Contents

Chapter1

Preface

Since 1986 GINAF Trucks has used the Hydro-Pneumatic Vehicle Suspension (HPVS) on various models of vehicle. This involved replacing the conventional (mechanical or air) suspension system by hydraulic cylinders.

In 1991 the Electronic Vehicle Steering (EVS) system was launched, which in combination with HPVS makes for sophisticated possibilities.

In this documentation attention will be given to the description, functioning, maintenance, diagnostics and operation of the HPVS and EVS.

1.1 General

This documentation contains information about the HPVS suspension system and the EVS steering system that were used on GINAF vehicles from about 1991 until 1998. During these production years different variants of the system were used, i.e. versions 3/3 and v6/0. Both of these variants will therefore be discussed.

Since the various versions can be used on different GINAF models, only “versions” will be referred to in this and subsequent chapters. For clarity’s sake, however, section 1.2 gives a list of which version corresponds to which vehicle model. In exceptional cases, though, this list may not reflect the actual situation!

1.2 List of versions

This documentation is applicable to vehicles in the G series (with DAF 95 cab) and in the M series (with DAF 85 cab), built between 1991 and 1998.

G-series (10x8)

M-series (8x4)

From 1986 to 1992 vehicles with HPVS were built with an electronics unit as illustrated below. The unit is mounted against the rear wall of the cab.

"Old" unit

This documentation is not applicable to vehicles on which this "old" unit is fitted.

The documentation does however apply to vehicles built in 1991-1998 that are fitted with the "e3" Electronic Control Unit (ECU), illustrated below, with **three** blue blocks with set screws under the cover.

e3 ECU

This ECU is located under the co-driver's seat or in the fuse box in the dashboard on the co-driver's side.

Once it has been ascertained that an e3 ECU is fitted, it is important to find out which hydraulics version the vehicle has. We have the following variants:

v3/3: HPVS suspension with 2 or 3 axles, 1 of which is a lifting axle. The lifting axle can be raised irrespective of the weight of the axle load.

v6/0: HPVS suspension with 2 axles without lifting axle.

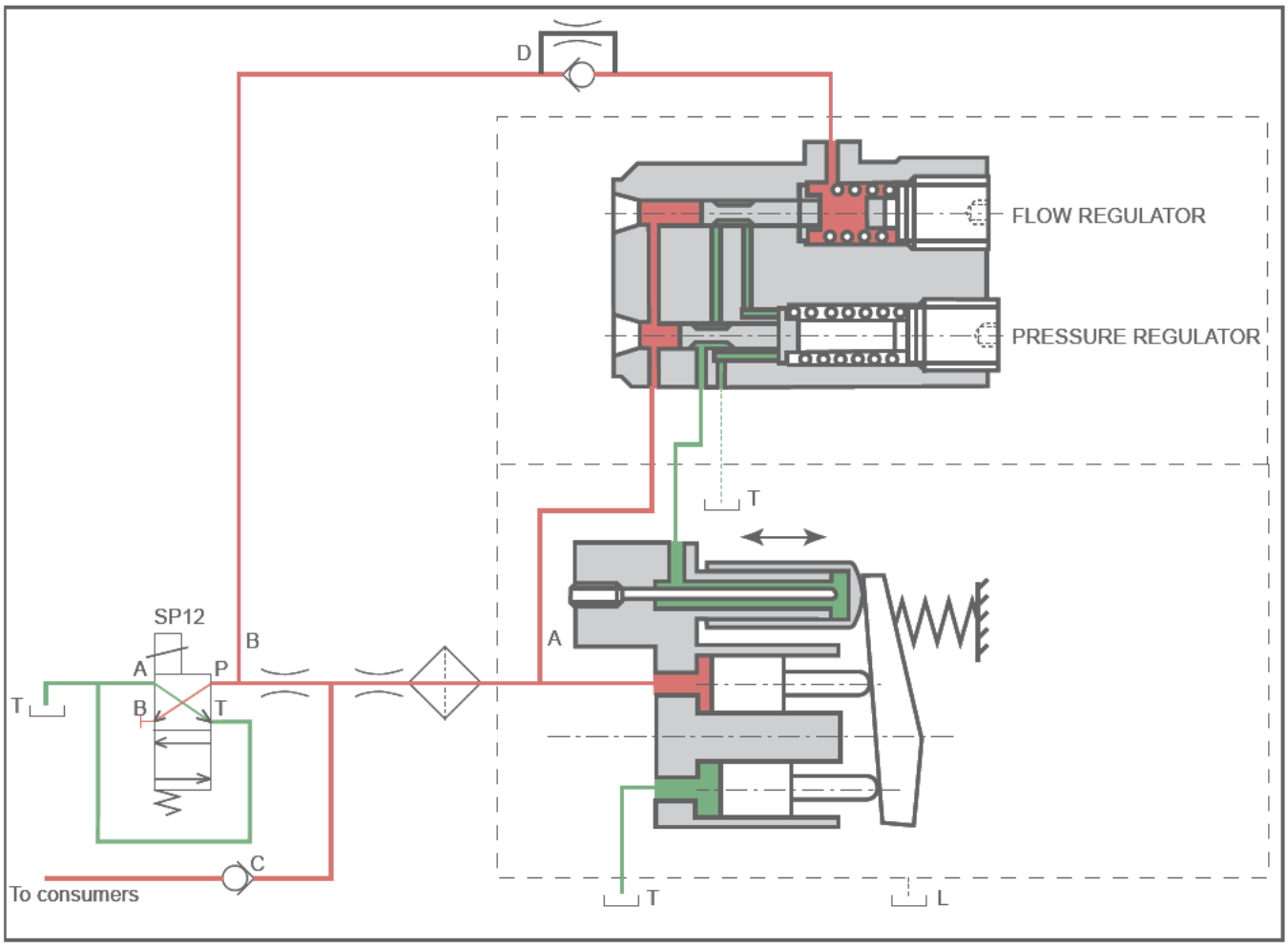
Vehicle models with a "-S" in the type designation are fitted with both HPVS and EVS.

The following table shows which hydraulics version corresponds to which vehicle model.

Vehicle model	Vehicle configuration	ECU version	Hydraulics version
G 3233-S	6x4	e3	v 6/0
G 3333-S / G 3335-S	6x6	e3	v 6/0
G 4243-S	8x4	e3	v 6/0
G 4443-S / G 4446-S	8x8	e3	v 6/0
G 5247 / G 5250	10x4	e3	v 3/3
G 5447 / G 5450	10x8	e3	v 3/3
G 5450-S	10x8	e3	v 3/3
M 3233-S	6x4	e3	v 6/0
M 3333-S / M 3335-S	6x6	e3	v 6/0
M 4243-S	8x4	e3	v 6/0

the flow, a pressure drop will develop across the throttles. After this throttle there is a branch (B), so that this oil pressure is on the right-hand side of the above-mentioned control plungers, together with an adjustable spring pressure.

The larger the oil flow through the throttles, the larger will be the pressure drop across them. If the pressure drop exceeds the set value, the plunger will move against the oil pressure (measured behind the throttles) and the spring pressure, so that oil pressure is again applied to the plunger, which adjusts the stop plate. As a result, the flow from the pump is continuously controlled in such a way that it does not exceed the set maximum.

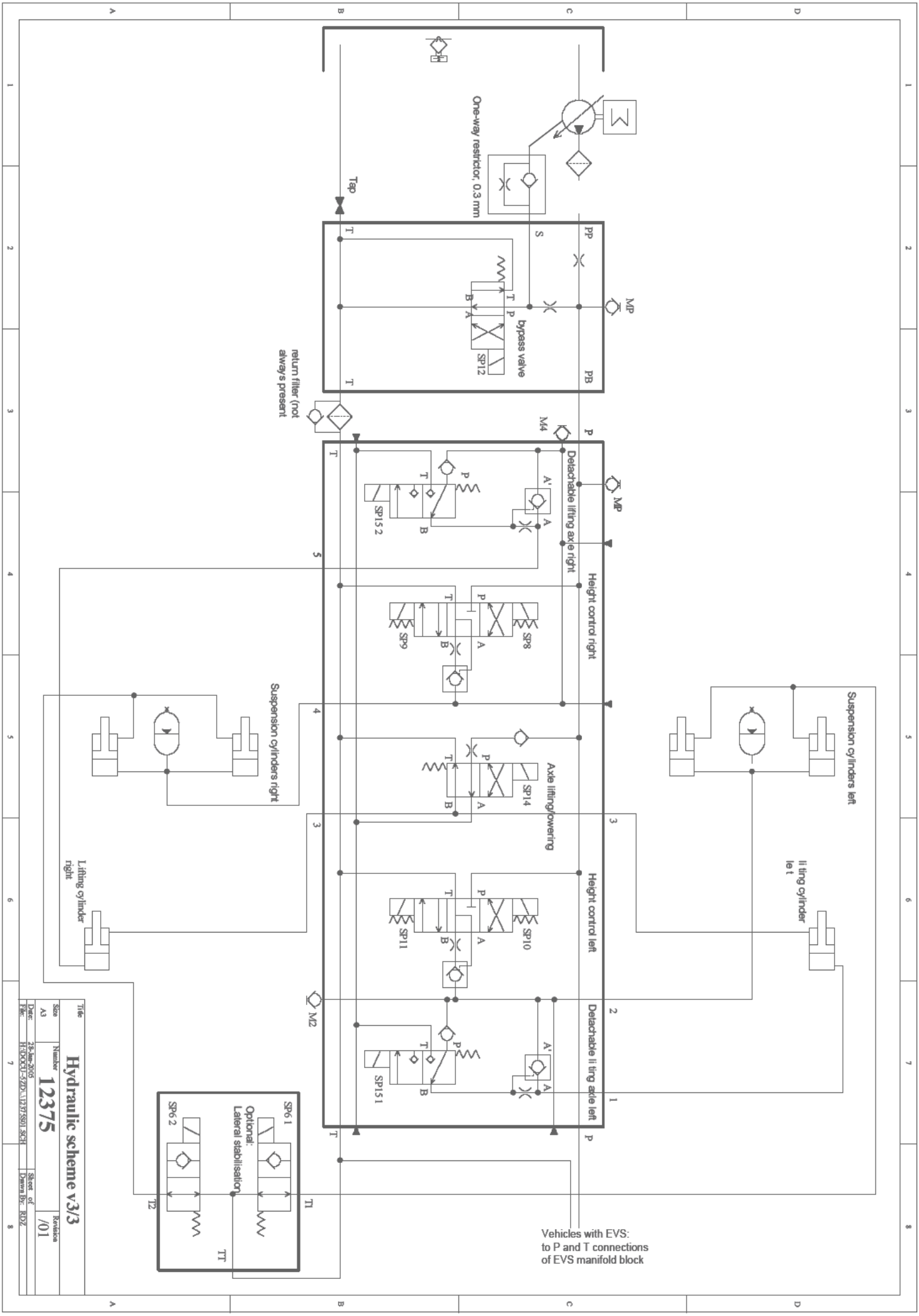


Pump control; SP12 energised

The flow is independent of the pressure delivered by the pump unless it reaches the maximum set value: the flow will then be reduced so as to prevent the pump pressure from exceeding the set maximum.

Because the pump is running all the time (i.e. is connected to the engine), it must be able to run without pressure when no pressure is required. This is regulated by a 4/2 control slide (SP12) and controlled by the ECU.

When this valve is energised, P is connected to B. B is plugged. This means that only oil can flow towards the manifold block. When no further oil is required (controlled by the ECU), the voltage will be removed from SP12. As a result, the parallel mode is activated, so that P is


One-way restrictor, 0.3 mm
Tap
bypass valve
SP12
MP
PP
PB
S
T
P
return filter (not always present
M4
Detachable lifting axle right
SP152
Height control right
SP9
SP8
Suspension cylinders right
Axle lifting/lowering
SP14
Height control left
SP11
SP10
Detachable li ting axle left
SP151
M2
Lifting cylinder right
li ting cylinder le t
Suspension cylinders left
SP6 1
Optional:
Lateral stabilisation
SP6 2
T1
T2
TT
Vehicles with EVS:
to P and T connections
of EVS manifold block
Title
Hydraulic scheme v3/3
Size
A3
Number
12375
Revision
/01
Date:
28-Jan-2005
File:
H:\DOCU~1\ZD\..\12375801.SCH
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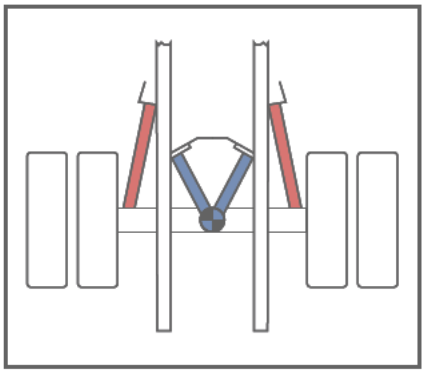
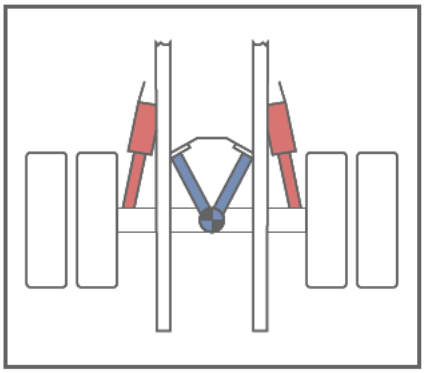
Chapter 4

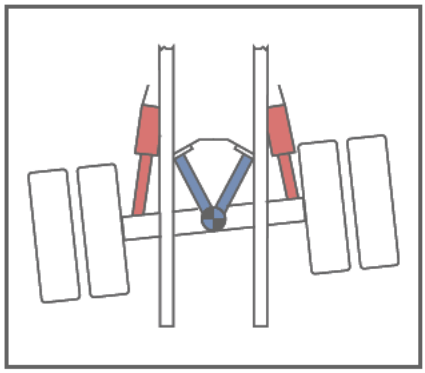
EVS

4.1 General

EVS (Electronic Vehicle Steering) is an electronically controlled, speed-dependent steering system for a rigid rear axle, driven or otherwise. This rear axle is controlled by two hydraulic cylinders.



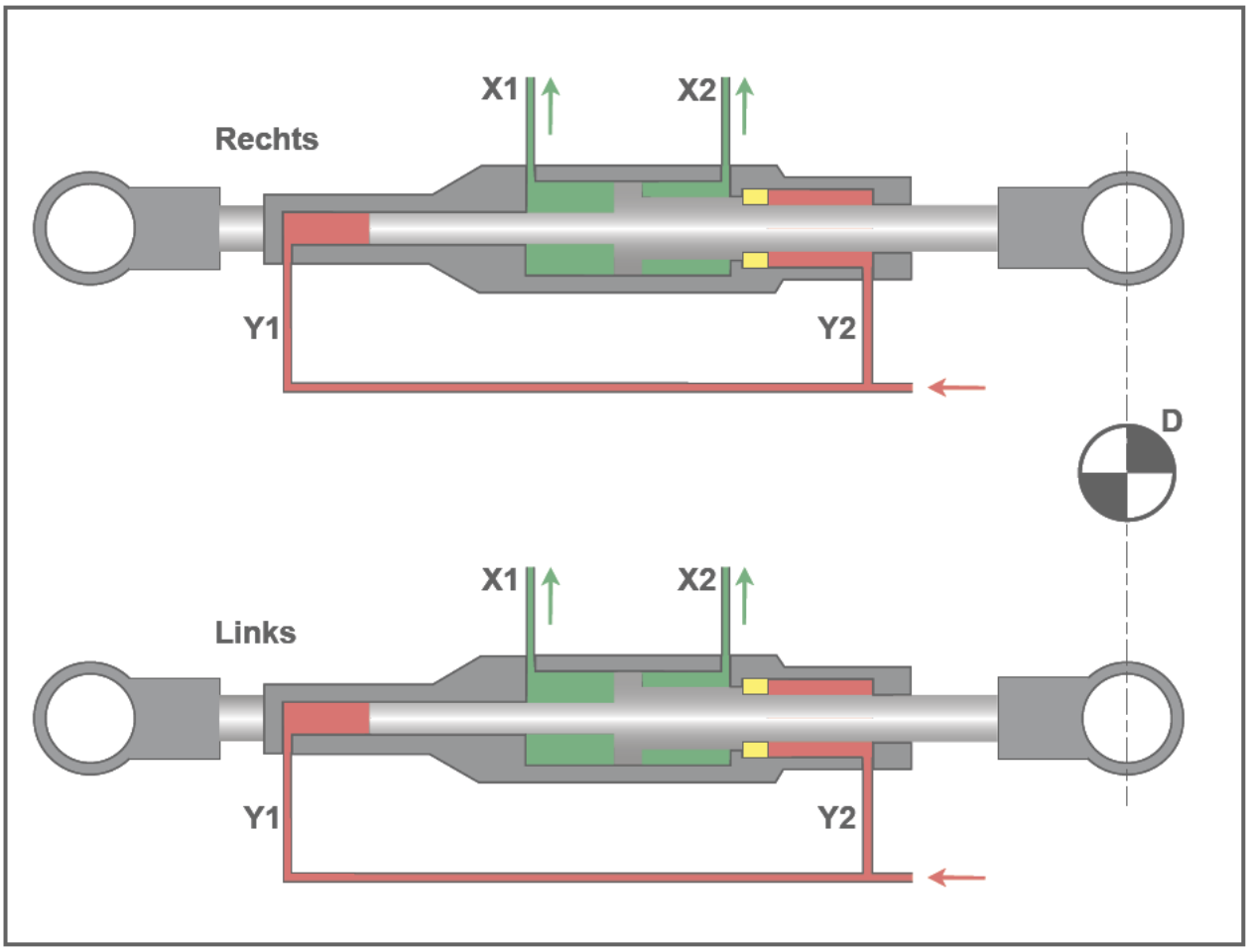




The basis for this is a standard rear axle suspension with a V-rod (blue) in the centre of the axle on top and with two torque rods (red) on the left and right underneath. With this arrangement the V-rod absorbs longitudinal and lateral forces, while the torque rods absorb only longitudinal forces. With EVS the lower torque rods are replaced by special hydraulic cylinders that give the axle a steering motion due to the change in length (one longer and the other shorter by the same amount). The axle turns about the ball of the V-rod, which is attached to the axle.

4.3 Operation; EVS cylinders

4.3.1 Centre position

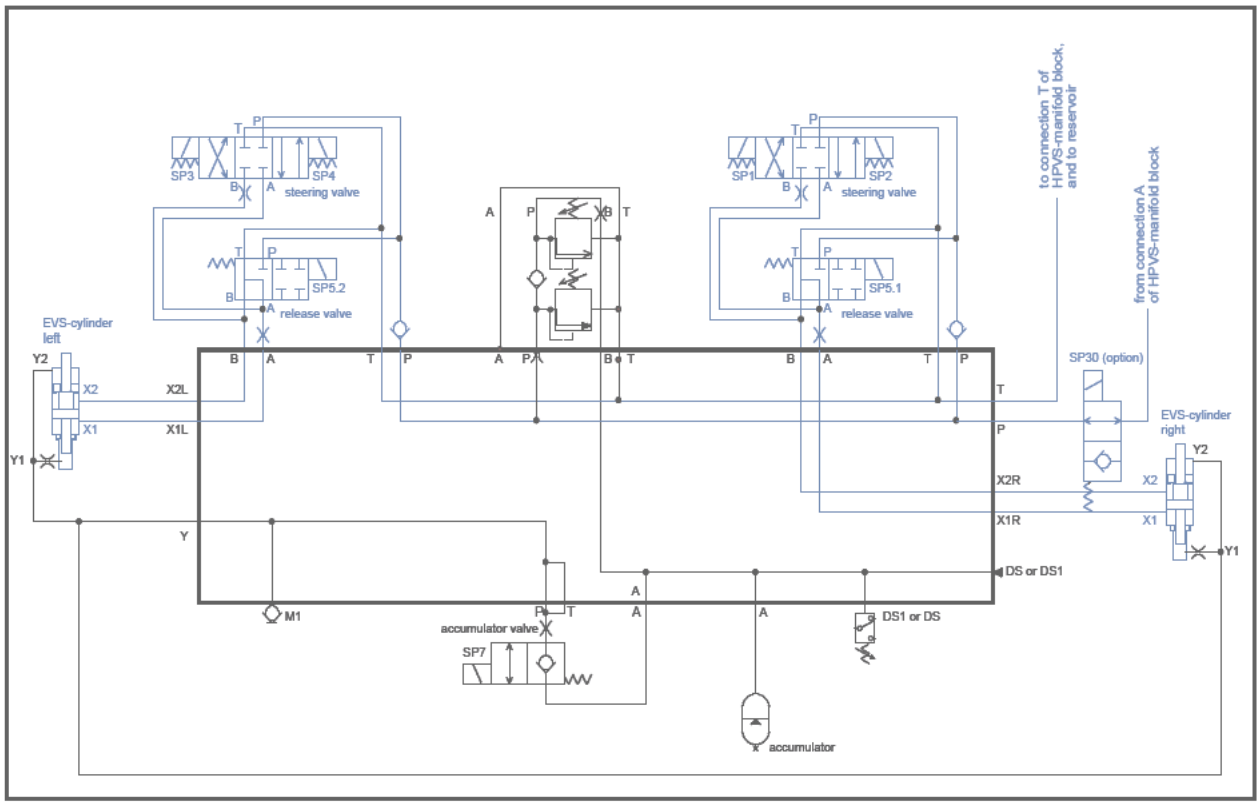


EVS; centre position

Connections X1 and X2 of both cylinders are connected to the reservoir. Connections Y1 and Y2 of both cylinders are kept under pressure by the emergency steering accumulator. This pressure is applied to the piston rod via connection Y1 and to the floating piston (shown in yellow) via Y2. Because the surface area of the floating piston is approximately twice as large as the surface area of the piston rod, the floating piston will carry the main piston to the left until the floating piston rests against the stop. At the same time, at Y1 the main piston is pushed to the right with half the force. The EVS cylinder is now fixed. This situation occurs when driving straight ahead at the transition speed or when the EVS switch on the control panel is off. When the transition speed is exceeded, i.e. the vehicle speed is higher than 45 km/h, the system will ensure that connections X1 and X2 are closed, so that the oil can no longer escape from the steering compartments. The cylinders are now subjected to dual hydraulic locking.

4.4 Operation; hydraulic diagram

4.4.1 The steering system



EVS hydraulic diagram: steering system (blue)

The steering system consists of a delivery and return connection from the HPVS manifold block, two steering valves with coils SP1, 2, 3 and 4 and two release valves SP5.1 and 5.2.

The purpose of the steering valves is to operate the steering cylinders.

If the release valves are not energised, the steering system is pressureless and steering is not possible, even if SP1, 2, 3 or 4 is energised. The X1 and X2 pipes are pressureless.

If the release valves are energised, the pump is activated by means of SP12 (see Chapter 2) and one or two of coils SP1 to 4 are energised, oil pressure may be built up in the cylinder(s) so as to make the axle steer.

In order to avoid unwanted oil flows, two throttles have been fitted (at SP1, 2 and SP3, 4). The non-return valves may be in the form of block construction (loose sandwich element) or a cartridge; in the latter case they are fitted in release valves SP5.1 and SP5.2. A few throttles have also been fitted so as to damp the oil flows.

SP5.1 and SP5.2 are connected in series and are therefore fitted with 12 volt magnets to ensure good wire breakage/short-circuit notification.

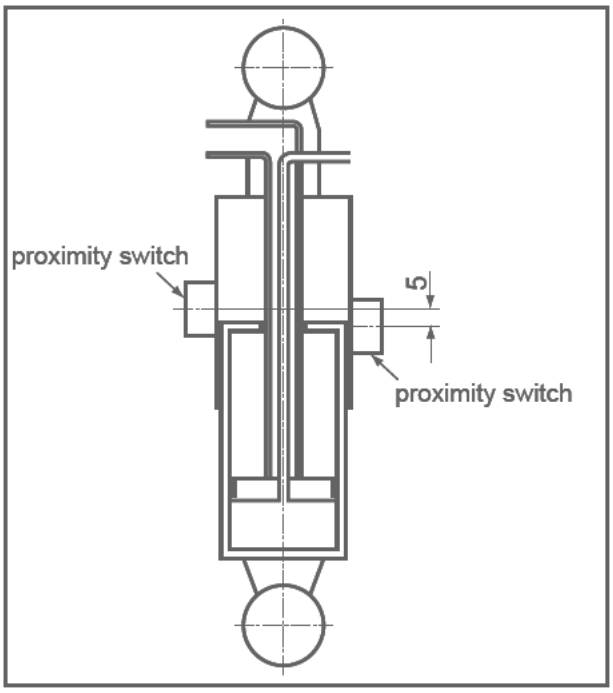
Chapter 5

Electrical system

5.1 Components

5.1.1 Proximity switches (height control)

The height control of the HPVS system is usually provided by four proximity switches on two cylinders. Two proximity switches are fitted for each cylinder of the controlled axle.



HPVS cylinder with proximity switch

The proximity switches for the height control are basically normal switches with an internal changeover contact. In addition to a power supply wire and an earth wire, two output wires are fitted. Depending on the position of the switch, a voltage that is approx. 0.5 V lower than the supply voltage will be applied to one of the output wires.

The changeover switch does not switch over because a mechanical contact takes place, but because an object is approaching. This proximity switch reacts only to metals. The changeover switch will switch over when metal comes within 12 mm of the sensitive side.

Irrespective of the position of the switch, voltage will always be applied to one output wire and not to the other. The proximity switches are 5 mm apart. The switches with housing are fitted on the cylinder's protective sleeve, in which holes have been made. As a result, they will not switch in reaction to the metal of the protective sleeve. The proximity switches will however switch when the cylinder tube comes past during rebound and compression because it is within the switching distance of 12 mm.

Fault code 11.2

As for fault code 11.1, for SP9.

Fault code 11.3

As for fault code 11.1, for SP10.

Fault code 11.4

As for fault code 11.1, for SP11.

Fault code 12

A check is run for this when the valve is activated. Voltage must be constantly present for approx. 1 sec. The system reacts as for fault code 2.

Fault code 13

Hier wordt op gecontroleerd wanneer de klep wordt aangestuurd. Er moet ca. 1 sec. A check is run for this when the valve is activated. Voltage must be constantly present for approx. 1 sec. The system remains activated, the buzzer gives a signal.

Note: on M series, and from end of 1993, SP13 is no longer fitted.

Fault code 14

A check is run for this when the valve is activated. Voltage must be constantly present for approx. 1 sec. Where superstab is fitted: as for fault code 11.1, otherwise the system continues to work as normal.

Fault code 15

Height and lateral levelling control systems are deactivated, steering system continues to function.

Note: on vehicles with ‘spring-loaded switches’ this fault code is not possible.

Fault code 16.1

Height control is deactivated, lateral levelling control and steering system are working normally.

Fault code 16.2

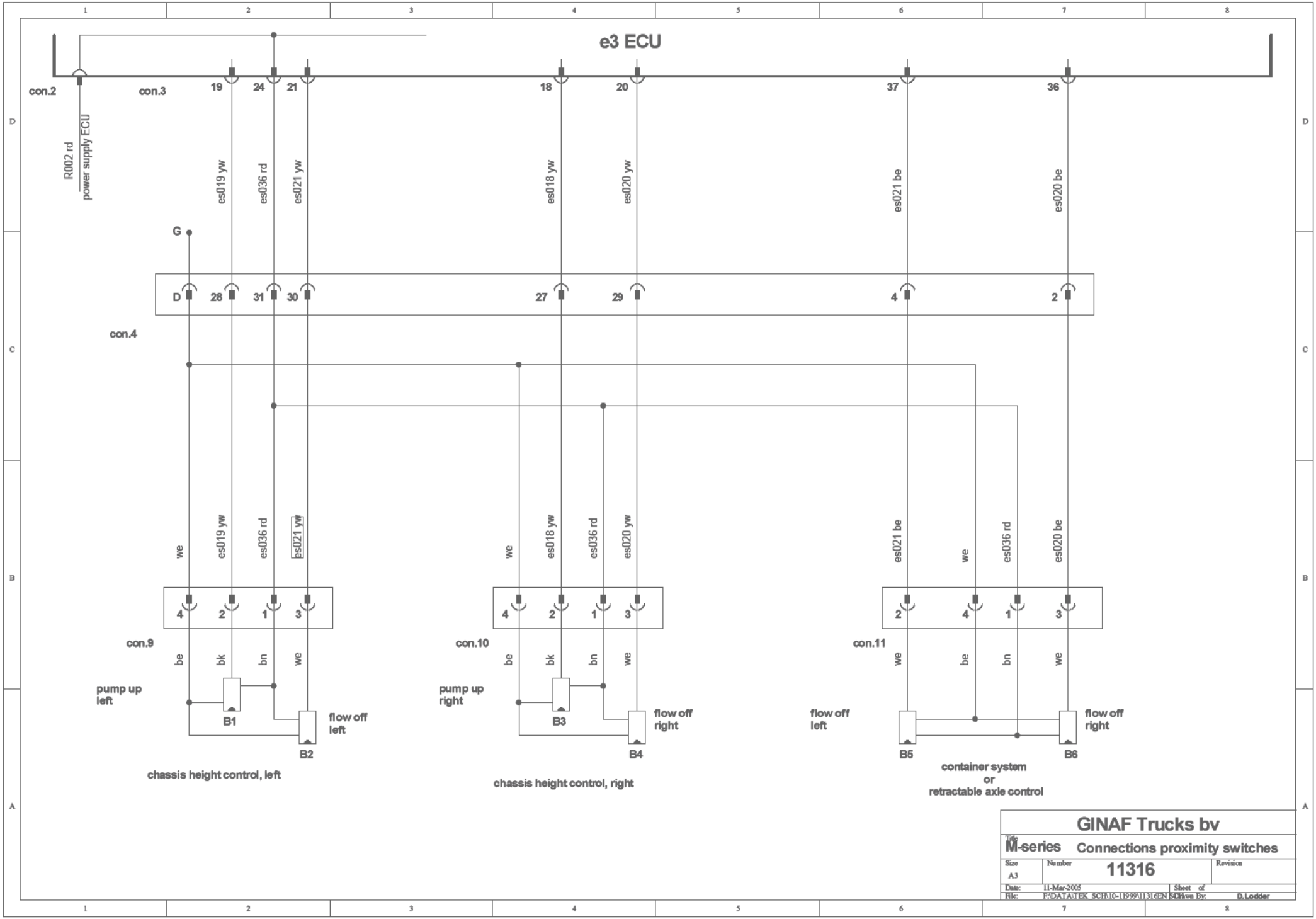
As for fault code 16.2, for right-hand side.

Fault code 17

Lateral levelling control is deactivated, height control and steering system are working normally.

Fault code 18

A check is run for this when the valve is activated. Voltage must be constantly present for approx. 1 sec. Raising the lifting axle is deactivated.


e3 ECU
con.2
con.3
19
24
21
18
20
37
36
R002 rd
power supply ECU
es019 yw
es036 rd
es021 yw
es018 yw
es020 yw
es021 be
es020 be
G
D
28
31
30
27
29
4
2
con.4
we
es019 yw
es036 rd
es021 yw
es018 yw
es036 rd
es020 yw
es021 be
we
es036 rd
es020 be
con.9
con.10
con.11
be
bk
bn
we
pump up
left
B1
flow off
left
B2
chassis height control, left
pump up
right
B3
flow off
right
B4
chassis height control, right
flow off
left
B5
flow off
right
B6
container system
or
retractable axle control
GINAF Trucks bv
M-series
Connections proximity switches
Size
A3
Number
11316
Revision
Date:
11-Mar-2005
Sheet of
File:
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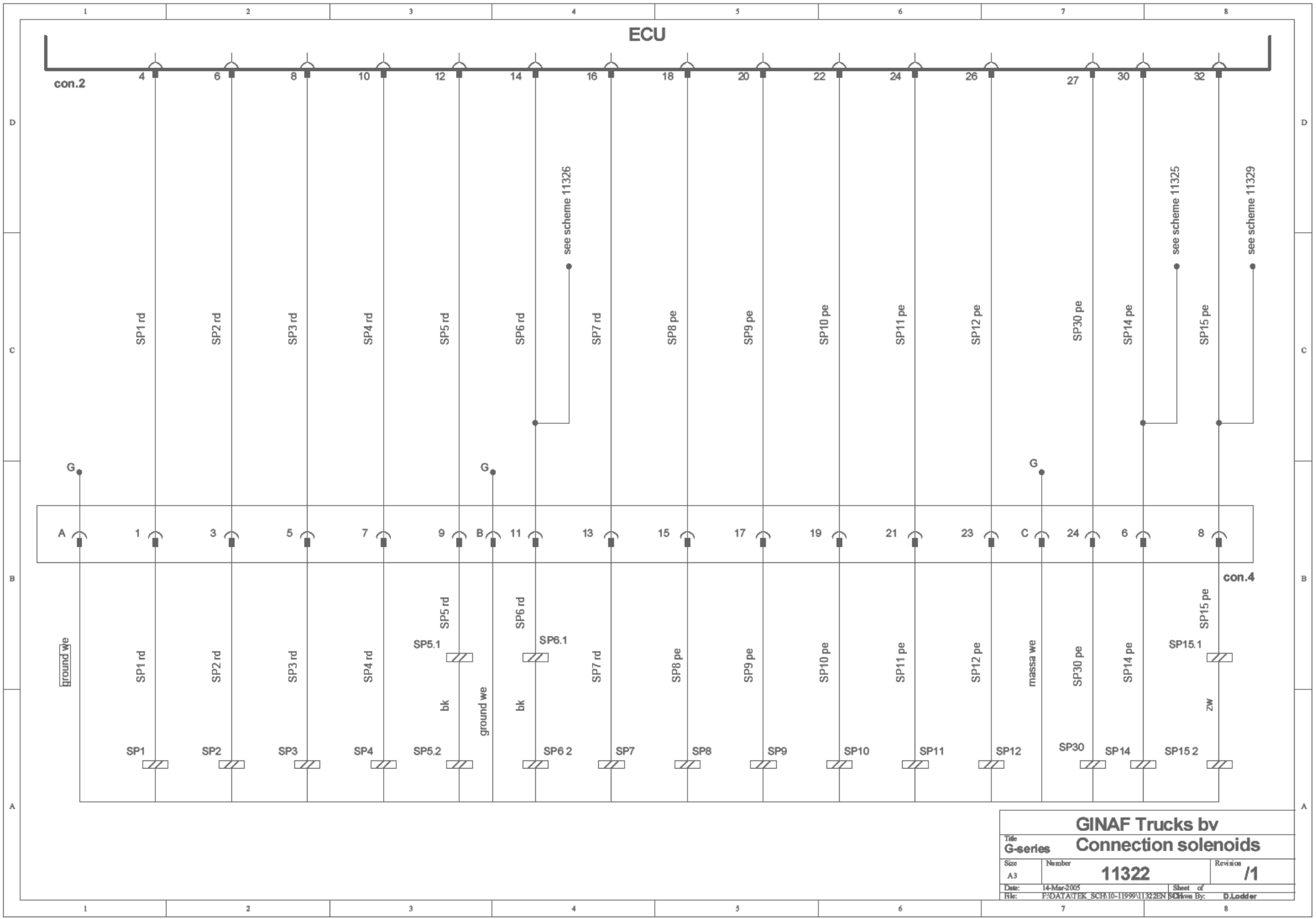
Drawn By:
D.Lodder


ECU
con.2
4
6
8
10
12
14
16
18
20
22
24
26
27
30
32
see scheme 11326
see scheme 11325
see scheme 11329
SP1 rd
SP2 rd
SP3 rd
SP4 rd
SP5 rd
SP6 rd
SP7 rd
SP8 pe
SP9 pe
SP10 pe
SP11 pe
SP12 pe
SP30 pe
SP14 pe
SP15 pe
G
G
G
A
1
3
5
7
9
B
11
13
15
17
19
21
23
C
24
6
8
con.4
ground we
SP1 rd
SP2 rd
SP3 rd
SP4 rd
SP5 rd
SP5.1
bk
ground we
SP6 rd
SP6.1
bk
SP7 rd
SP8 pe
SP9 pe
SP10 pe
SP11 pe
SP12 pe
massa we
SP30 pe
SP14 pe
SP15 pe
SP15.1
zw
SP1
SP2
SP3
SP4
SP5.2
SP6 2
SP7
SP8
SP9
SP10
SP11
SP12
SP30
SP14
SP15 2
GINAF Trucks bv
Title
G-series
Connection solenoids
Size
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Number
11322
Revision
/1
Date:
14-Mar-2005
Sheet of
File:
F:\DATA\TEK_SCH\10-11999\11322EN.SCH
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D.Lodder

Diagram 11323/00

Connection to potentiometers

Potm front	Front angle sensor
Potm rear left	Length sensor for rear left cylinder
Potm rear right	Length sensor for rear right cylinder

Connector	No. of pins	Shape	Position
Con. 3	37 bk	round	ECU
Con. 5	14 bk	round	Behind bulkhead on co-driver's side
Con. 6	4 bk	round	Near steering box
Con. 7	4 yw	round	On V-rod, 2nd tandem axle
Con. 8	4 we	round	On V-rod, 2nd tandem axle

G = Central earthing point, cab behind bulkhead, co-driver's side