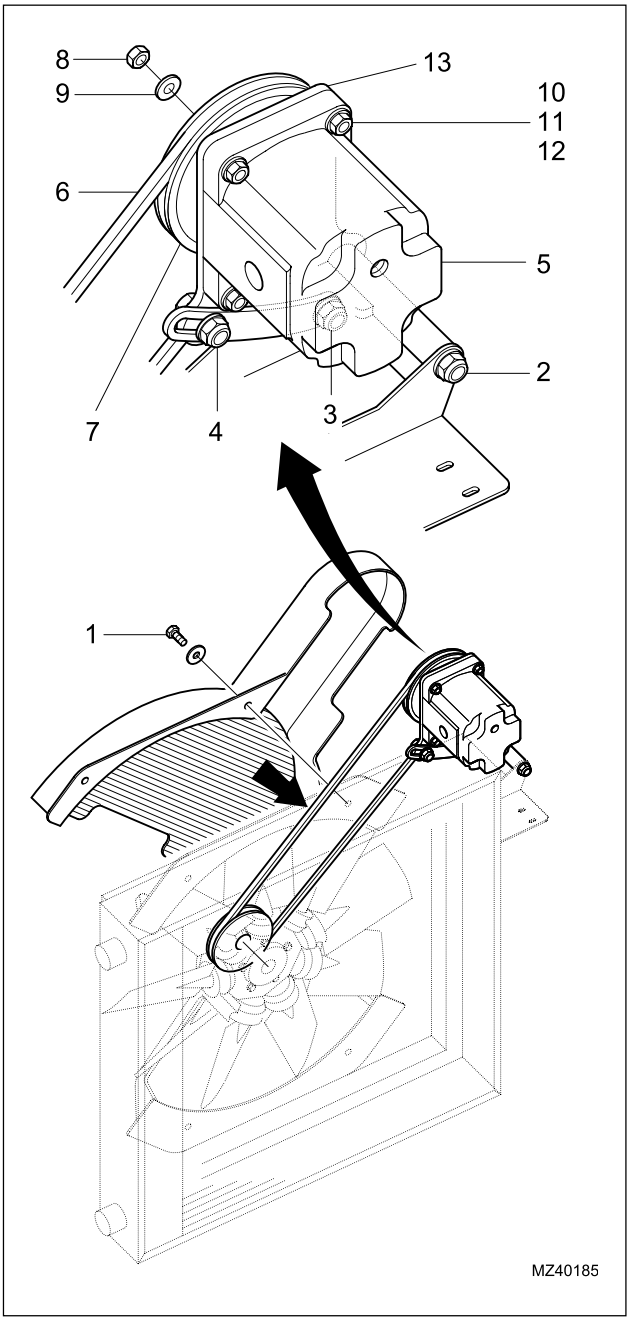
3. Use a new gasket (5) between the pump and timing case when installing the pump.

4. Refer to page 1.66, check the hydraulic level and replenish if necessary before the engine is started.

5. Purge the hydraulic system by starting the engine and operating all services to fully extend and retract cylinders several times.

6. Check the hydraulic level and refer to Page 1.66 and replenish if necessary.

FAN MOTOR (7)



NOTE: Up to Machines S/No.51200471 only.

Removal

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Open engine cover to gain access to fan motor.

4. Remove fan guard by unscrewing fasteners (1) and lifting guard clear.

5. Disconnect the three hydraulic hoses from the fan motor (5); blank the fan motor connections and open hoses.

6. Loosen the V-belt pivot fastener (2) and link arm fasteners (3 & 4). Remove V-belt (6) from pulley (7).

7. Remove the nut and washer (8 & 9) securing pulley (7) to fan motor and remove pulley.

8. Remove the four bolts, washers and nuts (10, 11 & 12) securing fan motor to mounting bracket (13) and remove fan motor.

Installation

1. Installation is the reverse of the above procedure.

2. Make sure the woodruff key is fitted to the fan motor drive shaft before fitting the pulley.

3. Tension the V-belt and check tension using a 'Fenner' or similar tension indicator. A force of 30 N at the mid-point on the belt should give a deflection of 8 mm.

4. Refer to Page 1.66, check the hydraulic level and replenish if necessary.

FAN DRIVE BEARINGS

NOTE: Up to Machines S/No.51200471 only.

Removal

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Open engine cover to gain access to fan motor.

4. Remove the fuel sediment bowl from its bracket.

5. Remove fan guard by unscrewing bolts (1) and lifting guard clear.

6. Loosen the V-belt pivot bolts (2) and link arm bolts (3). Remove V-belt (4) from pulley (5).

7. Loosen the mounting bolts (6) for the radiator and the bolts (7) beneath the fan motor and pull the radiator forwards slightly.

8. Remove the securing bolts from the fan carrier (8) and remove fan (9) complete with carrier.

9. Remove the setscrew (10) and washers (11 & 12) securing pulley (5) to the hub (13). Using a suitable puller, remove the pulley from the hub.

10. Remove the woodruff key (14) from the hub shaft and remove the hub from hub carrier.

11. Remove circlip (15) then push out bearing (16). Note position of spacer (17) then, using a small punch, remove bearing (18) from carrier.

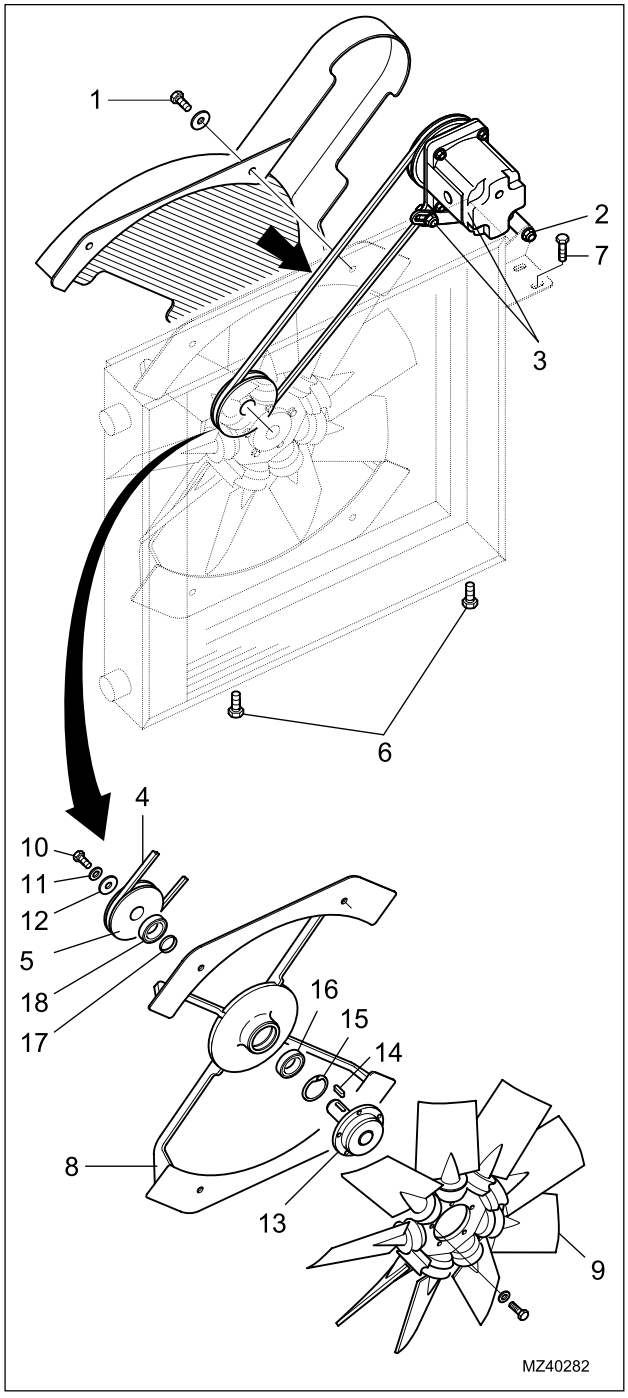
Installation

1. Installation is the reverse of the above procedure.

2. Make sure the woodruff key is fitted to the hub shaft before fitting the pulley.

3. Make sure the spacer is fitted tbetween the bearings before fitting the bearings.

4. Tension the V-belt and check tension using a 'Fenner' or similar tension indicator. A force of 30 N at the mid-point on the belt should give a deflection of 8 mm.



1.	Bolt	10	Setscrew
2.	Bolt	11	Washer
3.	Bolt	12	Washer
4.	V-belt	13	Hub
5.	Pulley	14	Woodruff key
6.	Bolt	15	Circlip
7.	Bolt	16	Bearing
8.	Carrier	17	Spacer
9.	Fan	18	Bearing

FAN MOTOR (7)

NOTE: From Machines S/No.51200472 only.

Removal

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Open engine cover to gain access to fan motor (4).

4. Remove fan guard (3) by unscrewing nuts (1) and washers (2) and lifting clear the guard (3).

5. Disconnect the three hydraulic hoses from the fan motor (4) and blank the fan motor connections and open hoses.

6. Loosen the four bolts (9), washers (10) and nuts, that attach the fan motor (4) to the fan casing (8). Remove V-belt (11) from the pulley (5).

7. Remove the nut (6) and washer (7) securing the pulley (5) to the fan motor (4). Remove the pulley (5).

8. Remove the four bolts (9), washers (10) and nuts, that attach the fan motor (4) to the fan casing (8). Remove the fan motor (4) from the machine.

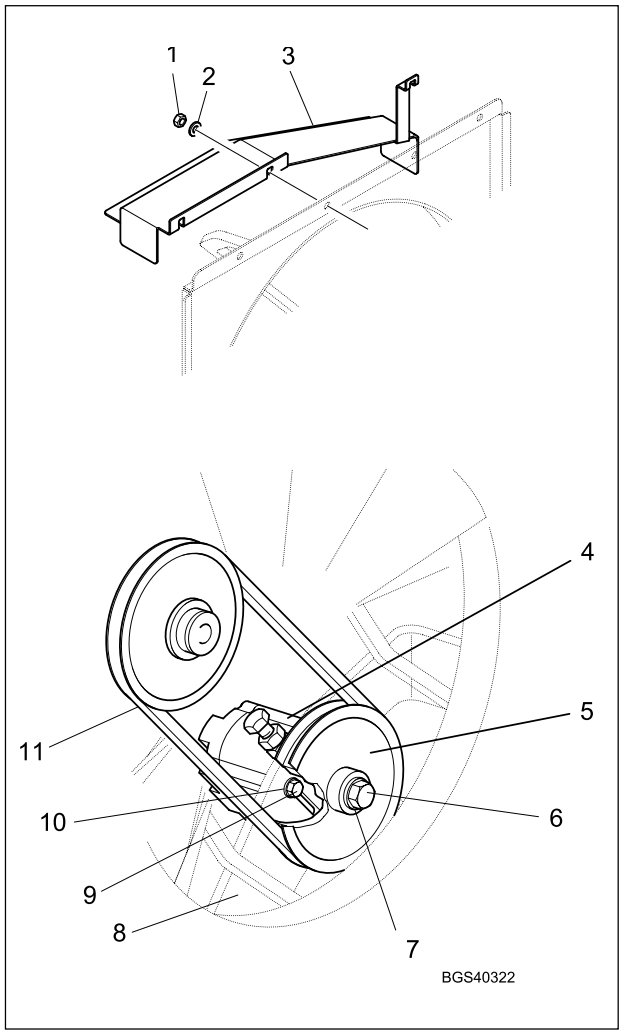
Installation

1. Installation is the reverse of the above procedure.

2. Make sure the woodruff key is fitted to the fan motor drive shaft before fitting the pulley (5).

3. Tension the V-belt (11) and check tension using a 'Fenner' or similar tension indicator. A force of 30 N at the mid-point on the belt should give a deflection of 8 mm.

4. Refer to Page 1.66, check the hydraulic level and replenish if necessary.



1.	Nut	7	Washer
2.	Washer	8	Fan casing
3.	Guard	9	Bolt
4.	Fan motor	10	Washer
5.	Pulley	11	V-belt
6	Nut		

FAN DRIVE BEARINGS

NOTE: From Machines S/No.51200472 only.

Removal

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Open engine cover to gain access to fan motor.

4. Remove the fuel sediment bowl from its bracket.

5. Refer to Page 1.72 and do steps 4 and 6, to remove the fan guard and loosen and remove the V-belt (7).

6. Remove the eight nuts and washers that secure the fan carrier (8) to the radiator. Remove the fan carrier (8), with the fan (14) and pulley (6) attached.assembly attached.

7. Remove the four securing bolts (16) and washers (15) that secure the fan (14) to the hub (13). Remove the fan (14).

8. Remove the setscrew (4) and washer (5) securing the pulley (6) to the hub (13). Using a suitable puller, remove the pulley (6) from the hub (13).

9. Remove the woodruff key (12) from the hub shaft and remove the hub (13) from hub carrier.

11. Remove circlip (9) then push out bearing (10). Note position of spacer (11) then, using a small punch, remove bearing (10) from carrier.

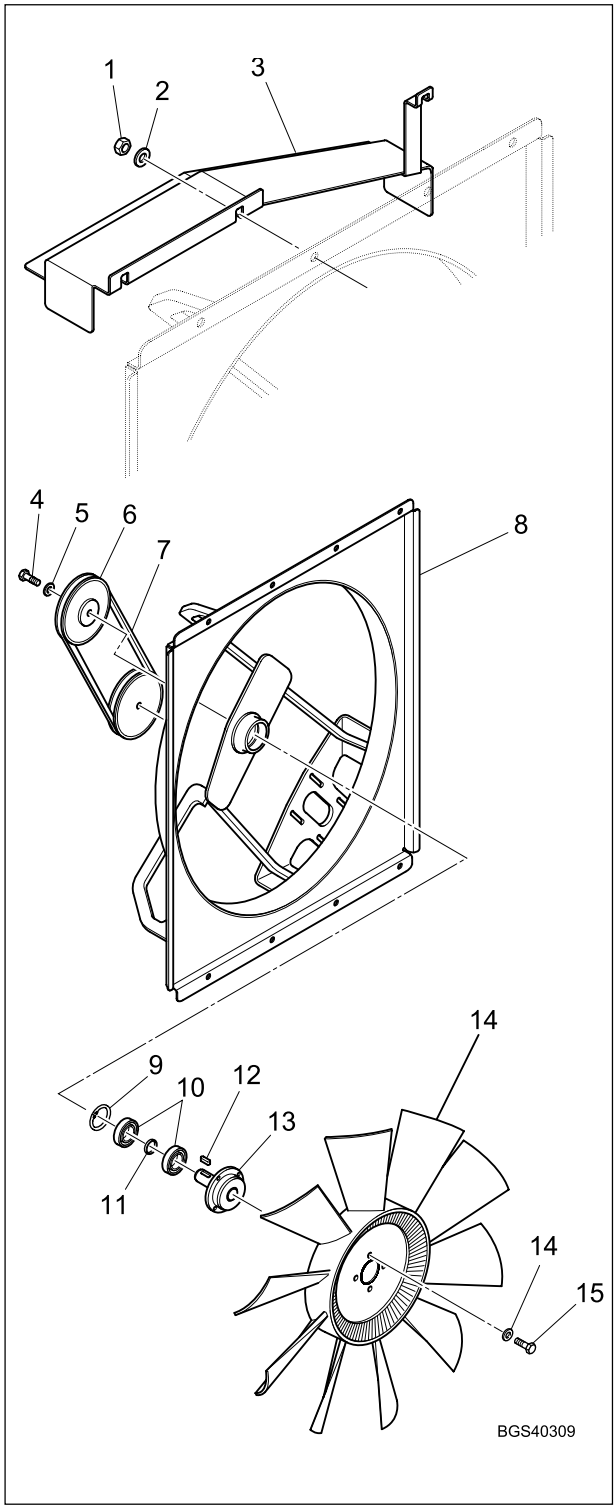
Installation

1. Installation is the reverse of the above procedure.

2. Make sure the woodruff key (12) is fitted to the hub shaft before fitting the pulley (6).

3. Make sure the spacer (11) is fitted between the bearings (10) before fitting the bearings.

4. Tension the V-belt (7) and check tension using a 'Fenner' or similar tension indicator. A force of 30 N at the mid-point on the belt should give a deflection of 8 mm.



1.	Nut	9.	Circlip
2.	Washer	10.	Brearing
3.	Guard	11.	Spacer
4.	Bolt	12.	Woodruff key
5.	Washer	13.	Hub
6.	Pulley	14.	Fan
7.	V-belt	15.	Washer
8.	Fan carrier	16.	Bolt

FAN REVERSE VALVE (72)

NOTE: From Machines S/No.51200472 only.

Removal

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Open engine cover to gain access to fan reverse valve (2) on the air cleaner bracket.

4. Disconnect the electrical connectors to the fan reverse valve solenoid (3) and the temperture switch.

5. Disconnect the five hydraulic hoses (1) from the fan reverse valve (2) and blank the valve connections and open hoses.

6. Remove the bolts (5) and washers (4) that attach the fan reverse valve (2) to the air cleaner bracket. Remove the fan reverse valve (2) from the machine.

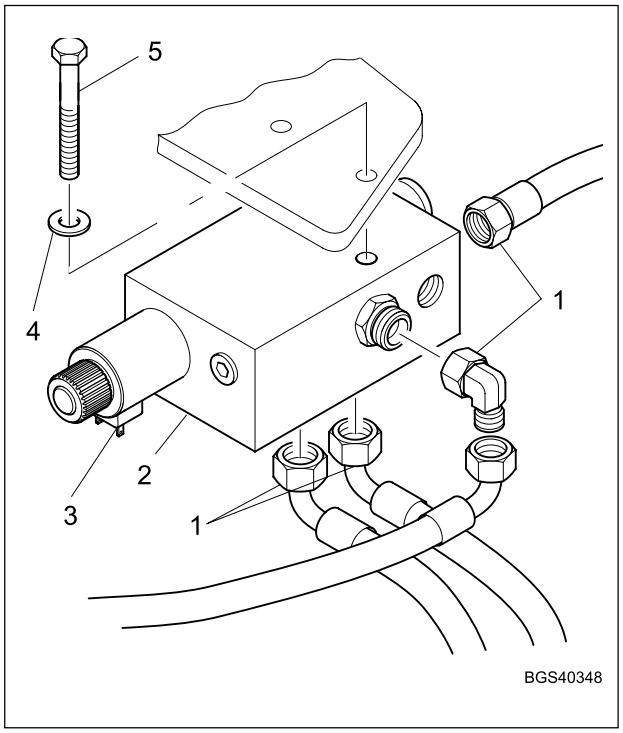
Installation

1. Installation is the reverse of the above procedure.

2. Refer to page 1.66, check the hydraulic level and replenish if necessary before the engine is started.

3. Purge the hydraulic system by starting the engine and operating the fan reverse system and all services. Fully extend and retract cylinders several times.

4. Refer to Page 1.66. Check the hydraulic level and replenish if necessary.



1. Hoses
2. Fan reverse valve
3. Solenoid valve
4. Washer
5. Bolt

PARKING BRAKE VALVE (71)

NOTE: From Machines S/No.51200472 only.

Removal

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Gain access to parking brake valve (1), located on the machine structure, adjacent to the front axle.

4. Disconnect the electrical connector to the parking brake valve solenoid (4).

5. Disconnect the three hydraulic hoses (5) from the parking brake valve (1) and blank the valve connections and open hoses.

6. Remove the bolt (6), washer (3) and nut (2) that attach the parking brake valve (1) to the structure. Remove the parking brake valve (1) from the machine.

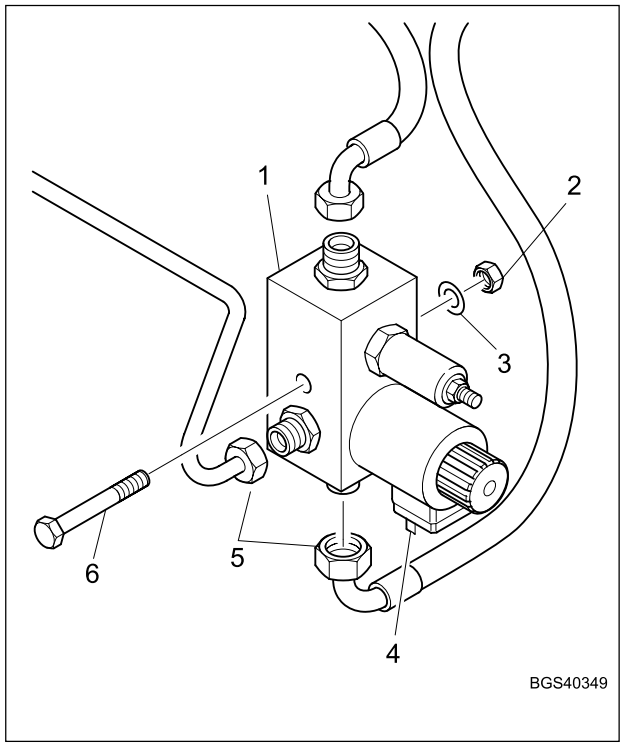
Installation

1. Installation is the reverse of the above procedure.

2. Refer to page 1.66, check the hydraulic level and replenish if necessary before the engine is started.

3. Purge the hydraulic system by starting the engine and operating the fan reverse system and all services. Fully extend and retract cylinders several times.

4. Refer to Page 1.66. Check the hydraulic level and replenish if necessary.



1. Parking brake valve
2. Nut
3. Washer
4. Solenoid valve
5. Hoses
6. Bolt

HYDRAULIC FILTER (9)

Removal

NOTE: The hydraulic filter is fitted in the engine compartment. Remove components as necessary to get access to the filter.

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

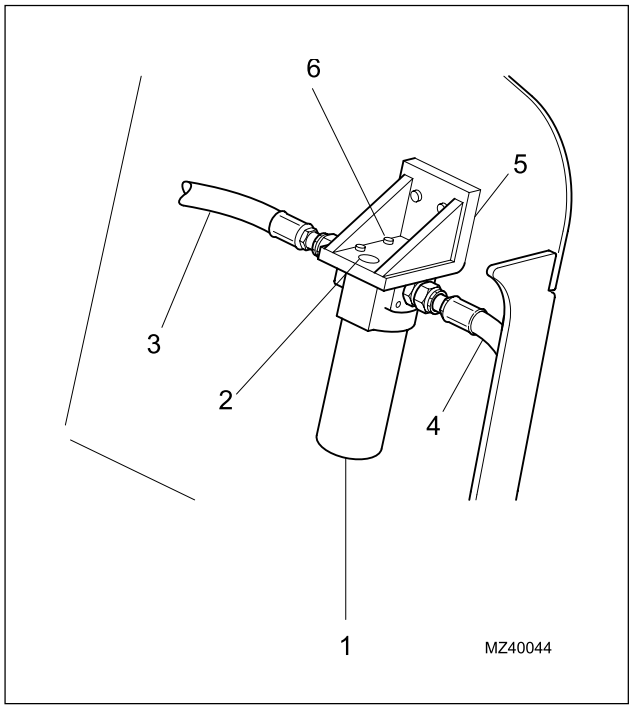
3. Make sure filter is free from dirt to avoid contamination of the hydraulic system.

4. Remove the indicator lead (2) from the indicator switch on the hydraulic filter (1).

5. Remove the inlet hose (3) and outlet hose (4) from the filter (1) and fit blanks to the hoses and filter.

6. Remove the four attachment bolts (6) securing the filter to the mounting bracket (5) and remove the filter.

7. Fit blanks to all openings on the filter and hoses to prevent the ingress of dirt.



1. Hydraulic filter **(9)**
2. Indicator lead
3. Inlet hose
4. Outlet hose
5. Mounting bracket
6. Bolt (Qty 4)

Installation

1. Installation is the reverse of removal.

2. Refer to the service manual and fit a new filter element.

3. Refer to page 1.66, check the hydraulic level and replenish if necessary before the engine is started.

4. Purge the hydraulic system by starting the engine and operating all services to fully extend and retract cylinders several times.

5. Refer to page 1.66, check the hydraulic level and replenish if necessary.

BRAKE VALVE (MICO) (10)

NOTE: Up to Machines S/No.51200471 only.

Operation

A single or tandem brake valve (MICO type) is fitted to the machine, depending on model. The method of operation is as follows:

NOTE: The single and tandem brake valve operation is similar, the tandem design has two spools and two sets of ports to allow for independent operation of each system regardless of condition of the other half.

With no force applied to the brake pedal, the valve is in the neutral position and hydraulic system pressure at the pressure port is blocked by the spool, the brake pressure port is open to tank through the tank port.

Initial application of the brake pedal moves the spool into a position where all the ports are closed and brake pressure has not been applied. Further movement of the pedal moves the spool beyond the closed position and allows pressurised fluid to flow to the brake port. When pedal movement is stopped, the pressure at each end of the spool balances and fluid flow stops. If further pressure is applied to the brake pedal the spool will allow more fluid to pass to the brakes until the spool balances again. Maximum brake pressure is achieved when the brake pedal is fully depressed and the piston is bottomed in the housing.

When the brake pedal is released, the spool moves to close the pressure port and gradually open the tank port to allow brake pressure to return to tank.

BRAKE VALVE (SAFIM) (10)

NOTE: From Machines S/No.51200472 only.

Operation

A single or tandem brake valve (SAFIM type) is fitted to the machine, depending on model. The method of operation is as follows:

NOTE: The single and tandem brake valve operation is similar. The primary difference is that the front and rear brakes are operated independently of each other by separate feed and return lines from the servo valve.

The brake pressure servo valve can be either single or dual depending on the model of the machine. The valve is constructed from 3 seperate modules, the master cylinder, valve body and end plate. Brake pedal travel and braking pressure are set using an adjusting screw, located on the base on the brake valve.

The operation of the servo valve is proportional to brake pedal movement. When the brake pedal is pressed, a pivoted lever moves a master cylinder, which positions an associated sprung loaded plunger. The plunger is in contact with the main shuttle valve in the valve body. The shuttle valve controls the flow of the pressure oil supply from the brake accumulator. The accumulator is supplied from the inlet (PVSP) section of the main hydraulic control valve. When the shuttle valve is moved, the oil supply from the accumulator is allowed to flow to the outlet connection in the end plate, which supplies the front and rear brakes units.

When the brake pedal is released, spring pressure in the master valve releases pressure on the shuttle valve and re-positions the brake pedal. The shuttle valve moves under spring pressure to close the oil supply from the accumulator and divert residual oil pressure from the brake system to the hydraulic tank, releasing the brakes.

SINGLE BRAKE VALVE (MICO) (10)

NOTE: Up to Machines S/No.51200471 only.

Removal

NOTE: The brake valve is fitted forward of the cab. Remove the front cover and any components as necessary to get access to the brake valve.

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Make sure brake valve is free from dirt to avoid contamination of the hydraulic system.

4. Position a suitable container under the valve to collect any oil spillage during removal.

5. Make sure the hoses are identified before removal to help installation.

6. Remove the system pressure hose (2) from brake valve connector ‘P’.

7. Remove the return hose (3) from brake valve connector ‘T’.

8. Remove the service hose (4) from brake valve connector ‘A’. Take care not to lose the orifice located in the fitting.

9. Remove the two attachment bolts (5) securing the brake valve (1) to the mounting bracket (6) and remove the brake valve.

10. Fit blanks to all openings on the brake valve and hoses to prevent the ingress of dirt.

Installation

1. Installation is the reverse of removal.

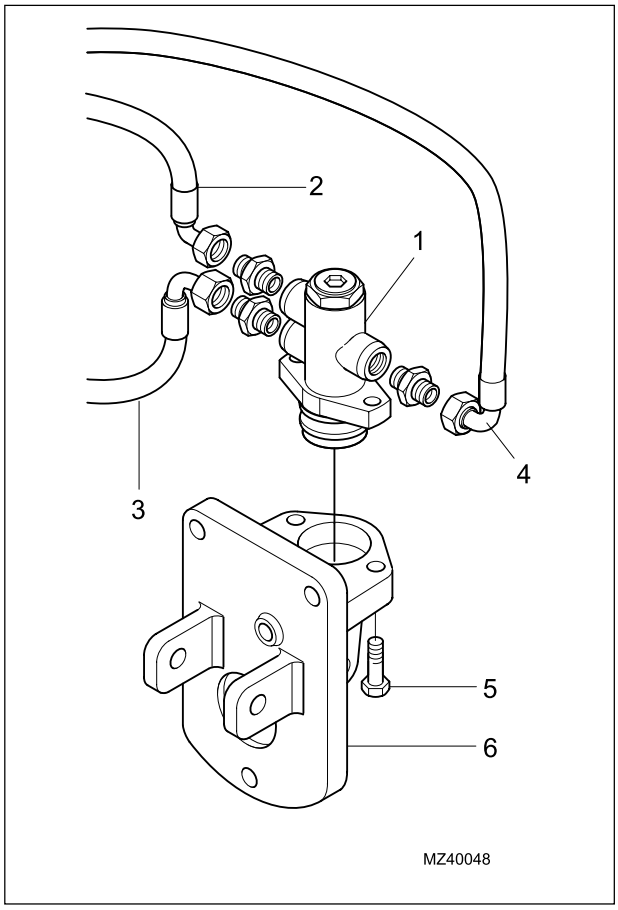
2. Make sure that the spool of the brake valve is fully out. If necessary, adjust the brake pedal adjustment cap-screw inside the cab until the spool of the brake valve is fully out. Then torque tighten the cap-screw lock nut to 25-27 Nm (18-20 lbf/ft.).

3. Refer to Page 1.66 and replenish the hydraulic tank before the engine is started.

4. Bleed the brake system (refer to Page 1.95) and test the brakes.

5. Purge the hydraulic system by starting the engine and operating all services to fully extend and retract cylinders several times.

6. Refer to Page 1.66, check the hydraulic level and replenish if necessary.



1. Brake valve **(10)**
2. Pressure hose ‘P’
3. Return hose ‘T’
4. Service hose ‘A’
5. Bolt
6. Bracket

Torque tighten the components as follows:

Bolt (5) – 25-27 Nm (18-20 lbf/ft.)

SINGLE BRAKE VALVE (MICO) (10) - Servicing

NOTE: Up to Machines S/No.51200471 only.

Servicing is normally restricted to the replacement of seals. When the bore of the cylinder or the piston is scored, the brake valve must be replaced.

Dismantling

1. Make sure all the blanks are secure in the ports then clean any dirt off the assembly before dismantling.

2. Remove boot (20*) from piston (19).

3. Remove piston (19), springs (15**), (16), (17) and shims (14) from housing bore.

NOTE: Some models also use a 6.35 mm (0.25 in.) spacer with shims. Note the number of shims removed from housing.

4. Examine bearing **(**18) for wear or damage, only remove if necessary.

NOTE: Excessive wear on bearing (18) and piston (19) require replacement.

5. Remove retainer assembly (13) from housing bore (a ball bearing is pressed into the retainer).

6. Loosen nut (1) and remove end plug (4) from housing. Remove spring (5), nut (1), washer (2) and O-ring (3*) from end plug (4).

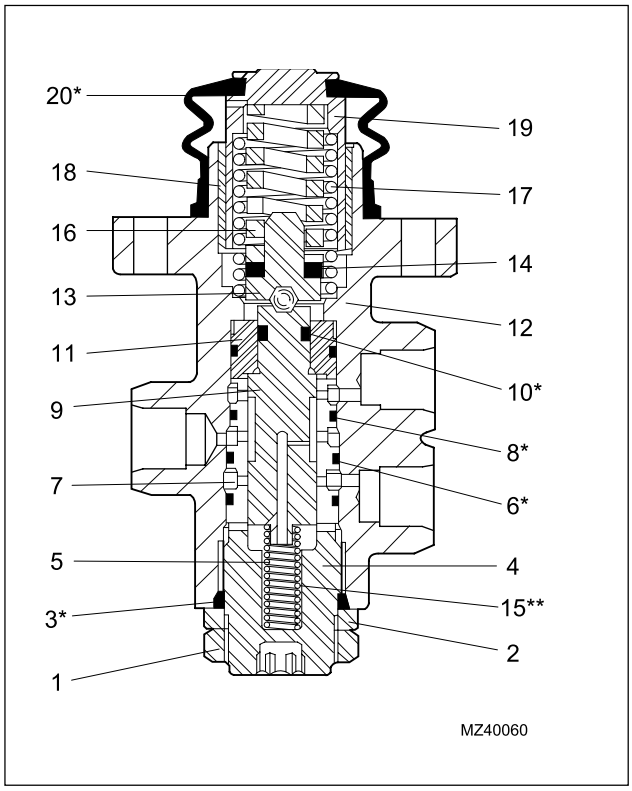
7. Use a wooden dowel to remove spacer (11), sleeve (7) and spool (9) assembly from housing bore.

NOTE: Take care not to scratch or mark sleeve (7) or housing bore.Sleeve (7) and spool (9) are a matched pair and must not be mixed with other parts. Excessive wear on sleeve or spool will require replacement.

8. Separate spacer (11) and spool (9) from sleeve (7).

NOTE: Take care not to damage cup or O-ring grooves or bore.

9. Remove O-ring (8*) and cup (10*) (note orientation) from spacer (11). Remove O-ring (8*) and O-rings (6*) from sleeve (7).



1.	Nut	11.	Spacer
2.	Washer	12.	Housing
3*.	O-ring	13.	Retainer assembly
4.	End plug	14.	Shim(s)
5.	Spring	15.**	Spring
6*.	O-ring	16.	Spring
7.	Sleeve	17.	Spring
8*.	O-ring	18.	Bearing
9.	Spool	19.	Piston
10.*	Cup	20*.	Boot

* Included in repair kit

** Not used in all models

SINGLE BRAKE VALVE (MICO) (10) - Assembly

Use a repair kit when assembling the valve, the repair kit contains a new cup, boot and O-rings.

Before assembly, lightly lubricate the parts from the repair kit and the spool and sleeve with clean hydraulic oil.

Make sure all parts are clean before assembly.

1. Install a new cup (10*) in spacer (11) and one new O-ring (8*) on spacer (11). Note direction of cup.

2. Install two new O-rings (6*) on large diameter end of sleeve (7) and new O-ring (8*) on small end of sleeve (7).

3. Carefully install spool (9) into sleeve (7). Note direction of spool.

4. Install sleeve (7) and spool (9) assembly into housing bore using a wooden dowel. Note direction of assembly. Install spring (5) into housing bore.

5. Install end plug (4) and torque load to 10.9-20.3 Nm (96-180 lbf/in.) to seat sleeves. Then loosen end plug ¼ turn and torque load to 1.1-6.0 Nm (10-60 lbf/in.). Install new O-ring (3), washer (2) and nut (1). Hold the end plug (4) with a wrench and torque load nut to 68.1-81.4 Nm (50-60 lbf/ft.).

6. Install retainer assembly (13) in housing.

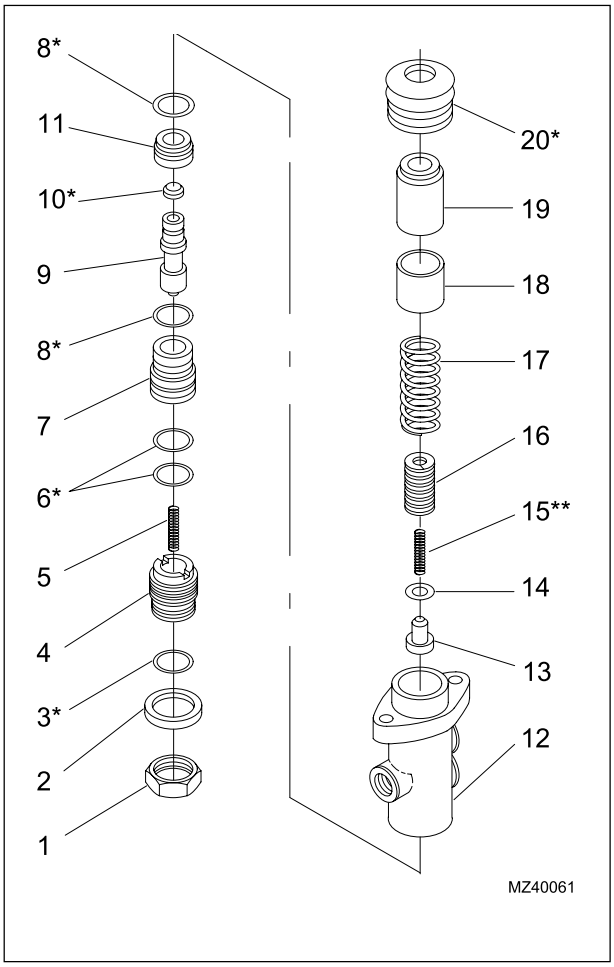
NOTE: Depress retainer (13) until it bottoms on spacer (11). Spool (9) and retainer (13) should return when released. If the spool and retainer do not return when released, the bore of sleeve (7) may be damaged.

7. Install shim(s) (14), springs (15**), (16) and (17) and piston (19) in housing bore.

NOTE: Not all models use spring (15**). Some models also use a 6.35 mm (0.25 in.) spacer with shims. Make sure the same number of shims and the spacer, that were removed during dismantling, are installed.

8. Install new boot (20*) on housing.

9. Test the brake pressure at service hose A on brake valve. Pressure can be adjusted by adding or removing shims (14) to retainer assembly (13).



1.	Nut	11.	Spacer
2.	Washer	12.	Housing
3*.	O-ring	13.	Retainer assembly
4.	End plug	14.	Shim(s)
5.	Spring		15**. Spring
6*.	O-ring	16.	Spring
7.	Sleeve	17.	Spring
8*.	O-ring	18.	Bearing
9.	Spool	19.	Piston
10*.	Cup	20*.	Boot

* Included in repair kit

** Not used in all models

SINGLE BRAKE VALVE (SAFIM) (10)

NOTE: From Machines S/No.51200472 only.

Removal

NOTE: The brake valve is fitted forward of the cab. Remove the front cover and any components as necessary to get access to the brake valve.

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Make sure brake valve is free from dirt to avoid contamination of the hydraulic system.

4. Position a suitable container under the valve to collect any oil spillage during removal.

5. Make sure the hoses are identified to help installation. Disconnect the three hoses (1) from the valve (10).

7. Remove the two protective caps (3) from the brake pedal attachment bolt (4). Remove the nut (8) and bolt (4) and remove the brake pedal (5).

8. Fit blanks to all openings on the brake valve and hoses to prevent the ingress of dirt.

9. Remove the four cap screws (7) from the base plate (6).

12. Remove the brake valve assembly (10) from the machine.

Installation

1. Installation is the reverse of removal.

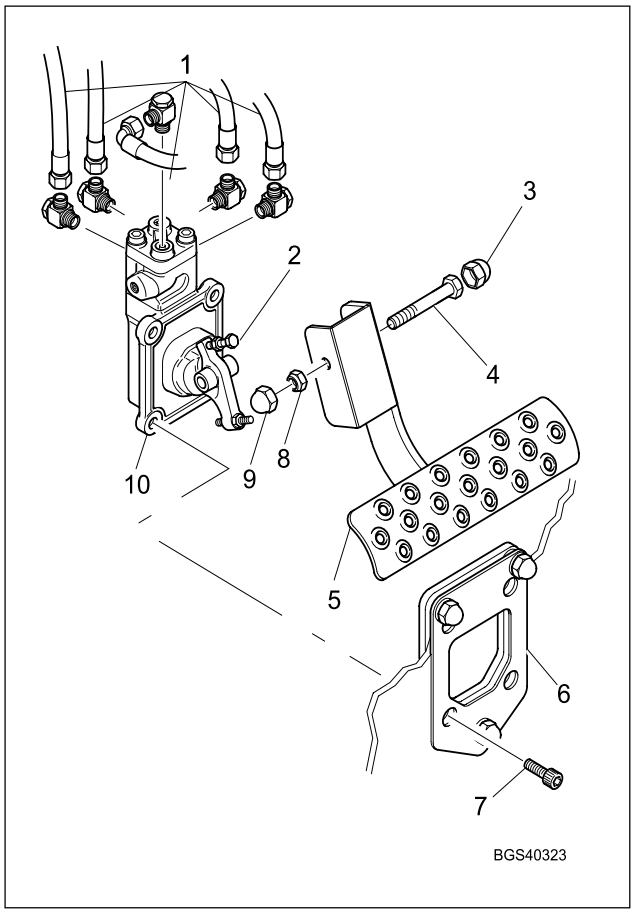
2. If necessary, adjust the brake pedal angle by adjusting the threaded peg (9) under the brake pedal (10). Once adjusted, tighten the peg lock nut.

3. Bleed the brake system (refer to Page 1.95) and test the brakes. If necessary, adjust the brake pressure by connecting a pressure gauge to test point 68 and apply the brakes. Adjust the brake pressure by altering the position of brake pedal travel with the adjuster screw (2).

4. Refer to Page 1.66 and replenish the hydraulic tank, before the engine is started.

5. Purge the hydraulic system by starting the engine and operating all services to fully extend and retract cylinders several times.

6. Refer to Page 1.66, check the hydraulic level and replenish if necessary.



SINGLE BRAKE VALVE (SAFIM) -Servicing

NOTE: From Machines S/No.51200472 only.

Servicing is normally restricted to the replacement of seals in the brake master and brake valve modules of the valve assembly. When any cylinder bore or sliding contact surface is scored, the brake valve must be replaced.

Dimantling (General)

NOTE: During intial dismantling, make sure all items are noted and kept with the correct part of the brake valve.

1. Make sure all the blanks are secure in the ports then clean any dirt off the assembly before dismantling.

2. Loosen the two screws (1) sufficient to remove the end plate (2) and brake valve module (3) from the brake master module (4).

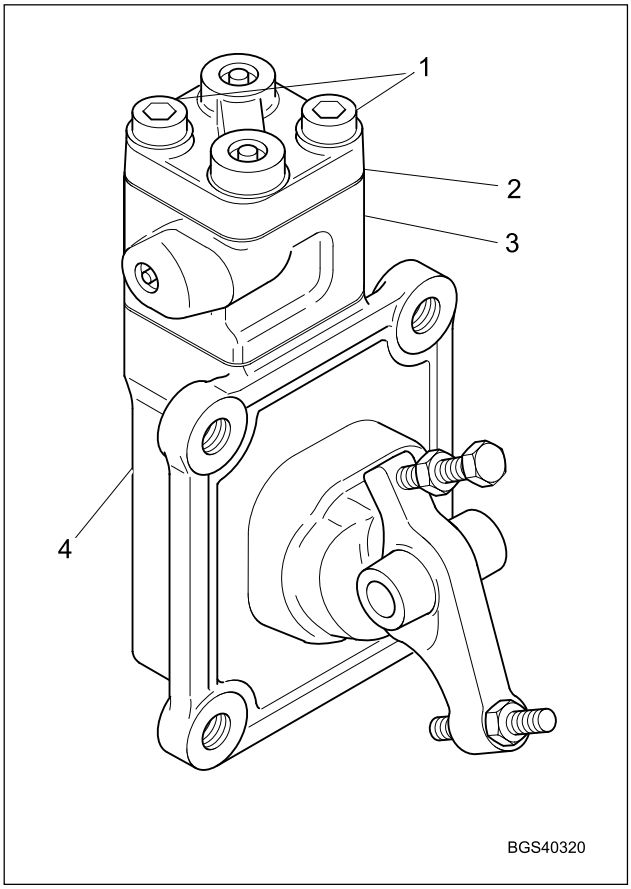
3. Carefully, as an assembly, remove the end plate (2) and brake valve module (3), with the two screws (1), from the brake master module (4).

4. Carefully remove the two screws (1) and seperate the end plate (2) from the brake valve module (3).

Assembly (General)

1. Installation is the reverse of removal.

2. If necessary, adjust the brake pedal angle/brake pressure (refer to brake valve installation procedure at Page 1.81).



1. Screws
2. End plate
3. Brake valve module
4. Brake master module

SINGLE BRAKE VALVE (SAFIM)-Servicing

NOTE: From Machines S/No.51200472 only.

Servicing is normally restricted to the replacement of seals in the brake master and brake valve modules of the valve assembly. When any cylinder bore or sliding contact surface is scored, the brake valve must be replaced.

Dismantling (Brake Master Module)

1. Remove the grub screw (2) that secures the pedal pivot pin (5) in position. Carefully drift out the pedal pivot pin (5) from the pedal base and extract the pedal lever (1) and cover (3).

2. Remove the end plug (4) from the brake master module (19).

3. Extract the valve cylinder (17) from the brake master module (19).

4. Remove the circlip (15) from the brake master module (19).

5. Carefully extract the O-seal (13), valve assembly and gland seal (18) from the brake master module (19).

6. Remove the plug (7) and washer (6) from the brake master module (19).

7. Remove the adjuster (8) and nut (9) from the brake master module (19).

8. Remove the screw (10) and pin (12) from the valve assembly. Seperate the the two end plates (14) and (16) and three springs (11) of the valve assembly.

9. Clean and examine the valve assemby parts and bore, pedal pivot pin (5) and pivot points of the brake master module (19).

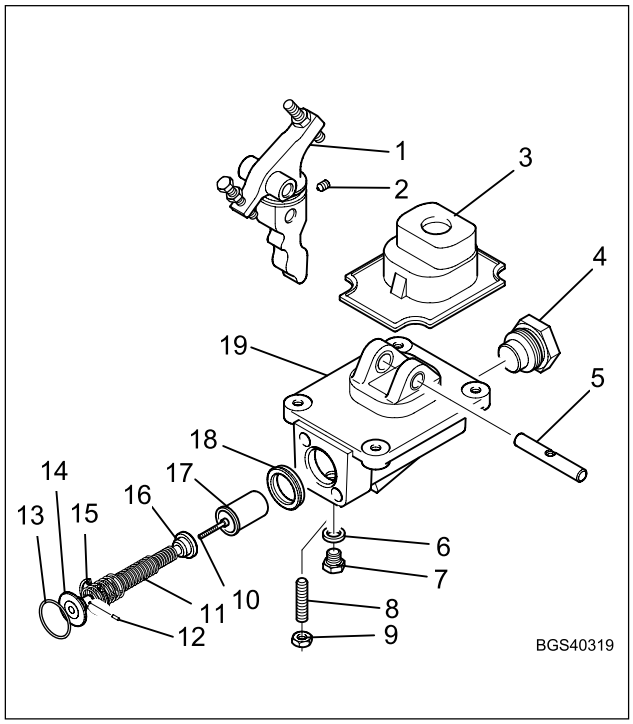
Assembly (Brake master module)

1. Installation is the reverse of the removal.

2. Make sure a new gland seal (18) and O-ring seal (13) are fitted.

3. Before assembly, lightly lubricate the parts from the repair kit and the spool and sleeve with clean hydraulic oil.

4. Make sure all parts are clean before assembly.



1. Pedal lever
2. Grub screw
3. Cover
4. End plug
5. Pivot pin
6. Plug
7. Washer
8. Adjuster
9. Nut
10. Screw
11. Springs
12. Pin
13. O-ring seal
14. End plate
15. Circlip
16. End plate
17. Valve cylinder
18. Gland seal
19. Brake master module

SINGLE BRAKE VALVE (SAFIM) -Servicing

NOTE: From Machines S/No.51200472 only.

Servicing is normally restricted to the replacement of seals in the brake master and brake valve modules of the valve assembly. When any cylinder bore or sliding contact surface is scored, the brake valve must be replaced.

Dismantling (Brake Valve Module)

1. Remove the spring (8) and shuttle valve (7) and O-seal (6) from the brake valve module (9).

2. Remove the four O-seals (10) from the brake valve module (9).

3. Remove the grub screw (5) from the brake valve module (9).

3. Remove the circlip (1) and extract the plug (11), sealing ring (2) and seal (3), valve (10) and spring (4) from the brake valve module (9).

4. Clean and examine the valve module (9), valve (4), shuttle vale (7) and plug (11).

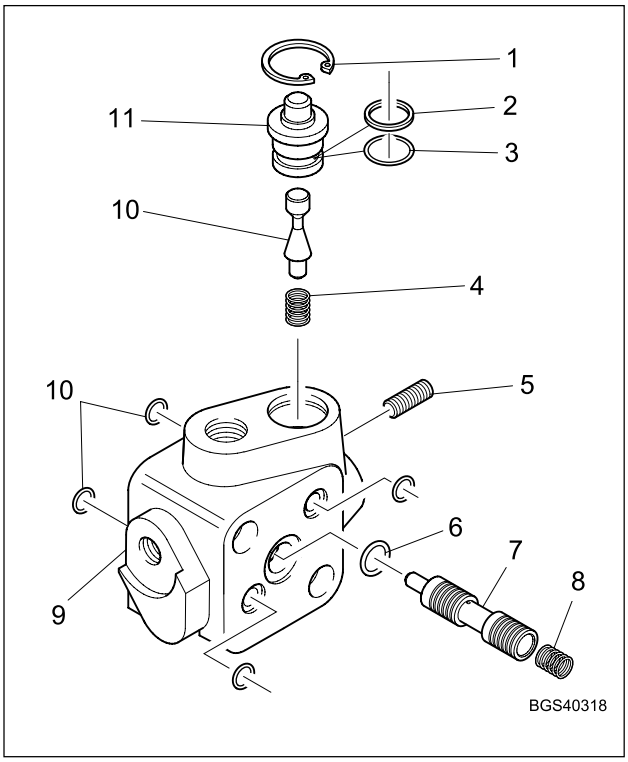
Assembly (Brake valve module)

1. Installation is the reverse of removal.

2. Make sure a new sealing ring (2) and O-ring seals (10), (2) and (6) are fitted.

3. Before assembly, lightly lubricate the parts from the repair kit and the spool and sleeve with clean hydraulic oil.

4. Make sure all parts are clean before assembly.



1. Circlip
2. Sealing ring
3. Seal
4. Spring
5. Grub screw
6. O-ring seal
7. Shuttle valve
8. Spring
9. Brake valve module
10. O-ring seal
11. Plug

DUAL BRAKE VALVE (MICO) (10)

NOTE: Up to Machines S/No.51200471 only.

Removal

NOTE: The brake valve is fitted forward of the cab. Remove the front cover and any components as necessary to get access to the brake valve.

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Make sure brake valve is free from dirt to avoid contamination of the hydraulic system.

4. Position a suitable container under the valve to collect any oil spillage during removal.

5. Make sure the hoses are identified before removal to help installation.

6. Remove the two system pressure hoses (2) and (3) from brake valve connectors 'P'.

7. Remove the two return hoses (4) and (5) from brake valve connectors 'T'.

8. Remove the two service hoses (6) and (7) from brake valve connectors 'A'.

9. Remove the two attachment bolts (8) securing the brake valve (1) to the mounting bracket (9) and remove the brake valve.

10. Fit blanks to all openings on the brake valve and hoses to prevent the ingress of dirt.

Installation

1. Installation is the reverse of removal.

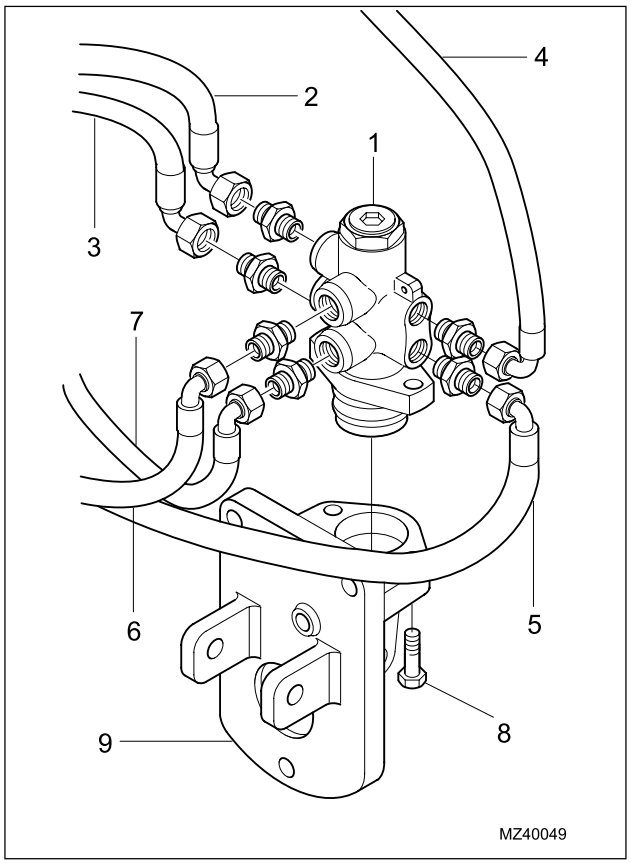
2. Make sure that the spool of the brake valve is fully out. If necessary, adjust the brake pedal adjustment cap-screw inside the cab until the spool of the brake valve is fully out. Then torque tighten the cap-screw lock nut to 25-27 Nm (18-20 lbf/ft.).

3. Refer to Page 1.66 and replenish the hydraulic tank before the engine is started.

4. Bleed the brake system (refer to Page 1.95) and test the brakes.

5. Purge the hydraulic system by starting the engine and operating all services to fully extend and retract cylinders several times.

6. Refer to Page 1.66, check the hydraulic level and replenish if necessary.



1. Brake valve **(10)**
2. Pressure hose 'P'
3. Pressure hose 'P'
4. Return hose 'T'
5. Return hose 'T'
6. Service hose 'A'
7. Service hose 'A'
8. Bolt
9. Bracket

Torque tighten the components as follows:

Bolt (8) – 25-27 Nm (18-20 lbf/ft.)

DUAL BRAKE VALVE (MICO) - Servicing

NOTE: Up to Machines S/No.51200471 only.

Servicing is normally restricted to the replacement of seals. When the bore of the cylinder or the piston is scored, the brake valve must be replaced.

Dismantling

1. Make sure all the blanks are secure in the ports then clean any dirt off the assembly before dismantling.

2. Remove boot (23*) from piston (22).

3. Remove piston (22), springs (18**), (19), (20) and shims (17) from housing bore.

NOTE: Some models also use a 6.35 mm (0.25 in.) spacer with shims. Note the number of shims removed from housing.

4. Examine bearing (21) for wear or damage, only remove if necessary.

NOTE: Excessive wear on bearing (21) and piston (22) require replacement.

5. Remove retainer assembly (18) from housing bore (a ball bearing is pressed into the retainer).

6. Loosen nut (1) and remove end plug (4) from housing. Remove spring (6), retainer (5), nut (1), washer (2) and O-ring (3*) from end plug (4).

7. Use a wooden dowel to remove spacer (14), sleeves (8) and (11) and spools (9) and (12) assembly from housing bore. This assembly must be removed through end plug (4) end of housing.

NOTE: Take care not to scratch or mark sleeves (8) and (11) or housing bore. Sleeve (8) and spool (9) also sleeve (11) and spool (12) are matched pairs and must not be mixed with other parts. Excessive wear on sleeve or spool will require replacement.

8. Separate spacer (14) and spools (9) and (12) from sleeves (8) and (11).

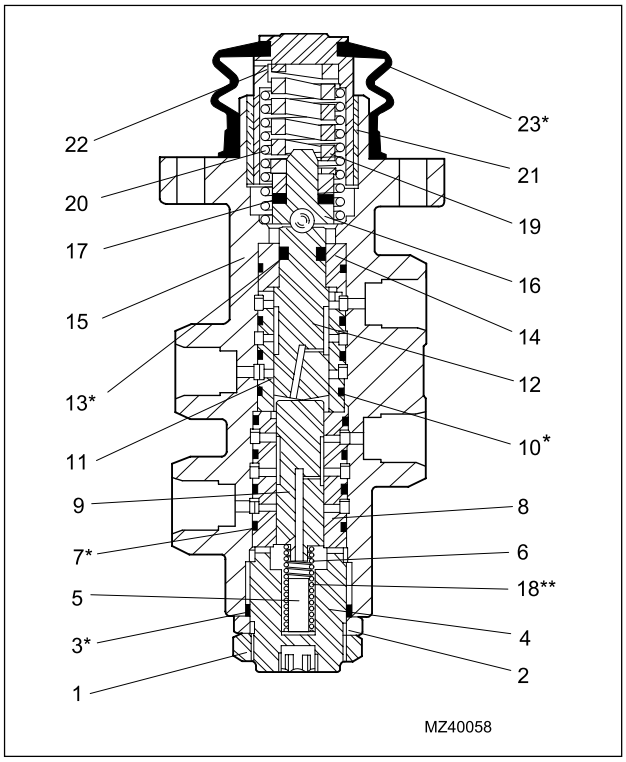
9. Remove O-ring (10*) and cup (13*) (note orientation) from spacer (14). Remove O-ring (10) from sleeve (11) and O-rings (7*) from sleeve (8).

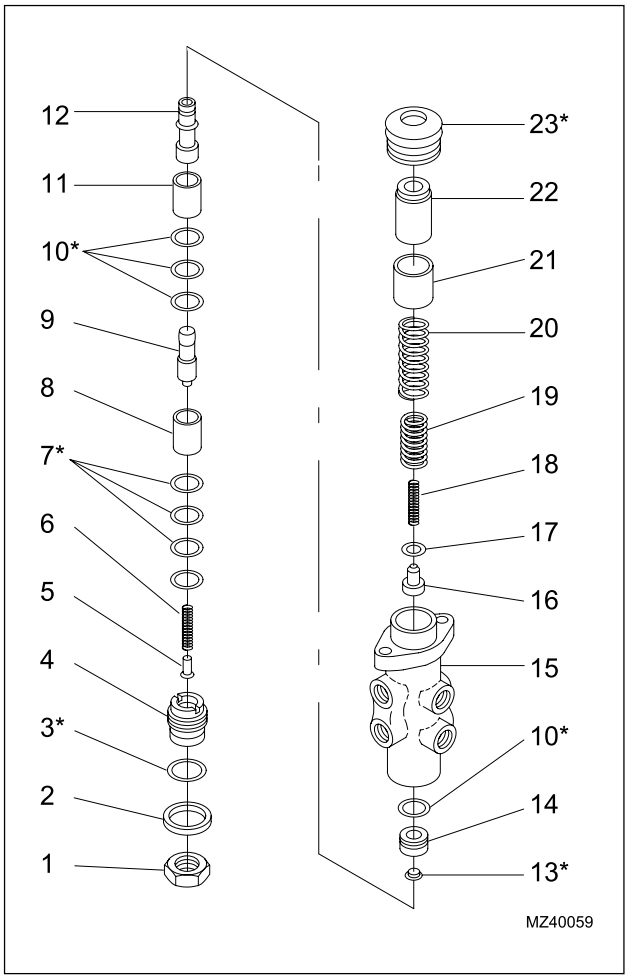
NOTE: Take care not to damage cup or O-ring grooves or bore.

1. Nut
2. Washer
3*. O-ring
4. End plug
5. Retainer
6. Spring
7*. O-ring
8. Sleeve
9. Spool
10*. O-ring
11. Sleeve
12. Spool
13*. Cup
14. Spacer
15. Housing
16. Retainer assembly
17. Shim(s)
18**. Spring
19. Spring
20. Spring
21. Bearing
22. Piston
23*. Boot

* Included in repair kit

** Not used in all models





DUAL BRAKE VALVE (MICO) - Servicing

Assembly

Use a repair kit when assembling the valve, the repair kit contains a new cup, boot and O-rings.

Before assembly, lightly lubricate the parts from the repair kit and the spools and sleeves with clean hydraulic oil.

Make sure all parts are clean before assembly.

1. Install a new cup (13*) in spacer (14) and one new O-ring (10*) on spacer (14). Note direction of cup.

2. Install new O-ring (10*) on sleeve (11) and new O-ring (7*) on sleeve (8).

3. Carefully install spool (12) into sleeve (11). Note direction of spool.

4. Install spacer (14) into housing bore through end plug (4) end of housing. Note direction of spacer.

5. Carefully install sleeve (11) and spool (12) assembly into housing bore using a wooden dowel. Note direction of assembly.

6. Carefully install sleeve (8) into housing until it rests against sleeve (11). Carefully install spool (9) into sleeve (8). Note direction of assembly.

7. Install spring (8) and retainer (5) into housing bore.

8. Install end plug (4) and torque load to 10.9-20.3 Nm (96-180 lbf/in.) to seat sleeves. Then loosen end plug ¼ turn and torque load to 1.1-6.0 Nm (10-60 lbf/in.). Install new O-ring (3*), washer (2) and nut (1). Hold the end plug (4) with a wrench and torque load nut to 68.1-81.4 Nm (50-60 lbf/ft.).

9. Install retainer assembly (16) in housing.

NOTE: Depress retainer (16) until it bottoms on spacer (14). Spools (9 and 12) and retainer (16) should return when released. If the spools and retainer do not return when released, the bore of sleeves (8 and 11) may be damaged.

10. Install shim(s) (17), springs (18**), (19), (20) and piston (22) in housing bore.

NOTE: Not all models use spring (18**). Some models also use a 6.35 mm (0.25 in.) spacer with shims. Make sure the same number of shims, and spacer, that were removed during dismantling are installed.

11. Install new boot (23*) on housing (15).

12. Test the brake pressure at service hose A on brake valve. Pressure can be adjusted by adding or removing shims (17) to retainer assembly (16).

DUAL BRAKE VALVE (SAFIM) (10) - Servicing

NOTE: From Machines S/No.51200472 only.

Removal

NOTE: The brake valve is fitted forward of the cab. Remove the front cover and any components as necessary to get access to the brake valve.

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Make sure brake valve is free from dirt to avoid contamination of the hydraulic system.

4. Position a suitable container under the valve to collect any oil spillage during removal.

5. Make sure the hoses (1) are identified to help installation. Disconnect the five hoses from the valve.

7. Remove the two protective caps (3) from the brake pedal attachment bolt (4). Remove the nut (8) and bolt (4) and remove the brake pedal (5).

8. Fit blanks to all openings on the brake valve and hoses to prevent the ingress of dirt.

9. Remove the four cap screws (7) from the base plate (6).

10. Remove the brake valve assembly (10) from the machine.

Installation

1. Installation is the reverse of removal.

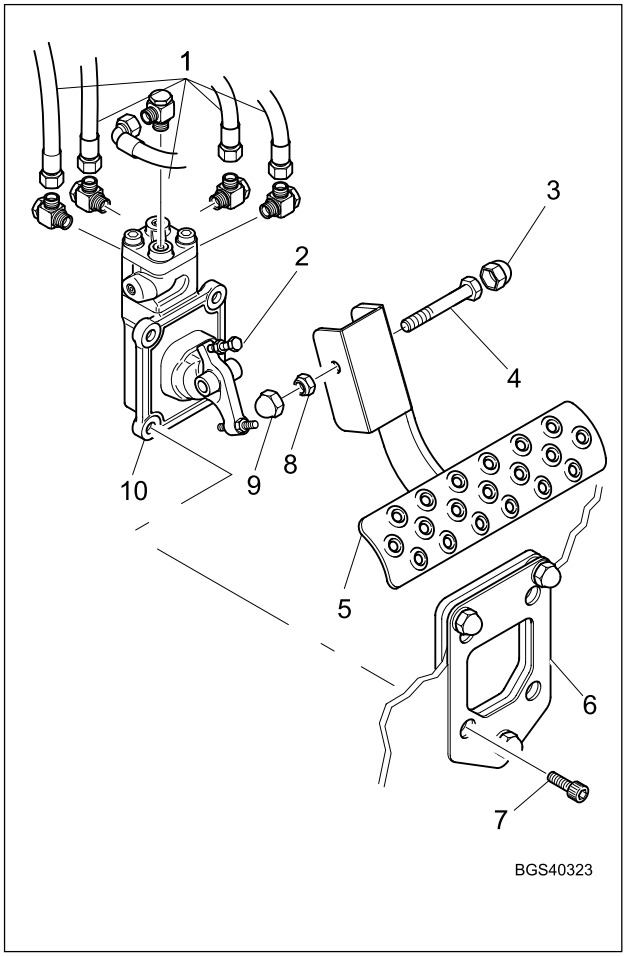
2. If necessary, adjust the brake pedal angle by adjusting the threaded peg (9) under the brake pedal (5). Once adjusted, tighten the peg lock nut.

3. Bleed the brake system (refer to Page 1.95) and test the brakes. If necessary, adjust the brake pressure by connecting a pressure gauge to test point 68 and apply the brakes. Adjust the brake pressure by altering the position of brake pedal travel with the adjuster screw (2).

4. Refer to Page 1.66 and replenish the hydraulic tank, before the engine is started.

5. Purge the hydraulic system by starting the engine and operating all services to fully extend and retract cylinders several times.

6. Refer to Page 1.66, check the hydraulic level and replenish if necessary.



1. Hoses
2. Adjuster
3. Protective cap
4. Bolt
5. Brake pedal
6. Base plate
7. Cap screw
8. Nut
9. Adjuster
10. Brake valve **(10)**

DUAL BRAKE VALVE (SAFIM)-Servicing

NOTE: From Machines S/No.51200472 only.

Servicing is normally restricted to the replacement of seals in the brake master and brake valve modules of the valve assembly. When any cylinder bore or sliding contact surface is scored, the brake valve must be replaced. The dismantling and installation (General) are similar to that detailed for the single servo valve (refer Page 1.82).

Dismantling (Brake Master Module)

1. Remove the grub screw (2) that secures the pedal pivot pin (5) in position. Carefully drift out the pedal pivot pin (5) from the pedal base and extract the pedal lever (1) and cover (3).

2. Remove the end plug (4) from the brake master module (19).

3. Extract the valve cylinder (17) from the brake master module (19).

4. Remove the circlip (15) from the brake master module (19).

5. Carefully extract the O-seal (13), valve assembly and gland seal (18) from the brake master module (19).

6. Remove the plug (7) and washer (6) from the brake master module (19).

7. Remove the adjuster (8) and nut (9) from the brake master module (19).

8. Remove the screw (10) and pin (12) from the valve assembly. Separate the two end plates (14) and (16) and three springs (11) of the valve assembly.

9. Clean and examine the valve assembly parts and bore, pedal pivot pin (5) and pivot points of the brake master module (19).

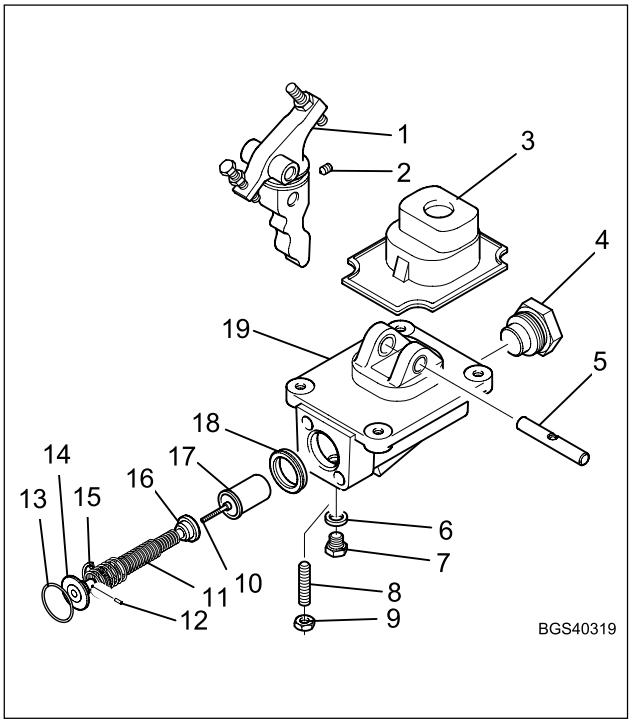
Assembly (Brake master module)

1. Installation is the reverse of the removal.

2. Make sure a new gland seal (18) and O-ring seal (13) are fitted.

3. Before assembly, lightly lubricate the parts from the repair kit and the spool and sleeve with clean hydraulic oil.

4. Make sure all parts are clean before assembly.



1. Pedal lever
2. Grub screw
3. Cover
4. End plug
5. Pivot pin
6. Plug
7. Washer
8. Adjuster
9. Nut
10. Screw
11. Springs
12. Pin
13. O-ring seal
14. End plate
15. Circlip
16. End plate
17. Valve cylinder
18. Gland seal
19. Brake master module

DUAL BRAKE VALVE (SAFIM) (10) - Servicing

NOTE: From Machines S/No.51200472 only.

Servicing is normally restricted to the replacement of seals in the brake master and brake valve modules of the valve assembly. When any cylinder bore or sliding contact surface is scored, the brake valve must be replaced.

Dismantling (Brake Valve Module)

1. Remove the shuttle valves (11) and O-seal (10) from the brake valve module (8).

2. Remove the four O-seals (9) from the brake valve module (8).

3. Remove the two grub screws that retain the two valve assemblies into the brake valve module (8).

3. Remove the circlips (1) and extract the plugs (12), sealing rings (2) and (4), O-seals (3) and (5), valves (6) and springs (7) from the brake valve module (8).

4. Clean and examine the valve module (8), shuttle valves (11), plugs (12) and valves (6) of the brake valve module (8).

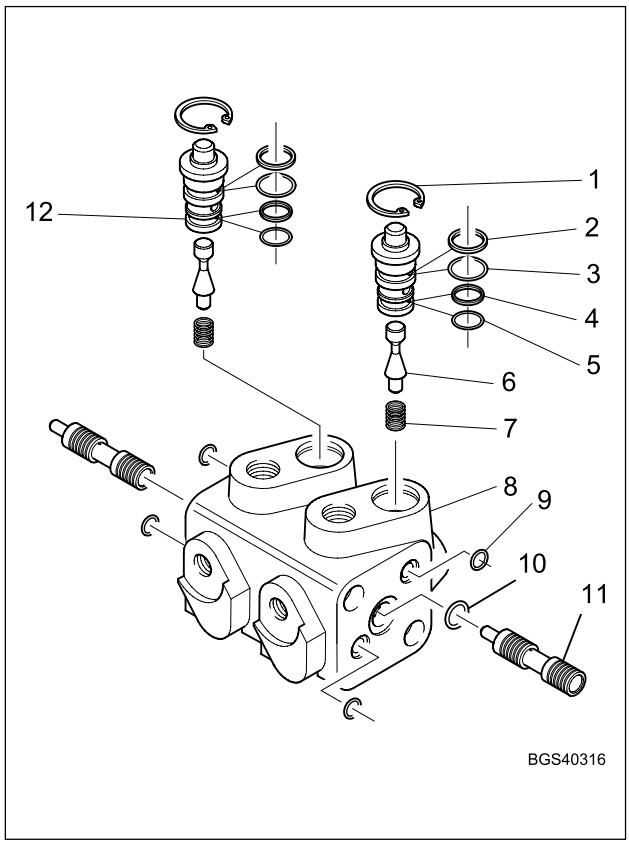
Assembly (Brake Valve Module)

1. Installation is the reverse of removal.

2. Make sure a new sealing rings (2) and (4) and O-ring seals (3), (5) and (9) are fitted.

3. Before assembly, lightly lubricate the parts from the repair kit and the spool and sleeve with clean hydraulic oil.

4. Make sure all parts are clean before assembly.



1. Circlip
2. Sealing ring
3. O-ring seal
4. Sealing ring
5. O-ring seal
6. Valve
7. Spring
8. Brake valve module
9. O-ring seal
10. O-ring seal
11. Shuttle valve
12. Plug

TRAILER BRAKE VALVE (47)

Removal

NOTE: A trailer brake valve is fitted on the forward surface of the rear service plate. Remove the rear cover from the boom and the rear service plate, if necessary to get access to the valve.

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Make sure valve is free from dirt to avoid contamination of the hydraulic system.

4. Identify and label the hydraulic hoses.

5. Position a suitable container under the valve to collect any oil spillage during removal.

6. Disconnect the service hoses (2), pilot hose (3), pressure hose (4) and return hose (5) from the valve and blank open connections on valve and hoses. Tie hoses clear of valve.

7. Remove the two hex: head screws (7) and washers (8) securing the valve to the rear bulkhead plate. Remove the valve (1) from the machine.

Installation

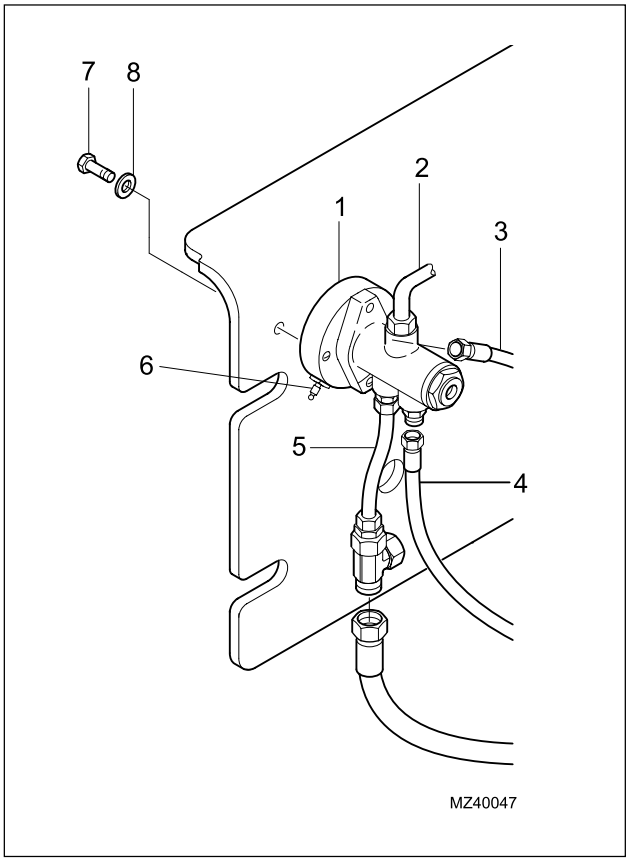
1. Installation is the reverse of the above procedure.

2. Refer to Page 1.66 and replenish the hydraulic tank before the engine is started.

3. Bleed the brake system (refer to Page 1.95) and test the brakes.

4. Purge the hydraulic system by starting the engine and operating all services to fully extend and retract cylinders several times.

5. Refer to Page 1.66, check the hydraulic level and replenish if necessary.



1. Trailer brake valve **(47)**
2. Service hose
3. Pilot hose
4. Pressure hose
5. Return hose
6. Bleed point
7. Hexagon headed screw
8. Washer

Servicing

Servicing is normally restricted to the replacement of seals. When the bore of the housing or the cylinder is scored, the valve must be replaced.

Dismantling

1. Make sure all the blanks are secure in the ports then clean any dirt off the assembly before dismantling.

2. Remove cap screws (17) securing base (16) to housing (11).

3. Remove sleeve (15), spool (13) and ball (12). Separate spool (13) from sleeve (15).

NOTE: Take care not to scratch or damage sleeve (7) or housing (11) bore. The sleeve (7) and spool (9) are a matched pair and must not be mixed with other parts. Excessive wear on sleeve or spool will require replacement.

4. Remove O-rings (14*) from sleeve (15).

5. Loosen nut (1) and remove end plug (4) from housing (11) bore. Remove spring (5), nut (1), washer (2) and O-ring (3*) from end plug (4).

6. Use a wooden dowel to remove spacer (10), sleeve (7) and spool (9) assembly from housing (11) bore.

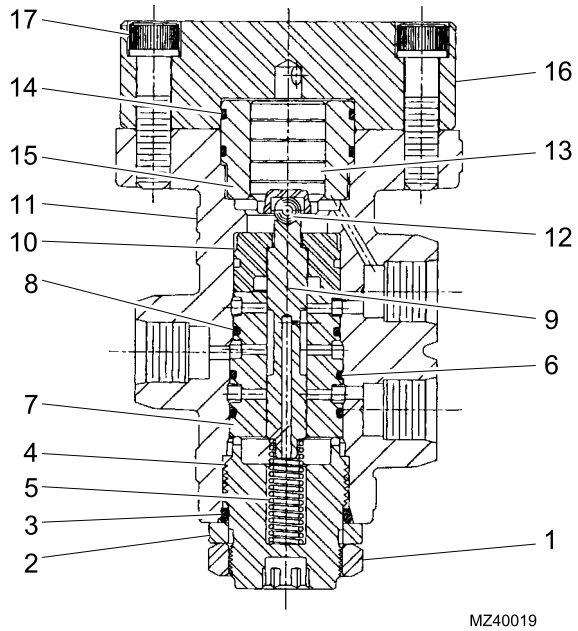
7. Separate spacer (10) and spool (9) from sleeve (7).

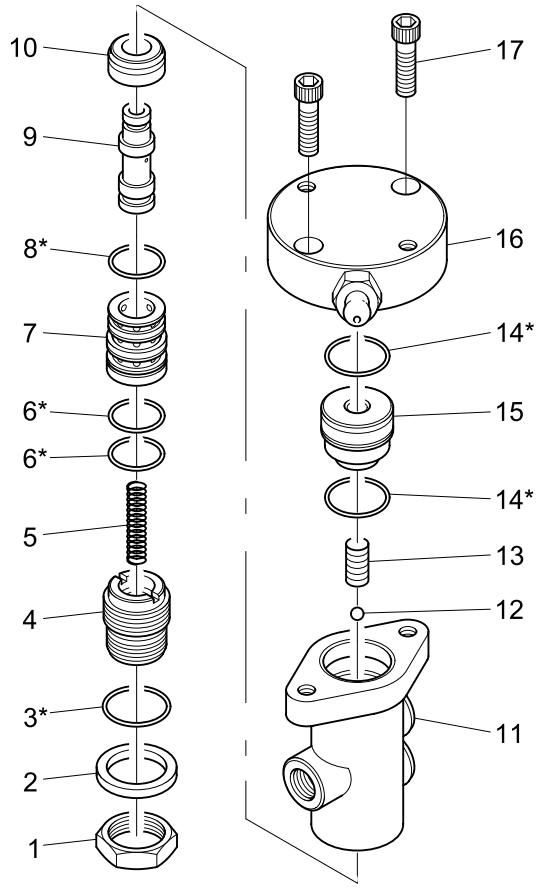
8. Remove O-rings (6*) and (8*) from sleeve (7).

NOTE: Take care not to damage O-ring grooves or sleeve.

1.	Nut	10.	Spacer
2.	Washer	11.	Housing
3*.	O-ring	12.	Ball
4.	End plug	13.	Spool
5.	Spring	14*.	O-ring
6*.	O-ring	15.	Sleeve
7.	Sleeve	16.	Base
8*.	O-ring	17.	Cap screw
9.	Spool		

* Included in repair kit





Assembly

Use a repair kit when assembling the valve, the repair kit contains new O-rings.

Before assembly, lightly lubricate the parts from the repair kit and the spools and sleeves with clean hydraulic oil.

Make sure all parts are clean before assembly.

1. Install new O-rings (6*) on large diameter end of sleeve (7) and a new O-rings (8*) on smaller diameter end of sleeve (7).

2. Carefully install spool (9) into sleeve (11). Note direction of spool.

3. Install spacer (10) into housing (11) bore through end plug (4) end of housing. Note direction of spacer.

4. Carefully install sleeve (7) and spool (9) assembly into housing (11) bore using a wooden dowel. Note direction of assembly.

5. Install spring (5) into housing (11) bore.

6. Install end plug (4) and torque load to 10.9-20.3 Nm (96-180 lbf/in.) to seat sleeve. Then loosen end plug ¼ turn and torque load to 1.1-6.0 Nm (10-60 lbf/in.).

7. Install new O-ring (3*), washer (2) and nut (1). Hold the end plug (4) with a wrench and torque load nut to 68.1-81.4 Nm (50-60 lbf/ft.).

8. Install new O-rings (14*) on sleeve (15). Carefully insert spool (13) into sleeve (15).

9. Install ball (12) on top of spool (9), already in housing. Install sleeve (15) assembly in housing (11) bore.

10. Carefully install base (16) over sleeve (15) while aligning cap screws (17) with holes in housing (11).

11. Test the brake pressure at connector A on trailer brake valve. Pressure can be adjusted by adding or removing shims (17) to retainer assembly (16). Torque load cap screws to 29.8 33.9 Nm (22-25 lbf/ft.).

BRAKE SYSTEM BLEEDING

General

Bleed the brake system after a brake system component change and when air in the system is suspected. Air in the system will not allow the brakes to release properly and may cause damage**.**

1. Start the engine and allow the accumulator to fully charge.

2. Stop the engine. Slowly apply and release brakes until they will not apply, waiting for one minute between applications. Repeat this operation three times.

3. Start the engine and allow the accumulator to fully charge then stop the engine. Operate the engine as necessary to maintain accumulator at working pressure throughout the bleeding procedure.

4. Attach a bleed tube to the bleed screw (1) on the brake unit nearest to the brake valve (front right) and put the bleed tube into a suitable container. Carefully open bleed screw (1), apply brakes until all air is bled out of line then close bleed screw (1) and remove bleed tube. Bleed the other brake units and the trailer brake valve in the order that follows:

A. Front left (2)
B. Rear right (3)
C. Rear left (4)
D. Trailer brake valve (5)

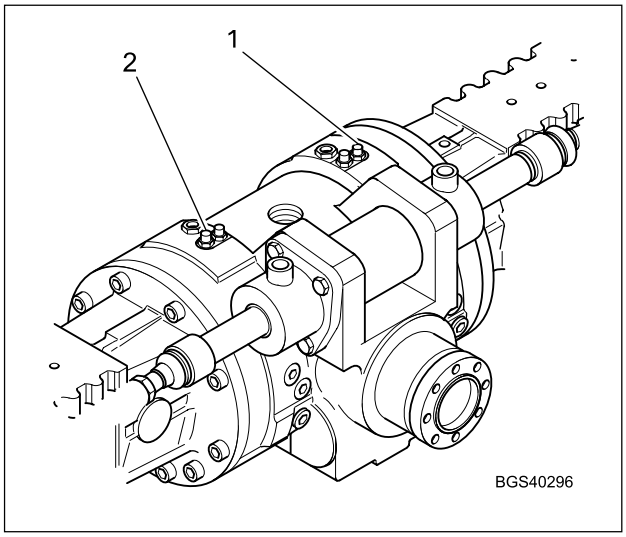
5. Release brake pressure for at least one minute.

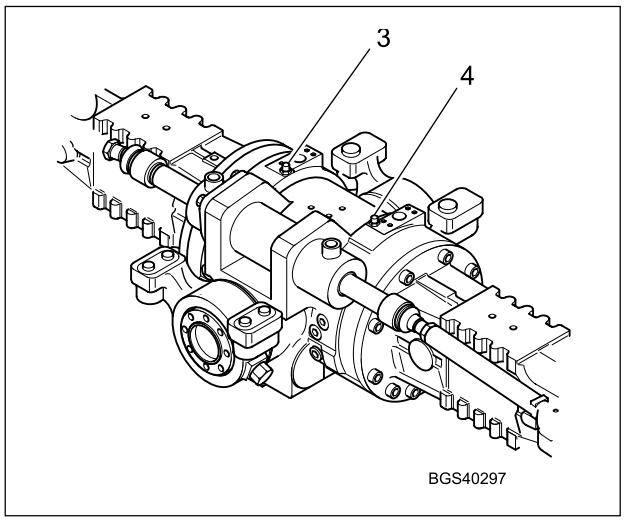
6. Apply brakes, hold pedal down for ten seconds then release pressure for one minute. Repeat this operation two more times.

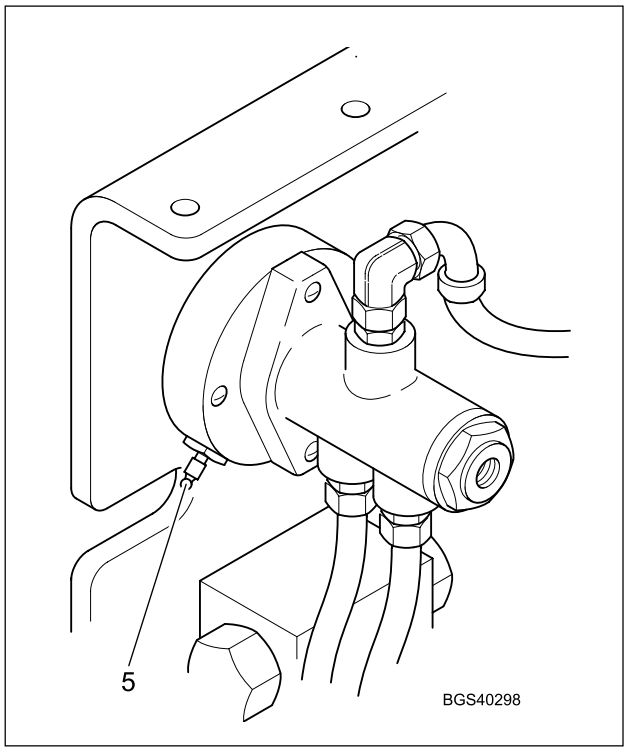
7. Bleed the brakes one more time.

8. Check the system components and brake lines for leaks.

9. Test the operation of the brakes.







DIVERTER VALVE (56)

Removal

NOTE: A diverter valve is fitted forward of the rear service plate, on a bracket attached to the left side chassis member. Remove the rear cover from the boom and the rear service plate, if necessary to get access to the valve.

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Make sure valve is free from dirt to avoid contamination of the hydraulic system.

4. Identify and label the hydraulic hoses.

5. Remove the electrical connection.

6. Position a suitable container under the valve to collect any oil spillage during removal.

7. Disconnect the hoses (2), (3), (4), (5), (9) and (10) from the valve (1) and blank open connections on valve and hoses. Tie hoses clear of valve.

8. Remove the four hexagon headed screws (6) and washers (7) securing the mounting bracket (8) to the machine. Remove the valve from the machine.

9. Remove the two, countersunk socket head, screws (11) securing the valve to the mounting bracket. Remove the valve from the mounting bracket.

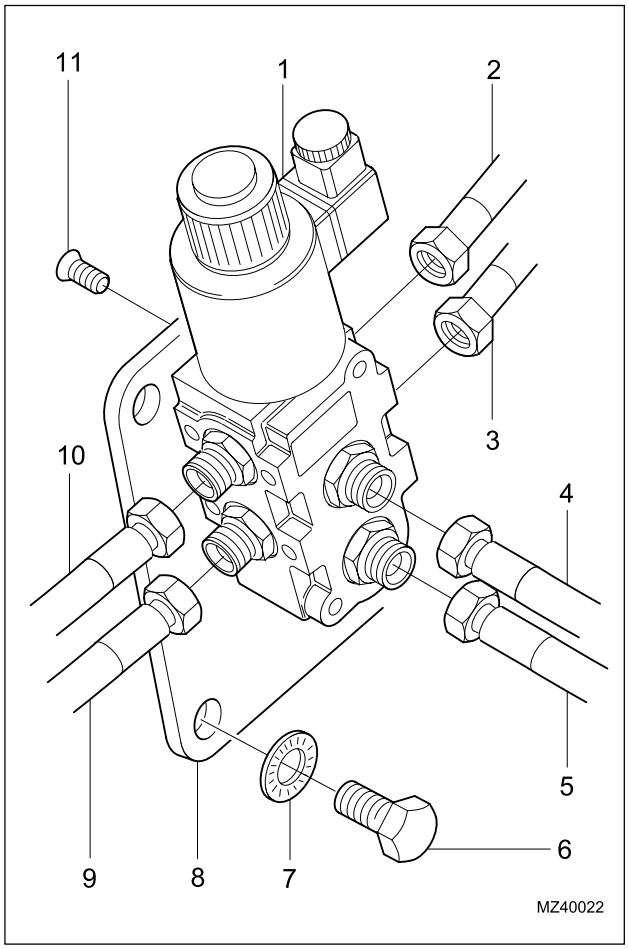
Installation

1. Installation is the reverse of the above procedure.

2. Refer to Page 1.66 and replenish the hydraulic tank before the engine is started.

3. Purge the hydraulic system by starting the engine and operating all services to fully extend and retract cylinders several times.

4. Refer to Page 1.66, check the hydraulic level and replenish if necessary.



1. Diverter valve **(56)**
2. 1st service pressure hose
3. 1st service return hose
4. Pressure hose from control valve
5. Return hose to control valve
6. Hexagon headed screw
7. Washer
8. Mounting bracket
9. Return hose from manifold
10. Pressure hose to manifold
11. Countersunk screw

MANIFOLD (57)

Removal

NOTE: A manifold is fitted forward of the rear service plate. Remove the rear cover from the boom and the rear service plate, if necessary to get access to the valve.

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Make sure manifold is free from dirt to avoid contamination of the hydraulic system.

4. Identify and label the hydraulic hoses.

5. Position a suitable container under the manifold to collect any oil spillage during removal.

6. Disconnect the hoses (4), (5), (7), (8) and (9) from the manifold (1) and blank open connections on manifold and hoses. Tie hoses clear of manifold.

7. Remove the two hexagon headed bolts (11), four washers (2), (10) and two nuts (3) securing the manifold (1) to the rear service plate. Remove the valve from the machine.

8. Remove the trailer tipping QR connector (6) (if fitted).

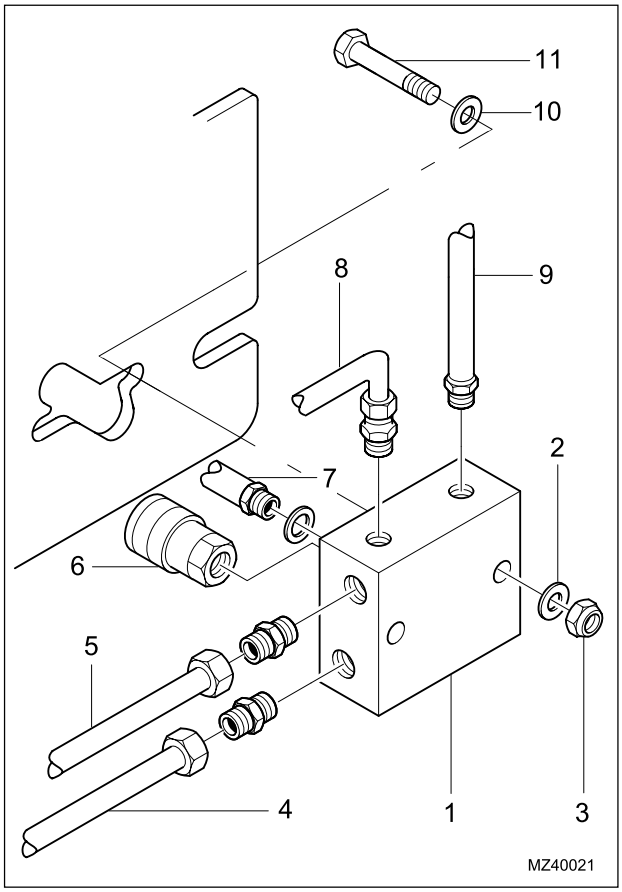
Installation

1. Installation is the reverse of the above procedure.

2. Refer to Page 1.66 and check the hydraulic level and replenish the hydraulic tank before the engine is started.

3. Purge the hydraulic system by starting the engine and operating all services to fully extend and retract cylinders several times.

4. Refer to Page 1.66, check the hydraulic level and replenish if necessary.



1. Manifold **(57)**
2. Washer
3. Nut
4. Return hose (to diverter valve)
5. Tap hose
6. Tipping QR connector (if fitted)
7. Hitch pressure hose
8. Pressure hose (from diverter valve)
9. Hitch return hose
10. Washer
11. Hexagon headed bolt

CONTROL VALVE (25)

Removal

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Remove the rear cover from the boom.

4. Remove the rear service plate for access, if necessary.

5. Make sure control valve is free from dirt to avoid contamination of the hydraulic system.

6. Vent the accumulator.

7. Identify and label the electrical connectors. Disconnect the electrical connectors and fit blanks to the connectors and valve.

8. Position a suitable container under the valve to collect any oil spillage during removal.

9. Identify and label the hoses. Disconnect all hoses from the control valve and blank open connections on valve and hoses. Tie hoses clear of valve.

10. Remove the bolts securing the valve mounting plate to the rear bulkhead plate. Remove the valve and mounting plate from the machine.

Installation

1. Installation is the reverse of the above procedure.

2. Make sure all hoses and electrical connectors are connected to the correct service.

3. Refer to Page 1.66 and replenish the hydraulic tank before the engine is started.

4. Purge the hydraulic system by starting the engine and operating all services to fully extend and retract cylinders several times.

5. Refer to Page 1.66, check the hydraulic level and replenish if necessary.

6. Check the main system pressure and set the pressure relief valve if necessary.

Servicing

Servicing is normally restricted to the replacement of seals, cleaning of ancillary valves and replacement of preset assemblies.

Dismantling

1. Make sure all the blanks are secure in the ports then clean any dirt off the assembly before dismantling.

2. Label all sections and make a note of the order that the components are assembled.

3. Stand the control valve on its end with the outlet section (PVP) (1) uppermost.

4. Remove the nuts (2) and washers (3) from the tie bolts (4) and remove the PVP section. Remove the other sections of the valve, one at a time.

5. Remove and discard the inter-section O-ring seals.

6. Examine the self-locating grooves for burrs, nicks or other damage.

7. Burrs may be removed by careful honing with a very fine grade stone. Any cut damage to a groove requires that section to be replaced.

Assembly

Use new O-rings when assembling the valve, lightly lubricated with clean hydraulic oil.

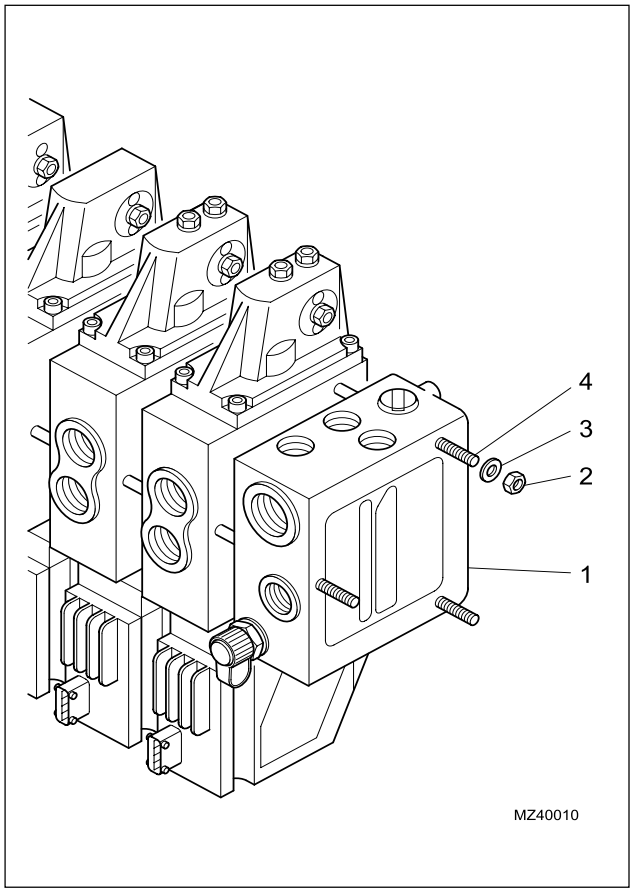
Before assembly, the section mating surfaces should be cleaned and lightly lubricated with clean hydraulic oil.

1. Assemble the sections onto the tie-bolts in the correct order, as noted during dismantling. Make sure that the identity marks align and the O-ring seals are located in the grooves

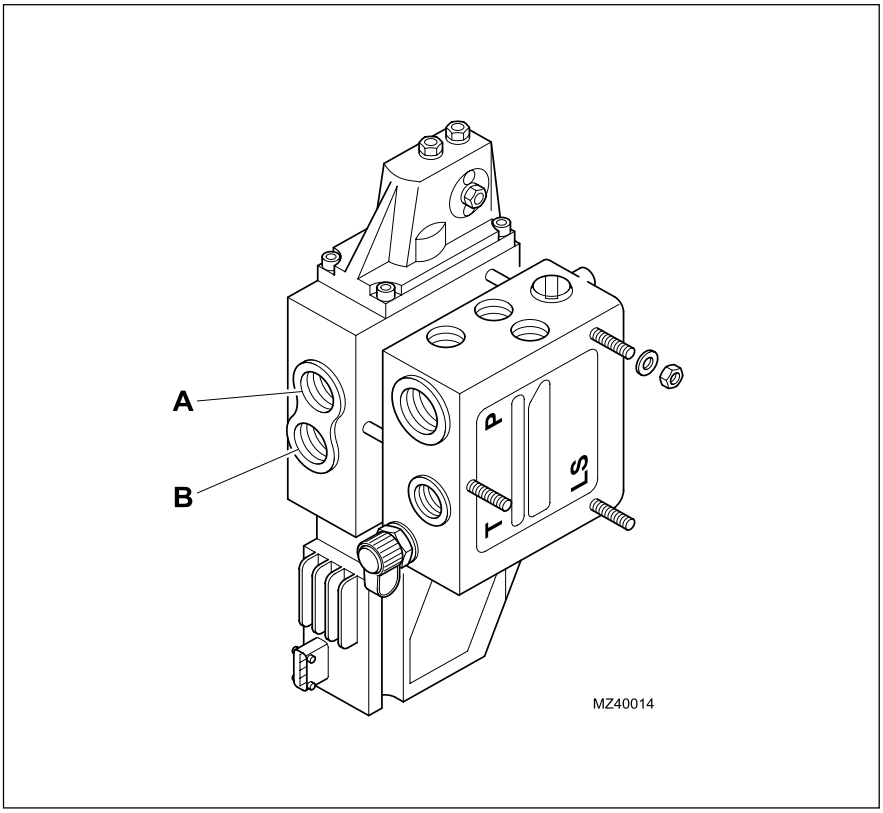
CAUTION *Take care when tightening the tie-bolts to avoid distorting the sections and possible binding of the spools and/or seal leakage.*

2. Fit the washers and nuts to the tie-bolts and tighten finger tight.

3. Tighten the tie-bolt nuts progressively in rotation and torque load to 25 Nm (18 lbf/ft.).



1 Outlet section (PVP) **(26)**
2 Nut
3 Washer
4 Tie-bolt



Max tightening torque		Connection		Connection	Connection	Connection
		P		A/B	T	LS
Screwed connection	BSP.-F	1/2 inch	3/4 inch	1/2 inch	3/4 inch	1/4 inch
	UNF	7/8 inch - 14	1 1/16 inch-12	7/8 inch - 14	1 1/16 inch-12	1/2 inch
With steel washer		130 Nm (1150 lbf/in.)	210 Nm (1850 lbf/in.)	130 Nm (1150 lbf/in.)	210 Nm (1850 lbf/in.)	40 Nm (350 lbf/in.)
With copper washer		30 Nm (270 lbf/in).	50 Nm (445 lbf/in.)	30 Nm (270 lbf/in.)	50 Nm (445 lbf/in.)	20 Nm (180 lbf/in.)
With aluminium washer		70 Nm (620 lbf/in.)	110 Nm (970 lbf/in.)	70 Nm (620 lbf/in.)	110 Nm (970 lbf/in.)	30 Nm (270 lbf/in.)
With cutting edge		130 Nm (1150 lbf/in.)	210 Nm (1850 lbf/in.)	130 Nm (1150 lbf/in.)	210 Nm (1850 lbf/in.)	40 Nm (350 lbf/in.)

Spool sections

General

The main components of a section are the main body and spool assembly. These components are modular, allowing combination to be matched to service requirements.

The crowd section contains relief valves. The lift, extend and auxiliary sections are of the same construction but without relief valves.

NOTE: Dismantling and assembly of the spool section describes the section with relief valves fitted. Disregard relief valve information for relevant sections.

Dismantling

1. Remove the screws (1) attaching mechanical handle assembly (2) to the main body (3) and detach from body. Remove and discard the O-rings (4).

2. Remove the screws (5) attaching actuator (6) to the main body (3) and detach from body. Remove and discard the O-rings (18).

NOTE: Dismantling of the spool section is not necessary when the fault is external leakage only.

3. Unscrew the tension rod (7) from the spool (8) and remove O-ring (9), two stops (10) and spring (11).

4. Unscrew the plug (12) from the spool (8) and remove O-ring (13). Carefully slide spool (8) out of main body (3).

5. Remove the pressure relief valves by unscrewing the plug (14), withdraw the O-ring (15), spring (16) and seat (17).

6. Clean the spool and housing in an approved solvent and dry using an air jet, do not use cloths or paper wipes.

7. Clean the pressure relief valves in an approved solvent and dry using an air jet, do not use cloths or paper wipes.

8. Examine the main body and spool for wear, burrs, blocked grooves or other damage. If any damage or wear is found, the main body (3) or spool (8) must be replaced.

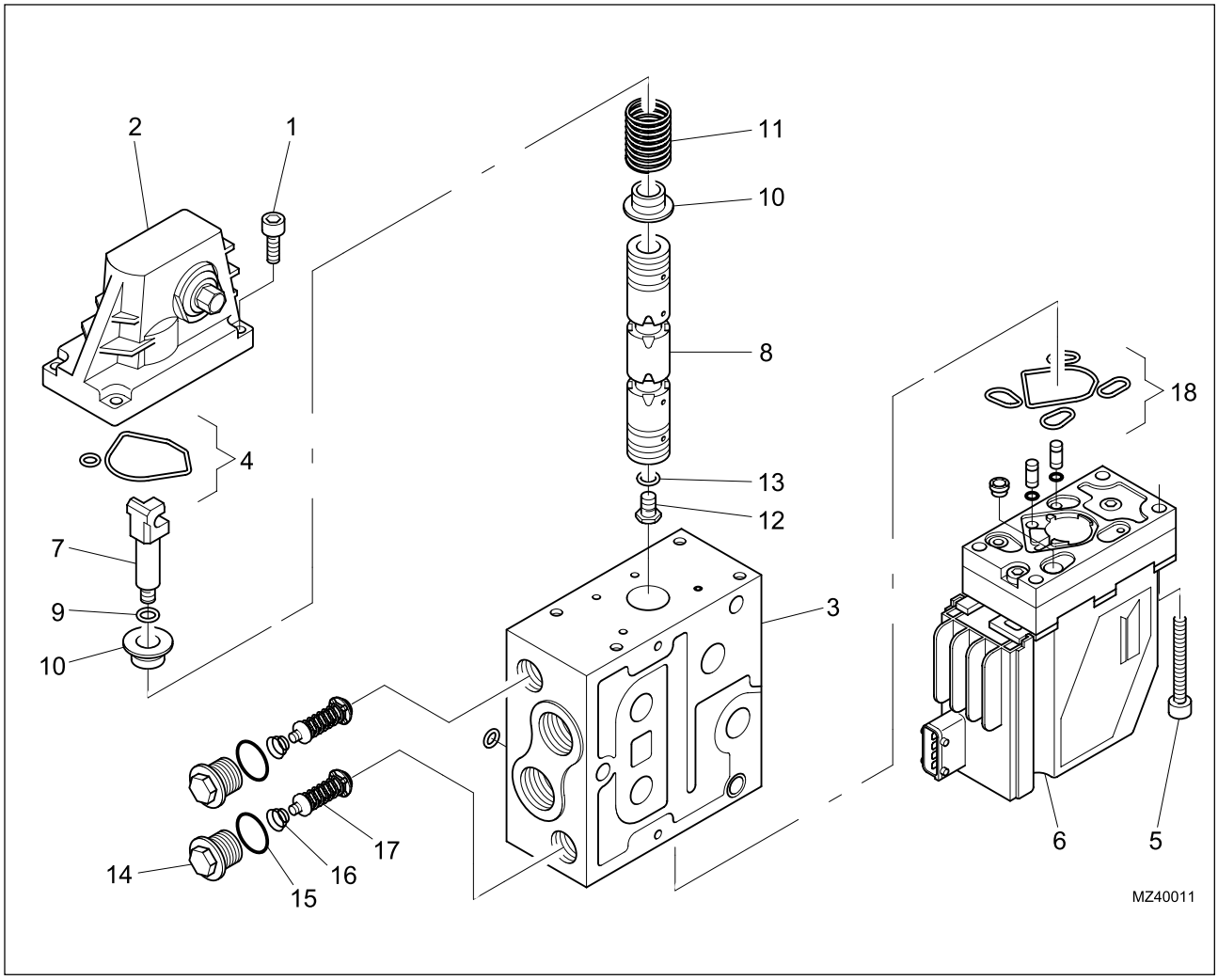
NOTE: If a pressure reducing valve is replaced, make sure the correct rated valve is fitted.

9. Examine the pressure relief valves for damage or wear. If any damage or wear is found, the valve must be replaced as a unit.

Assembly

Assemble the spool section in the reverse order to dismantling. Take care not to damage the spool or main body when installing the spool.

Use new O-rings during assembly.



1. Screw
2. Mechanical handle assembly
3. Main body
4. O-ring seal kit
5. Screw
6. Actuator
7. Tension rod
8. Spool
9. O-ring
10. Stop
11. Spring
12. Plug
13. O-ring
14. Plug – relief valve
15. O-ring – relief valve
16. Spring – relief valve
17. Seat – relief valve
18. O-ring seal kit

Inlet section (PVSP) (36)

General

The main components of the inlet section (PVSP) are the main body compensator spool, steering priority spool and an external BAC valve. Dismantling and assembly of the section is limited to these components.

Dismantling

1. Remove the check valve (1) from the main body (2), with an Allen key, complete with O-ring seals.

2. Remove the BAC valve (3) and O-rings from the main body (2).

3. Unscrew the LS adapter (4) from the main body (3), remove O-ring (5) and compensator spring (6).

4. Unscrew the plug (7) from the compensator spool on the main body (2).

5. Clean the main body in an approved solvent and dry using an air jet, do not use cloths or paper wipes.

6. Clean the BAC valve, check valve and compensator in an approved solvent and dry using an air jet, do not use cloths or paper wipes.

7. Examine the main body for wear, burrs, blocked grooves or other damage. If any damage or wear is found, the main body (3) must be replaced.

8. Examine the BAC valve for damage or wear. If any damage or wear is found, the valve must be replaced as a unit, it comes complete with all necessary O-rings.

9. Examine the check valve for damage or wear. If any damage or wear is found, the valve must be replaced as a unit, it comes complete with all necessary O-rings.

10.Examine the compensator valve for damage or wear. If any damage or wear is found, the valve must be replaced as a unit, it comes complete with all necessary O-rings.

11. Examine the priority valve for damage or wear. If any damage or wear is found, the valve must be replaced as a unit, it comes complete with all necessary O-rings.

Assembly

Assemble the inlet section (PVSP) in the reverse order to dismantling. Take care not to not to damage the main body when installing the components.

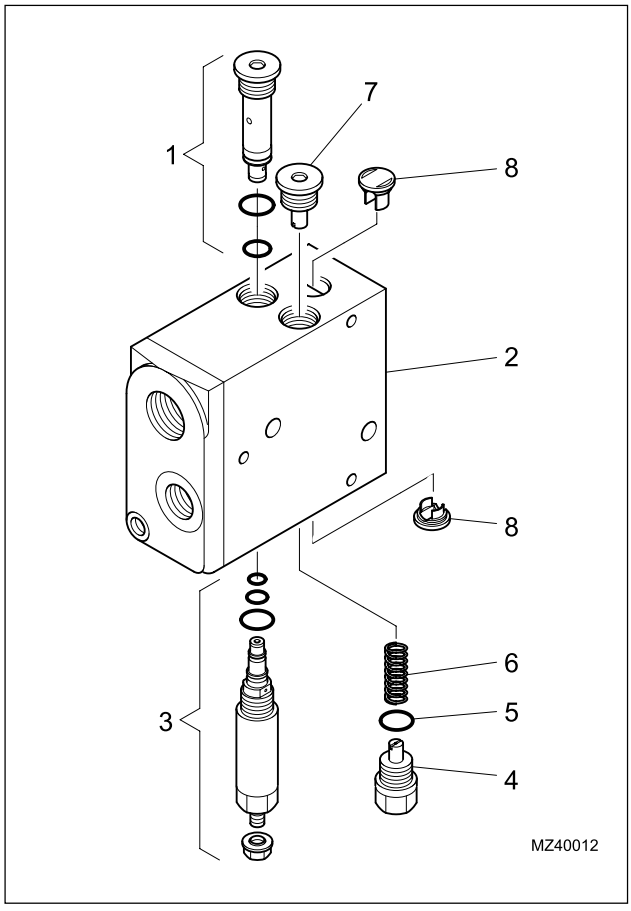
Torque tighten the components as follows:

BAC valve (3) - 40 ± 3 Nm (350 ± 26 lbf/ft.)

Adapter (4) - 40 ± 3 Nm (350 ± 26 lbf/in.)

Plug (7) - 40 ± 3 Nm (350 ± 26 lbf/in.)

Check valve (1) - 40 ± 3 Nm (350 ± 26 lbf/in.)



1. Check valve
2. Main body
3. BAC valve
4. LS adapter
5. O-ring
6. Spring
7. Plug - compensator
8. Plug – blanking

Outlet section (PVP) (26)

General

The main components of the outlet section (PVP) are the main body pressure raising spool, pilot valve assembly and a pressure relief valve. Dismantling and assembly of the section is limited to these components.

Dismantling

1. Remove the pressure relief valve as follows. Remove the blanking plug (1) from the main body (2). Unscrew the threaded stop (3) with an Allen key, and remove the O-ring seal (4), spring (5) and seat (6). Make a note of the number of turns needed to remove the stop (3).

2. Remove the pilot valve as follows. Remove the stop (7), O-ring (8), spring (9), seating (10) and spring (11) from the main body (2).

3. Remove the compensator valve as follows: Remove the plug (12) from the main body (2). Remove O-ring (13) compensator valve (14) and spring (15).

4. Clean the main body in an approved solvent and dry using an air jet, do not use cloths or paper wipes.

5. Clean the pressure relief valve, pilot valve and compensator valve in an approved solvent and dry using an air jet, do not use cloths or paper wipes.

6. Examine the main body for wear, burrs, blocked grooves or other damage. If any damage or wear is found, the main body (2) must be replaced.

7. Examine the pressure relief valve for damage or wear. If any damage or wear is found, the valve must be replaced as a unit, it comes complete with all necessary O-rings.

8. Examine the pilot valve for damage or wear. If any damage or wear is found, the valve must be replaced as a unit, it comes complete with all necessary O-rings.

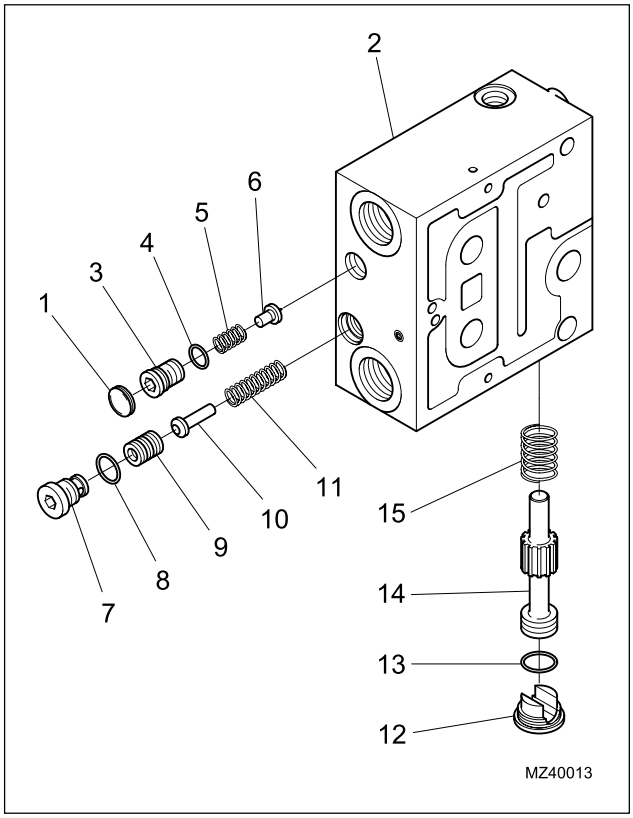
9. Examine the compensator valve for damage or wear. If any damage or wear is found, the PVP must be replaced, it comes complete with all necessary O-rings.

Assembly

1. Assemble the outlet section (PVP) in the reverse order to dismantling. Take care not to damage the main body when installing the components.

2. When the pressure relief valve is assembled, screw in the threaded stop (3) the number of turns noted during the dismantling procedure.

3. The pressure relief valve must be tested and adjusted as necessary, after the valve has been fitted to the machine.



1.	Blanking plug	8.	O-ring
2.	Main body	9.	Spring
3.	Stop	10.	Seating
4.	O-ring	11.	Spring
5.	Spring	12.	Plug
6.	Seat	13.	O-ring
7.	Stop	14.	Compensator valve
		15.	Spring

STEERING

Description

The steering system is fully hydrostatic. This means that the steering motion is transmitted hydraulically with no mechanical linkage between the steering wheel and the steered wheels. The hydraulic supply is by a dynamic system working with a load-sensing (LS) pump. Pump supply passes through a priority valve and generates a load-sensing signal.

Operation

The OSPF steering unit interfaces the steering valve with an adapter. Depending on the steering mode selected in the cab, (two-wheel steer, four-wheel steer or crab steer), the selector valve directs oil to the selected steering cylinder when input is made from the steering wheel.

In the neutral position, oil is allowed to flow freely from the priority valve through the steering unit to return (LS to T). As the steering wheel is turned the spools of the valve rotate against each other and proportionally direct oil to the selected steering cylinder. Not until the rotary valve is fully open is the LS connection to the tank fully closed.

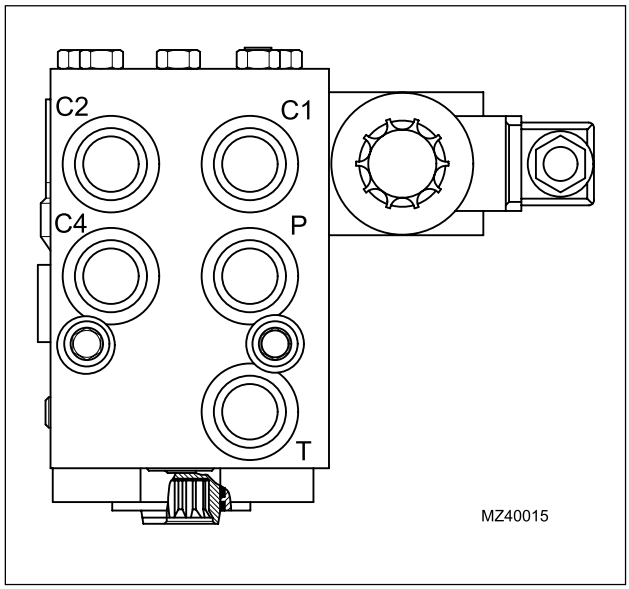
A pressure relief valve is fitted in the steering unit. If the pressure rises above 175 bar (2537 psi), the PRV will open and return excess pressure to tank.

Shock valves are fitted to in the steering unit to protect the cylinders and hoses and are set at a higher pressure than the PRV.

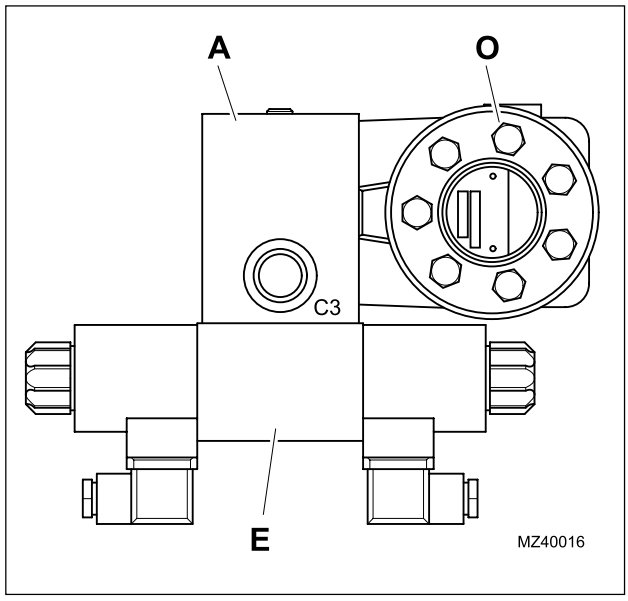
When hydraulic pressure fails, the vehicle can be steered manually. The steering wheel, when turned, drives the outer spool with the cross pin and the rotor is turned by the cardan shaft which acts as a manual pump to supply oil to the steering cylinder. In this case the steering effort required will be increased significantly.

Specification

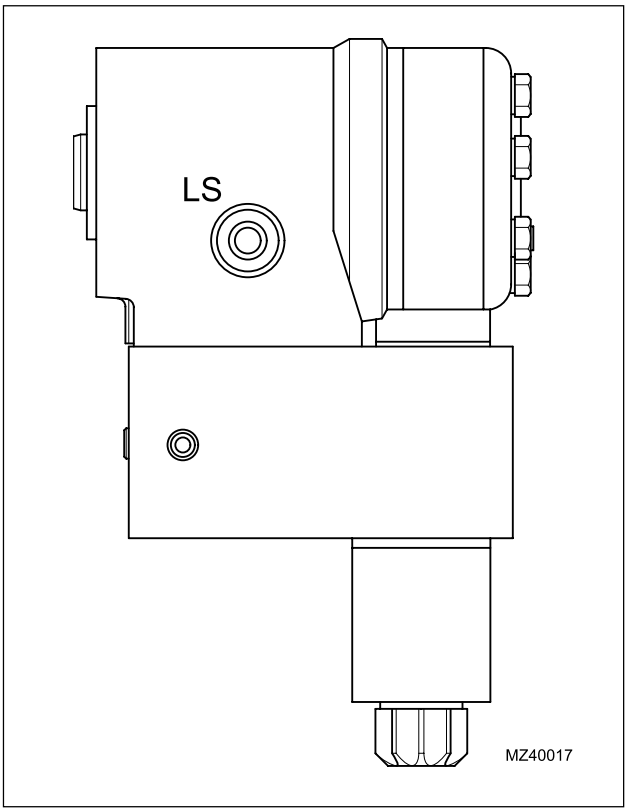
Type OSPF250LS
PRV 170-175 bar (2465-2537 psi)
Shock valve 225-245 bar (3262-3552 psi)
Displacement 250 cu.cm/rev



C1 To rear cylinder
C2 To rear cylinder
C4 To front cylinder
P Pressure from LS – pump
T Tank



C3 To front cylinder
O OSPF250 valve **(21)**
A Adapter
E Selector valve **(22)**



LS LS – line

Checking the steering system

Steering cylinder (15) and (19)

1. Raise and securely support the front axle.

2. Turn steering fully to left.

3. Disconnnect hose from adapter on right hand end of cylinder

4. Start the engine and operate steering wheel fully left to apply maximum hydraulic pressure to cylinder. Make sure no oil flows from open right hand connection.

5. Stop engine, connect hose to right hand hose to adapter and repeat above check on left hand side of cylinder.

6. Repeat all above checks on rear axle steering cylinder.

7. Start engine and bleed the hydraulic lines free of air.

Steering unit (OSPF) (21)

Start the engine and run until oil is at normal operating temperature and any air is purged from system. Set engine at maximum rev/min, turn the steering wheel until the steering stops make contact. If the steering wheel can be turned, the rotor, spool or shock valves are faulty and the steering unit must be replaced.

Servicing

Servicing is normally limited to the replacement of the three main components (steering unit, adapter and steering valve) and the seals between these components.

Steering valve assembly (22)

Removal

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Remove the front cover from outside of the cab.

4. Make sure the steering valve assembly is free from dirt to avoid contamination of the hydraulic system.

5. Identify and label the electrical connectors on the steering valve. Disconnect the electrical connectors and fit blanks to the connectors and valve.

6. Position a suitable container under the steering valve assembly to collect any oil spillage during removal.

7. Identify and label the hydraulic hoses. Disconnect all hoses from the steering valve assembly and blank open connections on valve and hoses. Tie hoses clear of valve.

8. From inside the cab, remove the nut, washer, three bolts and washers securing the valve to the steering column. Remove the valve from the machine by disconnecting the splined drive.

Installation

1. Installation is the reverse of the above procedure.

2. Make sure all hoses and electrical connectors are connected to the correct service.

3. Refer to page 1.66, check the hydraulic tank level and replenish before the engine is started.

4. Purge the hydraulic system by starting the engine and operating the steering to fully extend and retract front and rear steering cylinders several times.

5. Refer to Page 1.66, check the hydraulic level and replenish if necessary.

6. Check the steering operates correctly in all modes, (two-wheel steer, four-wheel steer and crab steer).

Dismantling

1. Remove the four cap head screws (1) attaching the steering valve (2) to the adapter (6). Remove and discard the O-ring seals (3).

2. Remove the two cap head screws (7) attaching the adapter (6) to the steering unit (4). Remove and discard the O-ring seals (5).

3. Examine the steering valve for damage to the block or solenoids and electrical connectors. If any damage is found, the valve must be replaced as a unit.

4. Examine the adapter for damage to the block. If any damage is found, the adapter must be replaced.

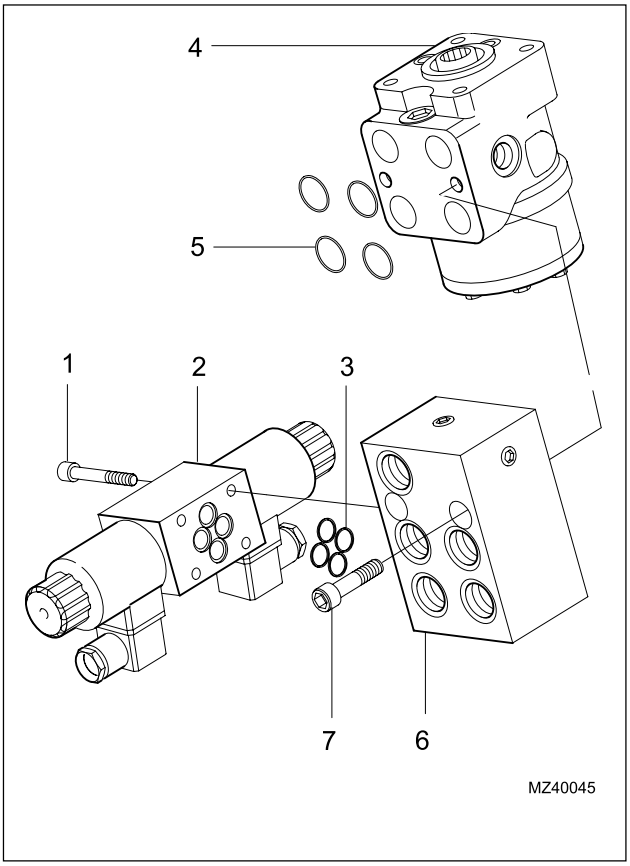
5. Examine the steering unit for damage to the block. If any damage is found, the unit must be replaced.

Assembly

1. Assemble the steering valve assembly in the reverse order to dismantling.

2.Use new O-rings during assembly.

3.Tighten the screws progressively in rotation.



1. Cap head screw – M5 x 45
2. Steering valve
3. O-ring
4. Steering unit
5. O-ring
6. Adapter
7. Cap head screw – M10 x 46

HYDRAULIC CYLINDERS

Extension cylinder (49)

Removal

1. Lower the boom to the horizontal position and extend the boom by 1.5 m (5 ft).

2. Stop the engine and chock the machine, apply the parking brake**.**

3. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

WARNING *The extension cylinder weighs 140 kg (308 lb). take care when handling, to avoid damage to components and injury to personnel.*

4. Remove the rear cover from the boom pivot.

5. Identify the hydraulic hoses to make sure they are reconnected correctly. Disconnect the four hydraulic hoses (3) on the bulkhead connector bracket (1) to the crowd cylinder and auxiliary services. Blank the connectors and open hoses.

6. Remove the two bolts and washer (2) securing the bulkhead connector bracket to the boom (11). Pull the bracket and hoses rearwards to clear the boom.

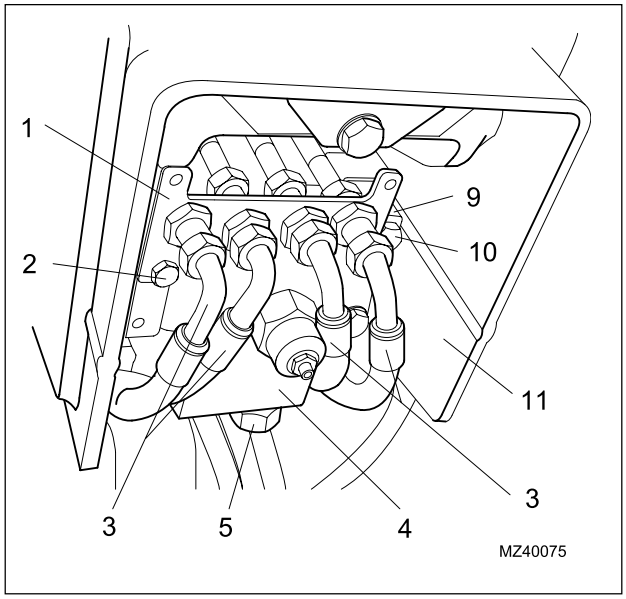
7. Identify the hydraulic hoses to make sure they are reconnected correctly. Disconnect the two hydraulic hoses (5) from the cylinder (4), blank the cylinder and open hoses.

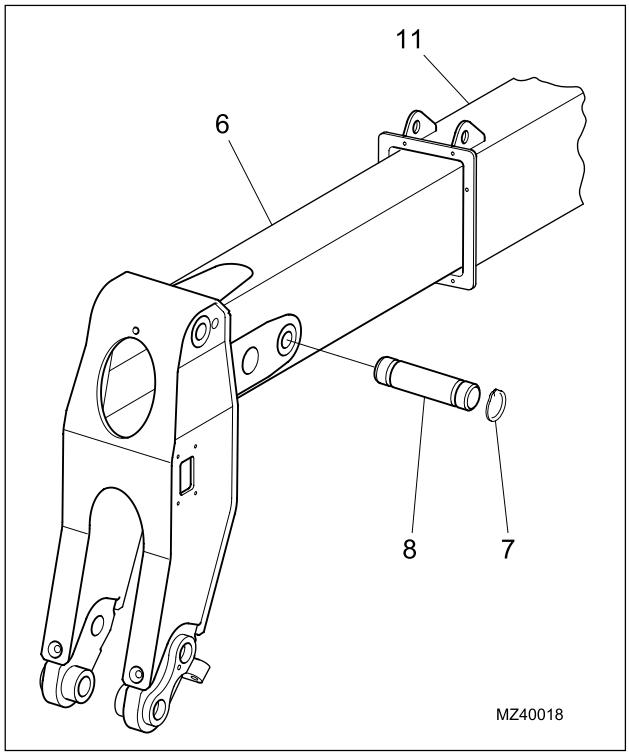
8. Remove the two circlips (7) retaining the forward attachment pin (8) to the inner boom (6). Drive out the forward attachment pin.

NOTE: Make a note of the position of the spigot mounting clamps located on each side of the rear cylinder attachment pin.

9. Remove the two bolts and washers (10), on each spigot mounting clamp (9), securing the rear attachment pin to the outer boom (11).

10. Remove the cylinder rearwards from the boom. Remove the rear attachment pin from the cylinder eye end.





1. Bulkhead connector bracket
2. Bolt/washer
3. Crowd/auxiliary hoses
4. Cylinder **(49)**
5. Cylinder hoses
6. Inner boom
7. Circlip (2 off)
8. Forward attachment pin
9. Spigot mounting clamp (2 off)
10. Bolt/washer (4 off)
11. Outer boom

Installation

NOTE: Note the position of the machined flats on the cylinder rear attachment pin, they must face forwards.

1. Installation is the reverse of the above procedure.

2. Refer to page 1.66, check the hydraulic level and replenish tank before engine is started.

3. Purge the hydraulic system by starting the engine and operating the extension, crowd and auxiliary services to fully extend and retract cylinders several times.

4. Refer to Page 1.66, check the hydraulic level and replenish if necessary.

Crowd cylinder (51)

Removal

1. Extend the boom and rest the carriage on the ground.

2. Stop the engine, apply the parking brake and disconnect the battery.

3. Refer to page 1.1 and dump hydraulic pressure.

WARNING *The crowd cylinder weighs 75 kg (165 lb). Take care when handling, to avoid damage to components and injury to personnel.*

NOTE: Make a note of the position of the spacers located on the upper and lower cylinder attachment pins.

4. Remove the two nuts (1), washers (2), socket headed bolts (3) and washers (2) securing lower cylinder attachment pin (4) to the lever (5). Drive out lower attachment pin and remove the spacer (6) from each side of cylinder (7) eye end.

NOTE: Cover plate (10) is only fitted to later models.

5. Remove the bolt (8) and washer (9) securing the cover plate (10) to the front of the boom (11) and remove cover plate, if fitted.

6. Identify the hydraulic hoses to make sure they are reconnected correctly. Disconnect the two hydraulic hoses from the cylinder, blank the cylinder and open hoses.

7. Support the cylinder. Remove the bolt (12) and washer (13) retaining the upper attachment pin (14). Drive out the upper attachment pin and remove the cylinder from the machine. Remove the spacer (15) from each side of cylinder eye end.

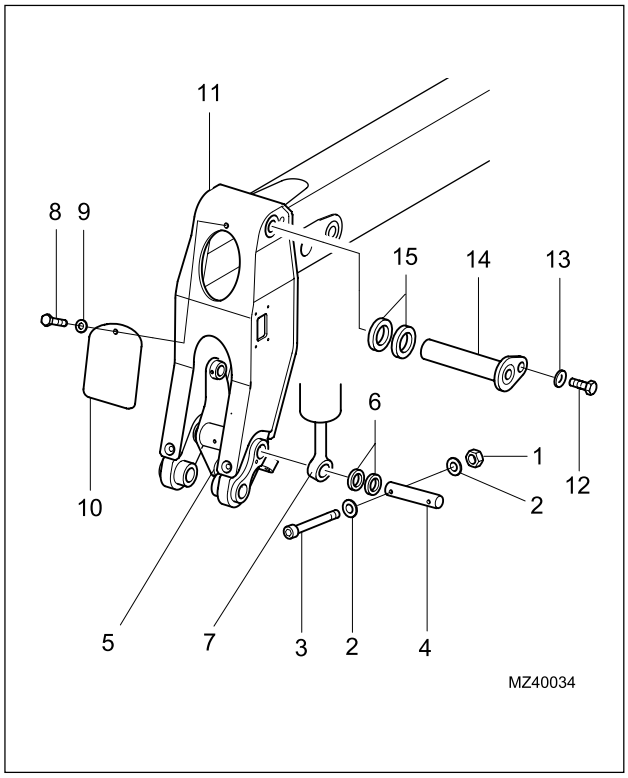
Installation

1. Installation is the reverse of the above procedure.

Refer to page 1.56, check the hydraulic level and replenish tank before engine is started.

2. Purge the hydraulic system by starting the engine and operating the service to fully extend and retract cylinder several times.

3. Refer to Page 1.56, check the hydraulic level and replenish if necessary.



1. Nut (2 off)
2. Washer (4 off)
3. Socket head bolt (2off)
4. Lower attachment pin
5. Lever
6. Spacer (2 off)
7. Cylinder **(51)**
8. Bolt
9. Washer
10. Cover plate
11. Boom
12. Bolt
13. Washer
14. Upper attachment pin
15. Spacer (2 off)

Compensator cylinder (53)

Removal

1. Raise the boom to a suitable height and support using lifting equipment or support stands.

2. Stop the engine and chock the machine, apply the parking brake**.**

3. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

WARNING *The compensator cylinder weighs 30 kg (66 lb). Take care when handling, to avoid damage to components and injury to personnel.*

NOTE: On early models, the upper and lower attachment pins are slotted and retained by a locking plate.

4. Support the upper end of the cylinder (1). Remove the bolt (2) and washer (3) retaining the upper attachment pin (4). Drive out the upper attachment pin and lower the cylinder onto the lift cylinder, if fitted, or a suitable support.

5. Identify the hydraulic hoses to make sure they are reconnected correctly. Disconnect the two hydraulic hoses (5) from the cylinder (1), blank the cylinder and open hoses.

NOTE: Make a note of the orientation of the spigot mounting brackets, the sloping side must face the front of the machine.

6. Support the cylinder and remove the four spigot mounting bolts (6) and washers (7) securing lower cylinder to the chassis (8). Remove cylinder from machine complete with spigot mounting brackets (13).

7. Remove the nut (9), washer (10) and bolt (11) attaching the cylinder lower pivot pin (12) to the two spigot mounting brackets (13). Remove the two spigot mounting brackets and the lower pivot pin (12) from the cylinder.

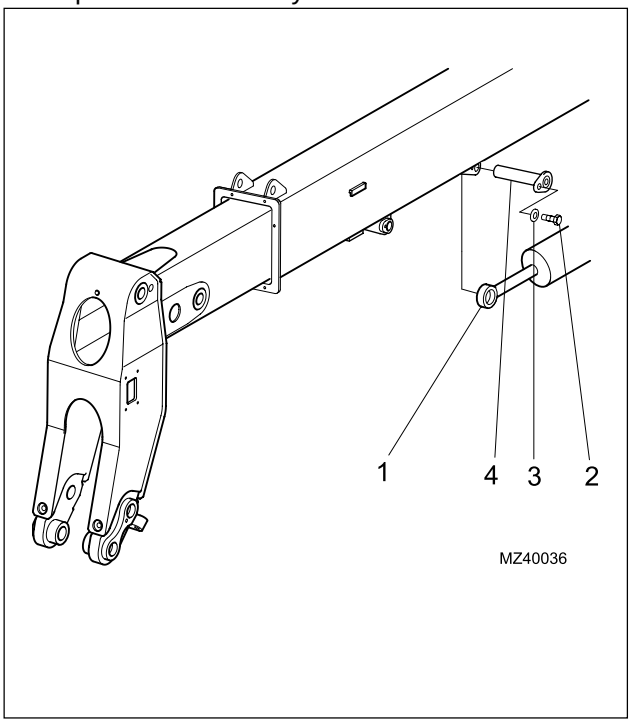
Installation

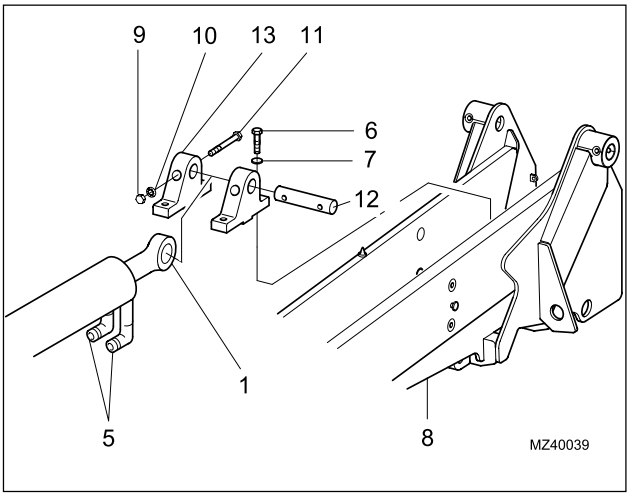
1. Installation is the reverse of the above procedure.

2. Refer to page 1.66, check the hydraulic level and replenish tank before engine is started.

3. Purge the hydraulic system by starting the engine and operating the service to fully extend and retract cylinder several times.

4. Refer to page 1.66 and check the hydraulic level and replenish if necessary.





1. Cylinder **(53)**
2. Bolt
3. Washer
4. Upper attachment pin
5. Hydraulic hoses
6. Bolt (4 off)
7. Washer (4 off)
8. Chassis
9. Nut (2 off)
10. Washer (2 off)
11. Bolt (2 off)
12. Pivot pin
13. Spigot mounting bracket (2 off)

Lift cylinder (54)

Removal

1. Raise the boom to a suitable height and support using lifting equipment or support stands.

2. Stop the engine and chock the machine, apply the parking brake**.**

3. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

WARNING *The lift cylinder weighs 130 kg (286 lb). Take care when handling, to avoid damage to components and injury to personnel.*

NOTE: On early models, the upper and lower attachment pins are slotted and retained by a locking plate.

4. Support the upper end of the cylinder (1). Remove the bolt (2), and washer (3) securing the upper attachment pin (4). Drive out the upper attachment pin and lower the cylinder onto a suitable support placed between the chassis and side members.

5. Identify the hydraulic hoses to make sure they are reconnected correctly. Disconnect the two hydraulic hoses (5) from the cylinder (1), blank the cylinder and open hoses.

CAUTION *Take care when removing the cylinder, that it does not damage the adjacent components.*

6. Support the cylinder (1) and remove the bolt (6) and washer (7) securing lower attachment pin (8) to the chassis (9). Drive out attachment pin and remove cylinder from machine.

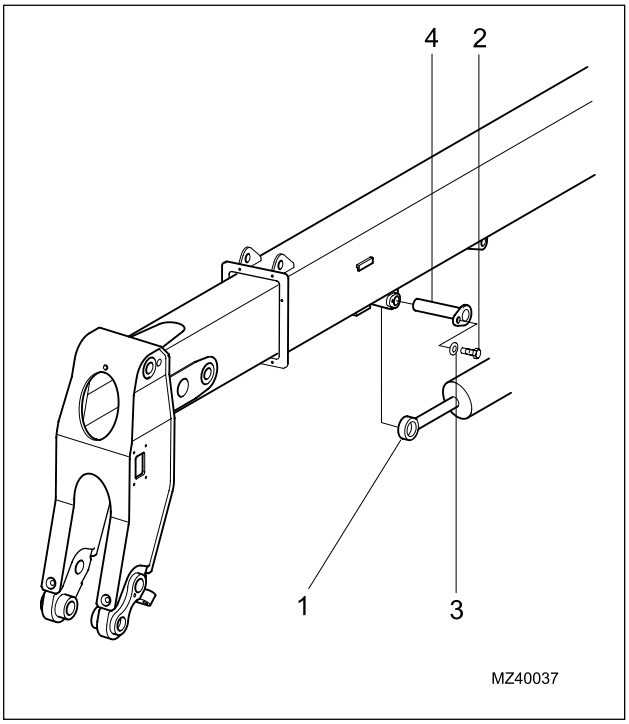
Installation

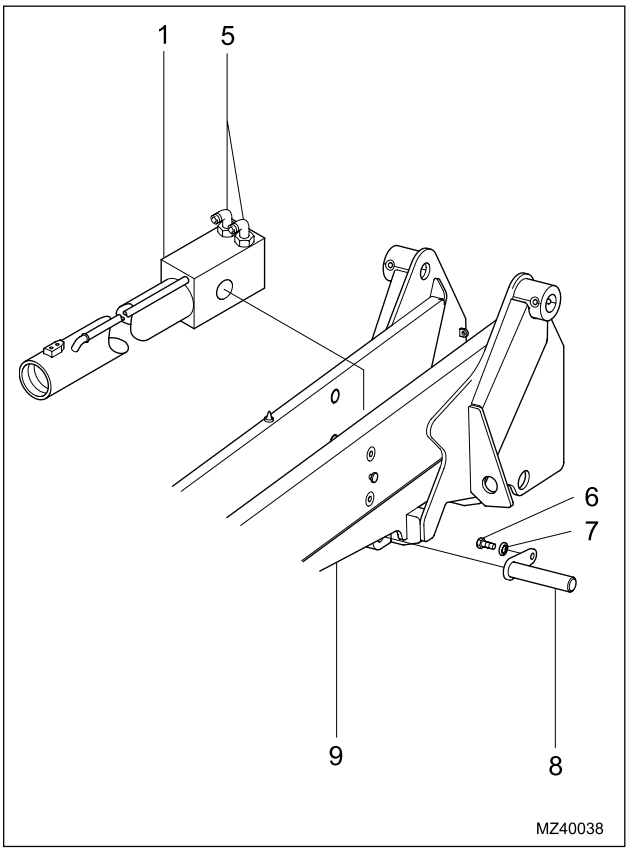
1. Installation is the reverse of the above procedure.

2. Refer to page 1.66, check the hydraulic level and replenish tank before engine is started.

3. Purge the hydraulic system by starting the engine and operating the service to fully extend and retract cylinder several times.

4. Refer to Page 1.66 and check the hydraulic level and replenish if necessary.





1. Cylinder **(54)**
2. Bolt
3. Washer
4. Upper attachment pin
5. Hydraulic hoses
6. Bolt
7. Washer
8. Lower attachment pin
9. Chassis

Extension, crowd, compensator and lift cylinder (49), (51), (53) and (54)

Servicing

The extension, crowd, compensator and lift cylinders are of the same internal construction; the only difference is the size. External differences consist of end fittings and piping to the cylinder.

WARNING *The hydraulic cylinders are heavy. Take care when handling cylinders, to avoid damage to components and injury to personnel.*

The dismantling and assembly procedure is based on the extension cylinder; all other cylinders are similar.

Dismantling

1. Clean the exterior of the cylinder with a suitable solvent and dry with compressed air. Do not use cloths or paper towels to dry component.

2. Drain as much hydraulic fluid as possible from the cylinder into a suitable container before dismantling.

3. Support the cylinder on 'V' blocks; make sure that when the piston is removed the components are not damaged.

WARNING *If compressed air is used to extend the piston assembly, the gland nut (17) must not be removed. release all pressure before the gland nut is removed.*

4. When the piston assembly is difficult to extend, a compressed air supply may be used to pressurize the cylinder. Use only the minimum pressure necessary to extend piston.

5. Using a suitable spanner, unscrew the gland assembly (1) from the cylinder (2).

6. Withdraw the piston rod (3) complete with piston assembly (4) from the cylinder (2). If necessary, fit a suitable size pin through the eye-end of the piston rod and carefully tap with a soft-faced hammer to remove piston rod.

7. Remove the grub screw (5) from the piston (6) unscrew and remove the piston from the piston rod.

8. Remove the spacer (7) (if fitted) from the piston rod.

9. Remove and discard all seals spacers and O-rings (8), (9), (10), (11) & (12) from the piston.

10. Remove and discard all seals and spacers (13), (14), (15), (17), (18) & (19) from the gland nut (16).

WARNING *The load control valve is factory set and should not be dismantled or adjusted except for resealing.*

11. If the load control valve (20) is faulty, remove by unscrewing, A new valve must be fitted.

Assembly

1. Assemble the hydraulic cylinder in the reverse order to dismantling.

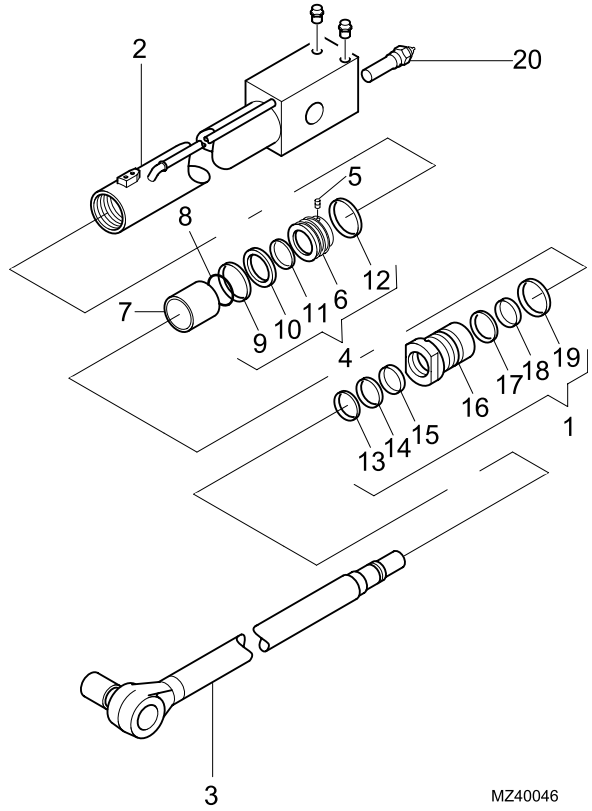
2. Use new O-rings, seals and spacers during assembly.

3. Make sure all old Loctite is removed from the threads of the piston, piston rod and grub screw before assembly. Apply Loctite sealant to threads of piston rod and securely screw piston to piston rod before fitting grub screw.

4. Lubricate O-rings, seals and spacers with clean hydraulic oil before and during assembly.

5. Torque tighten the components in accordance with Table on page 1.116.

Item	Component			
	Gland nut	Piston	Grub screw	Load control valve
Extension cylinder	720-770 Nm (530-568 lbf/in.)	2000 Nm (1474 lbf/in.)	18 Nm (13 lbf/in.)	100 Nm (74 lbf/in.)
Compensator cylinder	650 Nm (480 lbf/in.)	1500 Nm (1105 lbf/in.)	12 Nm (9 lbf/in.)	-
Crowd cylinder	950 Nm (700 lbf/in.)	2000 Nm (1474 lbf/in.)	18 Nm (13 lbf/in.)	85 Nm (63 lbf/in.)
Lift cylinder	950 Nm (700 lbf/in.)	2000 Nm (1474 lbf/in.)	18 Nm (13 lbf/in.)	85 Nm (63 lbf/in.)



1. Gland assembly
2. Cylinder
3. Piston rod
4. Piston assembly
5. Grub screw
6. Piston
7. Spacer (extension and lift only)
8. O-ring
9. Seal
10. Seal
11. Seal
12. Seal
13. Seal
14. Seal
15. Seal
16. Gland nut
17. Seal
18. Seal
19. Seal
20. Load control valve

Autohitch cylinder (58)

Removal

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

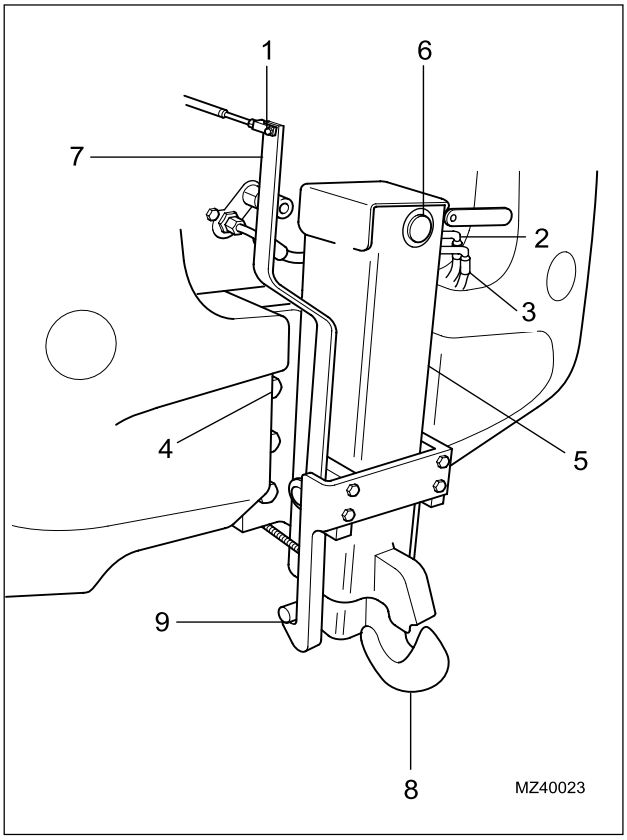
3. Disconnect the autohitch release cable.

4. Identify the hydraulic hoses to make sure they are reconnected correctly. Disconnect the two hydraulic hoses from the right side of the assembly, blank the cylinder connections and open hoses.

WARNING *The autohitch assembly weighs 300 kg (660 lb). Take care when handling assembly to avoid damage to components and injury to personnel.*

5. Support the autohitch assembly and remove the bolts and washers securing assembly to rear service plate. Slide assembly off the locating spigots and remove from machine.

6. Remove the split pin and washer securing the cylinder upper attachment pin (6) and remove pin. Manually operate the release lever (7) and slide the lower hook (8), complete with cylinder, out of the autohitch assembly. Remove the roll pin securing the lower attachment pin (9) to the lower hook and drive out the pin. Remove the cylinder from the lower hook.



1. Release cable
2. Hydraulic hose
3. Hydraulic hose
4. Attachment bolts
5. Autohitch assembly
6. Attachment pin
7. Release lever
8. Lower hook
9. Attachment pin

Installation

1. Installation is the reverse of the above procedure.

2. Refer to page 1.66, check the hydraulic level and replenish tank before engine is started.

3. Purge the hydraulic system by starting the engine and operating the autohitch service to fully extend and retract cylinder several times.

4. Refer to Page 1.66 and check the hydraulic level and replenish if necessary.

Dismantling

1. Clean the exterior of the cylinder with a suitable solvent and dry with compressed air. Do not use cloths or paper towels to dry component.

2. Drain as much hydraulic fluid as possible from the cylinder into a suitable container before dismantling.

3. Support cylinder on 'V' blocks; make sure that when the piston is removed the components are not damaged.

WARNING *If compressed air is used to extend the piston assembly, the threaded cap (1) must not be removed. Release all pressure before the threaded cap is removed.*

4. When the piston assembly is difficult to extend, a compressed air supply may be used to pressurize the cylinder. Use only the minimum pressure necessary to extend piston.

5. Using a suitable spanner, unscrew the threaded cap (1) from the cylinder (2).

6. Withdraw the piston rod (3) complete with piston assembly (4) and gland assembly (10) from the cylinder (2). If necessary carefully tap the fork-end of the piston rod with a soft faced hammer to remove piston rod.

7. Remove the grub screw (5) from the inner piston half (6) unscrew and remove the inner piston half from the piston rod.

8. Remove and discard the seal (7) O-ring (8) and outer piston half (9) from the piston rod.

9. Remove the gland assembly (10) and threaded cap (1) from the piston rod.

Remove and discard the O-ring (11), seal (12) and wiper ring (13) from the gland nut (14).

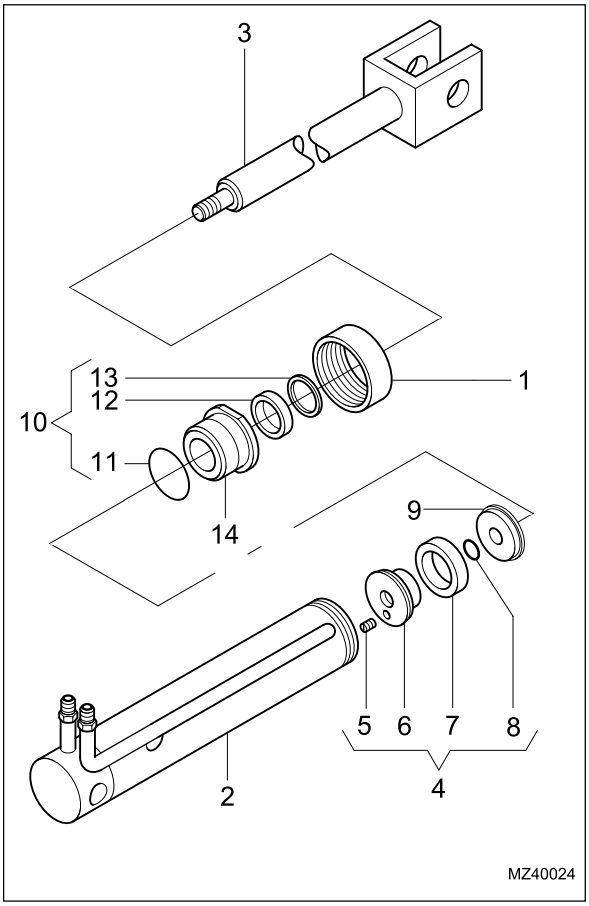
Assembly

1. Assemble the autohitch cylinder in the reverse order to dismantling.

2. Use new O-rings, seals and spacers during assembly.

3. Make sure all old Loctite is removed from the threads of the inner piston half, piston rod and grub screw before assembly. Apply Loctite sealant to threads of piston rod and grub screw and securely screw inner piston half to piston rod before fitting grub screw.

4. Lubricate O-rings, seals and wiper ring with clean



1. Threaded cap
2. Cylinder
3. Piston rod
4. Piston assembly
5. Grub screw
6. Inner piston half
7. Seal
8. O-ring
9. Outer piston half
10. Gland assembly
11. O-ring
12. Seal
13. Wiper ring
14. Gland nut

Carriage locking cylinder

Removal

1. Tilt the carriage and lower to ground

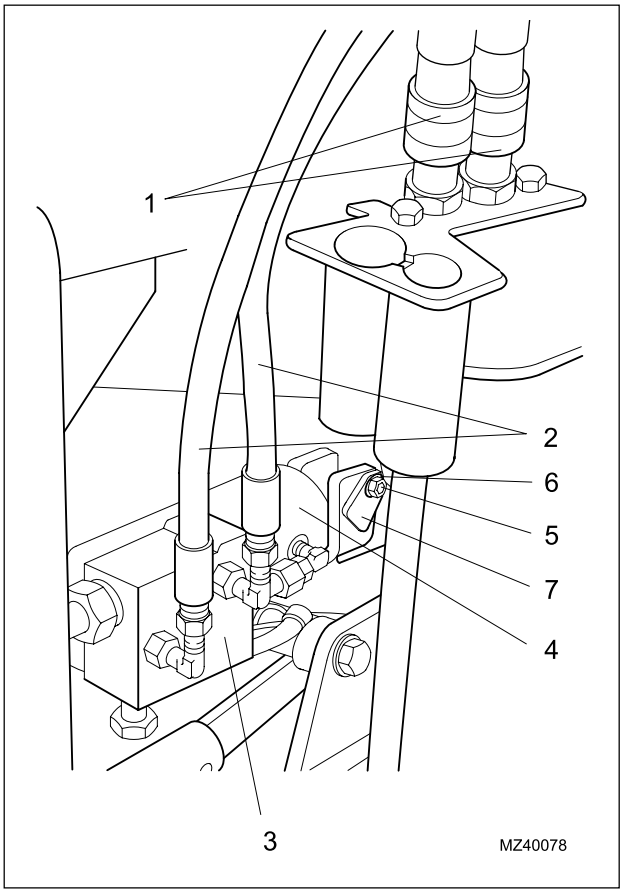
2. Stop the engine and chock the machine, apply the parking brake**.**

3. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

4. Disconnect the hydraulic quick-release couplings (1) on the carriage.

5. Identify the hydraulic hoses to make sure they are reconnected correctly. Disconnect the hydraulic hoses (2) from the pressure reducing valve (3), blank the valve and open hoses.

6. Remove the screws (5) and washers (6) securing the inner and outer cylinder attachment pins (7). Support the cylinder (4) then remove securing the inner and outer cylinder attachment pins (7). Remove cylinder from machine.



1. Quick-release coupling
2. Hydraulic hose
3. Pressure reducing valve
4. Cylinder
5. Screw
6. Washer
7. Pin

Installation

1. Installation is the reverse of the above procedure.

2. Refer to page 1.66, check the hydraulic level and replenish tank before engine is started.

3. Purge the hydraulic system by starting the engine and operating the carriage locking service to fully extend and retract cylinder several times.

4. Refer to Page 1.66 and check the hydraulic level and replenish if necessary.

5. Torque tighten the components as follows:

Screw (5) - 12 Nm (106 lbf/in.)

Dismantling

1. Clean the exterior of the cylinder with a suitable solvent and dry with compressed air. Do not use cloths or paper towels to dry component.

2. Drain as much hydraulic fluid as possible from the cylinder into a suitable container before dismantling.

3. Support cylinder on 'V' blocks; make sure that when the piston is removed the components are not damaged.

WARNING *If compressed air is used to extend the piston assembly, the gland nut (2) must not be removed. Release all pressure before the gland nut is removed.*

4. When the piston assembly is difficult to extend, a compressed air supply may be used to pressurize the cylinder. Use only the minimum pressure necessary to extend piston.

5. Remove the wire clip (1) securing the gland nut (2) from the cylinder (3).

6. Using a suitable peg spanner, unscrew the gland nut (2) from the cylinder (3).

7. Withdraw the piston rod (4) complete with piston and gland assembly from the cylinder (3). If necessary, fit an attachment pin into the piston rod and carefully tap the pin with a soft faced hammer to remove piston rod.

8. Unscrew the piston (5) from the piston rod (4).

9. Remove the piston guide ring (6) from the piston (5). Remove and discard the piston seal (7) and snap ring (8) from the piston.

10. Remove and discard the dual-seal ring (9), lip seal (10) and wiper ring (11) from the gland nut (2).

11. Unscrew the union (12) attaching the pressure reducing valve (13) to the cylinder connection. Remove the bolt (14) and three washers (15) securing the cylinder hose (16) to the valve (13) and remove the valve.

Assembly

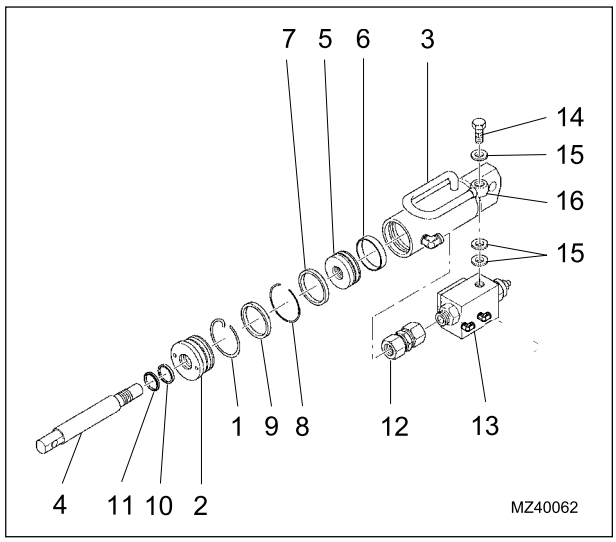
1. Assemble the carriage locking cylinder in the reverse order to dismantling.

2. Use new seals and wiper ring during assembly.

3. Make sure all old Loctite is removed from the threads of the piston and piston rod before assembly. Apply Loctite sealant to threads of piston rod and securely screw piston to piston rod.

4. Lubricate seals and wiper ring with clean hydraulic oil before and during assembly.

5. Make sure that the wire clip (1) is locking the gland nut (2) to the cylinder (3).



1. Wire clip
2. Gland nut
3. Cylinder
4. Piston rod
5. Piston
6. Piston guide ring
7. Seal
8. Snap ring
9. Dual-seal ring
10. Lip seal
11. Wiper ring
12. Union
13. Pressure reducing valve
14. Bolt
15. Washer
16. Cylinder hose

Steering cylinder (15) and (19)

Removal

1. Stop the engine and chock the machine, apply the parking brake**.**

2. Refer to page 1.1 and dump hydraulic pressure then disconnect the battery.

3. Identify the hydraulic hoses to make sure they are reconnected correctly. Disconnect the two hydraulic hoses from the cylinder (1); blank the cylinder connections and open hoses.

4. Remove the adapter (2) from the cylinder (1) to allow cylinder to slide through locating bracket.

5. Loosen the track rod end securing nut (4) on each track rod (5) and using a suitable removal tool; disconnect track rod ends from axle.

6. Loosen the ball joint lock nut (6) on the inboard end of each track rod (5) and remove the track rods from ball joint (7). Remove the ball joint from each end of the piston rod (8).

7. Remove the three screws (3), securing cylinder to axle and slide cylinder out of brackets.

8. Fit a blank to the open cylinder connection.

Installation

1. Installation is the reverse of the above procedure.

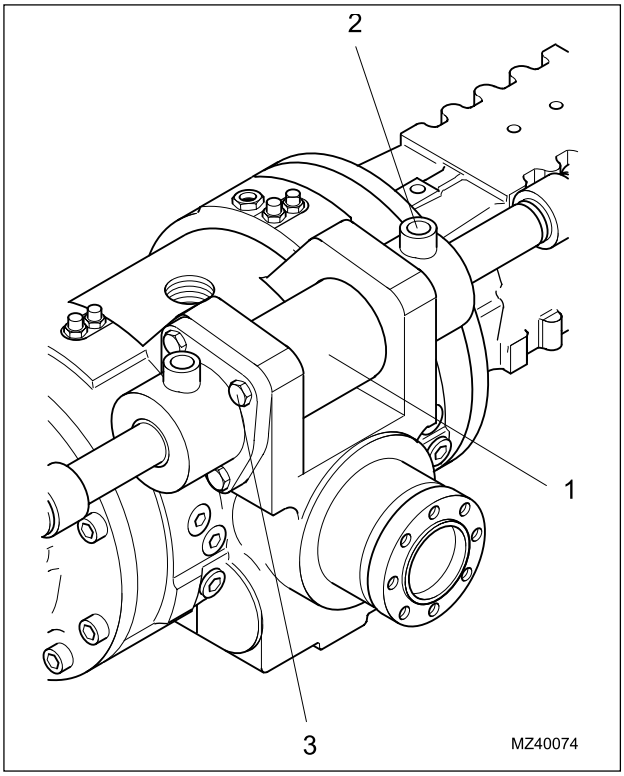
2. Refer to page 1.66. Check the hydraulic level and replenish tank before engine is started.

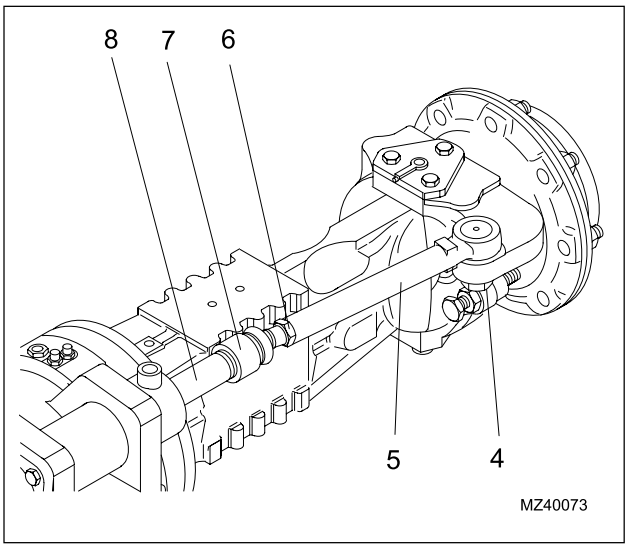
3. Purge the hydraulic system by starting the engine and operating the steering to fully extend and retract cylinder several times.

4. Refer to Page 1.66 and check the hydraulic level and replenish if necessary.

5. Refer to the axle section and adjust the tracking and on the rear axle, check the operation of the steering position switch.

6. Torque tighten the components as follows:
Cylinder retaining screws (5) - 120 Nm (88 lbf/ft.)
Ball joint (9) - 300 Nm (220 lbf/ft.)
Ball joint lock nut (8) - 250 Nm (184 lbf/ft.)
Tie rod nuts (6) - 220 Nm (162 lbf/ft.)





1. Cylinder **(15 & 19)**
2. Adapter
3. Screw (3 off)
4. Nut
5. Track rod
6. Lock nut
7. Ball joint
8. Piston rod

Dismantling

1. Clean the exterior of the cylinder with a suitable solvent and dry with compressed air. Do not use cloths or paper towels to dry component.

2. Drain as much hydraulic fluid as possible from the cylinder into a suitable container before dismantling.

3. Support cylinder on 'V' blocks; make sure that when the piston is removed the components are not damaged.

4. Remove the circlip (11) from the gland assembly (1). Push the gland assembly into the cylinder (2) and remove the snap ring (12).

5. Remove the gland assembly (1) from the cylinder (2) by pressing the piston rod (3) complete with gland assembly from the cylinder (2). If necessary, carefully tap the piston rod with a soft-faced hammer.

6. Remove the gland assembly (1) from the piston rod (3). Remove and the O-ring (4), piston rod seal (5) and wiper ring (6) from the gland assembly (1).

7. Remove the O-rings (7) and magnetic band (8) from the piston rod (3).

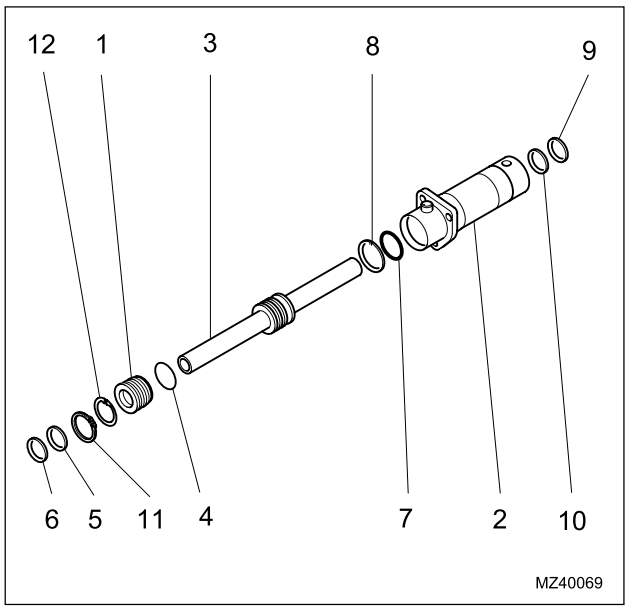
8. Remove the wiper ring (9) and piston rod seal (10) from the cylinder (2).

Assembly

1. Assemble the steering cylinder in the reverse order to dismantling.

2. Use new seals and wiper rings during assembly.

3. Lubricate seals and wiper rings with clean hydraulic oil before and during assembly.



1. Gland assembly
2. Cylinder
3. Piston rod
4. O-ring
5. Seal
6. Wiper ring
7. O-ring
8. Magnetic band
9. Wiper ring
10. Seal
11. Circlip
12. Snap ring

SECTION 2

ELECTRICS

WIRING TERMINATIONS

CIRCUIT IDENT No.	DESCRIPTION	NOTES	SHEET 1	SHEET 1A	SHEET 2	SHEET 2A	SHEET 3	SHEET 3A	SHEET 4	SHEET 4A	SHEET 5	SHEET 6	SHEET 7	SHEET 7A
1	Wire Terminal											B8		
2	Wire Terminal										B2, C2, E2			
3	Wire Terminal		E5	E5					D4, E3, F3, F8	D3, E3, F3, F8	A2, C2			
4	Wire Terminal								C3, E4	C2, E3	A3, B3, C3, F2			
5	Wire Terminal		E5	E5			E4	E4			B8	A7, F7		
6	Wire Terminal		D5	D5							A8	B3		
7	Wire Terminal		E5	E5			C7	C7			A6	B3, C5		
10	Wire Terminal						C2	C4						
11	Wire Terminal											C3		
12	Wire Terminal											C3		
13	Wire Terminal						C2	C2				C2		
15	Wire Terminal		E7	E7								D8		
17	Wire Terminal								E6	E6		E7		
18	Wire Terminal		E7	E7								C8		
19	Wire Terminal											C2		
23	Wire Terminal		B7	B7								B5		
24	Wire Terminal								C5, F7	C5, F7				
26	Wire Terminal						B6	B6	C5	C5				
29	Wire Terminal						D6	D6	F5	F5				
34	Wire Terminal								B4	B4		F7		
41	Wire Terminal									F5			D6	D6
42	Wire Terminal									D6				
44	Wire Terminal						C5						A4	A4
46	Wire Terminal										B5	F7		
50	Wire Terminal						B2	B2						
51	Wire Terminal										C4	B3, F7		
52	Wire Terminal				A4	A4	D2	D2			C4	B3, F7		
53	Wire Terminal				A4	A4	D2	D2						
54	Wire Terminal		A5	A5	B4	B4								
55	Wire Terminal		E2	E2			D2	D2					D8	C8

WIRING TERMINATIONS (continued)														
CIRCUIT IDENT No.	DESCRIPTION	NOTES	SHEET 1	SHEET 1A	SHEET 2	SHEET 2A	SHEET 3	SHEET 3A	SHEET 4	SHEET 4A	SHEET 5	SHEET 6	SHEET 7	SHEET 7A
58	Wire Terminal		A5	A5								C2		
59	Wire Terminal		A7	A7							A5			
60	Wire Terminal											B2		
61	Wire Terminal						D2, E3	D2, E3						
62	Wire Terminal		A5	A5			D2, E3	D2, E3				B2, B8		
63	Wire Terminal						D2	D2						
65	Wire Terminal			C3									E6	
78	Wire Terminal													
79	Wire Terminal											D8	F3	E2
80	Wire Terminal						D2	D2						
84	Wire Terminal		F2	F2								C8		
85	Wire Terminal		F2	F2			E8	E8					F2	C2
86	Wire Terminal		F2	F2			E8	E7				C3		
87	Wire Terminal		F2	F2	E8	E8								
88	Wire Terminal		F2	F2							E5	E5	B8	B8
91	Wire Terminal										E5	E8		
93	Wire Terminal													
94	Wire Terminal		A5	A5			E2	E2				B2,B8		
97	Wire Terminal										A8	D7		
108	Wire Terminal						B5	B5				E7		
109	Wire Terminal						C6	C6				E7		
111	Wire Terminal		B2	B2	B4	B4								
112	Wire Terminal		B2	B2								D7		
116	Wire Terminal		B3	B3								F3		
118	Wire Terminal								F8	F8		F5		
119	Wire Terminal								C6	B6		F5		
120	Wire Terminal								C6	C6	B7			
121	Wire Terminal						B7	B6			B7			
124	Wire Terminal		B2	B2			D7	C7						
127	Wire Terminal		B4	B4										
129	Wire Terminal		B4	B4			B2	B2						

WIRING TERMINATIONS (continued)

CIRCUIT IDENT No.	DESCRIPTION	NOTES	SHEET 1	SHEET 1A	SHEET 2	SHEET 2A	SHEET 3	SHEET 3A	SHEET 4	SHEET 4A	SHEET 5	SHEET 6	SHEET 7	SHEET 7A
130	Wire Terminal		B4	B4			C2	C2						
137	Wire Terminal						C4	C4						B7
138	Wire Terminal										B5			B7
139	Wire Terminal		F5	F5							B5			
144	Wire Terminal													
145	Wire Terminal													
146	Wire Terminal				E8	E1					B8			
155	Wire Terminal										B8	E5		
174	Wire Terminal						F8		A7	A7				
183	Wire Terminal											E5	B5	B4
185	Wire Terminal													
186	Wire Terminal													
187	Wire Terminal													
200	Wire Terminal		F5	F5			D5	D4						
212	Wire Terminal		A8	A8							C8			
215	Wire Terminal													
216	Wire Terminal													
218	Wire Terminal												C5	
218	Wire Terminal													
219	Wire Terminal													
220	Wire Terminal													
221	Wire Terminal													
223	Wire Terminal		A7	A7									B4	B4
224	Wire Terminal		A8	A8							E7			
238	Wire Terminal						C6	C6				A6	B5	A5
241	Wire Terminal													
242	Wire Terminal													
260	Wire Terminal													
261	Wire Terminal													

WIRING TERMINATIONS (continued)

CIRCUIT IDENT No.	DESCRIPTION	NOTES	SHEET 1	SHEET 1A	SHEET 2	SHEET 2A	SHEET 3	SHEET 3A	SHEET 4	SHEET 4A	SHEET 5	SHEET 6	SHEET 7	SHEET 7A
263	Wire Terminal													
266	Wire Terminal													
267	Wire Terminal													
270	Wire Terminal													
275	Wire Terminal													
277	Wire Terminal													
278	Wire Terminal													
279	Wire Terminal													
283	Wire Terminal													
284	Wire Terminal													
286	Wire Terminal						F5	F5						
287	Wire Terminal													
288	Wire Terminal													
289	Wire Terminal						F5	F5						
290	Wire Terminal						E5	E5						
293	Wire Terminal													
294	Wire Terminal													
295	Wire Terminal													
297	Wire Terminal											F4		
300	Wire Terminal											B5, D7		
301	Wire Terminal		C4	B4										E6
302	Wire Terminal		D4											E6
305	Wire Terminal													
306	Wire Terminal				E6	E6							C6	
311	Wire Terminal						C6	C1	A7	A7				
312	Wire Terminal						D5	B3	A6	A6				
317	Wire Terminal											F5	A7	A7
318	Wire Terminal						B8	B8	F7	F7				
319	Wire Terminal		B4	B4			B7	B7						
338	Wire Terminal				A6	A6								

COMPONENTS

CIRCUIT IDENT No.	DESCRIPTION	OMM REF.	NOTES	SHEET 1	SHEET 1A	SHEET 2	SHEET 2A	SHEET 3	SHEET 3A	SHEET 4	SHEET 4A	SHEET 5	SHEET 6	SHEET 7	SHEET 7A
1	Air Conditioning Clutch		Option										C3		
2	Air Conditioning Condenser		Option										C3		
3	Air Conditioning Switch		Option										C3		
4	Air Conditioning Thermostat		Option										C3		
5	Alternator			F8	F8										
6	APC												E5		
7	APC Control Relay	R18											C7		
8	Aux 1A Solenoid					D3	D3								
9	Aux 1B Solenoid					D3	D3								
10	Aux 1 Disable Relay	R10				D5	D5								
11	Aux 2A Solenoid		Option			B3	B3								
12	Aux 2B Solenoid		Option			B3	B3								
13	Battery			E8	E8										
14	Battery Dissconnect Switch			E8	E8										
15	Beacon Switch												F4		
16	Boom Side Work Lamps Switch												D6		
17	Boom Side Work Lamps - LH		Option					D3	D3						
18	Boom Side Work Lamps - RH		Option					D4	D3						
19	Boom Work Lamps Fuse	F27						D5	D5						
20	Boom Work Lamps Relay	R1						D5	D5						
21	Boom Work Lamps Switch							D7							
22	Brake Trans. Dump Switch													B6	B7
23	Brake Dump Relay	R4													B6
24	Cold Start Advance Soleniod			A6	A6										
25	Cold Start Temperature Switch			B6	B6										
26	Crowd/Dump Disable Relay	R15				D5	D5								
27	Crowd Soleniod					C3	C3								
28	Beacon		Option										F4		
29	DIN Socket												F5		

COMPONENTS															
CIRCUIT IDENT No.	DESCRIPTION	OMM REF.	NOTES	SHEET 1	SHEET 1A	SHEET 2	SHEET 2A	SHEET 3	SHEET 3A	SHEET 4	SHEET 4A	SHEET 5	SHEET 6	SHEET 7	SHEET 7A
30	LH Dip Beam Lamp									B3	B3				
31	RH Dip Beam Lamp									B3	B3				
32	Divertor Solenoid					B5	B5								
33	Dump Solenoid					C3	C3								
34	Electric Seat		Option									A6			
35	Extend Solenoid					C3	C3								
36	Fan Reverse Solenoid												A4		
37	Fan Reverse Switch												A7		
38	Flasher Relay	R3													
39	Fnr / Transmission Control Lever APCTransmission													F7	
40	Fnr / Transmission Control Lever Manual Transmission														F7
41	Front Wiper / Wash Switch							F6	F6						
42	LH Front Worklamp							B3	B3						
43	RH Front Worklamp							B3	B3						
44	Front Worklamps Relay	R5						B5	B5						
45	Front Worklamps Switch							B6	B6						
46	Fuel Sender												B4		
47	Fuel Solenoid			A6	A6										
48	Rear Wiper Fuse	F1						E7	E7						
49	Work Lights Fuse	F2						B1	B1						
50	Roading Fuse	F3				E7	E7								
51	Turn/Radio Fuse	F4										B7			
52	Heater/Fuel Gauge Fuse	F5											E5		
53	Hydraulic Control Fuse	F6				E7	E7								
54	Load Ind Fuse	F7				F7	F7								
55	Fog Lamp Fuse	F8								C5					
56	Rear Work Lamp Fuse	F9						C4	C4						
57	Front Work Lamp Fuse	F10						C4	B4						
58	Fuel Stop Solenoid Fuse	F11		A8	A8										

COMPONENTS

CIRCUIT IDENT No.	DESCRIPTION	OMM REF.	NOTES	SHEET 1	SHEET 1A	SHEET 2	SHEET 2A	SHEET 3	SHEET 3A	SHEET 4	SHEET 4A	SHEET 5	SHEET 6	SHEET 7	SHEET 7A
59	Stop Lamps Fuse	F12										E7			
60	Rh Side Lamp Fuse	F13								F6	F6				
61	LH Side Lamp Fuse	F14								D6	C6				
62	RH Main Beam Fuse	F15								B4	A4				
63	LH Main Beam Fuse	F16								A4	A4				
64	RH Dip Beam Fuse	F17								B4	B4				
65	LH Dip Beam Fuse	F18								B4	B4				
66	Turn Indicators Fuse	F19										B7			
67	APC Fuse	F20												D8	C7
68	Internal Lamps Fuse	F21											E5		
69	Front Wiper Fuse	F22						E7	E7						
70	Horn Fuse	F23								A6	A6				
71	Fuse	F24											C7		
72	Hazarar Switch											B7			
73	Head Lamp Relay	R8								B7	B7				
74	Heater Blower												E3		
75	Heater Switch												E4		
76	Horn							F4	F4						
77	Horn Switch							F6	F6						
78	Hydraulic Disable Relay	R11				E5	E5								
79	Hydraulic Temperature Relay	R17											B6		
80	Ignition Relay	R2		F5	F5										
81	Ignition Switch			E5	E5										
82	Instrument Panel												F6		
83	Interior Lamp and Switch												E3		
84	Joystick					D7	D7								
85	APC Line Fuse	F25												B6	
86	Fan Reverse Line Fuse	F26											B7		
87	Low Steer Pressure Warning Lamp		Option										E4		

COMPONENTS															
CIRCUIT IDENT No.	DESCRIPTION	OMM REF.	NOTES	SHEET 1	SHEET 1A	SHEET 2	SHEET 2A	SHEET 3	SHEET 3A	SHEET 4	SHEET 4A	SHEET 5	SHEET 6	SHEET 7	SHEET 7A
88	Lower Solenoid					C3	C3								
89	SLI DIsplay					F6	F6								
90	SLI Strain Gauge					F4	F4								
91	Main/Dip Switch									B6	B5				
92	LH Main Beam									A3	A3				
93	RH Main Beam									B3	B3				
94	Neutral Start Relay (APC Transmission)	R9						C4							
95	Neutral Start Relay (Manual Transmission) - FWD Signal	R9				C4	C4								
96	Neutral Start Relay (Manual Transmission) - REV Signal	R9				D4	D4								
97	Number Plate Lamp Isolation Relay										D4				
98	Number Plate Lamps									E4	D4				
99	Oil Pressure Switch												C8		
100	Handbrake Solenoid													B4	B3
101	Handbrake Switch													B5	B6
102	Air Filter Blocked Pressure Switch												B6		
103	Hydraulic Filter Blocked Pressure Switch												B6		
104	Low Brake Pressure Switch											A6			
105	Low Steer Pressure Switch												E4		
106	Handbrake Pressure Switch												E8		
107	Transmission Pressure Switch												D7		
108	Transmission Dump Pressure Switch													B7	A7
109	Radio											D5			
110	Raise Solenoid					C3	C3								
111	Rear Fog Lamp Switch									C5	C5				
112	LH Rear Fog Lamp									C3	C3				
113	RH Rear Fog Lamp									C3	C3				
114	Rear Hydraulic Service Switch					A7	A7								
115	LH Rear Worklamp							C3	C3						
116	RH Rear Worklamp							C3	C3						

COMPONENTS

CIRCUIT IDENT No.	DESCRIPTION	OMM REF.	NOTES	SHEET 1	SHEET 1A	SHEET 2	SHEET 2A	SHEET 3	SHEET 3A	SHEET 4	SHEET 4A	SHEET 5	SHEET 6	SHEET 7	SHEET 7A
117	Rear Work Lamps Relay	R6						C5	C5						
118	Rear Work Lamps Switch							C6	C6						
119	Retract Solenoid					C3	C3								
120	Reverse Alarm											F3			
121	LH Reverse Lamp											F3			
122	RH Reverse Lamp											F3			
123	Roading Lights Switch									F7	F7				
124	Roading (Hyd Disable) Switch					E7	E7								
125	LH Side Work Lamps		Option					C3	C3						
126	RH Side Work Lamps		Option					C3	C3						
127	LH Side Work Lamps Fuse	F28						C4	C4						
128	RH Side Work Lamps Fuse	F29						C4	C4						
129	Side Work Lamps Relay	R7						C5	C5						
130	Side Work Lamps Switch							C6	C6						
131	LH Boom Side Lamp		Option							E4	E4				
132	LH Side Lamp Front									D4	C4				
133	LH Side Lamp Rear									D4	D4				
134	RH Boom Side Lamp		Option							D4	D4				
135	RH Side Lamp Front									F4	F4				
136	RH Side Lamp Rear									E4	E4				
137	Side Lamp Relay	R13						B7	B7						
138	LH Speaker		Dealer Fit									D3			
139	RH Speaker		Dealer Fit									C3			
140	Speed Sensor													D3	
141	Starter Motor			D6	D6										
142	Starter Solenoid			E6	E6										
143	Starter Solenoid Relay	R12		C6	C6										
144	Steer Aligned Lamp Front Axle											E6			
145	Steer Aligned Lamp Rear Axle											D6			

COMPONENTS

CIRCUIT IDENT No.	DESCRIPTION	OMM REF.	NOTES	SHEET 1	SHEET 1A	SHEET 2	SHEET 2A	SHEET 3	SHEET 3A	SHEET 4	SHEET 4A	SHEET 5	SHEET 6	SHEET 7	SHEET 7A
146	Steer Select Switch						E5	E5							
147	Steer Sensor Front Axle											E3			
148	Steer Sensor Rear Axle											D4			
149	Steer Solenoid Front Axle						E3	E3							
150	Steer Solenoid Rear Axle						E3	E3							
151	LH Stop Lamp											E3			
152	RH Stop Lamp											E3			
153	Stop Lamp Switch											E5			
154	Temperature Sensor Eng .Coolant												C7		
155	Temperature Switch Hyd. Oil												B4		
156	Thermostart (Cold Start)						E3	E3							
157	Thermostart (Cold Start) Relay	R16					E4	E4							
158	Transmission Soleniod Fwd													E3	E2
159	Transmission Soleniod No 1													D2	D2
160	Transmission Soleniod No2													D2	D2
161	Transmission Soleniod Reverse													E2	D2
162	Transmission Soleniod Split													E3	E2
163	Trinery Switch High Pressure												C5		
164	Trinery Switch Low Pressure												C5		
165	LH Boom Turn Lamp		Option									C3			
166	LH Front Turn Lamp											B3			
167	LH Rear Turn Lamp											B3			
168	RH Boom Turn Lamp		Option									A3			
169	RH Front Turn Lamp											B3			
170	RH Rear Turn Lamp											B3			
171	Turn Signal Switch											B5			
172	Front Washer Motor							E5	E5						
173	Rear Washer Motor							E5	E5						
174	Rear Wiper/Washer Switch							F5	F5						

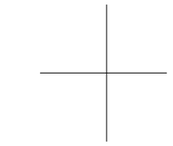
COMPONENTS

CIRCUIT IDENT No.	DESCRIPTION	OMM REF.	NOTES	SHEET 1	SHEET 1A	SHEET 2	SHEET 2A	SHEET 3	SHEET 3A	SHEET 4	SHEET 4A	SHEET 5	SHEET 6	SHEET 7	SHEET 7A
175	Front Wiper Moter							F5	F5						
176	Aux 1A Switch					D7	D7								
177	Aux 1B Switch					D7	D7								
178	Crowd Dump Switch					D7	D7								
179	Extend/Retract Switch					C7	C7								
180	Raise/Lower Switch					C7	C7								
181	Aux 2A Switch		Option			C7	C7								
182	Aux 2B Switch		Option			C7	C7								
183	Neutral Switch					B7	B7								
184	Rear Wiper Motor							E5	E5						
185	Not Allocated											E5			
186	Stop Lamp Switch														
187	Circuit Breaker												C4		
188	Air Conditioning Relay	R14											C3		
189	Condensor Fans												C3		
190	Hyd. Temp. Warning Light												F6		
191	Main Beam Warning Light												F6		
192	RH Turn Warning Light												F6		
193	LH Turn Warning Light												F6		
194	Trailer Turn Warning Light												E6		
195	Sidelights												E6		
196	Front Work Lamps Warning Light												E6		
197	Rear Work Lamps Warning Light												E6		
198	Park Brake Warning Light												E6		
199	Brake Pressure Warning Light												E6		
200	Fuel Gauge												D6		
201	Tachometer												D6		
202	Trans. Pressure Warning Light												D6		
203	Engine Temperature Gauge												C6		

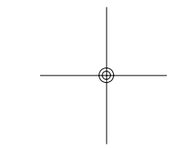
COMPONENTS

CIRCUIT IDENT No.	DESCRIPTION	OMM REF.	NOTES	SHEET 1	SHEET 1A	SHEET 2	SHEET 2A	SHEET 3	SHEET 3A	SHEET 4	SHEET 4A	SHEET 5	SHEET 6	SHEET 7	SHEET 7A
204	Alternator Warning Light												C6		
205	Oil Pressure Warning Light												C6		
206	Hydraulic Filter Switch												B7		
207	Air Filter Switch												B7		

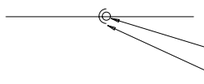
GENERAL INFORMATION ON FORMAT AND CODES USED IN THE SCHEMATIC



WIRES CROSSING BUT NOT JOINED TOGETHER

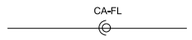


SPLICE CONTAINING THREE OR MORE WIRES
(WIRES JOINED TOGETHER)

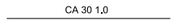


CONNECTOR POLARITY DESIGNATION

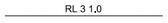
TWO WIRES CONNECTED TOGETHER
THE CODE DESCRIBES THE HARNESSES INVOLVED
CONNECTOR POLARITY IS ALSO SHOWN



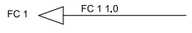
TWO WIRES CONNECTED CONNECTED TOGETHER
THE CODE DESCRIBES THE HARNESSES INVOLVED
CONNECTOR POLARITY IS ALSO SHOWN
NOTE PIN NUMBER NOT AVAILABLE ON CONNECTOR



WIRE WITHIN CIRCUIT.
HARNESS CODE, WIRE NUMBER AND SIZE (IN MM2)
ALSO SHOWN

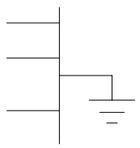


WIRE IN OPTIONAL / UNUSED / SHARED CIRCUIT

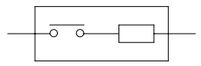


WIRE BREAK SHOWING HARNESS CODE AND WIRE NUMBER.
THE CIRCUIT IS REJOINED AT ANOTHER WIRE BREAK
WITH THE SAME CODE. IN SOME INSTANCES THE OTHER HALF
OF THE WIRE BREAK MAY BE SHOWN AS A COMPLETE CIRCUIT

ELECTRICAL GROUND AT SPECIFIC POINT
OR ON MACHINE STRUCTURE



CIRCUITS GOING TO ELECTRICAL GROUND



COMPONENT(S) PART OF A SINGLE UNIT OR
PART OF A BIGGER SUB-ASSEMBLY (e.g. ENGINE)

WIRE / CONNECTOR CODE	HARNESS
AC	APC HARNESS - CAB SIDE
AE	ACCUMULATOR EXTENSION
AP	APC POWER
BM	BOOM
CA	CAB
CH	CHASSIS
EN	ENGINE
FC	FAN REVERSE - CAB SIDE
FE	FAN REVERSE - ENGINE SIDE
FL	FRONT LIGHTS (LHS / RHS)
FR	FAN REVERSE LINK HARNESS
HE	HORN EXTENSION
JL	JOYSTICK
N1	BATTERY NEGATIVE CABLE
NA	NEUTRAL START - APC TRANSMISSION
ND	NUMBER PLATE LIGHT DISABLE
NM	NEUTRAL START - MANUAL TRANSMISSION
NP	NUMBER PLATE LIGHT
P1	BATTERY POSITIVE CABLE - BATTERY TO DISCONNECT SWITCH
P2	BATTERY POSITIVE CABLE - DISCONNECT SWITCH TO STARTER
RF	ROOF
RL	REAR LIGHTS (LHS / RHS)
TL	TRAILER SOCKET
UP	UNDERPOD

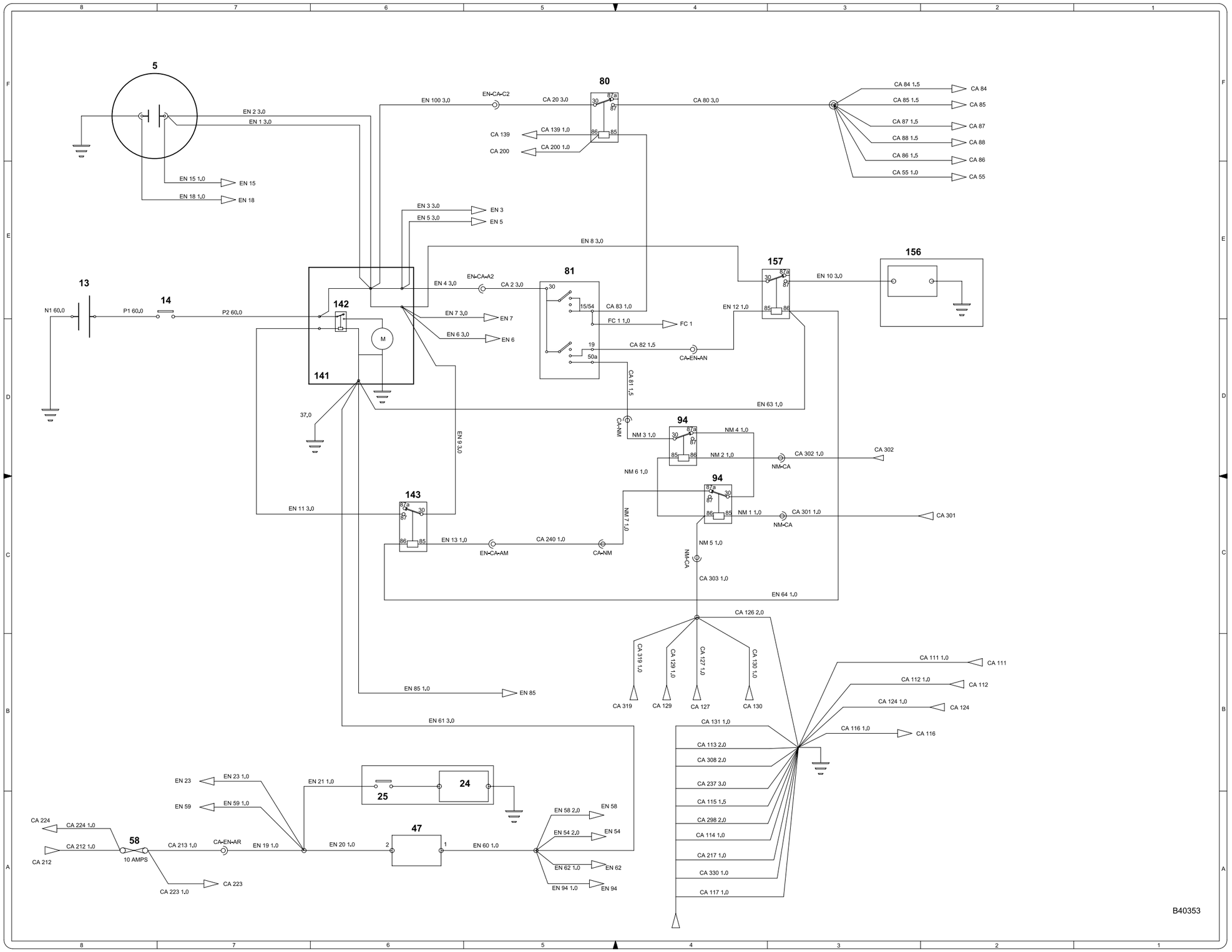
THE TABLE ABOVE DESCRIBES THE CODES USED IN THE SCHEMATIC FOR CONNECTORS AND WIRES

CODE	COLOUR
BK	BLACK
BR	BROWN
BU	BLUE
GN	GREEN
GY	GREY
OR	ORANGE
PK	PINK
PU	PURPLE
RD	RED
WH	WHITE
YL	YELLOW

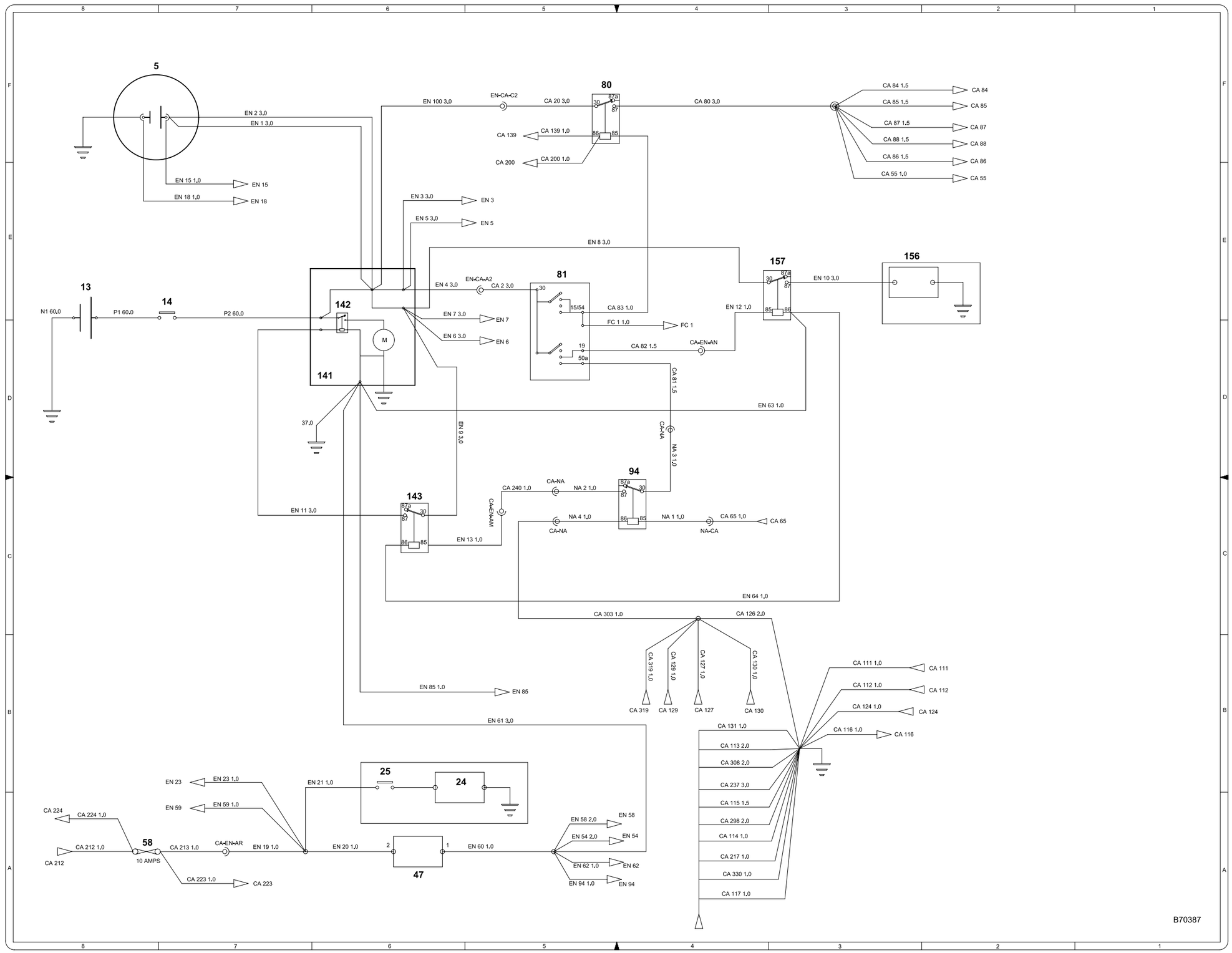
THE TABLE ABOVE DESCRIBES THE WIRE COLOUR CODES USED IN THE SCHEMATIC

B40352

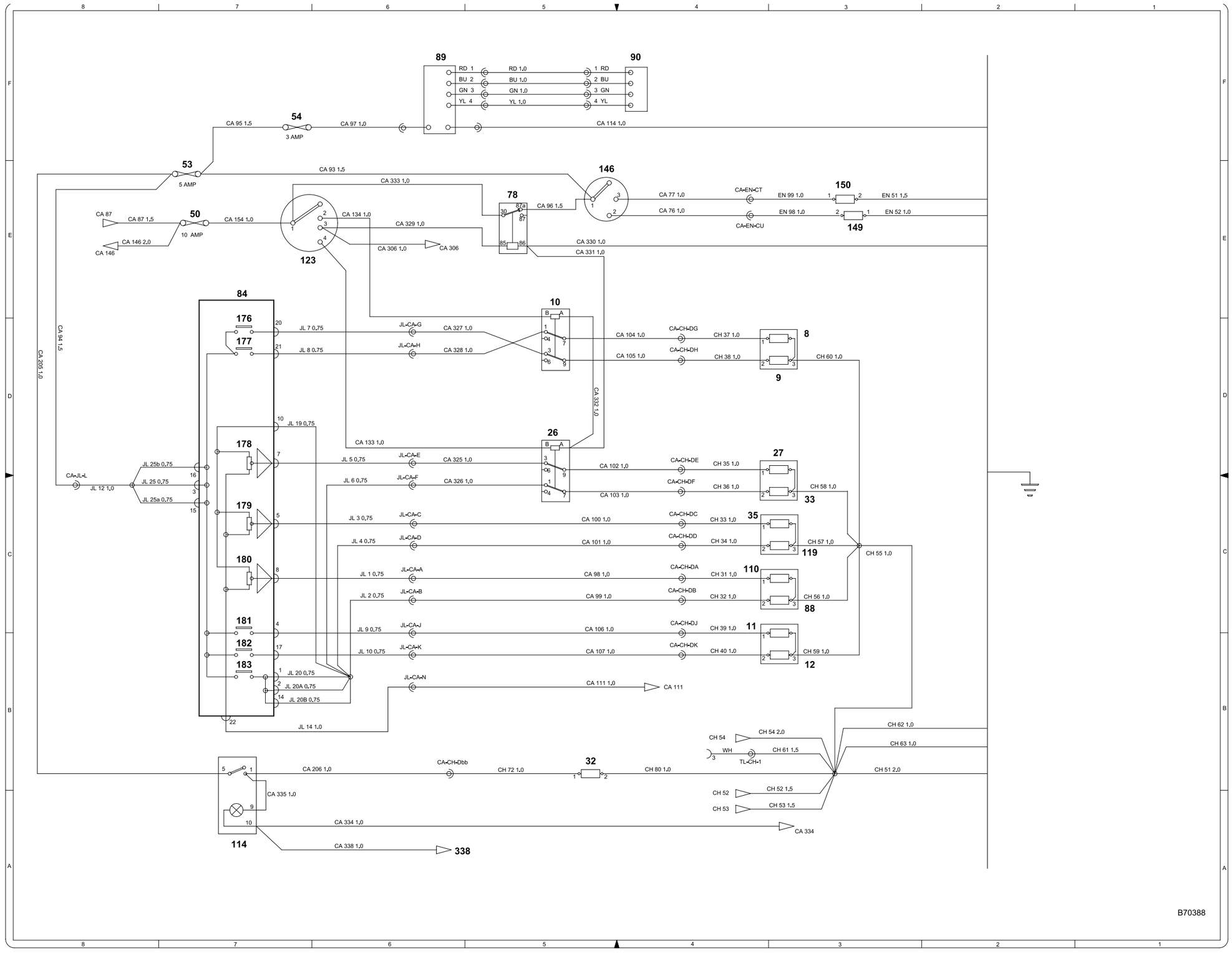
SHEET 1 - POWER GENERATION, STARTING, NON APC



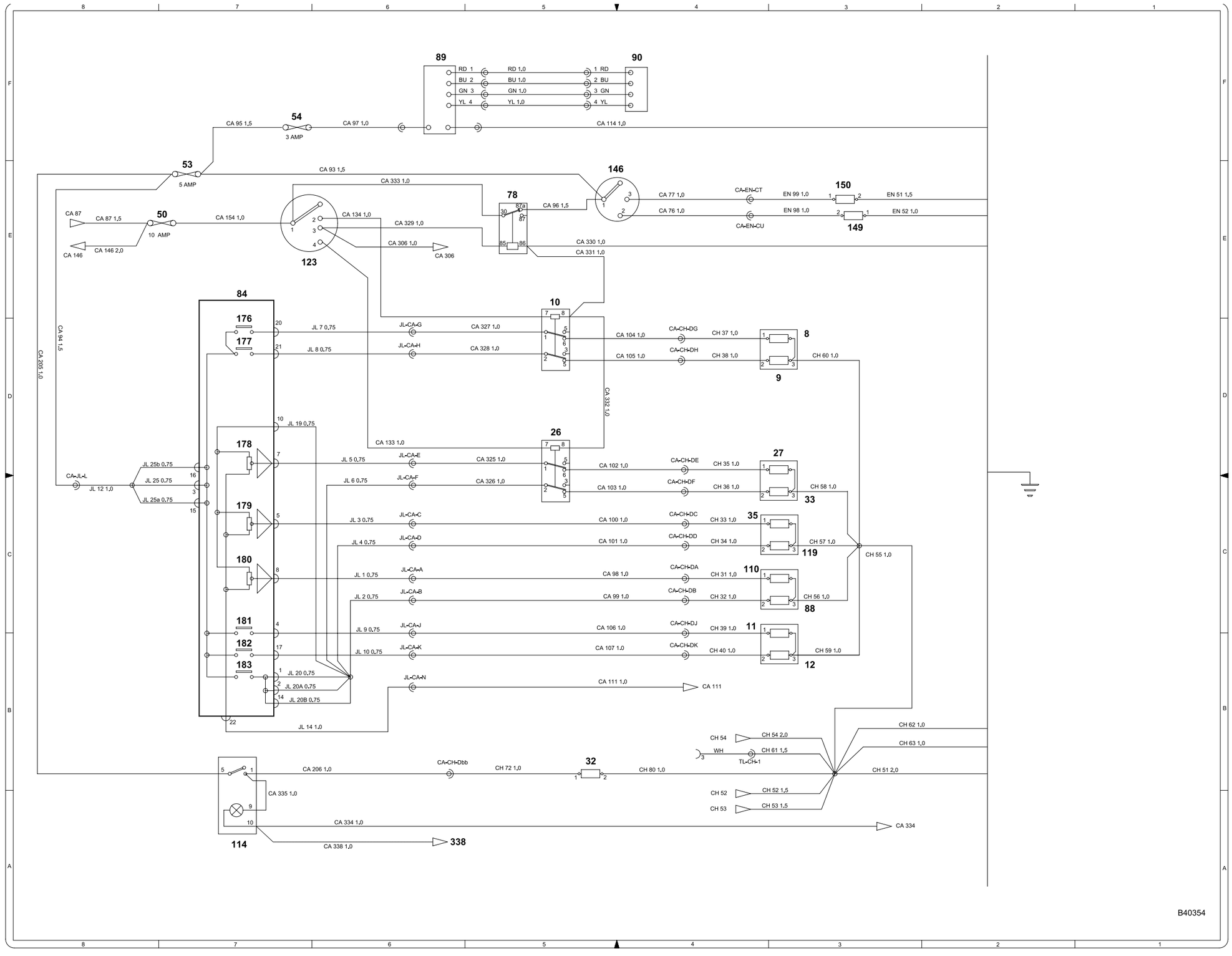
SHEET 1A - POWER GENERATION, STARTING, WITH APC



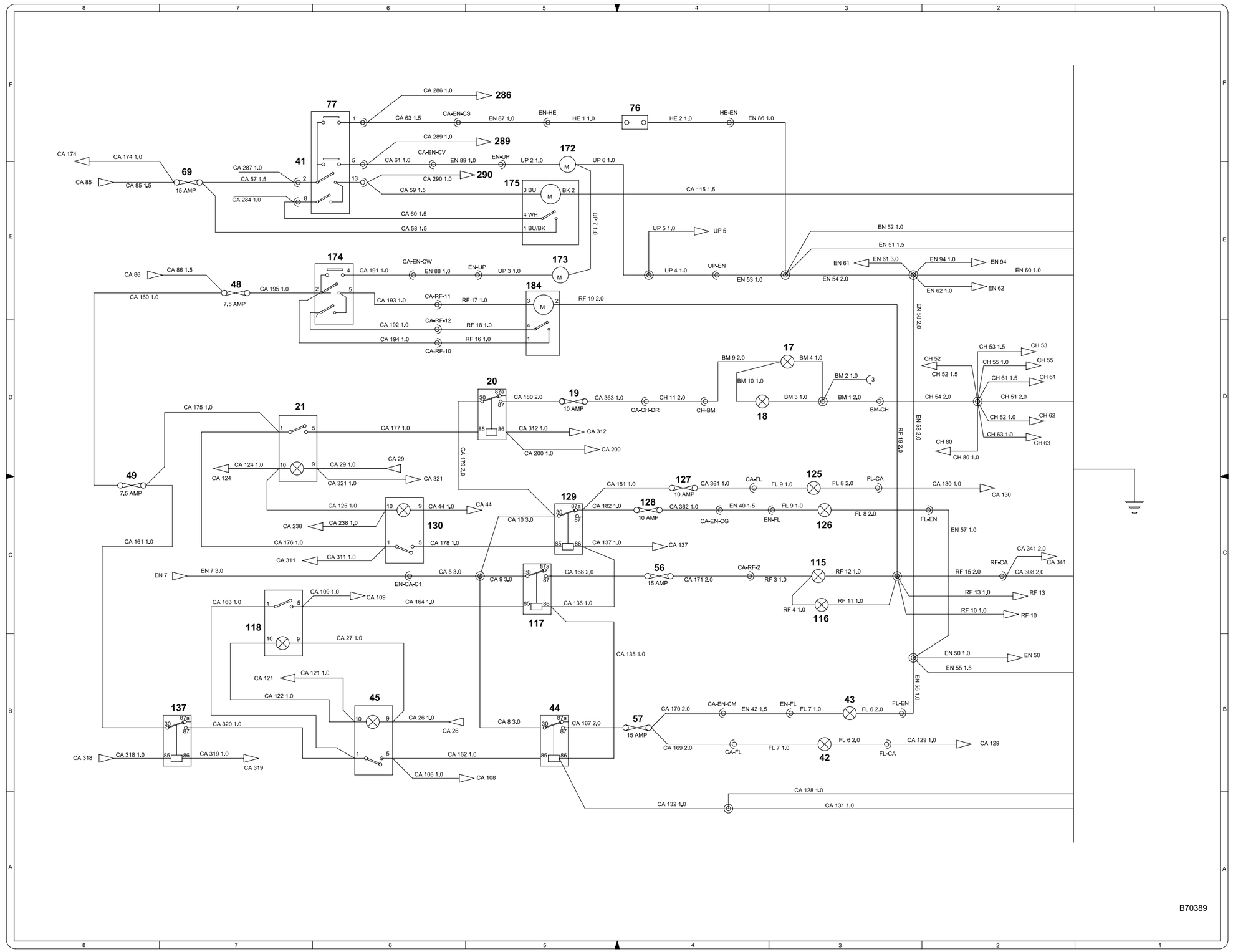
SHEET 2 - HYDRAULIC CONTROLS, STEERING CONTROL, SAFE LOAD INDICATOR, LARGE LOCKOUT RELAY 2.6



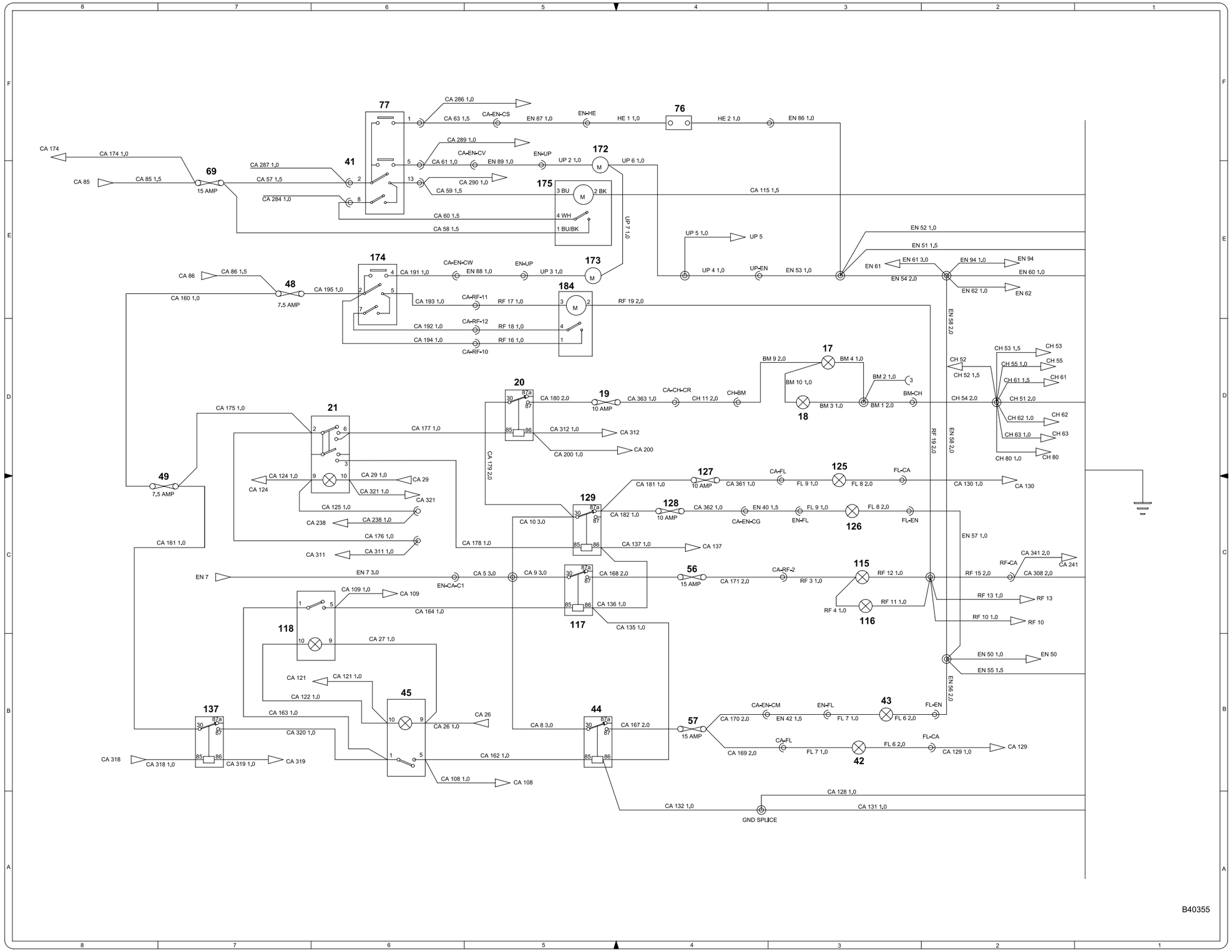
SHEET 2A - HYDRAULIC CONTROL, STEERING CONTROL, SAFE LOAD INDICATOR, MINI LOCKOUT RELAY



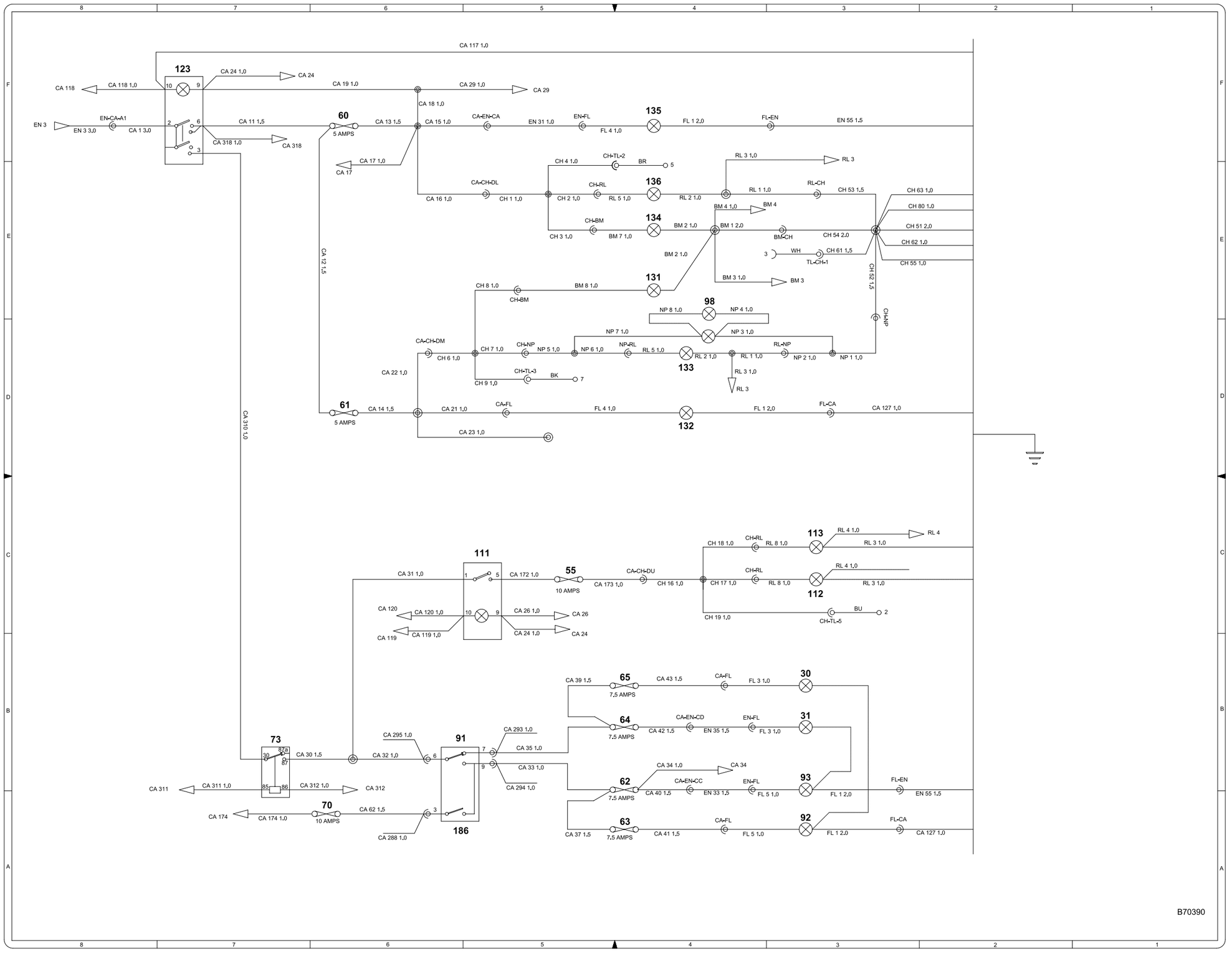
SHEET 3 - WIPERS, WASHERS, HORN, WORKLIGHTS



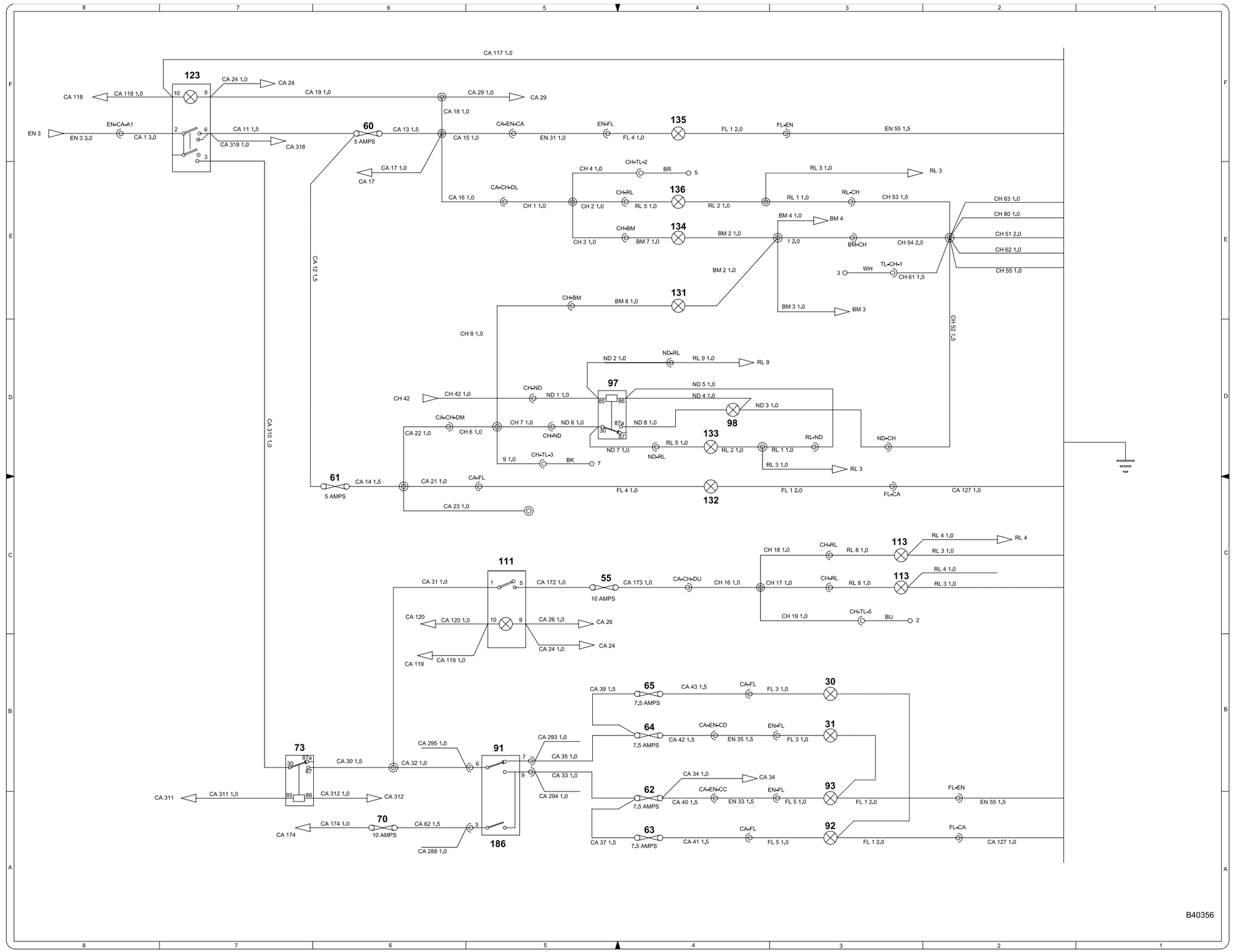
SHEET 3A - WIPERS, WASHERS, HORN, WORKLIGHTS, COMBINED BOOM/SIDE WORK LIGHTS SWITCHING 2.9



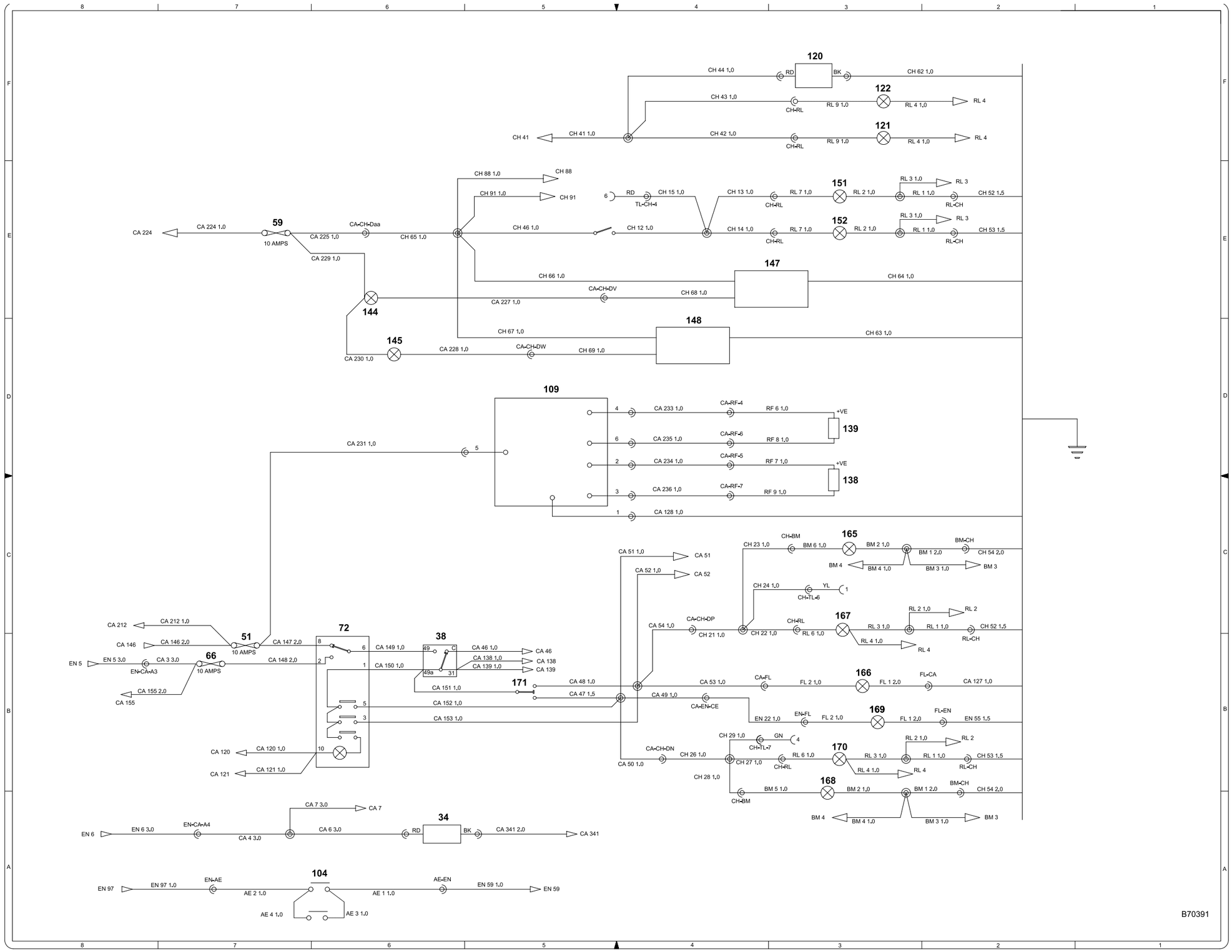
SHEET 4 - HEAD/SIDE LIGHTS, FOG LIGHTS, NUMBER PLATE LIGHTS, HEAD FLASHER



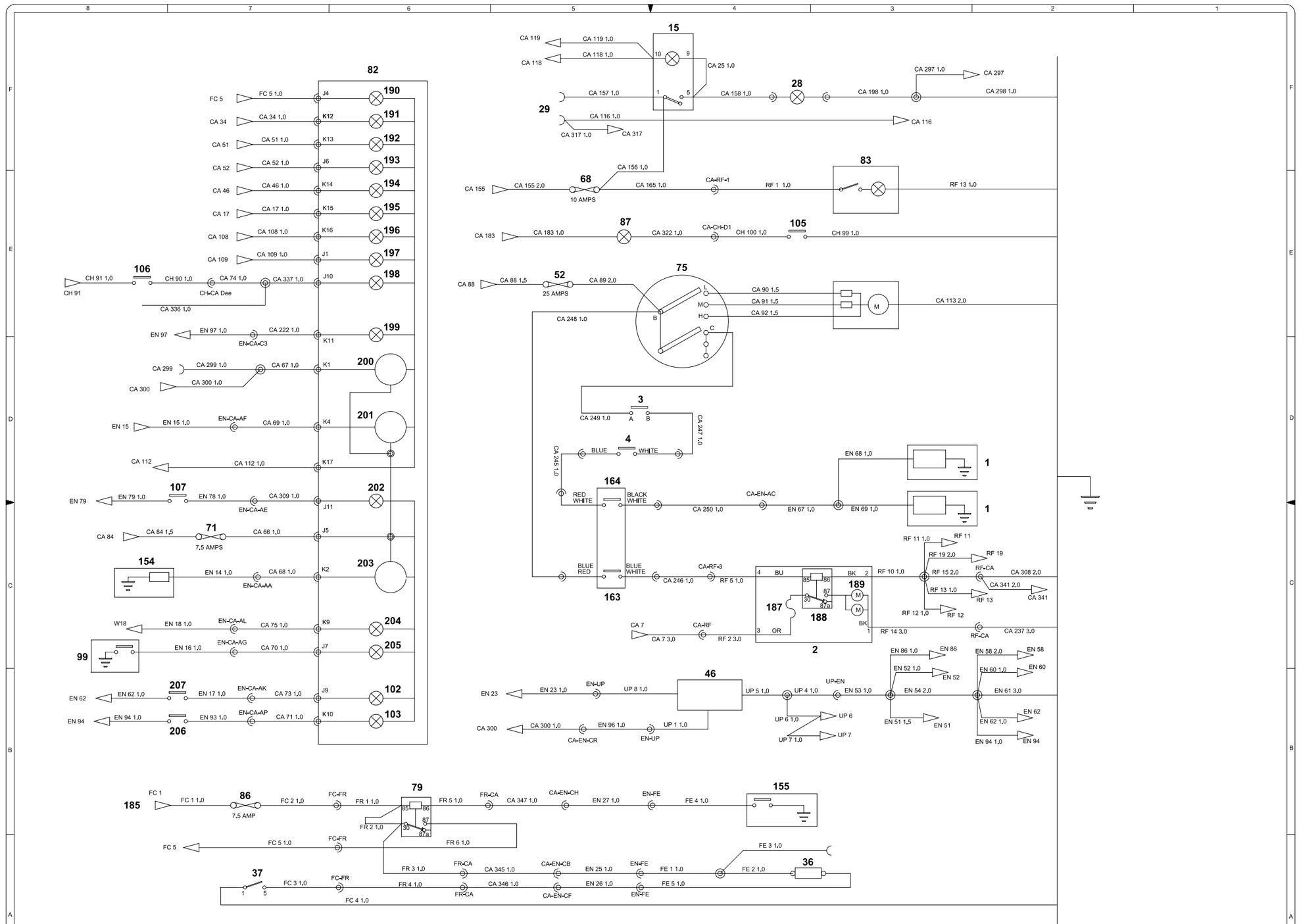
SHEET 4A - HEAD/SIDE LIGHTS, FOG LIGHTS, NUMBER PLATE LIGHTS, HEAD FLASH



SHEET 5 - TURN INDICATORS, REVERSE LAMPS, STEER SENSORS, STOP LIGHTS, RADIO



SHEET 6 - INST DISPLAY, SENSOR SWITCHES, FAN MOTOR, AIRCON, INTERIOR LIGHT, BEACON, FUEL SENDER, FAN REVERSE, HYD TEMP 2.13



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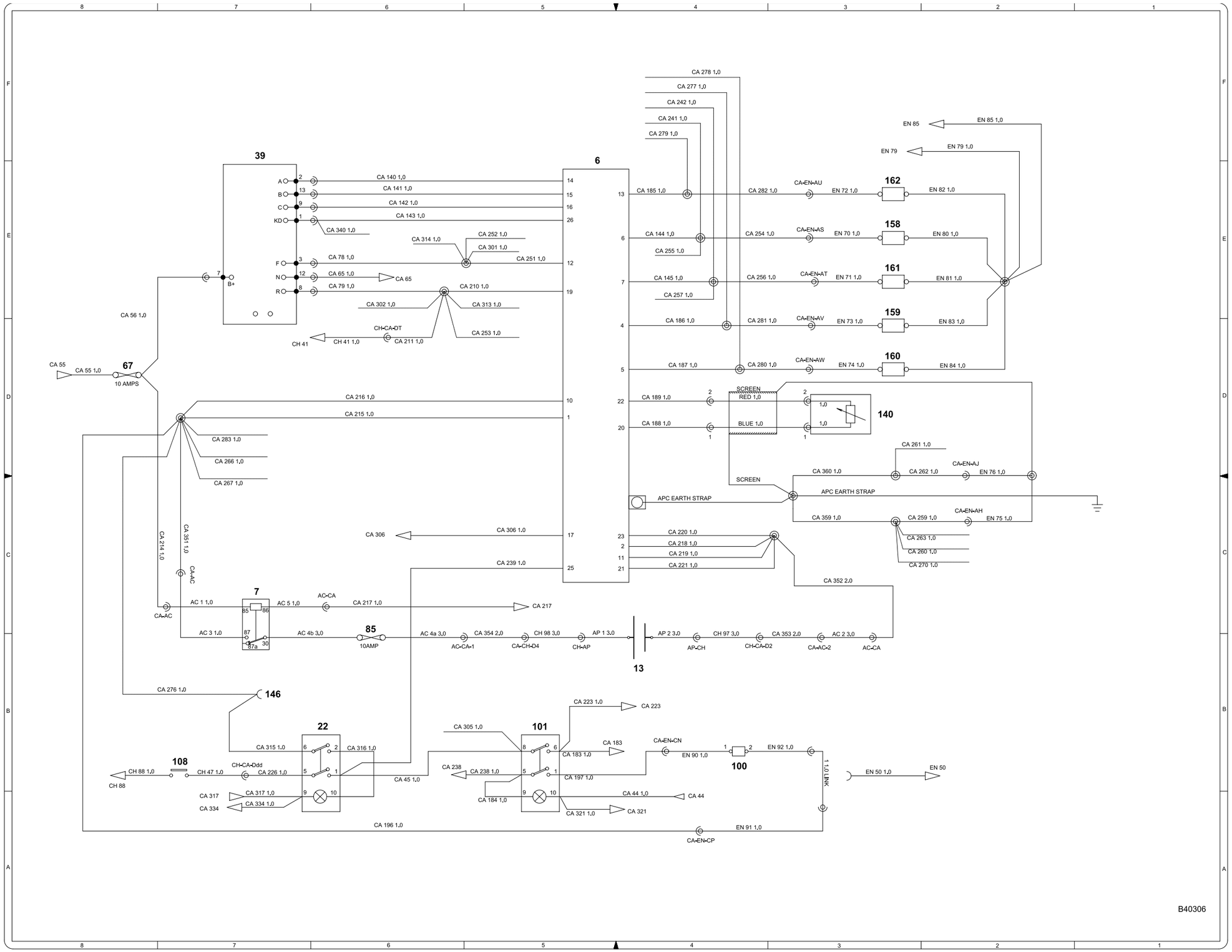
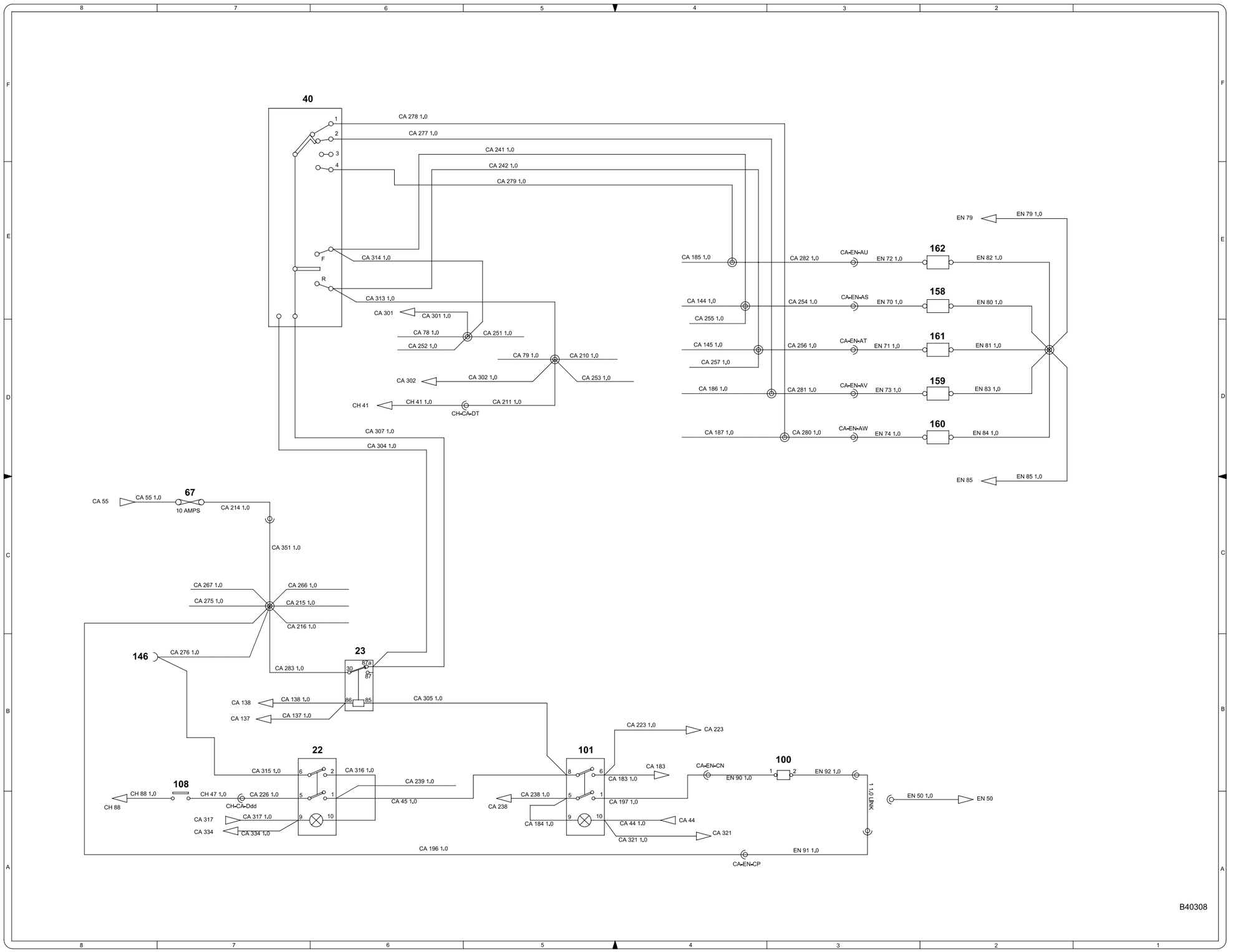
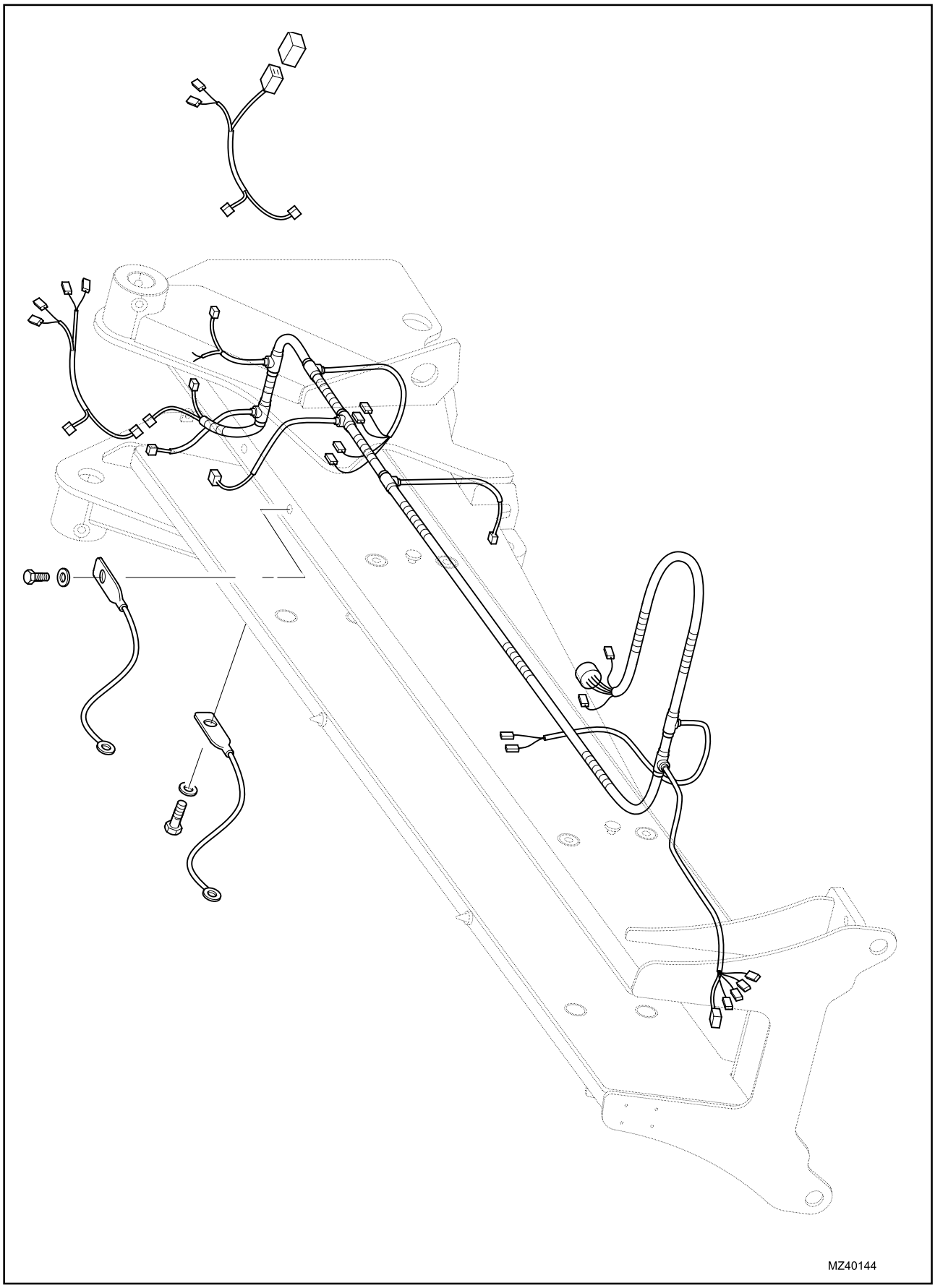
SHEET 7 - APC 50 WITH IGN CONTROLLED APC BAT FEED, SCREENED SENSOR CABLE, P/BRAKE LINK 2.14



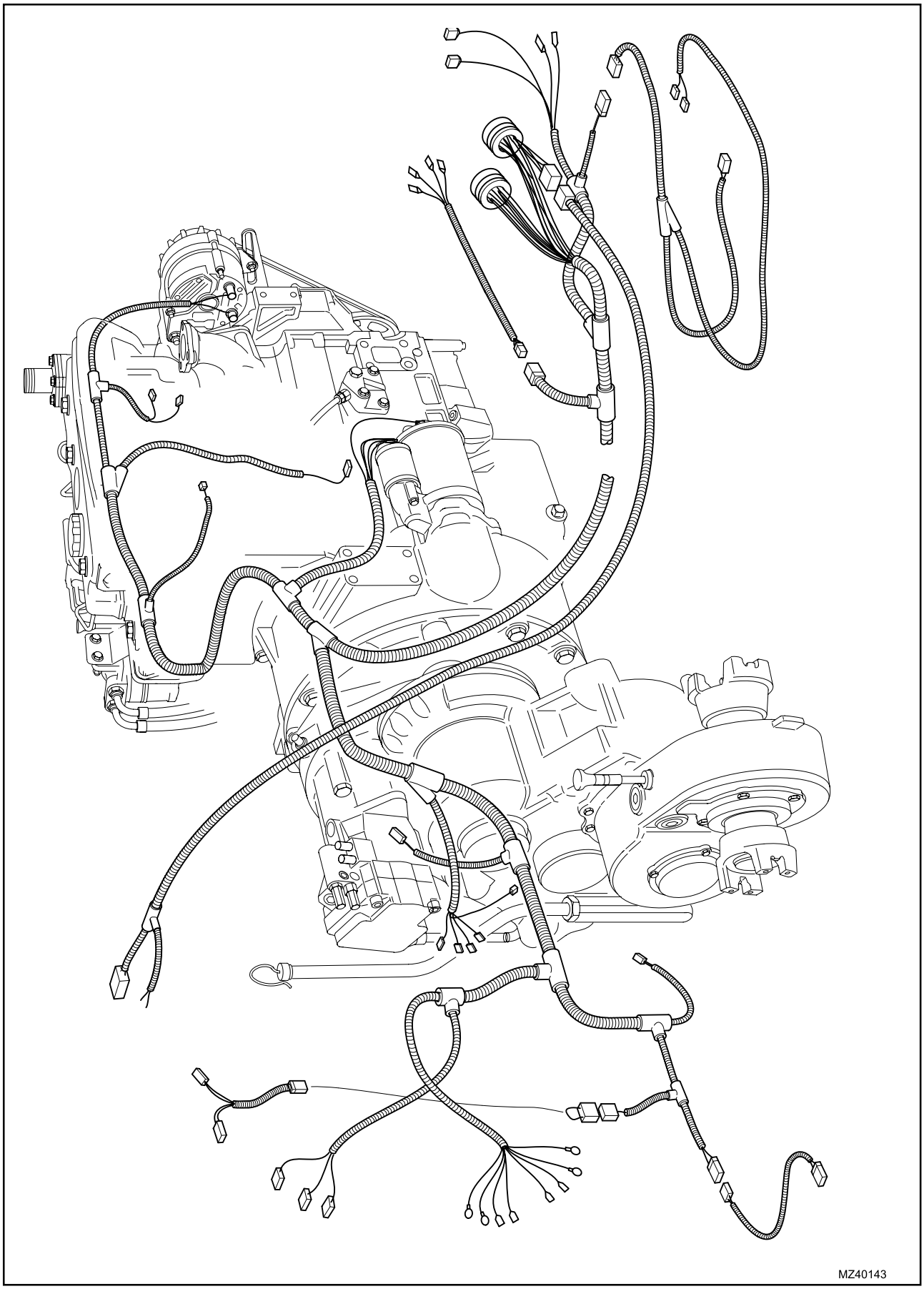
SHEET 7A - NON APC, CORRECT P/BRAKE AND TRANS DUMP, NO P/BRAKE CONTROLLER, CIRCUIT LINK 2.15



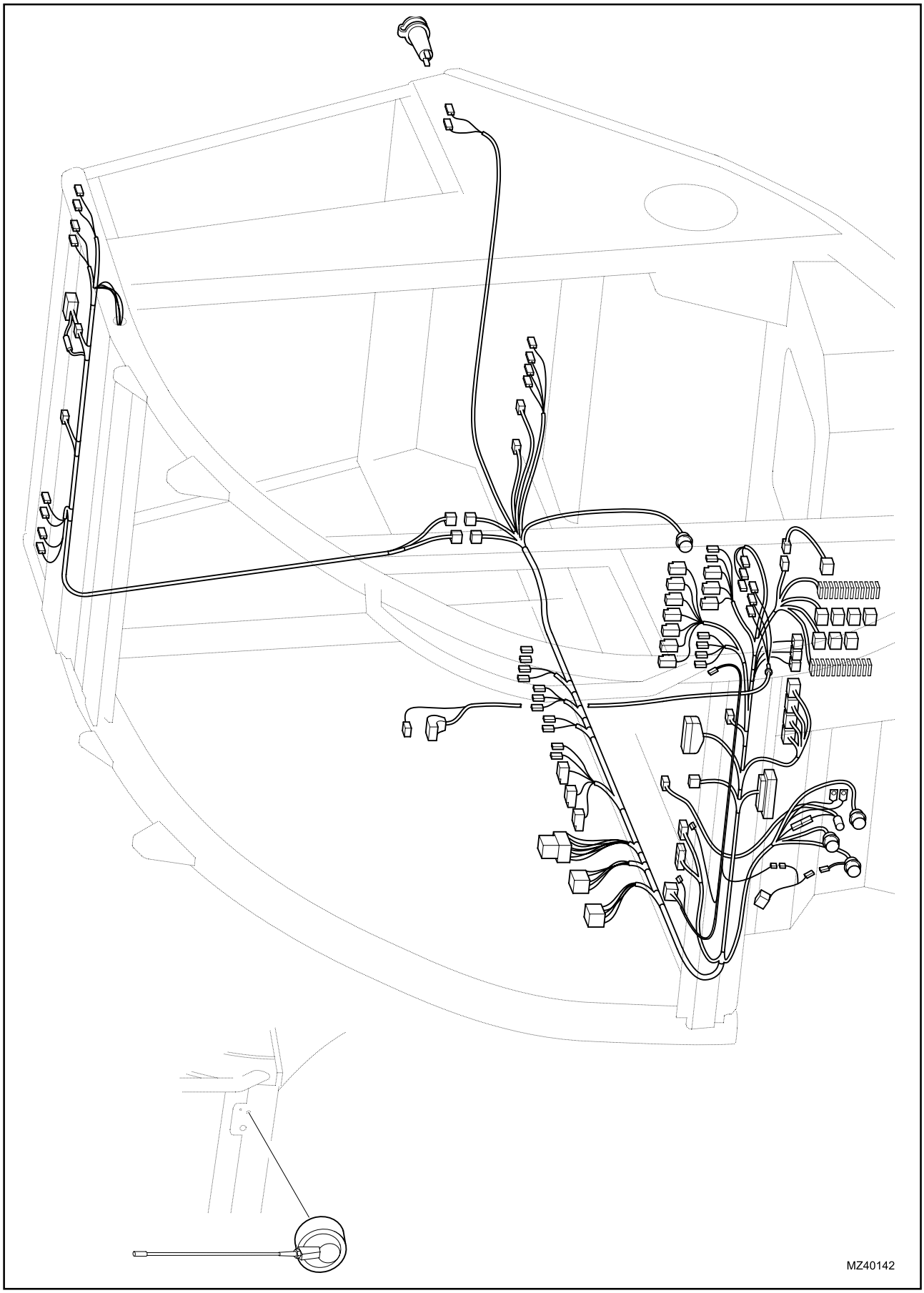
CHASSIS LOOM



ENGINE LOOM



CAB LOOM



LONGITUDINAL STABILITY INDICATOR

Description

The Longitudinal Stability Indicator (LSI) monitors the forward stability of the machine. The LSI provides audible and visual signals in order to alert the operator to the condition of a loaded machine.

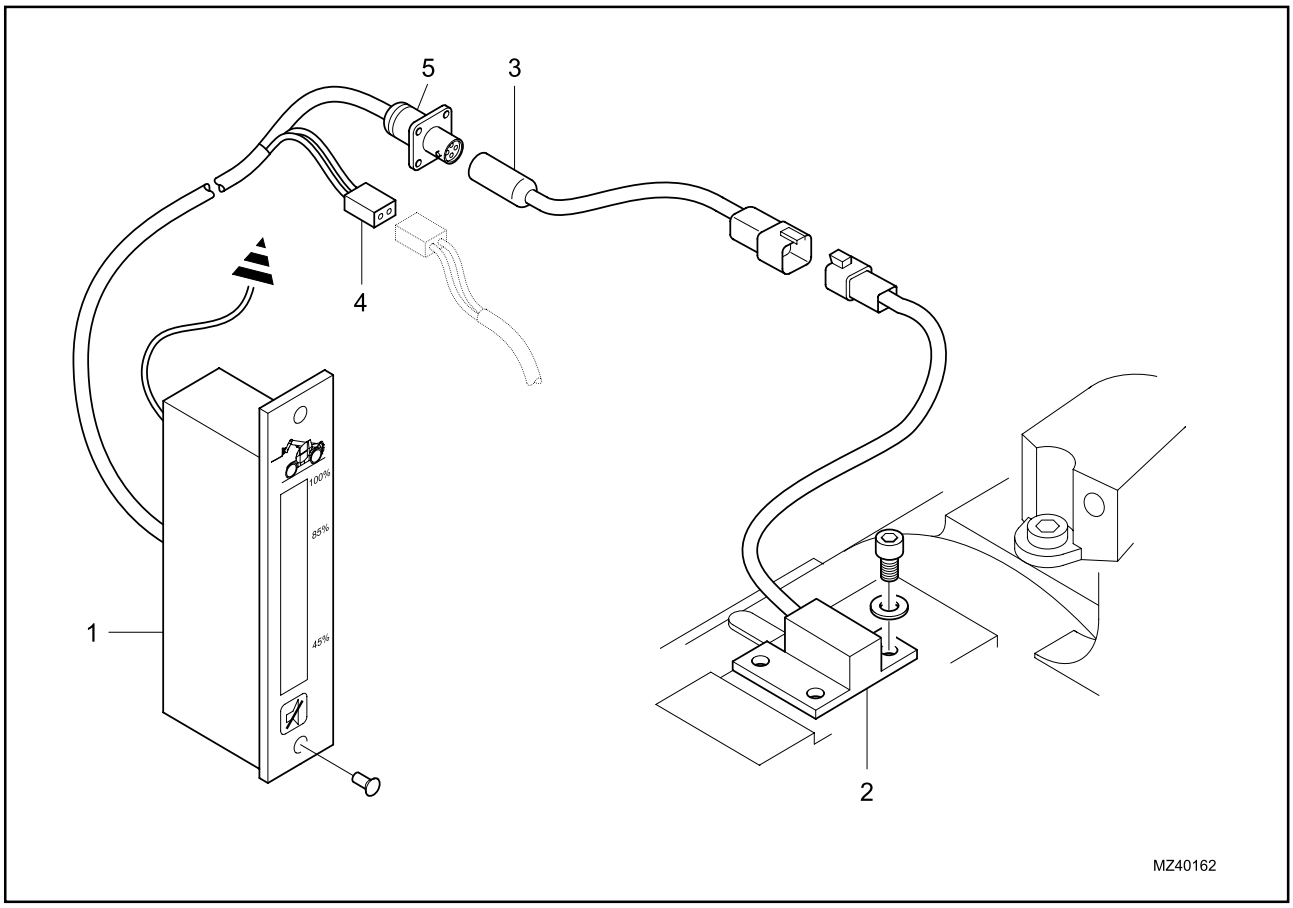
The main components of the LSI are a sensor (2) and a display module (1). The sensor is mounted on the rear axle and the display module is located inside the cab on the cab right side console. An intermediate harness (3) connects to the display module connector (5) and the sensor. The intermediate harness is routed from the space between the rear of the cab and the hydraulic control valve through the cab to the instrument panel. The LSI is powered by the machines electrical system and power is supplied to the display module through a connector (4).

The LSI is activated when the engine start switch is turned to the ON position. The sensor sends electrical signals to the display module which then provide the operator with audible and visual signals. The display module attempts to simulate the load chart for the machine.

The electrical signal that is sent from the sensor to the display module is proportional to the strain that is applied to the sensor. The sensor is subject to the same strains that are applied to the rear axle. These strains depend on the weight of the load that is carried on the work tool and the amount of boom extension.

The following power supply table shows the power supply required to operate the LSI. The current will depend on the load that is indicated on the display module (1).

Power Supply	
Nominal Voltage	12 Volts DC
Voltage Range	10.5 Volts to 15.5 Volts
Current	100mA to 300mA (1)



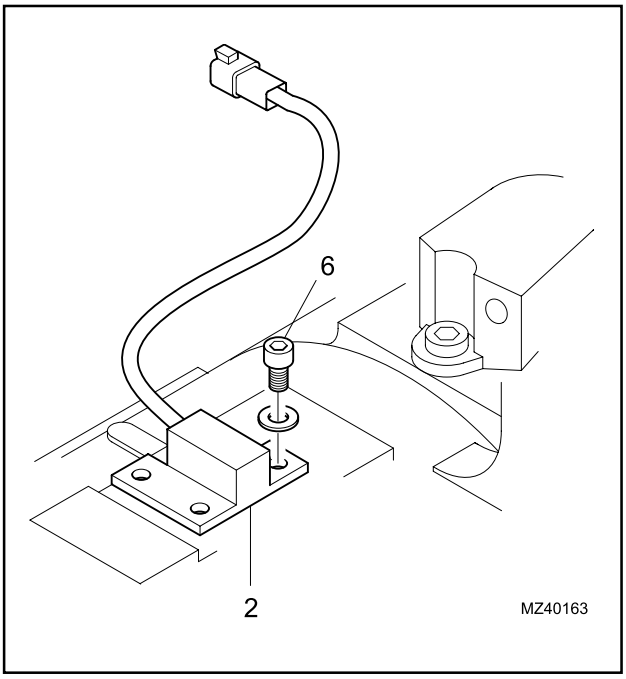
SENSOR

Specifications

Sensor		
Physical size	Length	60mm (2.4 inch)
	Width	60mm (2.4 inch)
	Height	25mm (1 inch)
Temperature range (storage)	Min	-25°C (-13°F)
	Max	75°C (167°F)
Temperature range (operating)	Min	-5°C (23°F)
	Max	75°C (167°F)
Humidity	Min	0%
	Max	100%

The sensor is a sealed unit with a wiring harness and plug attached.

The sensor (2) is bonded and secured by three bolts (6) to the top of the rear axle.



The type of sensor installed on the machine is known as a strain sensor or strain gauge. The strain sensor measures the change in electrical resistance that results from the amount of strain (stretch) that is applied to the wires in the sensor. Factors that affect the amount of strain applied to the sensor are:

1. The weight of the load that is carried on the work tool.

2. The amount of boom extension.

3. The angle of the boom.

As the electrical resistance in the sensor changes, a change in voltage is measured by the display module. As more strain is applied to the sensor, a greater change in voltage is measured.

DISPLAY MODULE

Specification

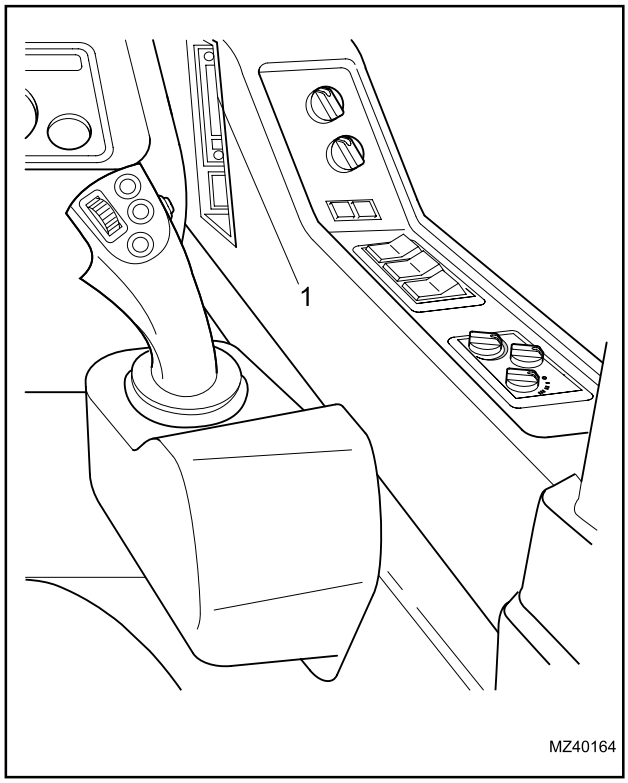
Display Module		
Physical size	Length	120mm (4.72 inch)
	Width	110mm (4.3 inch)
	Height	30mm (1.2 inch)
Temperature range (storage)	Min	-25°C (-13°F)
	Max	75°C (167°F)
Temperature range (operating)	Min	0°C (32°F)
	Max	50°C (122°F)
Humidity	Min	10% (No Moisture Condensation)
	Max	90% (No Moisture Condensation)

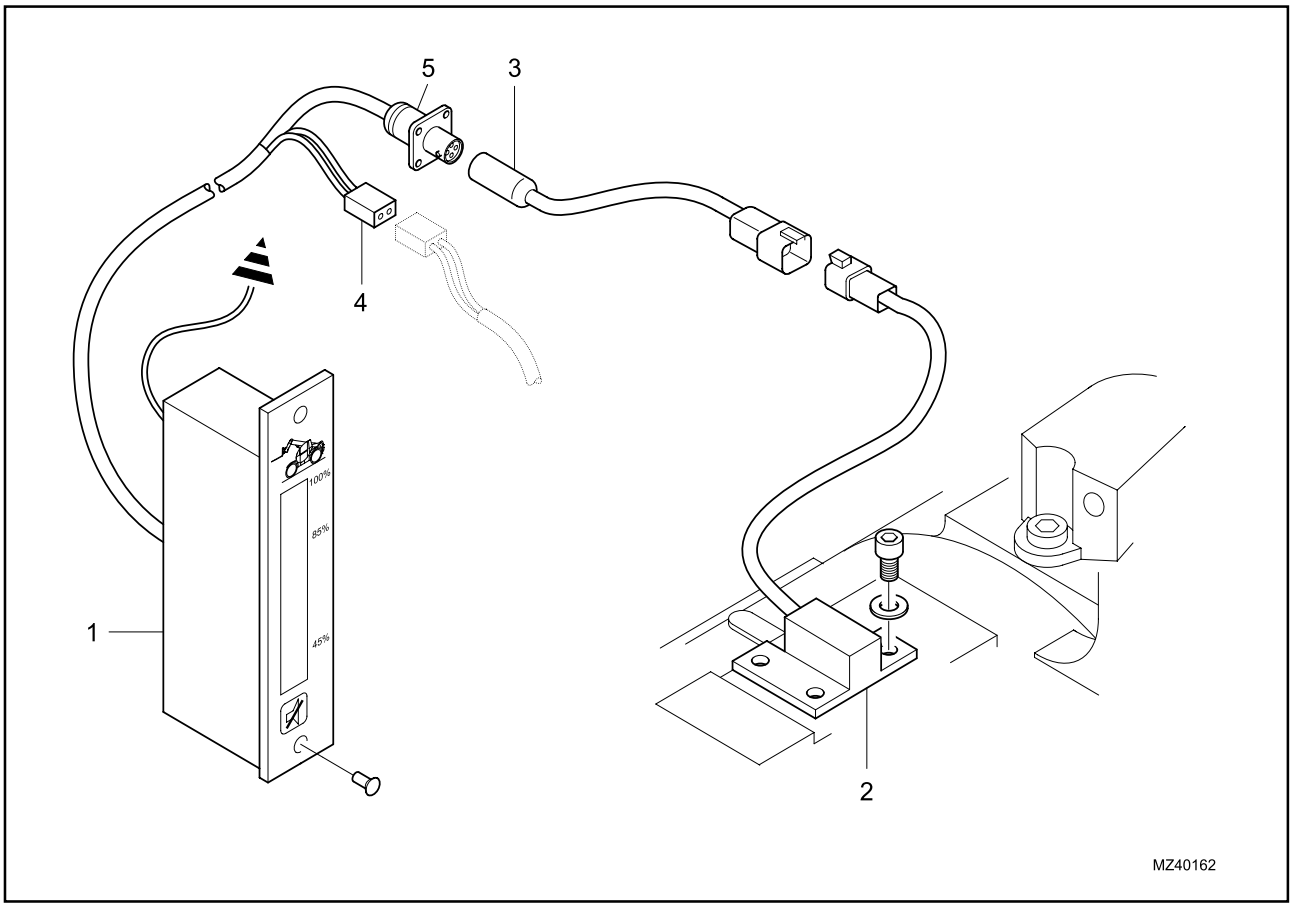
DISPLAY MODULE

The display module (1) is mounted in the cab side console on the right side of the cab. The display module provides audible and visual signals in order to alert the operator to the forward stability of the machine.

A harness with two connectors is attached to the display module. The 4-way connector (5) is used to connect the display module via an intermediate wiring harness (3), that is routed through the cab, to the harness on the sensor (2) fitted to the rear axle. The second connector (4), a 2-way version, is used to connect to the main electrical system of the machine to provide power to the LSI.

The display module measures the load from the sensor by changes in voltage. This is then calculated as a percentage value of the maximum load. Indicators are then illuminated on the panel of the display module according to the percentage value. The display module has eleven indicators.





The display module indicators and switches are listed below. The indicators and mute switch are located on the front of the display module.

Green indicator (7) shows that the LSI is receiving power and is powered up.

NOTE: The single green indicator does not indicate correct operation or guarantee calibration.

Green indicator (8) is a 50% load indicator.

Green indicator (9) is a 60% load indicator.

Green indicator (10) is a 65% load indicator.

Green indicator (11) is a 70 % load indicator.

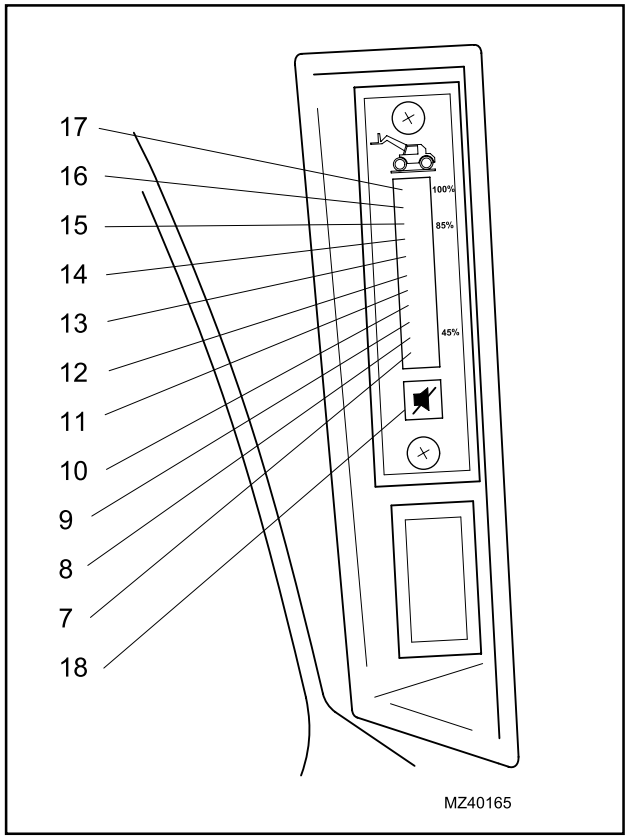
Green indicator (12) is a 75% loads indicator.

Green indicator (13) is a 80% load indicator.

Amber indicators (14) and (15) are 75% load indicators.

Red indicators (16) and (17) are 100% load indicators.

Switch (18) marked  initiates a self-diagnostic routine test for the display module and is also used to mute the alarm audible warning. It is also used for setting a zero point when calibrating the display module.

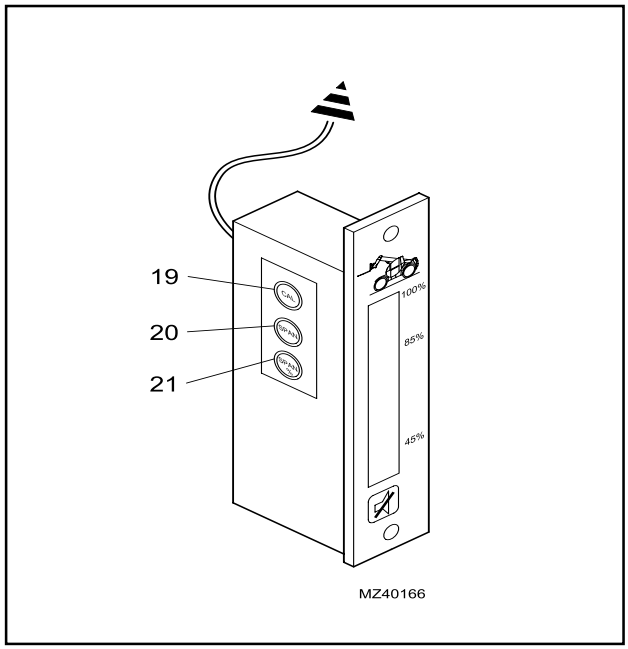


The following push buttons are located on the side of the display module.

Push button (19) is labelled “CAL”. This is an on/off switch for the calibration mode.

Push button (20) is labelled ”Span” and push button (21) is labelled “Span+%”. These push buttons are used in the calibration mode to obtain the calibration point for setting the indicators.

When the engine start switch is turned to the ON position, for the first two to three seconds, all indicators will be illuminated and the audible alarm will sound. This indicates that the display module is performing an internal self-check. When the display module has completed its internal self-check all indicators except indicator (7) will be extinguished and the audible alarm will cease. Indicator (7) will remain illuminated at all times that the system is powered up. Any error signals displayed in the first 30 seconds after power up should be disregarded.



When the load on the machine increases from 50% to 80% green indicators (8), (9), (10), (11), (12) and (13) illuminate progressively. When one or two green indicators are illuminated the lift operation is within the machine stability. When all the green indicators are illuminated the lift operation is still within the machines capability but extra caution is necessary.

When the amber indicators (14) and (15) illuminate the audible alarm sounds intermittently. This indicates that the limit for the longitudinal stability of the machine has been reached. Extra caution is necessary. **Do not increase the outreach of the load.**

When red indicators (16) and (17) are illuminated and the audible alarm sounds continuously, the limit for the longitudinal stability of the machine has been exceeded. **When this condition occurs, do not proceed with the lift operation.** To restore longitudinal stability to the machine the following steps must be carried out in this sequence.

1. Retract the boom (if boom is extended).
2. Lower boom (if boom is elevated).

TESTING AND ADJUSTMENT

Troubleshooting

Machine preparation for troubleshooting.

NOTE: Full rear wheel steering onto the axle stops can give a false reading on the display module.

The machine must be prepared correctly before attempting any troubleshooting on the system. Use the following procedure to prepare the machine.

1. Park the machine on level ground.

2. Engage the parking brake.

3. Retract the boom.

4. Lower the coupler and the work tool to the ground.

5. Stop the engine.

Visual inspection

Carry out a visual inspection of the main system components before attempting any instrument checks on the system. Use the following procedure to inspect the system.

1. Inspect the display module for damage or loose mounting.

2. Inspect the sensor on the rear axle for loose attachment bolts.

3. Inspect the sensor on the rear axle for secure bonding and signs of corrosion at the bonded surface.

4. Inspect the wiring harness, that connects the system components together, look for cuts or other damage.

System Check

NOTE: Disregard any error indications displayed during the first 30 seconds after power up.

1. Turn the engine start switch to the ON position. All the indicators will be illuminated for two to three seconds and the audible alarm will sound. This indicates that the LSI is performing an internal self-check. On completion of self-check all indicators except indicator (7) will be extinguished and the audible alarm will cease.

NOTE: If self-check is performed with a load on the boom, more than one indicator will remain illuminated.

2. Refer to the appropriate load chart. Pick up a load that is heavy enough to tip the machine when the boom is fully extended and raise the coupler 150 mm (6 in.) above the ground.

NOTE: Keep the coupler 150 mm (6 in.) above the ground.

3. Extend the boom in stages and observe the indicators on the display module. As the boom is extended indicators (8) through (13) on the display module must illuminate progressively.

4. Continue to extend the boom. As the boom approaches the point of instability, amber indicators (14) and (15) must be illuminated and the audible alarm sounds at approximately half second intervals.

5. Continue to extend the boom. As the boom extends past the point of instability, red indicators (16) and (17) illuminate and the audible alarm sounds continuously.

6. Retract the boom.

7. Press and hold  switch (18). All indicators must illuminate and the audible alarm must sound. When the  switch (18) is released the display module should return to normal operation.

NOTE: If the system does not behave as expected there may be a fault or the system could require calibration. Refer to section headed “Calibration”.

Error indications from the display module

• If none of the indicators are illuminated the display module may not be receiving power. Alternatively an internal protection device may have operated due to a fault in the system. Unplug the power connector(4) for the display module and check the power supply. If there is power to the module and the fault persists install a new display module. Refer to section headed “Display module - Replace” for the procedure.

• If indicator (7) is flashing quickly and indicator (10) and (11) are illuminated, the output from the sensor may be negative. The output from the sensor may be more than 100% of the load range. If so the system requires calibration. Refer to section headed “Calibration”.

• If indicators (8), (9), (10), (11), (12) and (13) flash slowly there is a fault in the display module. Replace the display module. Refer to section headed “Display module - Replace” for the procedure.

• If all the indicators are flashing slowly except indicator (7), which is flashing quickly, the sensor may be damaged or disconnected. Check the connection to the sensor. Check the operation of the sensor using a spare sensor. If necessary replace the damaged sensor and calibrate the system. Refer to sections headed “Sensor Test” and “Calibration” for the procedure.

• If the audible alarm sounds continuously and the machine is not overloaded the display module is not calibrated correctly. Also if all the indicators are illuminated and the machine is not overloaded the display module is not calibrated correctly. Refer to section headed “Calibration” for the procedure.

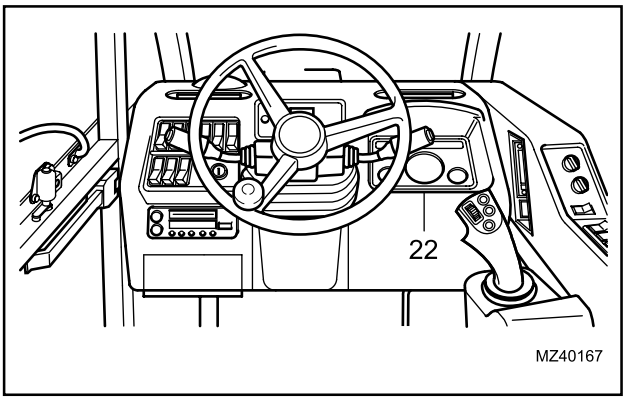
Sensor - Test

General

The sensor is bonded to the centre of the rear axle of the machine. Problems that are associated with the sensor are usually due to a break in the electrical circuit or failure of the adhesive that bonds the sensor to the rear axle.

A break in the electrical circuit usually results in all the indicators on the display module flashing slowly except indicator (7) which will flash quickly. The audible alarm will also sound intermittently.

A failure of the adhesive that bonds the sensor to the rear axle usually results in no readout or erratic readout from the display module.



Procedure to test the operation of the sensor

1. Park machine on level ground.

2. Engage parking brake

3. Fully retracted boom.

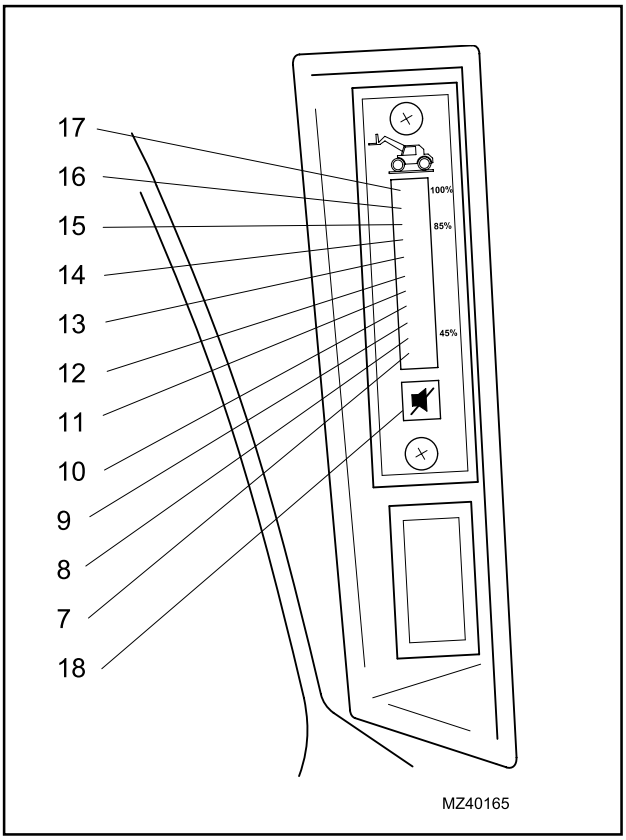
4. Fully lower boom.

5. If fitted, remove work tool from coupler.

6. Ensure wheels are set to straight ahead.

7. Stop the engine.

8. Turn engine start switch to ON position. The display module in the cab will perform a self-check.
On completion of self-check only green indicator (7) should be illuminated.



If indicators (8) to (17) are flashing slowly and indicator (7) is flashing quickly the sensor may be damaged or disconnected.

(a) Check the two connections to the sensor. One of the connectors is located behind instrument panel (22). The other connection is located between the rear of the cab and the hydraulic control valve. This connects the harness for the sensor to the intermediate harness which is routed through the cab.

(b) Test the operation of the sensor by substituting a spare sensor. If necessary replace the sensor. Refer to “Procedure to install sensor”.

If indicator (7) is flashing quickly and indicators (10) and (11) are illuminated, the output from the sensor may be negative. (The output of the sensor may be more than 100% of the load range). Refer to “Calibration procedure” and calibrate the system.

If the display module does not comply with any of the previous steps in this procedure, the problem may not be with the sensor. Refer to “Testing and Adjustment - System Check” for further information.

Procedure to install a sensor

The sensor has three pads which are bonded and bolted to the rear axle.

NOTES: (1) When bolted to the rear axle the elements of the sensor must not be twisted or stretched. If the elements are twisted or stretched an offset will be applied to the sensor.
(2) When bonding sensor to rear axle ensure matting surfaces are free from dirt, grease and any other contamination. A poor bond will affect the performance of the system.

Adhesive (154-8875) and activator (154-8876) are required to install the sensor to the rear axle.

The procedure to install the sensor is as follows.

1. Disconnect the connector that attaches the sensor to the intermediate harness. Remove any cable straps that secure the sensor harness.

2. Remove the three bolts that secure the sensor to the rear axle and remove the sensor.

3. Thoroughly clean the surface area on the rear axle where the sensor is to be mounted. All traces of adhesive must be removed. Remove all traces of paint and corrosion. Use a suitable cleaning agent to remove the main debris and degrease the surface.

4. Ensure the area is thoroughly degreased and dry with a suitable clean cloth.

5. Prepare the new sensor for fitting. Remove any protective coating and thoroughly clean the mating surface of the sensor.

6. Hold the sensor to the axle and check the alignment of the three bolt holes. Loosely install the three bolts and check that the sensor is not pre-stressed by the bolts.

7. Remove the bolts and sensor.

8. Ensure the area is still clean and apply a thin film of activator (154-8876) to the surface area of the axle where the sensor is to be mounted.

9. Apply a thin film of adhesive (154-8875) to the mounting surface of the sensor.

10. Install the sensor onto the axle and secure with the three bolts. Tighten the three bolts in the following sequence.

(i) Tighten each bolt finger tight.

(ii) Tighten each bolt to a torque setting of 10 Nm (7.5lbf/ft.).

(iii) Tighten each bolt to a torque setting of 20 Nm (14.75lbf/ft.).

(iv) Tighten each bolts to a torque setting of 30 Nm (22lbf/ft.).

11. Connect the sensor harness to the intermediate harness. If necessary secure with cable straps.

12. Allow a minimum of four hours for the adhesive to cure. Refer to the instructions for the specific adhesive.

13. When adhesive is thoroughly cured, refer to “Calibration procedure” and calibrate system.

Procedure to replace the Display Module

The display module cannot be repaired. If faulty it must be replaced with a new part.

The procedure to install a new display module is as follows.

1. Remove the two screws (23) that secure the display module (1) to the cab side console on the right side of the cab.

2. Remove the instrument panel (22).

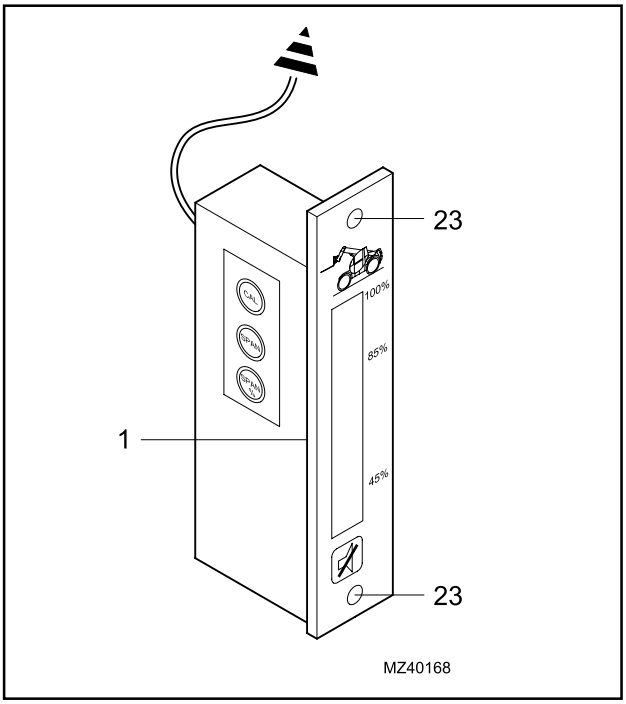
3. Use the hole for the instrument panel in order to locate connector (4) for the power supply and connector (5) for the sensor. Trace the harness from the display module in order to identify the connectors.

4. Disconnect connectors (4) and (5).

5. Remove the display module, with attached harness and connectors, from the cab side console.

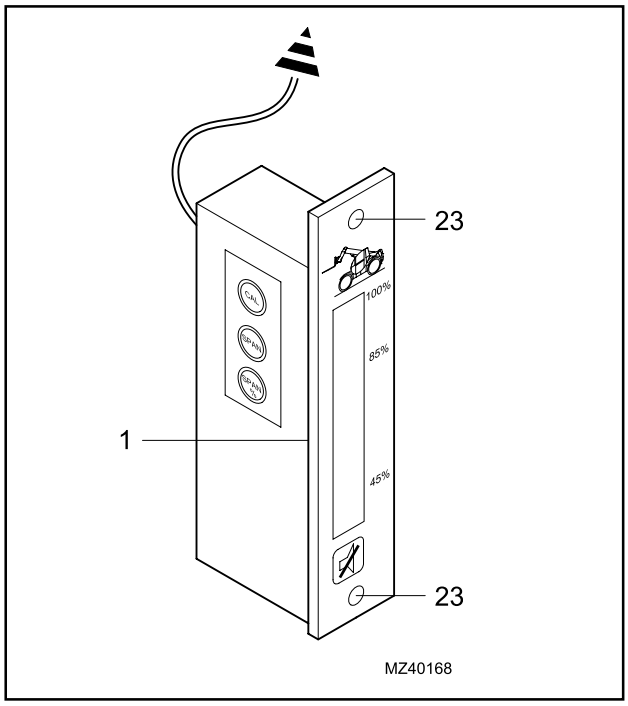
6. Install a new display module into the cab side console. Connect the harness to the power supply and to the sensor with connectors (4) and (5).

7. Reinstall the instrument panel.



8. Install two screws (23) in order to secure the display module to cab side console.

9. Refer to “Calibration procedure” and calibrate system.



Calibration

When a new sensor has been installed, or when a new display module has been installed, the LSI system must be calibrated.

When the system is calibrated, a zero point for the load is first set. The zero point is set when the boom coupler has no load fitted and the boom is lowered and fully retracted. A load is then fitted to the boom coupler and the 100% calibration point is set. Push buttons (19), (20) and (21) on the display module are used to set the calibration points.

Calibration procedure

Use the following procedure to set the zero and 100% calibration points:

Before proceeding with the calibration set up, ensure the following conditions are met:

1. The machine is parked on level ground.

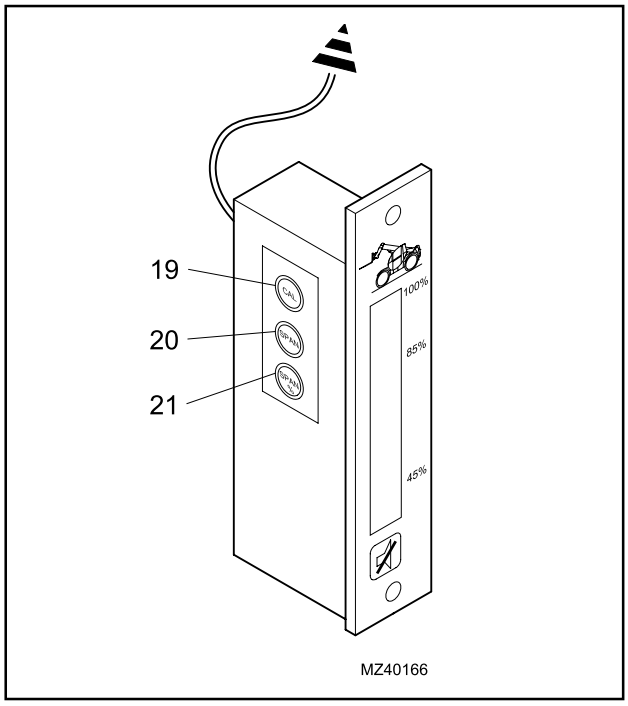
2. Wheels are steered to the straight ahead position.

3. The boom is fully retracted.

4. The bottom of the coupler is 150 mm (6in.) above the ground.

5. A work tool is not installed on the coupler.

6. The engine is running and the parking brake is applied.



The calibration procedure is as follows:

1. Remove the display module (1) from the cab side console in order to gain access to the push buttons (19), (20) and (21) that are required to calibrate the LSI. Refer to “Procedure to replace the display module” for further information.

2. Briefly press the push button (19) marked “CAL” and release. This action will put the display module in the calibrate mode. Green indicator (7) and red indicator (16) should start to flash quickly.

NOTE: If the display module is in the calibrate mode and push button (19) is pressed, the display module will return to the normal operate mode.

3. Wait approximately 15 seconds. Briefly press the push button (18) marked  and release. This will store the current load as the zero calibration point. Green indicator (7) must illuminate for two to three seconds. Also the audible alarm must sound once to indicate that the correct zero calibration point has been set. The display module should then revert to the calibration mode. The green indicator (7) and the red indicator (16) must flash quickly.

NOTE: When the zero calibration point is set, the 100% calibration point is set to a low value. This will cause the audible alarm to sound continuously if the 100% calibration point is not set in the following steps of this procedure.

4. Pick up an appropriate work tool. The work tool must be of the type that will allow a load heavy enough to tip the machine forward.

5. Refer to the appropriate load chart. Pick up a load.

NOTE: The load must be heavy enough to just tip the machine when the boom is fully extended in order to obtain the correct calibration.

6. Extend the boom. Keep the bottom of the coupler 150 mm (6in.) above the ground. Continue to extend the boom until the machine tips forward. The rear wheels must be just off the ground.

7. Wait approximately 15 seconds until the machine is not rocking.

NOTE: The machine must not be rocking or vibrating.

8. Press the push button (21) marked “SPAN+%” and release. A value of 100% is then set. This is calculated from the current load which is assumed to be 110%. Only the red indicator (17) must illuminate for approximately two to three seconds. Also the audible alarm must sound three times. After these warnings the display module should revert to the calibrate mode. Green indicator (7) and red indicator (16) must flash.

9. Press the push button (19) marked “CAL” and release. The action will return the display module to the normal operating mode. Green indicator (7) and red indicator (16) will stop flashing. If 100% load is still applied, all indicators will illuminate and the audible alarm will sound. Calibration of the system is now complete.

10. Retract the boom. The rear wheels will come back into contact with the ground. Leave the load in place on the work tool.

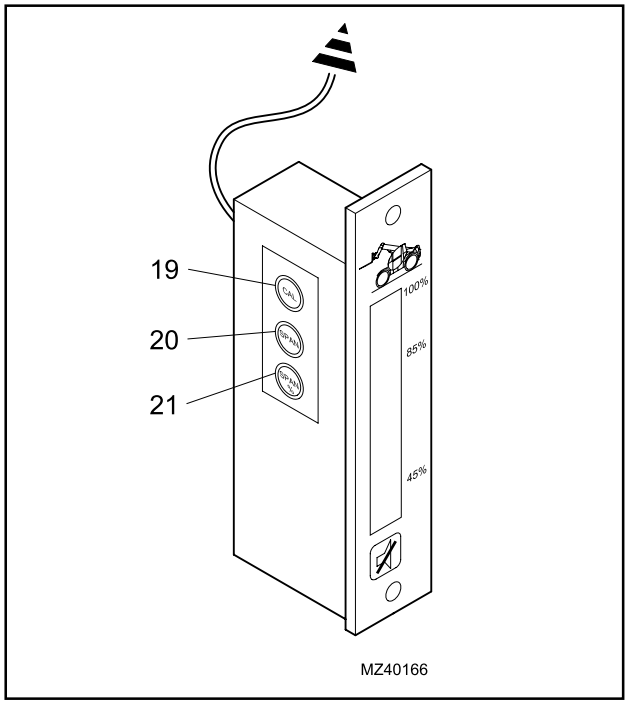
11. Carefully extend and retract the boom whilst observing the display module. Ensure that the display module gives the readings that are expected. Refer to “Description - Display module”.

12. Set down the load and disengage from the work tool.

13. Retract the boom. Lower the work tool to the ground and stop the engine. Turn engine start switch to OFF position.

Resetting the zero point

If it is necessary to readjust the zero point without resetting the 100% calibration point, perform the following procedure.



Before proceeding with the calibration set up ensure the following conditions are met:

1. The machine is parked on level ground.

2. Wheels are steered to the straight ahead position.

3. The boom is fully retracted.

4. The bottom of the coupler is 150 mm (6 in.) above the ground.

5. A work tool is not installed on the coupler.

6. The engine is running and the parking brake is applied.

The calibration procedure is as follows:

1. Remove the display module (1) from the cab side console in order to gain access to the push buttons (19), (20) and (21) that are required to calibrate the LSI. Refer to “Procedure to replace the display module” for further information.

2. Ensure the display module is in the normal operating mode.

3. Press the push button (20) marked “SPAN” and hold pressed. Only the green indicator (7) must flash.

4. At the same time press the  button (18) on the display module. Green indicator (7) must illuminate continuously for two to three seconds and the audible alarm must sound once. Green indicator (7) must then start to flash again. The zero setting has now been reset, but the 100% calibration point has remained unchanged.

5. Stop the engine. Turn engine start switch to the OFF position.

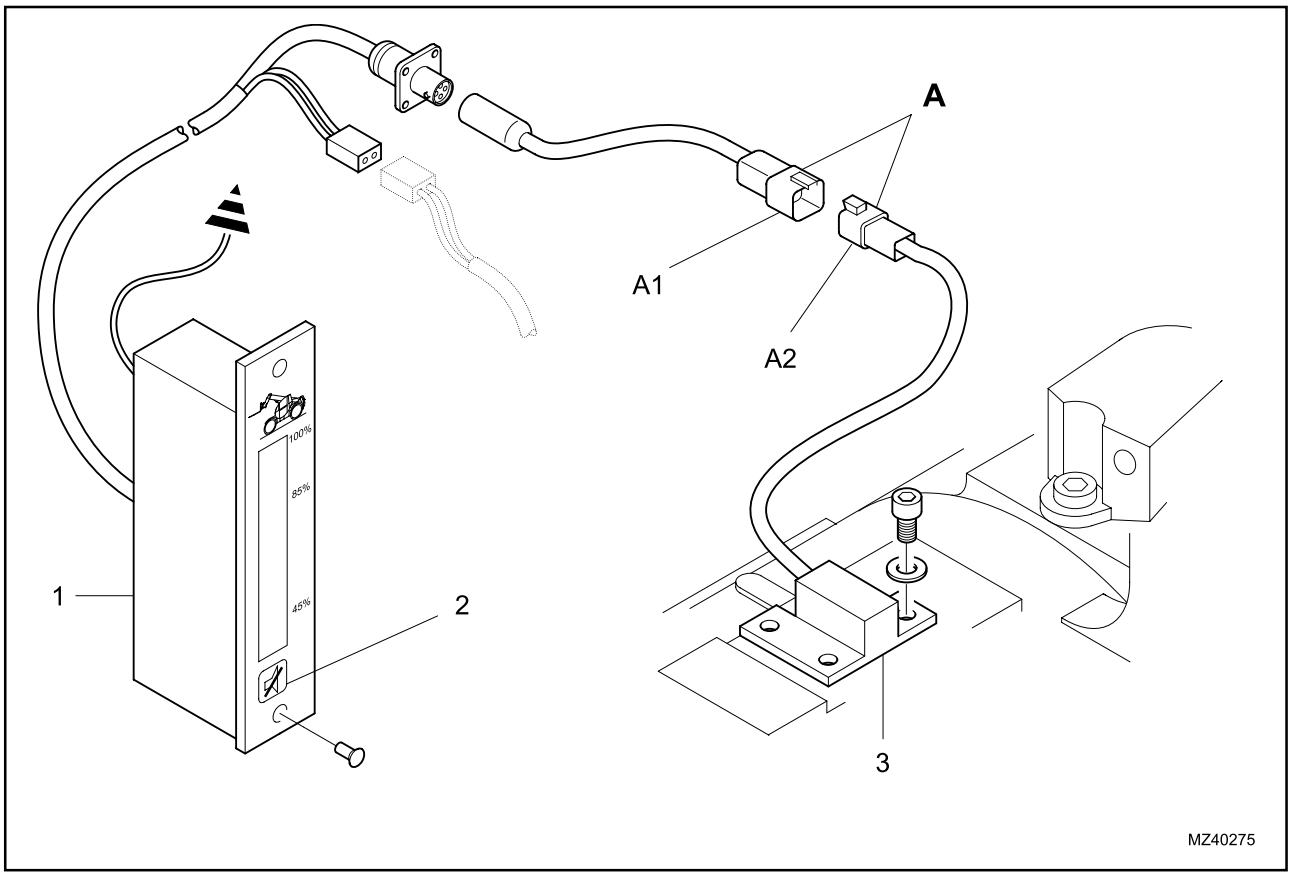
Testing Load Sensor Function

Functional test of Load Sensor Indicator

1. Switch on ignition.

2. Switch on the road travel switch on and ensure the bottom light of the indicator comes on.

3. Press test switch (2) on the display module (1), ensure all lights come on and buzzer is heard.



1	Longitudinal stability indicator	A	Load sensor connector A
2	Test switch	A1	Machine harness connector
3	Load Sensor (155)	A2	Load sensor cable connector

Procedure

4. Drive the machine for approximately 15 minutes so that axle reaches normal operating temperature.

5. Stop the machine in the following condition:

- On straight and level ground
- With all wheels straight ahead
- Ensure parking brake released
- With the boom pivot point and the carriage pivot point at the same height
- With the boom fully retracted
- Ensure forks and front attachments removed.

6. Disconnect load sensor electrical connector (A) on rear axle.

7. Using a multimeter set to mV and test probes Part No. 365 747.0, connect test probes to pins 3 and 4 of connector (A2).

Green cable (pin 3) = + signal voltage
Yellow cable (pin 4) = - signal voltage

8. Switch on the ignition and the main hydraulic switch.

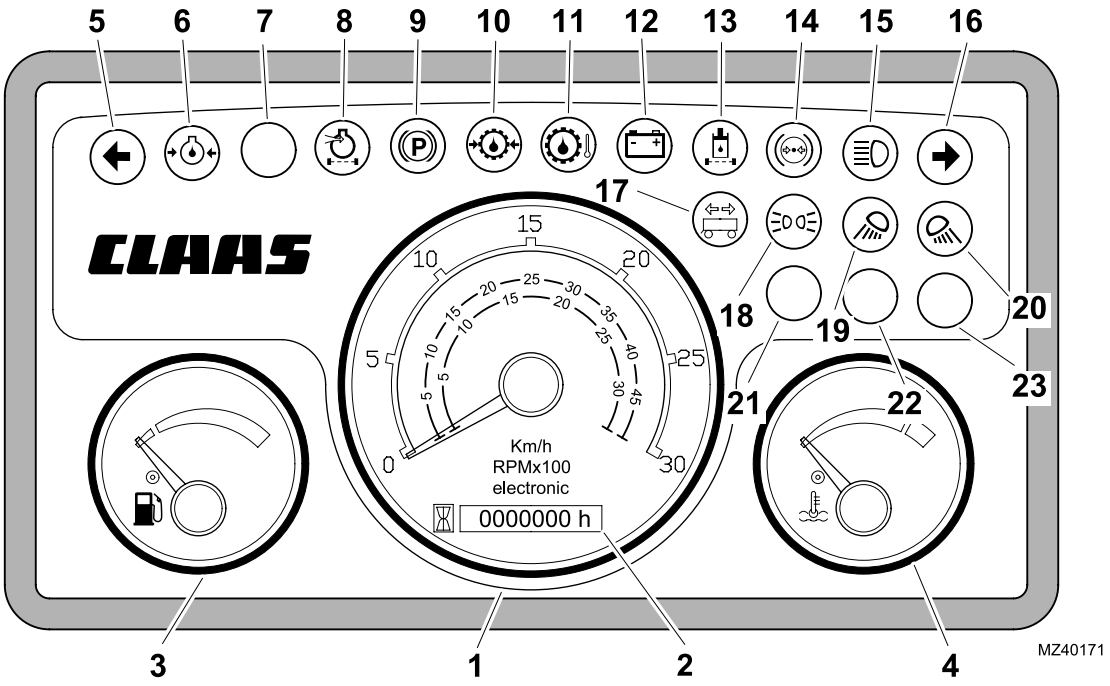
9. Carry out the following tests:

- Test the reading when the machine is not loaded
- Test the reading when the machine is at maximum permissible weight (test weight)
- The reading should be approximately 1.5 - 2.0 mV less at maximum permissible weight than when not loaded.

NOTE: The reading can indicate a negative value.

MAIN INSTRUMENT PANEL

Description



1. Tachometer
2. Hour meter
3. Fuel gauge
4. Engine coolant temperature gauge
5. Direction indicator light (left)
6. Engine oil pressure light
7. Spare
8. Air cleaner filter blockage light
9. Parking brake warning light
10. Transmission oil pressure warning light
11. Transmission oil temperature warning light
12. Battery charge indicator light
13. Hydraulic filter blockage warning light
14 Power brake pressure warning light
15. Headlight main beam warning light
16. Direction indicator light (right)
17. Trailer turn indicator light
18. Road light indicator light (where used)
19. Front work lights indicator light (where used)
20. Rear work lights indicator light (where used)
21. Spare
22. Spare
23. Hydraulic fluid temperature (from machine S/No.51200472 only)

The main instrument panel is located in the cab to the right of the steering wheel.

Removal

The panel is located in facia by snap conectors. Hold bezel of panel with fingertips and pull out of facia.

Installation

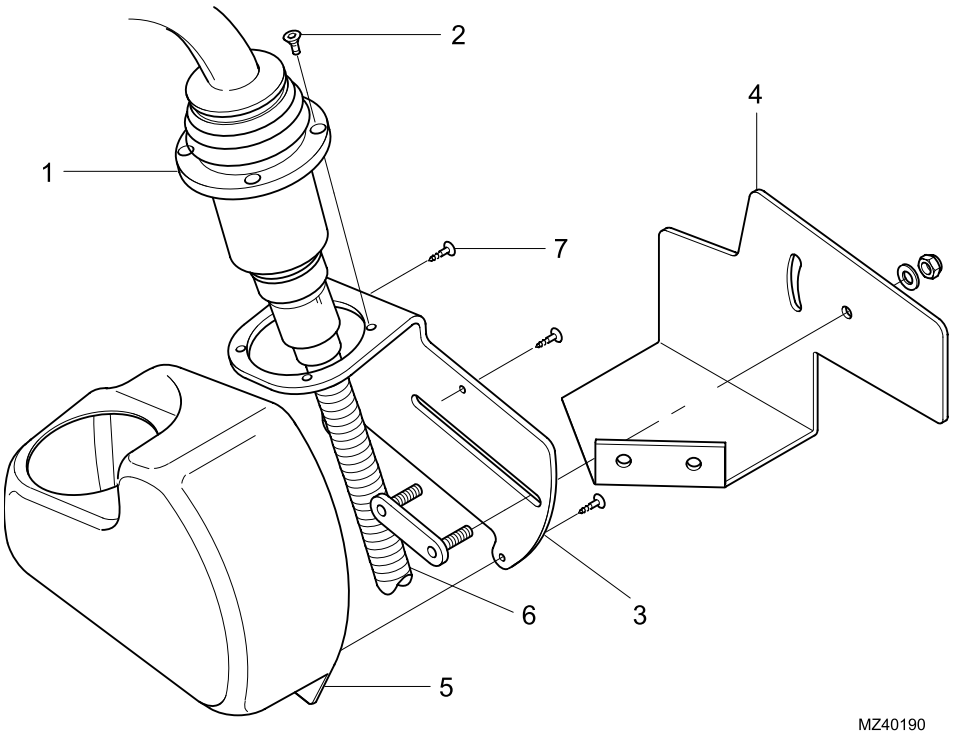
Align panel and push into facia.

Functional Description

Ident No.	Description	Operation
1.	Tachometer	Measures engine rpm - Low idle 975 - Off load 2450 - Torque stall 2100 ± 50. The inner scale measures approximate road speed, this is only valid in 3rd gear (Non APC) and 5th gear (APC).
2.	Hours meter	Measures machine usage whilst engine is running.
3.	Fuel gauge	As the fuel tank is an irregular shape the quantity of fuel registered by the gauge between Empty and 1/2 is greater than the quantity between 1/2 and Full.
4.	Engine coolant temperature gauge	Measures coolant temperature at the thermostat housing. As the gauge is not annotated an approximate guide is that normal operating temperature shows the needle in a vertical position on the gauge.
5.	Direction indicator light (left)	Illuminates when the left turn signal is given.
6.	Engine oil pressure light	Illuminates on initial start up and then only if the engine oil pressure drops below a preset level.
7.	Spare	
8.	Air cleaner filter blockage light	Illuminates when the pressure differential between the clean air and that in the inlet manifold exceeds a preset level. This indicates an obstruction in the air cleaner.
9.	Parking brake warning light	Illuminates when the parking brake is applied and indicates pressure in the parking brake circuit has fallen below 16 bar.
10.	Transmission oil pressure warning light	Illuminates when the transmission charge pressure has fallen below 16 bar.
11.	Transmission oil temperature warning light	Illuminates when the transmission oil temperature exceeds 120°C.
12.	Battery charge indicator light	Illuminates on initial start up or when a charging fault is present.
13.	Hydraulic filter blockage warning light	Illuminates on start up and then only when the bypass valve in the hydraulic filter is opening.
14.	Power brake pressure warning light	Illuminates on start up and then only if the power brake pressure drops below 116 bar. When the engine is stopped one full application should illuminate this warning.
15.	Headlight main beam warning light	Illuminates when full beam headlamp is in use.
16.	Direction indicator light (right)	Illuminates when the right turn signal is given.
17.	Trailer turn indicator light	Illuminates only when the trailer socket is connected and the trailer turn signal lamps are functioning and when the 4-way hazard warning lamps are operated even without a trailer.
18.	Road light indicator light	Illuminates when roadlights are switched on. Does not indicate correct function.
19.	Front work lights indicator light	Illuminates when worklights are switched on. Only operates when roadlights are on. Does not indicate correct function.
20.	Rear work lights indicator light	Illuminates when worklights are switched on. Only operates when roadlights are on. Does not indicate correct function.
23	Hydraulic fluid temperature	Illuminates when the temperature of the hydraulic oil becomes excessive - from Machines S/No.51200472 only - fan reverse system

SOLO CONTROL JOYSTICK

The solo control joystick (1) is mounted, using four screws (2), on a moveable bracket (3) attached to a fixed bracket (4) on the right hand side of the operators seat.



Removal

1. Disconnect the vehicle battery.

2. Remove the four screws (2) that hold the joystick to the cover pod (5).

3. Remove the three screws (7) and remove the cover pod over the joystick.

4. Disconnect the electrical connector (6) and remove the joystick from the bracket.

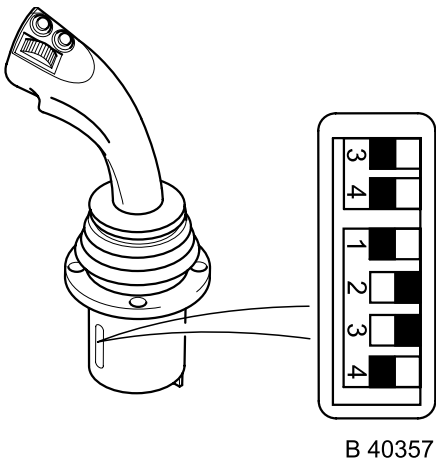
Installation

1. Installation is the reversal of the removal procedure.

2. When fitting a new joystick ensure dipswitch settings are set to the correct positions before installation.

3. Reconnect vehicle battery.

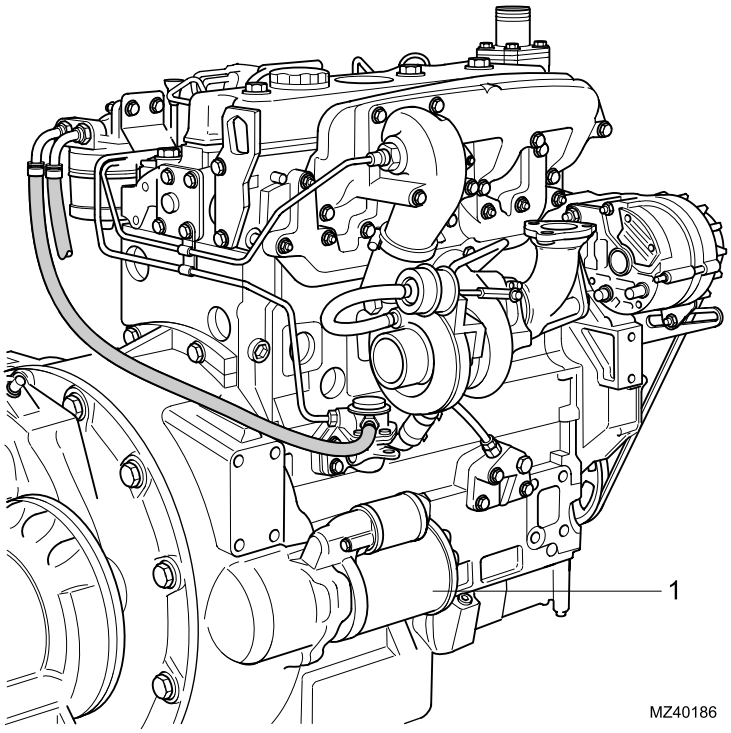
4. Operate the joystick to ensure that it functions correctly.



NOTE: Ensure the invertor switches located on the base of the joystick are in the above position.

STARTER

The starter motor (1) is a pre-engaged heavy duty type located on the inboard side of the engine.



Removal

To remove the starter motor for the vehicle carry out the following procedure:

NOTE: The sound proofing/underbody guard must be removed for access to the starter (from Machines S/No.51200472 only).

1. Disconnect the vehicle battery.

2. From beneath the facia machine locate and remove the cable connections to the motor.

3. From above the engine remove the air cleaner assembly and the air induction tube to gain access to the upper mounting bolt of the motor.

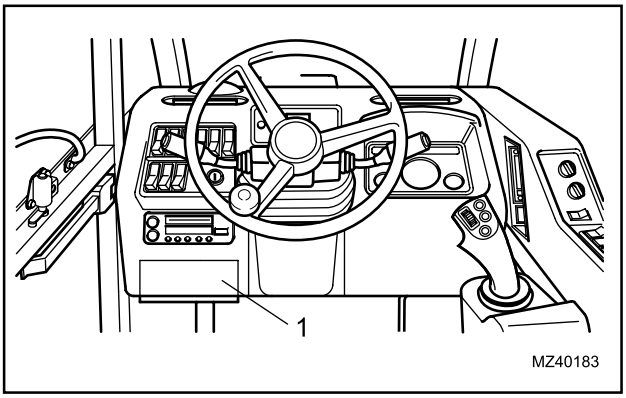
4. From beneath the machine remove the remaining motor retaining bolts, slide back the motor to disengage it from the drive ring and lower to ground.

5. Withdraw from beneath the machine.

Installation

Installation is the reverse of the removal procedure.

FUSEBOX AND RELAYS



Description

The fuse and relay box (1) is located below the facia mounted switches and radio (if fitted) on the left hand side of the cab. Where it is attached to a support bracket by four screws and washers.

Removal

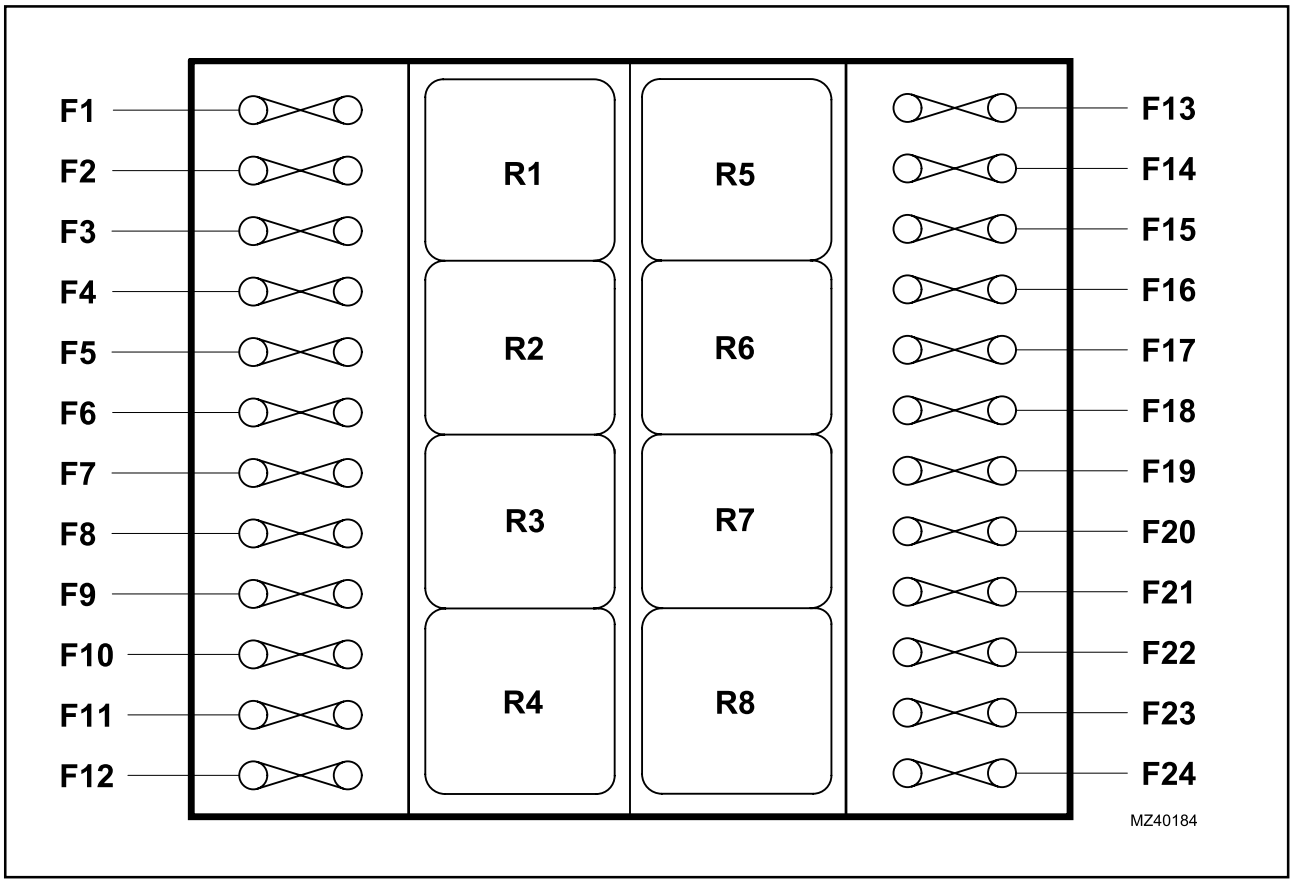
1. Disconnect the battery.

2. From beneath the facia panel locate the fusebox and remove the four screws and washers securing it to the support bracket. If a radio is fitted, withdrawing it from the facia may improve access.

3. Lower the fusebox below the facia panel. Mark the wires and disconnect them from the rear of the fusebox. Withdraw the fusebox.

Installation

Installation is the reverse of the above procedure.



Fuses

F1	7.5 Amp	-	Rear wiper
F2	7.5 Amp	-	Working lights
F3	10 Amp	-	Road switch
F4	10 Amp	-	Direction indicators/Radio
F5	25 Amp	-	Heater
F6	5 Amp	-	Hydraulic controls
F7	3 Amp	-	Safe load indicator
F8	10 Amp	-	Rear fog lights
F9	15 Amp	-	Rear working lights
F10	7.5 Amp	-	Front working lights
F11	10 Amp	-	Engine run/Fuel sender/Brake low pressure light
F12	10 Amp	-	Stop lights/Steering sensor/ Transmission dump light

Relays

R1			Boom working lights
R2			Ignition
R3			Direction indicators
R4			Transmission dump
R5			Front working lights
R6			Rear working lights
R7			Side working lights
R8			Headlights
F13	5 Amp	-	Right hand side light
F14	5 Amp	-	Left hand side light
F15	7.5 Amp	-	Right hand main beam
F16	7.5 Amp	-	Left hand main beam
F17	7.5 Amp	-	Right hand dip beam
F18	7.5 Amp	-	Left hand dip beam
F19	10 Amp	-	Hazard warning light
F20	10 Amp	-	Transmission controls
F21	10 Amp	-	Interior light/Beacon/Din socket
F22	15 Amp	-	Steering column multifunction switch
F23	10 Amp	-	Headlight flash
F24	7.5 Amp	-	Instrument panel
F25			Air conditioning

ALTERNATOR

The alternator is capable of producing the total electrical power requirements of the machine. It is fitted on the inboard side of the engine and belt driven from the crankshaft pulley. The alternator contains an integral voltage regulator.

The following precautions must be taken to avoid damage to the alternator and voltage regulator:

1 Do not disconnect the battery while the engine is running. This will cause a voltage surge in the alternator charge system which will damage the diodes and/or transistors.

2 Do not short any connections to ground.

3 Do not check the current flow using “spark contact”.

4 Always disconnect the battery ground terminal before removing the alternator.

5 Always disconnect the battery ground terminal when charging the battery in the vehicle using a battery charger.

Alternator drive belt check

To ensure maximum life from the drive belt it is recommended that the drive belt be checked at regular intervals, as detailed in the Operator’s Manual, for wear, damage and tension. Visually check the belt for signs of wear or damage and replace as necessary.

1. Check the belt tension as follows.(For best results a ‘Fenner’ or similar belt tension gauge should be used).

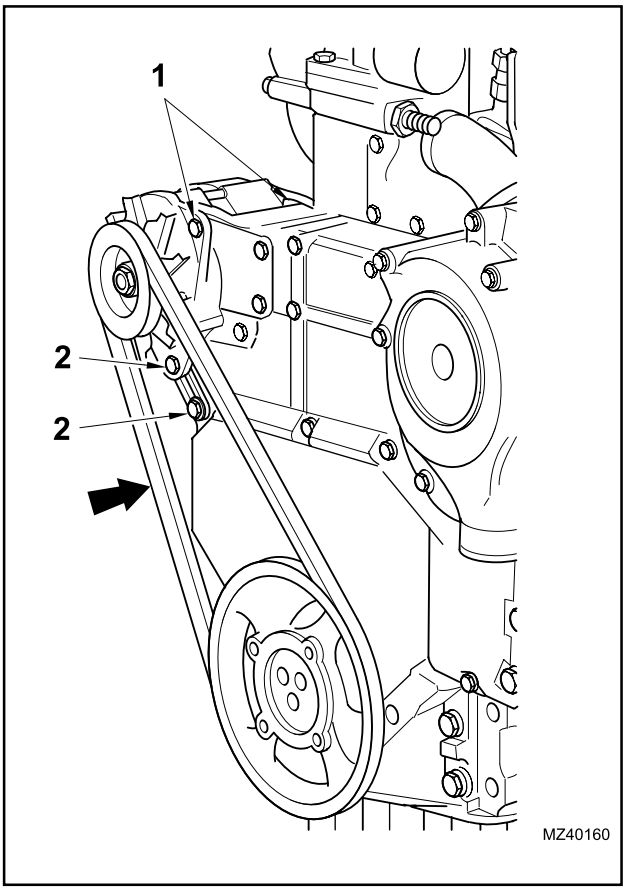
2. Fit the gauge at the centre of the longest free length and check the tension in accordance with the manufactures instructions.

3. If no gauge is available, press the belt with the thumb at the centre of the longest free length using a force of 45 N. The resultant belt deflection should be 10 mm.

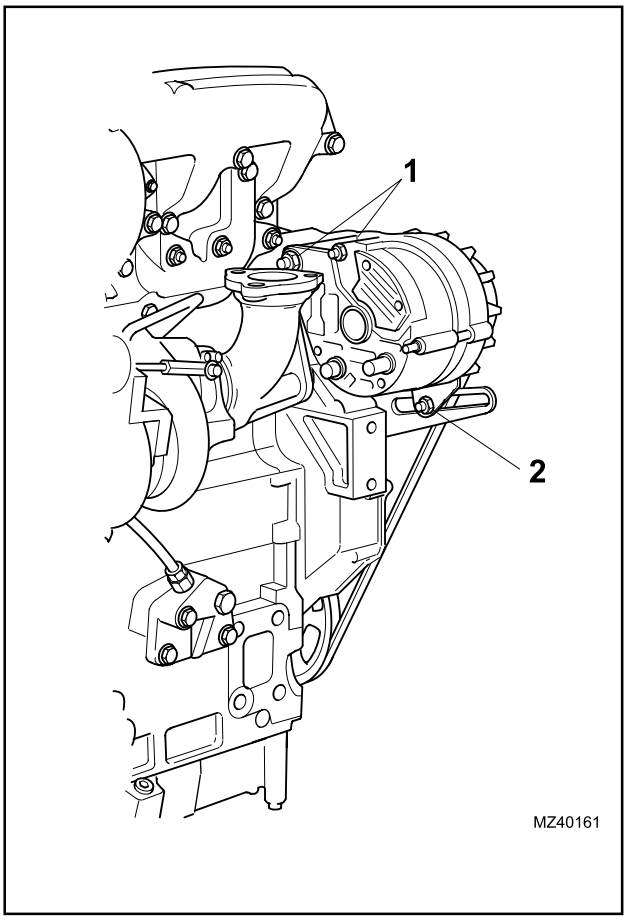
4. If the belt tension has to be adjusted carry out the following steps:

5. Loosen the pivot fasteners of the alternator (1) and the adjustment bar (2). Adjust the alternator to give the correct tension and tighten the fasteners.

6. Recheck the belt tension.



NOTE: New belts should be re-checked after the first 20 hours of use.



Removal

In the event that the alternator has to be removed from the vehicle, carry out the following steps:

1. Disconnect the battery.

2. Disconnect the alternator electrical connections.

3. Loosen the alternator pivot fasteners (1) and the alternator adjustment bar fastener (2).

4. Release the belt tension and remove the belt.

5. Remove the adjustment bar fastener (2) from the alternator and remove the pivot fasteners (1). (Make a note of the position of the washers and distance pieces to ensure correct reassembly).

6. Remove the alternator.

Installation

1. Place the alternator in position and assemble loosely the alternator pivot fasteners and adjustment bar fastener. (Ensure that the washers and distance pieces removed earlier are refitted correctly).

2. Fit the drive belt and move the alternator so that the drive belt tension is correct. (See Alternator Drive Belt Check).

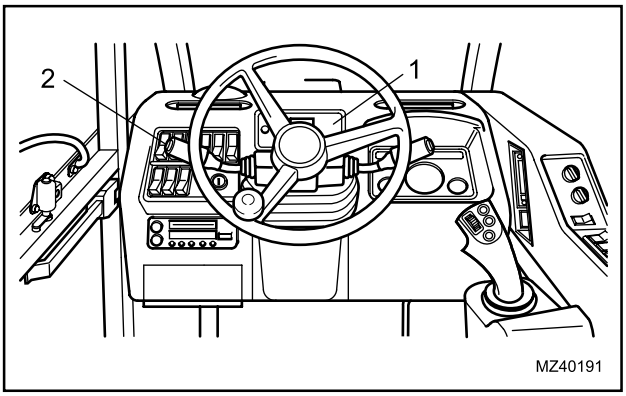
3. Tighten the pivot and adjustment bar fasteners and recheck the drive belt tension.

4. Reconnect the alternator electrical connections.

5. Reconnect the battery.

AUTOMATIC POWERSHIFT

The Automatic powershift consists of an automatic powershift controller (1) located on the dashboard directly in front of the steering wheel and an FNR switch assembly (2) attached to the left hand side of the steering column.



Automatic Powershift Controller

Removal

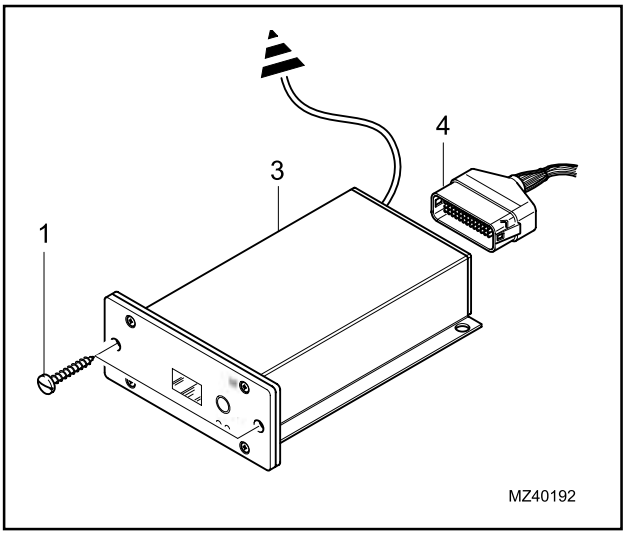
To remove the controller (1) carry out the following procedure:

1. Disconnect the vehicle battery.

2. Remove the two self tapping screws (3).

3. Carefully withdraw the controller (1) from the dashboard ensuring no strain is put on the electrical loom and the earth strap (5) (from Machines S/No.51200472 only).

4. Disconnect the electrical connector (4) and the earth strap (5) (from Machines S/No.51200472 only) from the rear of the controller and remove from the dashboard.



Installation

1. Connect the electrical connector (4) and the earth strap (5) (from Machines S/No.51200472 only) to the rear of the controller (1).

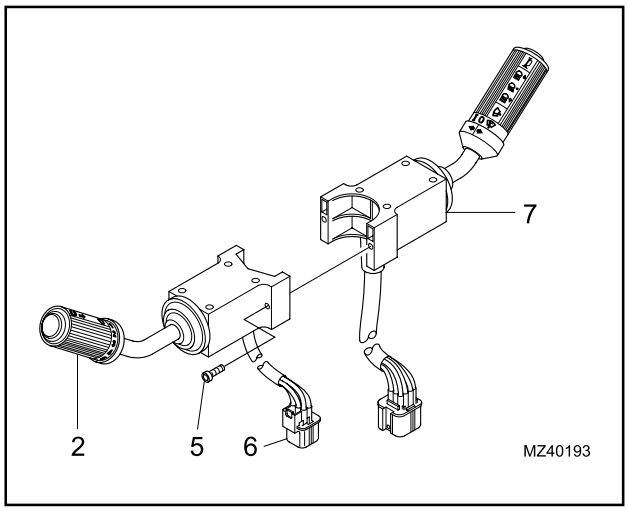
2. Insert the controller into the dashboard.

3. Fit the two self-tapping screws (3) into the controller fascia and tighten.

4. Reconnect thre vehicle battery.

5. Carry out test of the Automatic powershift system using procedure the laid down in the Operator's Manual.

Forward/Neutral/Reverse (FNR) switch assembly



Removal

To remove the FNR switch assembly (2) carry out the following procedure:

1. Disconnect the vehicle battery.

2. Remove the two socket head screws (5) that secure the FNR switch assembly (2) to the multi-function switch (7).

3. Disconnect the electrical connector (6) from the steering column loom.

4. Remove the FNR switch assembly.

Installation

1. Connect the electrical connector (6) to the steering column loom.

2. Position the FNR switch assembly (2) onto the steering column and align with the multi-function switch (7). Insert the two socket head screws (5) and tighten.

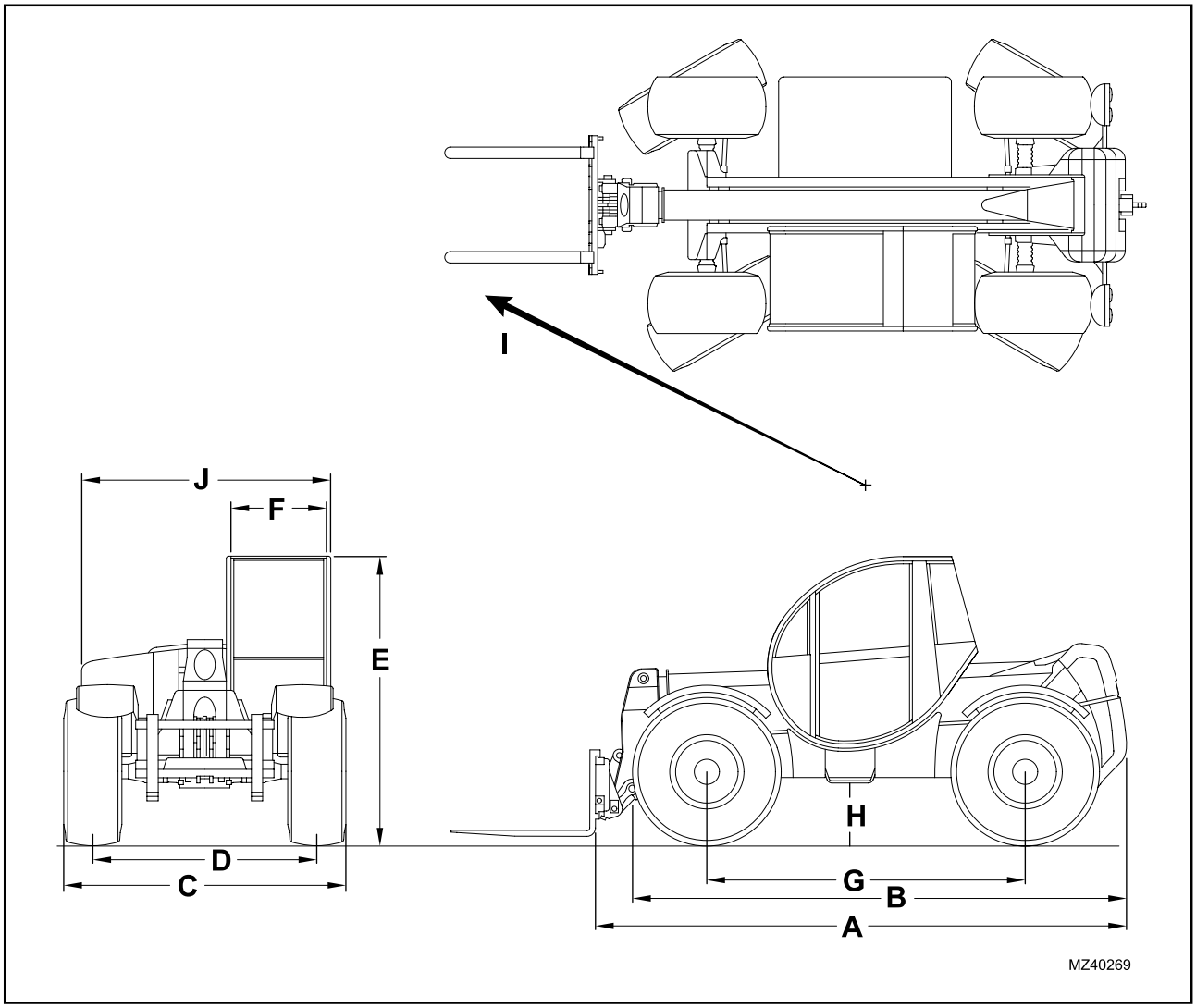
3. Reconnect the vehicle battery.

4. Carry out a test of the Automatic powershift system using procedure laid down in the Operator's Manual.

SECTION 3

TECHNICAL DATA

		K50	K60	K70
Dimensions				
A Length to front of carriage	mm	4705	4705	4705
B Length front to rear wheels	mm	3876 (20 in .tyres)	4079	4079
C Overall width	mm	2300	2300	2300
D Track width	mm	1920	1920	1920
E Height over cab on std tyres	mm	2380 (20 in. tyres)	2450	2450
F Interior cab width	mm	900	900	900
G Wheelbase	mm	2800	2800	2800
H Ground clearance	mm	410 (20 in. tyres)	446	446
I Turning radius on std tyres	mm	3450	3450	3450
J Overall bodywork width	mm	2235	2235	2235
Weight (unladen)	kg	6963	7605	7800



		K50	K60	K70
Performance				
Max lift height on std tyres	mm	6012	6200	7211
Max lift capacity	kg	3000	4000	3500
Load centre	mm	500	500	500
Capacity at full height	mm	3000	3000	2000
Reach at max load	mm	1473	1300	1755
Height with max capacity	mm	6006	5370	5782
Max forward reach	mm	3003	3144	3937
Max capacity at max reach	kg	1250	1500	1500
Carriage specifications		ITA3B	ITA3B	ITA3B
Break out force	kN	49	52	52
Machine speed (km/hr) for 106 hp				
Forward 1		6.3	6.3	6.3
Forward 2		8.7	8.7	8.7
Forward 3		12	12	12
Forward 4		17	17	17
Forward 5		28	28	28
Forward 6		40	40	40
Reverse 1		6.3	6.3	6.3
Reverse 2		12	12	12
Reverse 3		28	28	28

		K50	K60	K70
Carriage				
Max crowd forward fully lowered - degrees below horizontal		60	60	60
Max crowd back fully lowered - degrees behind vertical		13	13	13
Max crowd forward fully raised - degrees below horizontal		7	7	7
Max crowd backward fully raised - degrees beyond vertical		82	82	82
Total carriage rotation - degrees		163	163	163
Max distance between forks - mm		1200	1200	1200
Cycle time				
Lift	sec	7.7	7.7	7.7
Lower	sec	5.6	5.6	5.6
Extend	sec	4.7	4.8	6.8
Retract	sec	3.4	4.0	5.8
Crowd forward (dump)	sec	2.5	2.5	2.5
Crowd backward	sec	2.4	2.4	2.4

		K50	K60	K70
Engine				
Perkins 1004.40T	kW (PS)	78.5 (106)	78.5 (106)	78.5 (106)
Net output	Nm (rpm)	394 (1400)	394 (1400)	394 (1400)
Perkins 1004.40TW	kW (PS)	91.0 (122)	91.0 (122)	91.0 (122)
Net output	Nm (rpm)	434 (1500)	434 (1500)	434 (1500)
Cooling				
Thermostat - opens	°C	70 - 80	70 - 80	70 - 80
Thermostat - fully open	°C	90 - 95	90 - 95	90 - 95
Transmission		DANA T12000	DANA T12000	DANA T12000
Gear Selector		APC Powershift	APC Powershift	APC Powershift
No of gears	(Fwd/Rev)	6/3 (40 km/h)	6/3 (40 km/h)	6/3 (40 km/h)
No of gears	(Fwd/Rev)	5/3 (25 km/h)	5/3 (25 km/h)	5/3 (25 km/h)
No of gears	(Fwd/Rev)	4/2 (20 km/h)	4/2 (20 km/h)	4/2 (20 km/h)
Gear Selector		Non APC	Non APC	Non APC
No of gears	(Fwd/Rev)	3/3 (25 km/h)	3/3 (25 km/h)	3/3 (25 km/h)
No of gears	(Fwd/Rev)	4/3 (40 km/h)	4/3 (40 km/h)	4/3 (40 km/h)
Tyres				
Cross Ply, Agri		15.5/80-24	15.5/80-24	15.5/80-24
Radial Ply, Agri		445 R 24	445 R 24	445 R 24
Radial Ply, Agri		495 R 24	495 R 24	495 R 24
Radial Ply, Agri		420 R 20	420 R 20	420 R 20
Radial Ply, Ind		455/70R24	455/70R24	455/70R24
Flotation		600 - 26.5	600 - 26.5	600 - 26.5

		K50	K60	K70
Hydraulics				
Pump type		Load sensing	Load sensing	Load sensing
Primary system max. pressure	bar	250	250	250
Primary system max flow				
(Up to Machines S/No.51200471)	l/min	122 @ 2300 rpm	122 @ 2300 rpm	122 @ 2300 rpm
(From Machines S/No.51200472)	l/min	122 @ 2200 rpm	122 @ 2200 rpm	122 @ 2200 rpm
Primary system (load sensing)	bar	14	14	14
Primary system (standby)	bar	20	20	20
Secondary system max. pressure	bar	160	160	160
Secondary system max flow	l/min	50	50	50
No. of aux. services	option	2 front, 1 rear	2 front, 1 rear	2 front, 1 rear
Electrics				
Battery capacity	Amp/hr	128	128	128
Alternator output	Amp	65	65	65
Capacities				
Hydraulic system	litre	128	128	128
Hydraulic tank	litre	67	67	67
Fuel tank	litre	200	200	200
Engine oil	litre	9	9	9
Engine coolant	litre	31	31	31
Transmission	litre	16	16	16
Transmission transfer box	litre	0.4	0.4	0.4
Axle - front	litre	9.5	9.5	9.5
Axle - rear	litre	10	10	10
Axle - final drive (each)	litre	0.8	0.8	0.8
Screen wash	litre	6.5	6.5	6.5

Paul Dodd
Field Service Manager

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