

Load Control (Supplement)

- ⇒ [Introduction \(□ 1\)](#)
- ⇒ [LCS \(Six Valve Manifold\) \(□ 9\)](#)
- ⇒ [LC1 and LC4 \(540-170 Only\) \(□ 37\)](#)
- ⇒ [LC2 and LC3 \(□ 67\)](#)
- ⇒ [LC5 \(□ 151\)](#)
- ⇒ [MC05 \(□ 187\)](#)
- ⇒ [MC06 \(□ 217\)](#)
- ⇒ [Fault Finding \(□ 321\)](#)
- ⇒ [Testing and Adjustment \(□ 329\)](#)



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Notes:



Contents	Page No.
Introduction	
About This Supplement	1
About the Load Control Systems	2
Identification	3
Care and Safety	7
LCS (Six Valve Manifold)	
Introduction	9
Circuit Description	11
Hydraulics Schematic	20
Electrical Schematic	22
Harness Data	24
Logic Sequence	28
Calibration	31
LC1 and LC4 (540-170 Only)	
Introduction	37
Circuit Description	39
Hydraulics Schematic	47
Harness Data	50
Logic Sequence	54
Installation	56
Calibration	62
LC2 and LC3	
Introduction	67
Circuit Description - 528-70	69
Circuit Description - 535-95, 531-70, 536-70 and 541-70	75
Circuit Description - 533-105 and 540-140	86
Circuit Description - 535-125 HiViz and 535-140 HiViz	99
Hydraulics Schematic	109
Harness Data	114
Logic Sequence (All LC2/LC3 Systems)	131
Calibration	133
LC5	
Introduction	151
Circuit Description	153
Hydraulics Schematic	169
Harness Data	172
Logic Sequence	178
Calibration	180
MC05	
Introduction	187
Circuit Description	189
Hydraulics Schematic	201
Harness Data	204
Electrical Schematics	209
Logic Sequence	211
Calibration	213
MC06	
Introduction	217
Circuit Descriptions - Parallel Machines	219

Contents	Page No.
Circuit Description - LSP + Gearpump Machines	235
Circuit Description - LSP + Variflow Machines	250
Hydraulics Schematics	265
Harness Data	277
Electrical Schematics	300
Logic Sequence	305
Calibration	307
Fault Finding	
All Load Control Systems	321
Testing and Adjustment	
Testing	329
Adjustment	340

Introduction

About This Supplement

Machine Model and Serial Number

This publication provides information for the following Load Control Systems:

- LCS (Six Valve Manifold) Load Control System
- LC1/LC4 Load Control System
- LC2/LC3 Load Control System
- LC5 Load Control System
- MC05 Load Control System
- MC06 Load Control System

See the appropriate system topic for machine serial nos., where relevant.

Using the Service Manual Supplement

This manual is a supplement to the JCB Loadall Service Manual. The information covers the JCB Loadall machines fitted with the Load Control System.

Each variant of Load Control System (see opposite) is dealt with separately, each having its own topic in this Supplement.

Only those areas of the machine which are different from the standard Loadall are dealt with here. For all other information refer to the appropriate Loadall Service Manual.

Unless specified otherwise, all references to 'Service Manual' in this supplement are to be taken as meaning the Service Manual specific to the standard machine.

Read the standard Service Manual and this supplement completely and carefully to familiarise yourself with the machine before carrying out any servicing procedures.

Units of Measurement

T1-001_2

In this publication, the S.I. system of units is used. For example, liquid capacities are given in litres. The Imperial units follow in parentheses () eg 28 litres (6 gal).

Cross References

T1-004_2

In this publication, page cross references are made by presenting the subject title printed in bold, italic and underlined. It is preceded by the 'go to' symbol. The number of the page upon which the subject begins, is indicated within the brackets. For example: ⇒ ***Cross References*** (1).

About the Load Control Systems

General Information

A Load Control System (LCS) is an enhancement to the devices that JCB currently fit as standard, i.e. loadcharts, boom extension markers and Load Moment Indicator (LMI). These are still the primary source of information to allow the operator to operate the machine correctly. The Load Control System offers additional control if the operator makes an inadvertent movement of the load. The system must not be relied upon as the primary source of protection for the machine. The duty of care is still with the operator/site agent to:

- know the mass and load centre of loads being handled.
- know boom angle and extension that will be required to place the load (this can be checked by doing a dry run first without the load)
- whilst moving the load, obey LMI indications, lift charts and boom extension markers.

Note: *Note: The LCS provides a degree of protection only against the machine tipping forward. It does not protect against tipping sideways or rearwards, nor tipping due to the machine being used on unsuitable ground nor operator mishandling (sharp direction changes, etc.).*

Neither will the system protect against instability due to the stabiliser legs being lifted nor misuse of the chassis levelling (sway) function (if either of these options are fitted).

Identification

There are many variants of the Load Control System. Although they all have a common purpose - to help prevent the load moving into a position which would make the machine unstable - there are variations in the way this is achieved on different Loadall models. Also, some variants of the system incorporate additional features such as stabiliser isolation and load retrieval. The following table

will help you identify which variant may be installed on any particular model of Loadall.

Note: For 536-60, 536-70, 531-70, 535-95 and 541-70 machines, you will need also to refer to the table of Hydraulic System Variants. → [Table 2. Identification of Hydraulic System Variants \(536-60, 536-70, 535-95, 531-70 & 541-70\) \(□ 5\)](#)

Table 1. System Applicability, Identifying Features and Territorial Availability

Territories	540-170	540-140	537-135	535-140 Hi-Viz	535-140	535-125 Hi-Viz	535-125	535-95	533-105	532-120	541-70	536-70	531-70	536-60	528-70	System	Description and Identifying Features	Visual Identifier
France			●					●	●	●					●	LCS	Original system (now obsolete). Identifying features: large 6-valve manifold mounted on the chassis side plate and twin aperture LMI.	
Rest of the World (ROW) (not Australia/New Zealand)		●	●	●	●	●	●	●	●	●	●	●	●		●	LC2	2 stage cut -out system. Identifying features: Additional switch in cab for Load Control selection. Load Control Valve inserted between pump and valve block and single aperture LMI with 4 way and 6 way connectors.	
ROW (not Australia/New Zealand)		●	●	●	●	●			●	●						LC3	As LC2 + stabiliser isolation. Identifying features: as LC2, plus stabilisers isolate at 10° boom angle.	

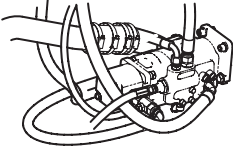
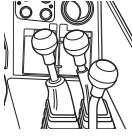
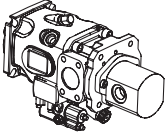
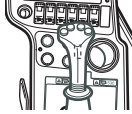
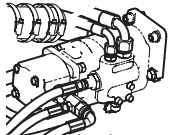

Territories	540-170	540-140	537-135	535-140 Hi-Viz	535-140	535-125 Hi-Viz	535-125	535-95	533-105	532-120	541-70	536-70	531-70	536-60	528-70	System	Description and Identifying Features	Visual Identifier
ROW (not Australia/New Zealand)		●		●	●	●	●									LC5	2 stage cut -out system + lift & retract to retrieve load. Identifying features: Additional switch in cab for Load Control selection. Load Control Valve inserted between pump and valve block, single aperture LMI with 4 way and 6 way connectors and switches on the valve block.	
ROW (not Australia/New Zealand)	●															LC1	540-170 system. Identifying features: twin LMI aperture with 4 way & 6 way connectors.	
ROW (not Australia/New Zealand)	●															LC4	As LC1+ stabiliser isolation. Identifying features: as LC1, plus stabilisers isolate at 10° boom angle.	
Australia/New Zealand	●															MCO5	As LC1 + AS1418.19. Identifying features: twin aperture LMI with 4 way & 8 way connectors.	
Australia/New Zealand				●		●		●	●		●	●	●	●		MCO6	2 stage cut-out system + lift & retract to retrieve load + AS1418.19. Identifying features: Additional switch in cab for Load Control selection. Boom back switch, single aperture LMI with 4 way & 6 way connectors.	

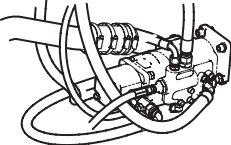
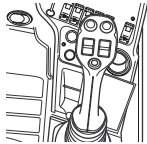
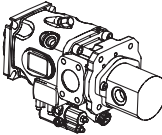
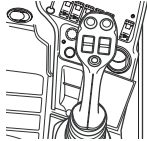
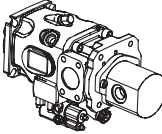
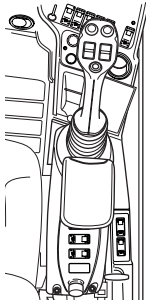
Hydraulic System Variants (536-60, 536-70, 535-95, 531-70 & 541-70)

The hydraulic circuit of the 536-60, 536-70, 535-95, 531-70 and 541-70 machines may be one of a number of variants. Each variant requires a slightly different Load Control System. If you are working with one of these machines it is important that you know which type of hydraulic system is

installed, to ensure that you refer to the correct hydraulic and electrical diagrams in this supplement. The following table shows the easily identifiable differences between hydraulic systems.

Table 2. Identification of Hydraulic System Variants (536-60, 536-70, 535-95, 531-70 & 541-70)

System Type	Main Pump Type	Control Lever Type
<p>Parallel System</p>	<p>Fixed flow double or triple gear pump.</p> 	<p>Parallel control valve (black) with four manual spools. Separate control levers for boom and auxiliary services.</p> 
	<p>Fixed flow double or triple gear pump.</p> 	<p>Parallel control valve (black) with two electro servo and two manual spools. Cab mounted control lever with push button controls.</p> 
	<p>Fixed flow double gear pump.</p> 	<p>Parallel control valve (black) with two integrated electro servo spools and two manual spools. Cab mounted control lever with thumbwheel controls. Hydraulic services are controlled by a machine control ECU with electronic flowshare feature.</p> 

System Type	Main Pump Type	Control Lever Type
LSP Gearpump System	Fixed flow triple gear pump. 	Flowshare control valve (blue) with two proportional electro servo and two manual spools. Cab mounted control lever with thumb wheel controls. 
LSP Variflow System	Variable flow pump with one fixed flow gearpump for cooling fan, sway and servo oil supply. 	Flowshare control valve (blue) with two electro servo and two manual spools. Cab mounted control lever with thumbwheel controls. 
	Variable flow pump with one fixed flow gearpump for cooling fan, sway and servo oil supply. 	Flowshare control valve (blue) with four integrated electro servo spools. Seat pod mounted control lever with thumbwheel controls 

Care and Safety

Safety Notices

In this publication and on the machine, there are safety notices. Each notice starts with a signal word. The signal word meanings are given below.

DANGER

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

INT-1-2-1

WARNING

Denotes a hazard exists. If proper precautions are not taken, the operator (or others) could be killed or seriously injured.

INT-1-2-2

CAUTION

Denotes a reminder of safety practices. Failure to follow these safety practices could result in injury to the operator (or others) and possible damage to the machine.

INT-1-2-3

General Safety

DANGER

Study this Supplement and the Service Manual for the machine before carrying out any maintenance work on the machine. You must always understand and observe the relevant laws and regulations. If you are unsure about anything, ask your JCB Distributor.

INT-1-2-6



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LCS (Six Valve Manifold)

Introduction

Machine Model and Serial Number

The LCS Load Control System (LCS) is compatible with following models in the JCB Loadall machine range:

- 528-70 Up to SN 797511
- 532-120 Up to SN 1064455
- 533-105 Up to SN 1064702
- 535-95 Up to SN 1064715
- 537-135 Up to SN1064473

General Description

When the LCS is selected, it reduces the risk of tipping forward when the machine reaches a predetermined point near to its maximum working limit.

This is achieved by stopping boom lower, boom extend, dump and crowd functions, in order to prevent further movement of a load past the predetermined point.

Boom lift and boom retract functions are allowed in order to retrieve the load from a point of cutout.

The system has two working modes, Load Control Mode and Ground Work Mode. Load Control Mode is automatically entered when the machine is started.

Note: *The LCS provides a degree of protection only against the machine tipping forward. It does not protect against tipping sideways or rearwards, nor tipping due to the machine being used on unsuitable ground nor operator mishandling (sharp direction changes, etc.).*

Neither will the system protect against instability due to the stabiliser legs being lifted nor misuse of the chassis levelling (sway) function (if either of these options are fitted). The stabilisers and/or chassis levelling rams are not interlocked into the LCS.

In Load Control mode, the boom lower hydraulic supply is progressively reduced (derated) as the weight on the rear axle becomes less, ensuring that the load movement is stopped smoothly and without jerking. The tilt hydraulic flow is also restricted; this restriction is constant

throughout the range. The extend function operates as normal until the limit is reached.

It is, therefore, a characteristic of the system that lowering and tilt movements are slightly slower than when Ground Work mode is selected. This is normal and does not indicate a machine fault.

Once the limit is reached, any movement of the load which would further reduce the stability of the machine is prevented. This means that extend, lower, crowd and dump functions are all disabled.

In Ground Work mode, the system functions as the standard LMI.

Testing procedures described in this manual should be carried out on level ground with the road wheels in the straight ahead position.

The LCS Indicator Display

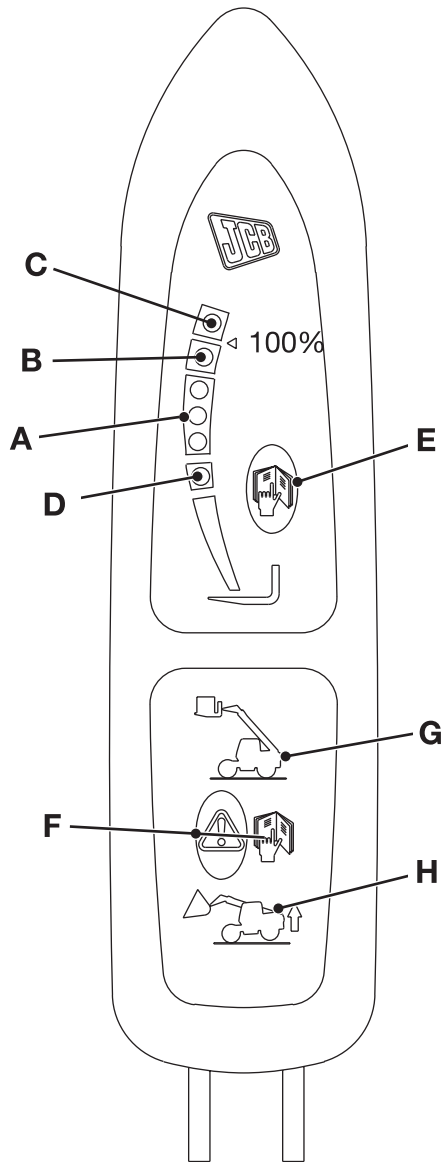


Fig 1.

- | | | |
|----------|--------------------------|---|
| A | Green LEDs (3) | Safe when lit |
| B | Amber LED | Caution when lit - approaching machine stability limits |
| C | Red LED | Danger when lit - machine at limit of stability |
| D | Power ON indicator | |
| E | Display button | |
| F | Mode change button | |
| G | Load Control mode symbol | Lit when Load Control mode selected, flashes when red LED C is lit (in Load Control mode) |
| H | Ground Work mode symbol | Lit when Ground Work mode selected |

Circuit Description

Introduction

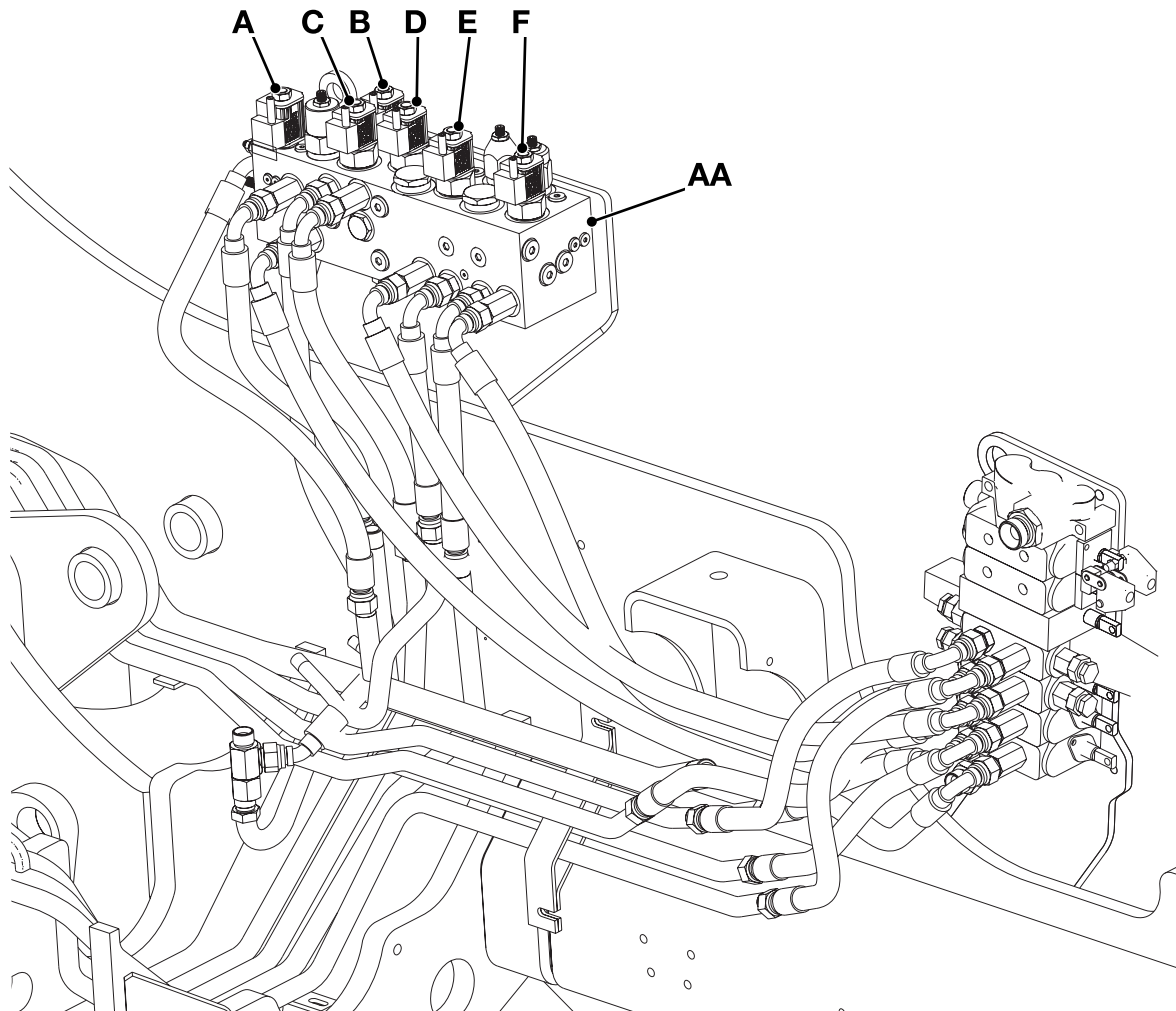


Fig 2. Typical Circuit

The following description, outlines the operation of the LCS as fitted to Series I machines fitted with stabilisers (532-120, 533-105 and 537-135). It should be read with reference to the following:

- ⇒ [Hydraulics Schematic \(□ 20\)](#)
- ⇒ [Electrical Schematic \(□ 22\)](#)
- ⇒ [Logic Sequence \(□ 28\)](#)

In non-stabilised machines (528-70, 535-95), valve **C** (lift circuit control valve) is not fitted and references to valve **C** should be ignored. The lift service operates normally.

Interface with Standard Hydraulic System

Load Control functions are controlled by the six valve manifold **AA**, which is inserted in the hydraulic circuit

between the main control valve block and the service rams.

Refer to:

- ⇒ [Component Key \(□ 12\)](#)
- ⇒ [Fig 2. \(□ 11\)](#)
- ⇒ [Fig 3. \(□ 13\)](#)

Component Key

⇒ [Fig 2. \(□ 11\)](#) and ⇒ [Fig 3. \(□ 13\)](#)

AA	Six valve manifold
A	Proportional valve (PWM) regulating lower service
B	Solenoid valve controlling lower service regulation
C	Solenoid valve controlling lift service ⁽¹⁾
D	Solenoid valve controlling extension and tilt services
E	Solenoid valve controlling tilt circuit (dump)
F	Solenoid valve controlling tilt circuit (crowd)
K	Part of main valve block
M	Main valve block tilt output
N	Main valve block extend output
P	Main valve block lift output
R	Dump (crowd ram rod end)
S	Crowd (crowd ram head end)
T	Extend (Extension ram head end)
V	Lower (Lift ram rod end)
W	Retract (Extension ram rod end)
X	Lift (Lift ram head end)
Y	Return to hydraulic tank
7	Flow regulator
8	Non-return valve (0.1 bar back pressure)
9	Relief valve
10	Relief valve
11	Relief valve
12	Counterbalance valve
13	Restrictor (1.8 dia.)
14	Restrictor (0.5 dia.)
15	Filter
16	Cavity plug

(1) *Machines without stabiliser legs (528-70, 535-95) do not have solenoid valve C fitted and port L3 is plugged.*

Note: Valves **B**, **C** and **D** are fitted with manual overrides.

Note: All valves are shown in the de-energised position.

Note: Valve **C** and associated components shown thus are fitted only to machines equipped with stabilisers:

Note: Pilot lines are shown thus:

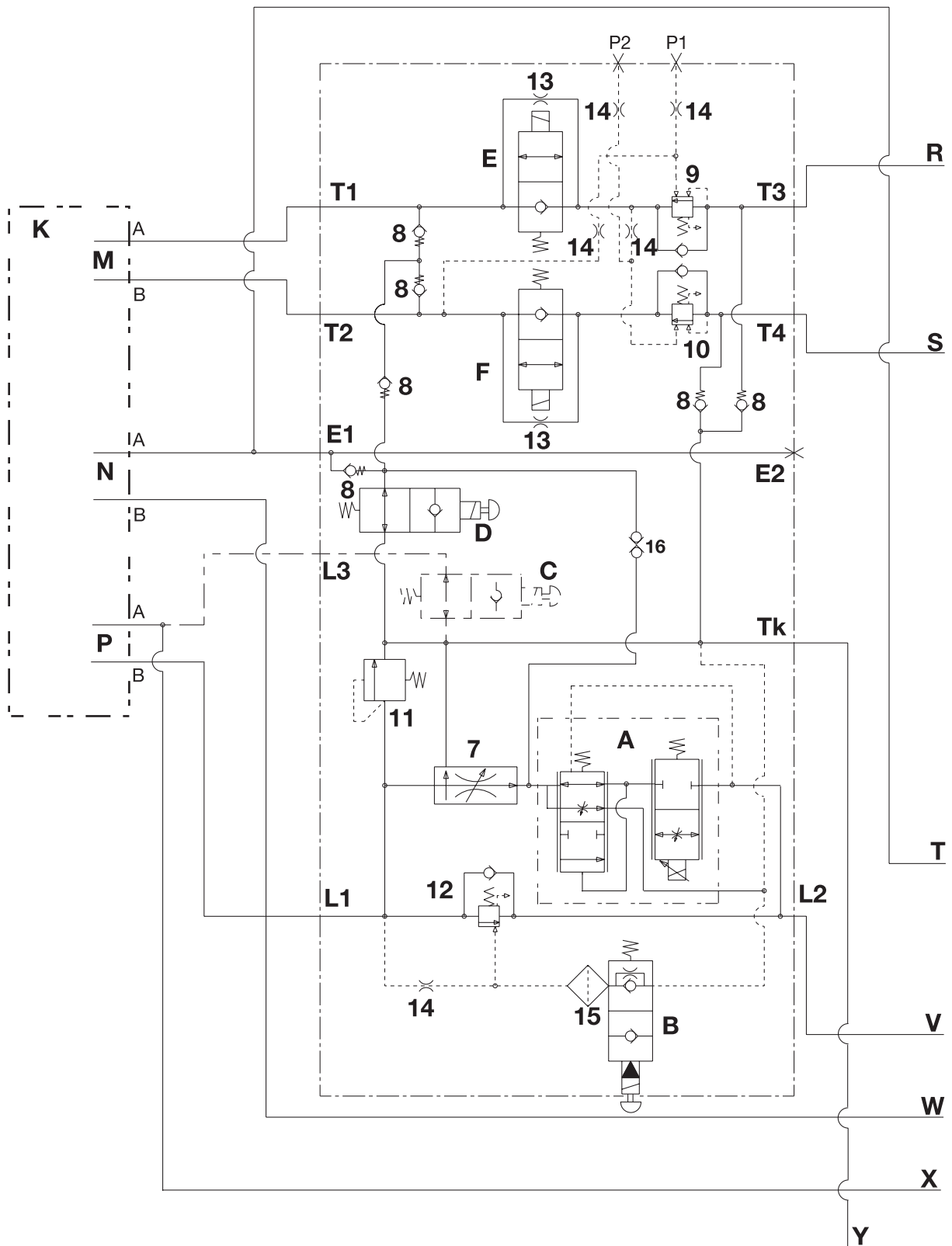


Fig 3. Six Valve Manifold AA

Start up

Note: In the following description, the various thresholds have the meanings below:

Minimum Threshold	Green Lights (LED) on
Maximum Threshold	Red Light (LED) on

The amber light (LED) will be on between minimum and maximum thresholds.

- 1 When the machine is started, the system always enters Load Control (LC) mode by default. If the stabilisers (if fitted) are down or if the boom is elevated less than 45°, the system continues to Mode Selection.
- 2 If the stabilisers (if fitted) are up and the boom is elevated more than 45°, the system operation continues as described below.

Solenoids **B**, **C**, **E** and **F** have 0 Volts applied. Therefore, valves **B**, **C**, **E** and **F** are de-energised.

a Valve **B** allows pilot oil to flow to tank, causing counterbalance valve **12** to remain closed. This means that flow to the lower service is via flow regulator **7** and proportional valve **A**. Flow regulator **7** applies a preset (26 litres/min maximum) restriction on the oil flow, proportional valve **4** applies a variable degree of restriction which depends on the LMI transducer signal. [⇒ Proportional Valve \(□ 17\)](#), for the operation of the proportional valve.

b Valves **E** and **F** block the direct flow to the tilt services and allow flow to dump or crowd only through restrictors **13**. Valve **C** directs lift service oil from the main valve block (MVB) back to tank, preventing further lifting.

- 3 If the signal from the LMI transducer is below the maximum threshold (green or amber light on), 12 Volts energises solenoid **D**. Valve **D** blocks the return of extend service oil to tank. Valve **A** is open, to a degree determined by the LMI transducer signal. Under these conditions, boom extension and retraction is permitted and the boom may be lowered (at a much reduced speed) to a position below 45°. The system then continues to Mode Selection.

Note: Maximum and minimum threshold values are preset during manufacture and cannot be changed.

- 4 If the signal from the LMI transducer is above the maximum threshold (red light on) (see item 2), solenoid **D** is de-energised. Valve **D** returns the extend and tilt service oil to tank, preventing tilt or boom extension. Proportional valve **A** is fully closed. Boom extension and lowering is not permitted and the boom may only be retracted in order to reduce load moment.
- 5 If retraction of the boom is sufficient to bring the load moment below the maximum threshold, operation continues as in paragraph 2. If the boom cannot be retracted further and the load moment is still above the maximum threshold, it will be necessary to use Override Mode, to lower the boom below 45°. The system continues to Mode Selection.

Mode Selection

- 1 If the machine is in LC mode and it is intended to continue in that mode, no change of mode is required and the system will carry on in LC mode. [⇒ Load Control Mode \(□ 16\)](#).
- 2 If a change of mode is required, the system is put into a mode change loop by the operator pressing and holding the mode change button for five seconds to initiate the change.

If the signal from the LMI transducer is above the minimum threshold (amber or red lights on), the mode change is prevented and the system remains in the current mode. The load moment must be reduced below minimum threshold (green lights on) by retracting, lifting or reducing the load and the mode change button pressed again to initiate mode change.

Note: Before changing mode, the boom should be retracted and lowered and any load removed. It is not good practice (although the system does not prohibit it) to initiate mode changes whilst the boom is raised or extended or if the machine is carrying a load.

- 3 Change mode:
 - a** From LC to Ground Work (GW) mode: If the signal from the LMI transducer is below the minimum threshold, the change is permitted. The LMI LEDs flash indicating that the mode change has taken place, until the mode change button is released,

when the GW symbol is lit. ⇒ [Ground Work Mode \(□ 16\)](#).

- b** From GW to LC mode: If the signal from the LMI transducer is below the minimum threshold, the change is permitted. The LMI LEDs flash indicating that the mode change has taken place, until the mode change button is released, when the LC symbol is lit. ⇒ [Load Control Mode \(□ 16\)](#).

Ground Work Mode

- 1 Solenoid **A** has 0 Volts applied, solenoids **B, C, D, E** and **F** all have 12 Volts applied. Therefore, the proportional valve is completely closed and all other valves are energised.
- 2 Valve **B**, in the energised position, blocks the path for pilot pressure to tank. Pilot pressure operates counterbalance valve 12, allowing lift service oil to flow to the lift ram. At the same time, valve **C** energises, blocking the return path to tank. These conditions allow boom lift to operate normally.
- 3 Valves **E** and **F** bypass restrictors **13** in the tilt circuit, and valve **D** blocks the return path to tank for the tilt and extend oil. This allows tilt, dump and crowd services to operate normally.
- 4 In GW mode, all services operate normally at normal machine speed. The machine will continue to operate in GW mode until a mode change to LC mode is required. [⇒ Mode Selection \(□ 14\)](#).

Load Control Mode

- 1 If the stabilisers are down, valve **C** is energised. If the stabilisers are up, and the boom is below 45°, again valve **C** is energised. In either of these conditions, valve **C** blocks the return to tank for the lift oil, allowing the lift service to operate normally.
- 2 If the stabilisers are up, and the boom is above 45°, solenoid **C** has 0 Volts applied, and valve **C** is de-energised. In this case, valve **C** directs lift service oil from the main valve block (MVB) back to tank, preventing further lifting.
- 3 Solenoids **B, E** and **F** have 0 Volts applied. Therefore, valves **B, E** and **F** are de-energised.
 - a Valve **B** allows pilot oil to flow to tank, causing counterbalance valve 12 to remain closed. This means that flow to the lower service is via flow regulator **7** (26 litres/min maximum) and proportional valve **A**. For the operation of the proportional valve. [⇒ Proportional Valve \(□ 17\)](#).
 - b Valves **E** and **F** block the direct flow to the tilt services and allow dump or crowd only through restrictors **13**, slowing the operating speed.

- 4 If the signal from the LMI transducer is below the minimum threshold (green lights on), valve **D** is energised. Valve **D** blocks the return of extend and tilt service oil to tank. Proportional valve **A** is fully open. Under these conditions, the machine operates as normal, with the lower service flow, restricted by restrictor **7** and proportional valve **A** (even when fully open, valve **A** imposes a certain degree of restriction on the flow).
- 5 If the signal from the LMI transducer is between the minimum and maximum thresholds, valve **D** is again energised. Proportional valve **A** is partially open, to a degree dependant on the LMI signal. Under these conditions, all services are operative, with tilt operating at a speed limited by restrictors **13** and boom lower speed regulated by proportional valve **A** in accordance with the load moment, as represented by the LMI signal.
- 6 The conditions described in paragraphs 4 and 5 represent the normal working conditions in LC mode. The system will continue to cycle around this loop until conditions change, i.e. the load moment goes above the maximum threshold, the ignition is switched off or a change to GW mode is required.
- 7 If the signal from the LMI transducer is above the maximum threshold, valve **D** is de-energised. Proportional valve **A** is fully closed. Under these conditions, tilt, lower and extend services are all disabled.
- 8 As the machine is operating at the maximum allowed load moment, the LEDs flash and the audible alarm sounds to warn the operator.
- 9 All functions except lift and retract being disabled, the operator must lift or retract in order to reduce the load moment to a level below the maximum threshold. Otherwise, the system will remain in the conditions described above.
- 10 If lift or retracting the boom brings the load moment below the maximum threshold, the system recycles through the load control loop continuously until the ignition is switched off or a mode change is required.
- 11 It is possible that the machine may be in a position such that, even with the boom fully retracted, the load moment may be above the preset maximum threshold. In this case, it is necessary to use Override Mode. [⇒ Override Mode \(□ 17\)](#)

Override Mode

1 To enter Override mode, press and hold the test button. Press the mode change button and hold both buttons pressed. After ten seconds, visual confirmation of the mode change is given by the display LEDs and both mode symbols flashing.

Note: Override can only be entered from LC mode. Whilst in Override, both mode buttons must be held pressed continuously. Releasing either or both buttons results in the system changing back to LC mode.

2 Solenoids **A**, **C** and **D** have 12 Volts applied. Solenoids **B**, **E** and **F** have 0 Volts applied. Therefore, proportional valve **A** and valves **C** and **D** are energised and valves **B**, **E** and **F** are de-energised.

- a Valve **B** causes the lower service oil to flow via restrictor **7** and proportional valve **A**. Because the load moment is at or above the maximum threshold, the proportional valve allows only the minimum flow of oil to the lower service. [⇒ Proportional Valve \(17\)](#).
- b Valves **C** and **D** allow operation of the lift service and the tilt and extend services respectively.
- c Valves **E** and **F** allow dump or crowd only through restrictors **13**, slowing the operating speed.

WARNING

Work to the load chart and boom indicators, the load moment is at maximum level.

5-2-4-16

3 Careful use of the controls may be used to lower and recover the load. The mode change and test buttons may now be released and the system will revert to LC mode.

Note: Valves **B**, **C** and **D** are fitted with a manual override to enable operation of the machine in the event of solenoid failure. This facility must be used only by suitably trained and qualified personnel.

Proportional Valve

Note: The figures mentioned below are for purposes of explanation only and are not to be taken as accurate for servicing purposes.

The proportional valve regulates the flow of oil to the lower service when in circuit. Unlike the other valves, which are energised by a constant 12 Volts d.c., the proportional valve is controlled by a method known as pulse width modulation (PWM).

The energising supply is switched on and off at 100Hz, and the LC system varies the ratio of the time 'on' compared with the time 'off'.

This produces a square wave of 100Hz, with a variable mark to space (M/S) ratio.

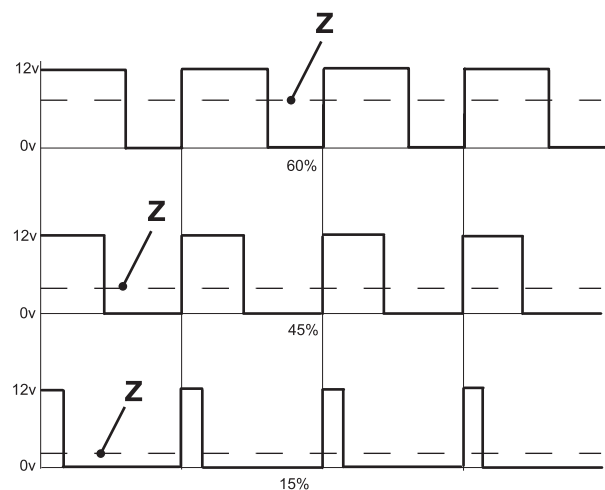


Fig 4.

The average current **Z** through the solenoid, and hence the average time the valve is open varies with the M/S ratio, thus regulating the flow rate of the oil to the lower service.

Below the minimum threshold, the M/S ratio is constant at 60%, allowing the unregulated flow through the valve. (Note that this is restricted by restrictor **7** to a maximum of 26 litres/min).

As the load moment increases to the minimum threshold (red light on), the M/S ratio drops to 45%, reducing the flow to the ram.

Between the minimum T_{MIN} and maximum T_{MAX} thresholds (amber light on), the M/S ratio, and hence the flow to the ram **F**, varies in accordance with the load moment **LM** (as sensed by the LMI transducer) between the values of 45% at the minimum threshold (green lights on) and 15% at the maximum threshold (red light on). As a result, the rate at which the boom can be lowered is regulated in proportion to the load moment.

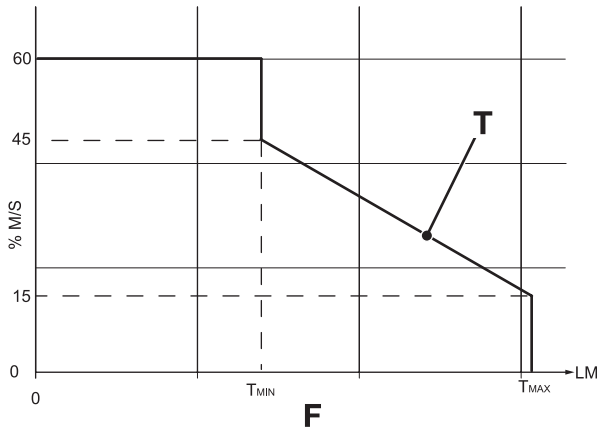


Fig 5.

When the maximum threshold is reached, the energising supply is cut off completely, so closing the proportional valve and preventing further lowering of the boom.

The exception to this is in Override mode only, where the energising supply is not cut off and lowering at the minimum rate is still permitted.



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Component Key

As the Load Control System (LCS) may be fitted to several types of Loadall machine, those parts of the schematic which show non-LCS parts of the overall hydraulic schematic are to be taken as being representative only.

The schematics shown here, within the bold outline **AA**, show how the LCS is integrated into a typical JCB Loadall.

For details of the standard hydraulic system of a particular machine, reference should be made to that machine's Service Manual.

Note: Machines without stabiliser legs (528-70, 535-95) do not have solenoid valve **C** fitted and port **L3** is plugged.

Hydraulics Schematic

- AA** Six valve manifold
- A** Proportional valve (PWM) regulating lower service
- B** Solenoid valve controlling lower service regulation
- C** Solenoid valve controlling lift service
- D** Solenoid valve controlling extension and tilt services
- E** Solenoid valve controlling tilt circuit (dump)
- F** Solenoid valve controlling tilt circuit (crowd)
- 7** Flow regulator
- 8** Non-return valve (0.1 bar back pressure)
- 9** Relief valve
- 10** Relief valve
- 11** Relief valve
- 12** Counterbalance valve
- 13** Restrictor (1.8 dia.)
- 14** Restrictor (0.5 dia.)
- 15** Filter
- 16** Cavity plug

Table 3. Relief Valve Pressure Settings

Item	Model(s)	Setting
9	528-70, 532-125, 537-135	276 Bar
	533-105, 535-95	250 Bar
10	528-70	250 Bar
	532-125, 537-135	330 Bar
	533-105	241 Bar
	535-95	276 Bar
11	All machines	210 bar



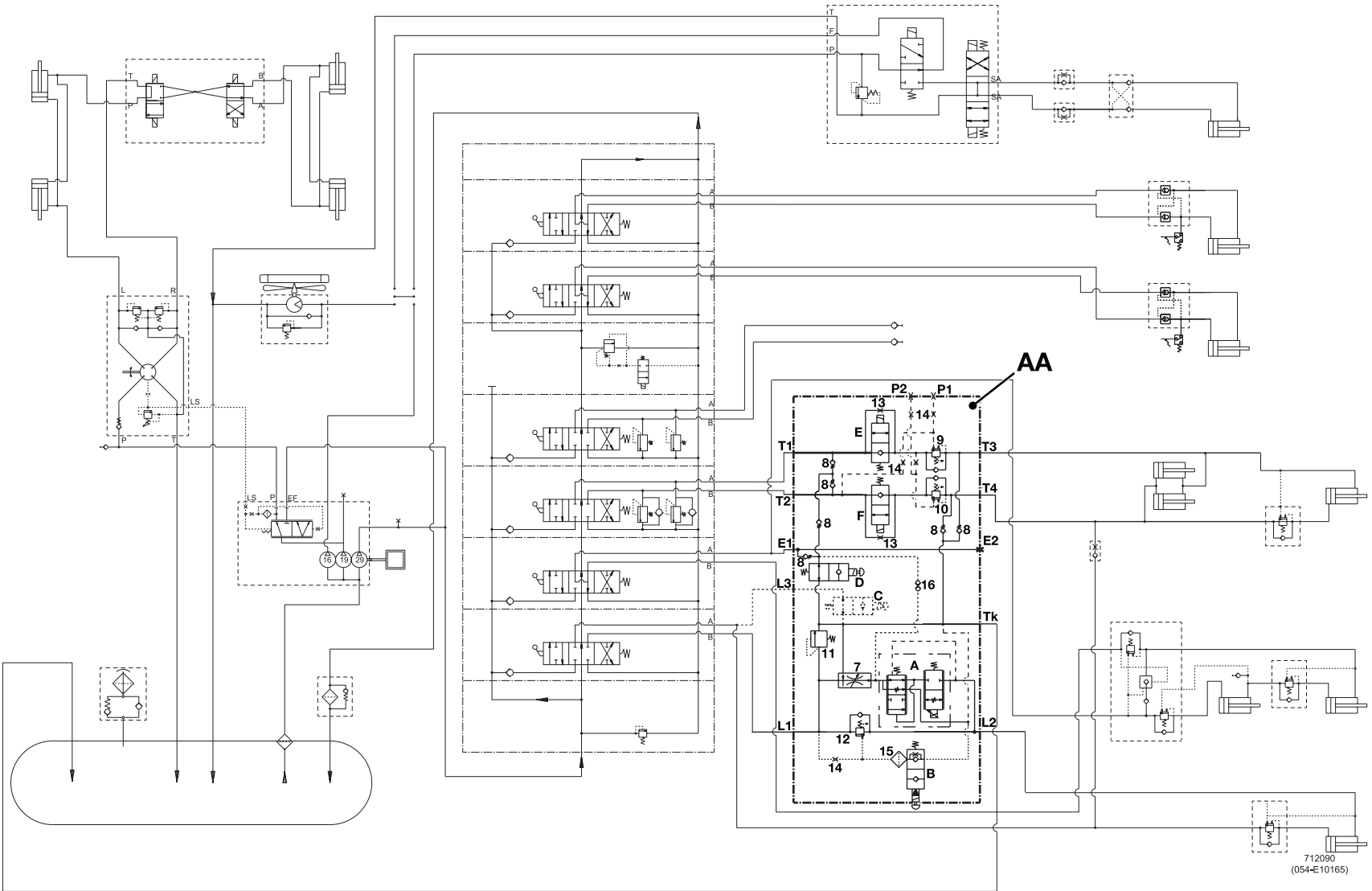


Fig 6. LCS Hydraulic Schematic

Electrical Schematic

Component Key

Note: Item numbers shown on the illustration are for purposes of circuit explanation only and do not correspond to those shown on the relevant Schematic in Section C of appropriate Service Manual.

Note: Machines without stabiliser legs (528-70, 535-95) do not have solenoid valve C fitted.

Note: Items 5 to 8 are as fitted in standard machine (see Schematic in Section C of appropriate Service Manual) and operate accordingly. LCS equipped machines have the additional connection (907B) as shown.

- A** Solenoid, proportional (PWM) valve
- B** Solenoid, valve B
- C** Solenoid, valve C
- D** Solenoid, valve D
- E** Solenoid, valve E
- F** Solenoid, valve F
- 1** Load Control System (LCS) indicator
- 1a** ⇒ [Table 4. 14-Way LCS Connector \(□ 22\)](#).
- 1b** ⇒ [Table 5. 4-Way Standard LMI Connector \(□ 22\)](#).
- 2** Transducer
- 3** Left stabiliser position switch (closed when stabilisers down)
- 4** Right stabiliser position switch (closed when stabilisers down)
- 5** Boom proximity switch (boom angle)
- 6** Stabiliser isolation relay
- 7** Stabiliser isolation solenoid
- 8** Stabiliser isolation switch (in cab)

Table 4. 14-Way LCS Connector

Pin	Signal
1	12v Supply
2	12v Supply
3	PWM supply solenoid A (Proportional valve)
4	0/12v output to solenoid B
5	0/12v output to solenoid C
6	0/12v output to solenoid D
7	0/12v output to solenoid E
8	0/12v output to solenoid F
9	Left stabiliser leg input (12v when leg down)
10	Right stabiliser leg input (12v when leg down)
11	Boom angle input (12v when boom angle <45°)
12	Earth
13	Earth
14	Not used

Table 5. 4-Way Standard LMI Connector

Pin	Signal
1	Earth
2	Transducer
3	12v Supply
4	Transducer

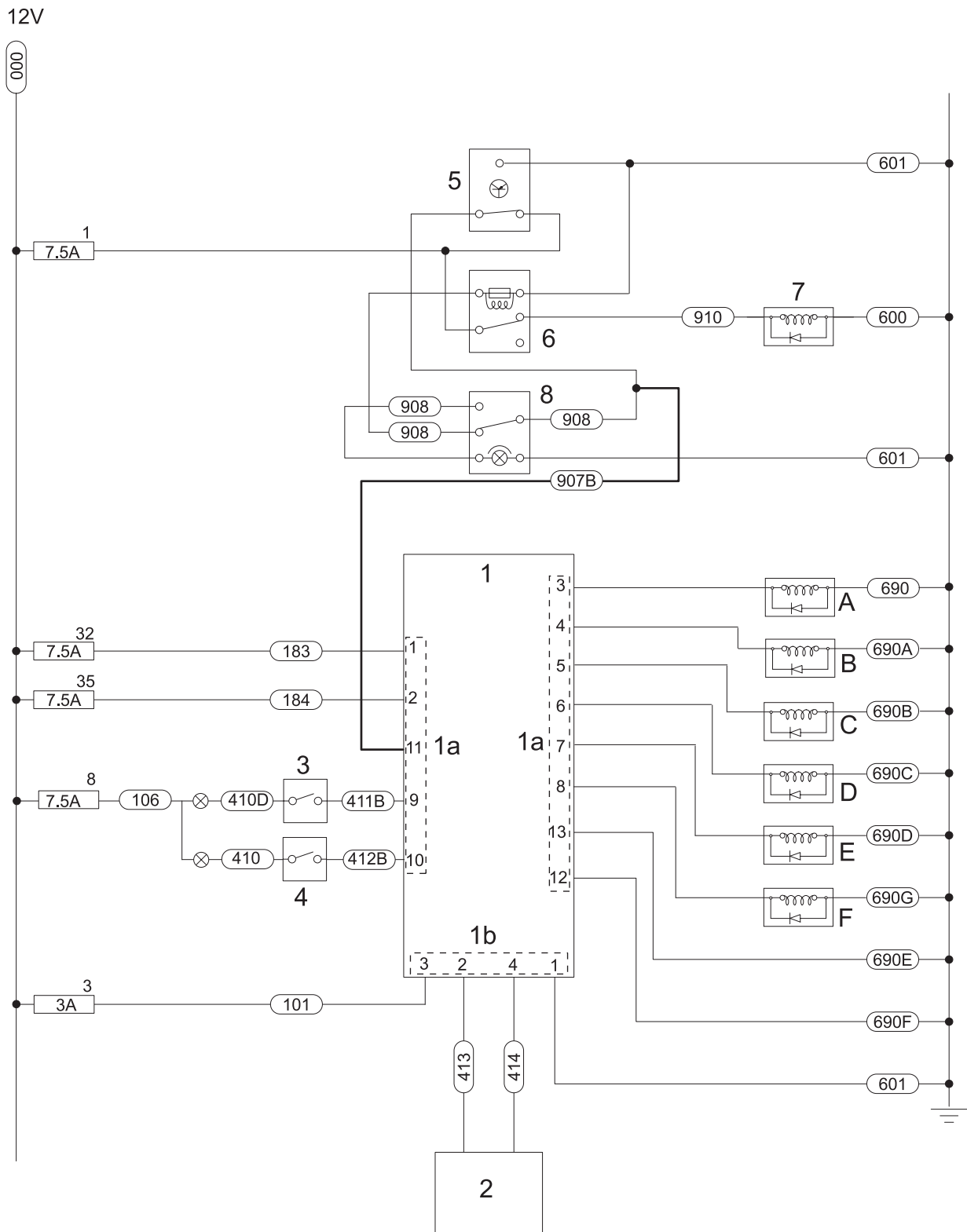


Fig 7. LCS Electrical Schematic

Harness Data

Drawings

includes tables showing wire connections and destinations for all the connectors on the harness.

The following drawings are reproduced from production electrical harness drawings. Each harness drawing

Table 6. Chassis Harness

Part Number	Issue	Description	Drawing(s)
721/11167	1	LCS (All Models)	⇒ Fig 8. (□ 25)

Table 7. Panel Harness

Part Number	Issue	Description	Drawing(s)
721/11168	1	LCS (All Models)	⇒ Fig 9. (□ 26)

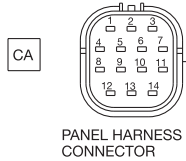
Table 8. Stabiliser Harness

Part Number	Issue	Description	Drawing(s)
721/11227	1	LCS (All Models)	⇒ Fig 10. (□ 27)

Chassis Harness

Note: Solenoid connections are indicated by letters stamped on the manifold.

CA	PANEL CONN			EE, EF
TERM	WIRE	SIZE	DEST	TYPE
1	690F	1.0	CK 1	EJ, C
2	1860	1.0	CB 1	EJ, C
3	1861	1.0	CC 1	EJ, C
4	1862	1.0	CD 1	EJ, C
5	1863	1.0	CE 1	EJ, C
6	1864	1.0	CF 1	EJ, C
7	1865	1.0	CG 1	EJ, C
8	690E	1.0	CK 1	EJ, C
9	411B	1.0	CJ 1	EJ, C
10	412B	1.0	CJ 2	EJ, C
11	907B	1.0	SD	EJ, C
12				E
13				E
14				E



CB	SOLENOID 'A'			ME, MG
TERM	WIRE	SIZE	DEST	TYPE
1	1860	1.0	CA2	NH
2	690	1.0	CK1	NH

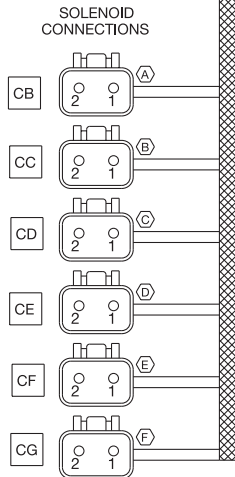
CC	SOLENOID 'B'			ME, MG
TERM	WIRE	SIZE	DEST	TYPE
1	1861	1.0	CA3	NH
2	690A	1.0	CK1	NH

CD	SOLENOID 'C'			ME, MG
TERM	WIRE	SIZE	DEST	TYPE
1	1862	1.0	CA4	NH
2	690B	1.0	CK1	NH

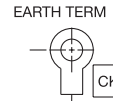
CE	SOLENOID 'D'			ME, MG
TERM	WIRE	SIZE	DEST	TYPE
1	1863	1.0	CA5	NH
2	690C	1.0	CK1	NH

CF	SOLENOID 'E'			ME, MG
TERM	WIRE	SIZE	DEST	TYPE
1	1864	1.0	CA6	NH
2	690D	1.0	CK1	NH

CG	SOLENOID 'F'			ME, MG
TERM	WIRE	SIZE	DEST	TYPE
1	1865	1.0	CA7	NH
2	690G	1.0	CK1	NH

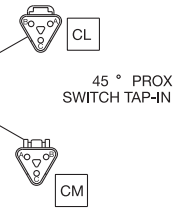


CK	EARTH TERMINAL			
TERM	WIRE	SIZE	DEST	TYPE
1	690	1.0	CB2	NZ
	690A	1.0	CC2	
	690B	1.0	CD2	
	690C	1.0	CE2	
	690D	1.0	CF2	
	690E	1.0	CA8	
	690F	1.0	CA1	
690G	1.0	CG2		



SD	AK	
WIRE	SIZE	DEST
907	1.0	CMA
907A	1.0	CLA
907B	1.0	CA11

CL	PROX.SWIT.MALE TAP-IN			MK,MM
TERM	WIRE	SIZE	DEST	TYPE
A	907A	1.0	SD	NK
B	601DL	1.0	CMB	NK
C	121D	1.0	CMC	NK



CM	PROX.SWIT.FEMALE TAP-IN			MJ,ML
TERM	WIRE	SIZE	DEST	TYPE
A	907	1.0	SD	NH
B	610DL	1.0	CLB	NH
C	121D	1.0	CLC	NH

CJ	STAB.HARNESS			ER,ES
TERM	WIRE	SIZE	DEST	TYPE
1	411B	1.0	CA 9	EJ, C
2	412B	1.0	CA10	EJ, C

Fig 8. 721/11167 - LCS (All Models) Chassis Harness

721/11167 Issue 1



Panel Harness

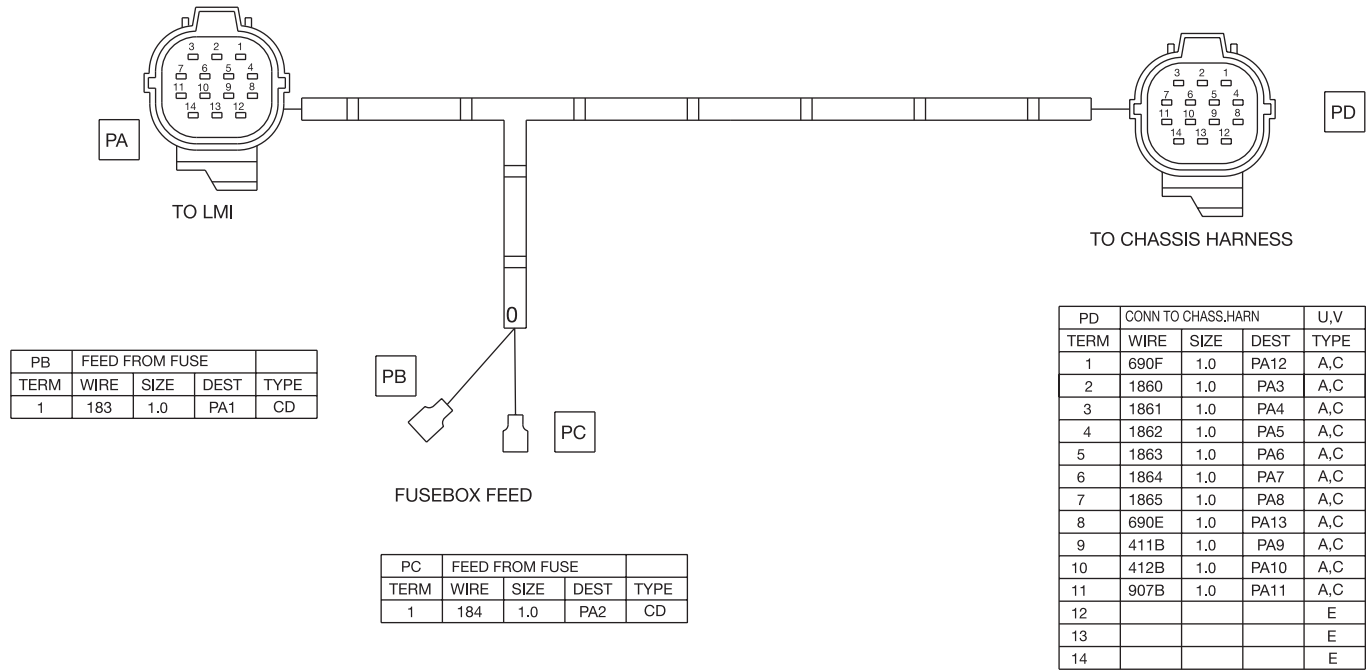


Fig 9. 721/11167 - LCS (All Models) Panel Harness

721/11168 Issue 1



Stabiliser Harness

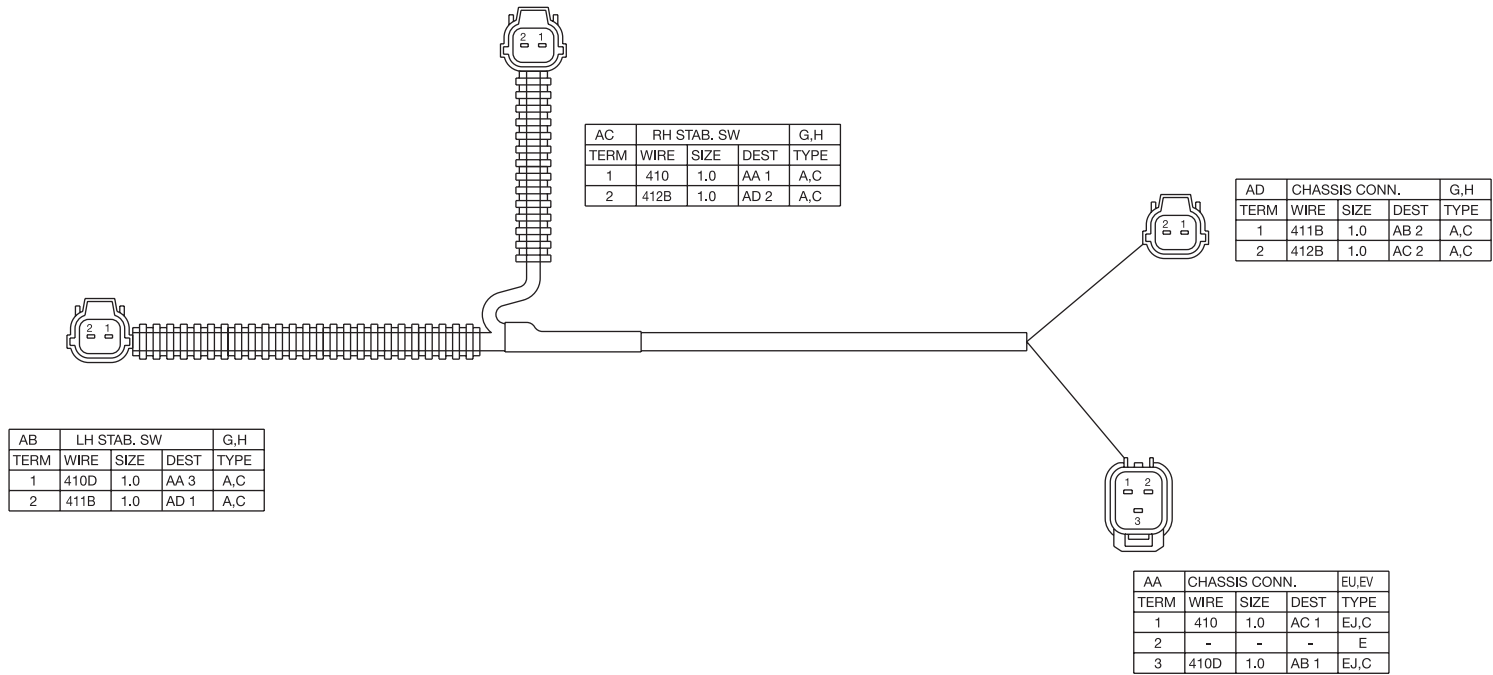


Fig 10. 721/11227 - LCS (All Models) Stabiliser Harness

721/11227 Issue 1



Logic Sequence

Introduction

This Logic sequence should be read in conjunction with:

⇒ [Circuit Description \(□ 11\)](#)

⇒ [Hydraulics Schematic \(□ 20\)](#)

⇒ [Electrical Schematic \(□ 22\)](#)

Each item should be read sequentially, unless indicated (for example: Go to item 10).

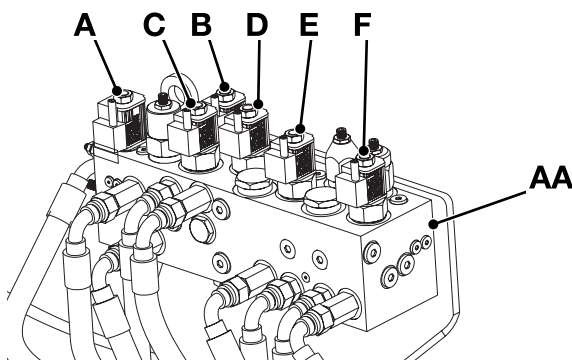


Fig 11. Solenoid Locations

- A Solenoid, proportional (PWM) valve
- B Solenoid, valve B
- C Solenoid, valve C⁽¹⁾
- D Solenoid, valve D
- E Solenoid, valve E
- F Solenoid, valve F

(1) Machines without stabiliser legs (528-70, 535-95) do not have solenoid valve C fitted.

Note: In the following description, the various thresholds have the meanings below:

- Minimum Threshold Green Lights (LED) on
- Maximum Threshold Red Light (LED) on

The amber light (LED) will be on between minimum and maximum thresholds.

Note: MVB = Main Valve Block.

- 1 Start Machine.
- 2 Machine defaults to Load Control Mode.
 - a Load Control Mode Symbol Illuminated.
- 3 >45° boom angle and stabiliser leg up?

- a Yes - Go to item 4.
- b No - Go to item 8.
- 4 Solenoid B = 0V. Flow regulator for lower in circuit.
 - Solenoid E = 0V, Solenoid C = 0V. Lift oil from MVB to tank.
- 5 532-120, 533-105, 537-135 Only - solenoid C = 0V. Lift oil from MVB to tank.
- 6 LMI Signal:
 - a Below maximum threshold (red light not on).
 - Solenoid D - 12V. Extend oil from MVB to ram.
 - Proportional valve partially open. Lower oil from MVB to ram (supply limited). Go to item 3.
 - b Above maximum threshold (red light on)
 - Solenoid D = 0V. Extend oil from MVB to tank.
 - No power to proportional valve (fully closed).
- 7 Retract boom to reduce load moment (or use override). Go to item 3.
- 8 Is mode change required?
 - a Yes - Go to item 9.
 - b No - Go to item 15.
- 9 Which mode?
 - a Load Control, Go to 10.
 - b Ground Work, Go to 12.
- 10 Press and hold mode switch for 5 seconds. LMI signal:
 - a Above min. threshold (amber or red light on) - prevent mode change. Go to 11.
 - b Below min. threshold (green lights on) - allow mode change. LMI display LEDs flash indicating change. Release mode button. Go to 2a.
- 11 Press and hold mode button. No change takes place, Load Control symbol remains lit.
 - Reduce load moment by retract/lift or retract boom and remove load. Go to 10.

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for your reading.**

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