05:00-04

Issue 1 en

Gearbox

GRS890/900 GR801/900

Control circuit, split/range

Description of Operation and Work Description

1711 043

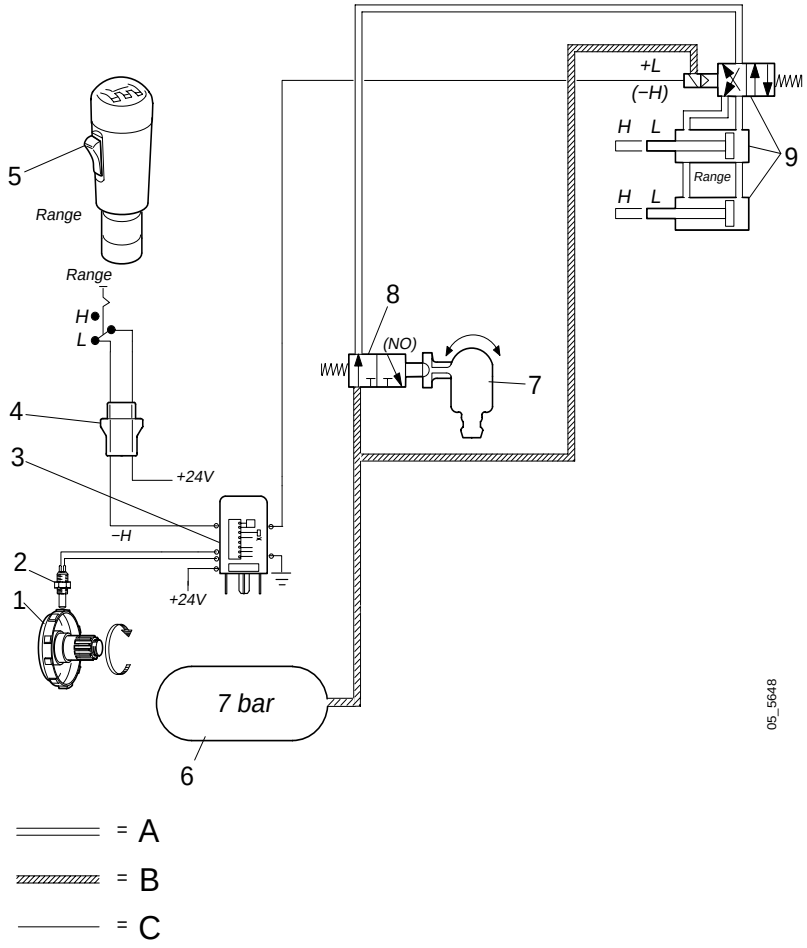
Contents

Control circuit

General

The components of the range circuit and its operation are the same as for GR801/900 and GRS890/900. The sections dealing with the split circuit and its components applies only to GRS890/900.

Wiring and compressed air diagram for GR801/900



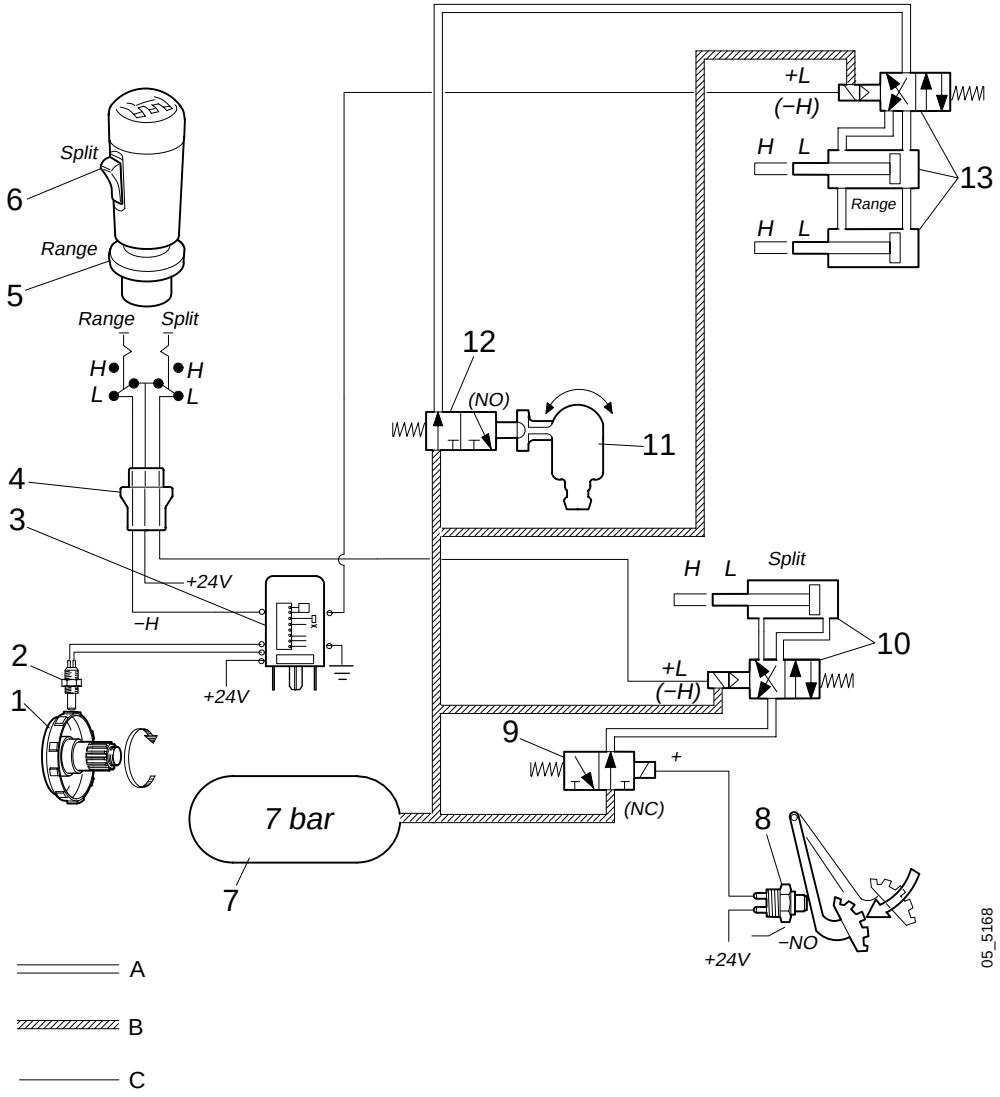
A = Air line, pressurized/not pressurized

B = Air line, pressurized

C = Electric lead

1 *Output shaft, on gearbox*
2 *Engine speed sensors*
3 *Overrevving protection*
4 *Splice*
5 *Range switch*
6 *Air tank*
7 *Selector fork*
8 *Neutral position valve*
9 *Range cylinders with control valve*

Wiring and compressed air diagram for GRS890/900



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1 *Output shaft*
2 *Engine speed sensors*
3 *Overrevving protection*
4 *Splice*
5 *Range switch*
6 *Split switch*
7 *Air tank*
8 *Clutch pedal switch*
9 *Interlock valve, split*
10 *Splitter control cylinder with control valve*
11 *Selector fork*
12 *Neutral position valve*
13 *Range cylinders with control valve*

Changing gear with pre selection

Select the range with the range switch. Shifting between high and low range occurs when the gear lever passes the neutral position.

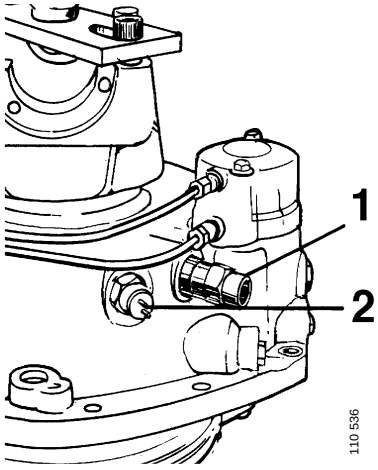
Select the splitter range with the splitter switch. Shifting occurs when you declutch.

Speed sensor

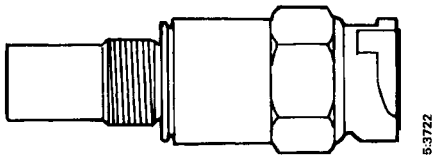
Operation

The speedometer sensor and engine speed sensor are of speed sensor type. They are located in the gearbox's planet gear housing. The sensors produce 10 pulses per revolution. The speed sensor is security sealed.

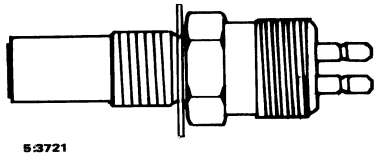
There should be a 1.0 mm thick steel washer underneath the engine speed sensor.



1 Speedometer sensor (T20)
2 Engine speed sensor (T17)



Speedometer sensor



Engine speed sensors

Protection against overrevving

The gearbox is protected against overrevving. The protection consists of an engine speed sensor and an overrevving protection device.

Function

The function of the overrevving protection is to prevent the gear being changed down into the low range at excessive speed, above 30 km/h.

The overrevving protection device is mounted on the central electric unit, position RP15.

The overrevving protection device incorporates a safety function which prevents changing down into the low range:

- In the event of a break in the sensor circuit.
- If the sensor inputs are in contact with a power supply or earth.

If the sensor circuit is shorted, no pulses will be obtained from it. As a result, there will be protective function to prevent changing down into the low range.

When current is turned on, the overrevving protection device checks the sensor circuit. This takes about one second for the latest overrevving protection version and between two and three seconds for the earlier version.

On the overrevving protection device is a contact pin, 9. This pin shows whether a fault has arisen in the overrevving protection device or sensor circuit. If the fault is present when the power is turned on, shifting into the low range cannot be performed.

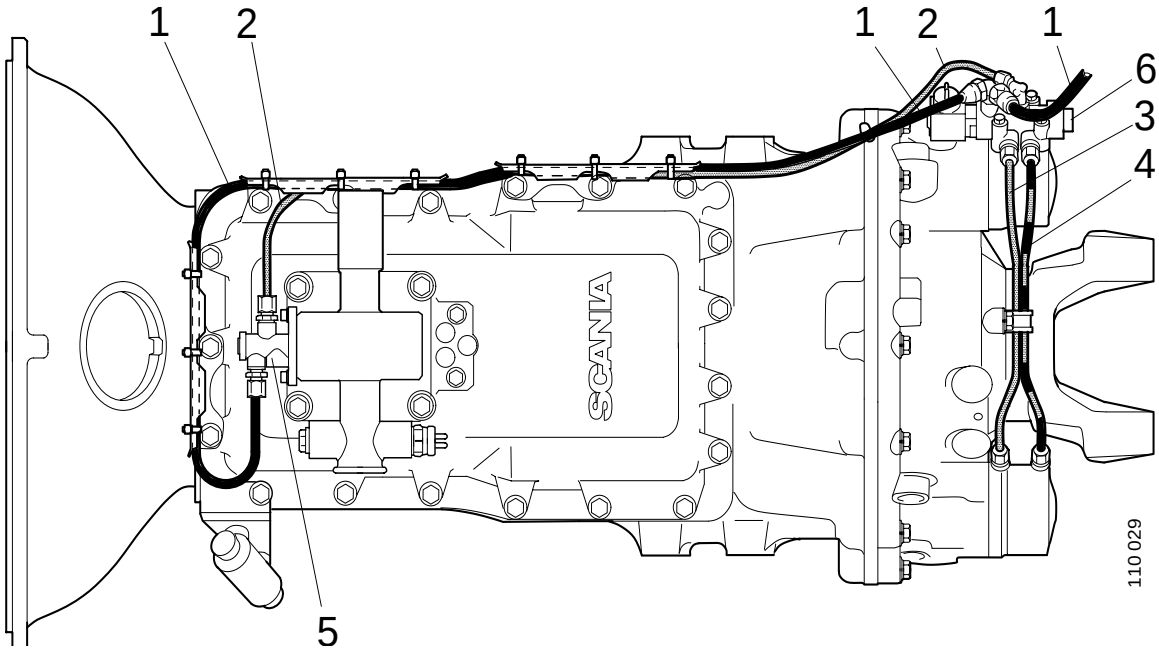
For emergency driving when there is a fault in the overrevving protection device or speed sensor circuit, a standard relay can be fitted in place of the overrevving protection device. Shifting into the low range will then be possible.

Note: If the overrevving protection device is replaced by a standard relay there will be no protection against overrevving. The risk then exists of gearbox or clutch damage if the low range gear is engaged at too high a speed.

Control circuit, air

Description

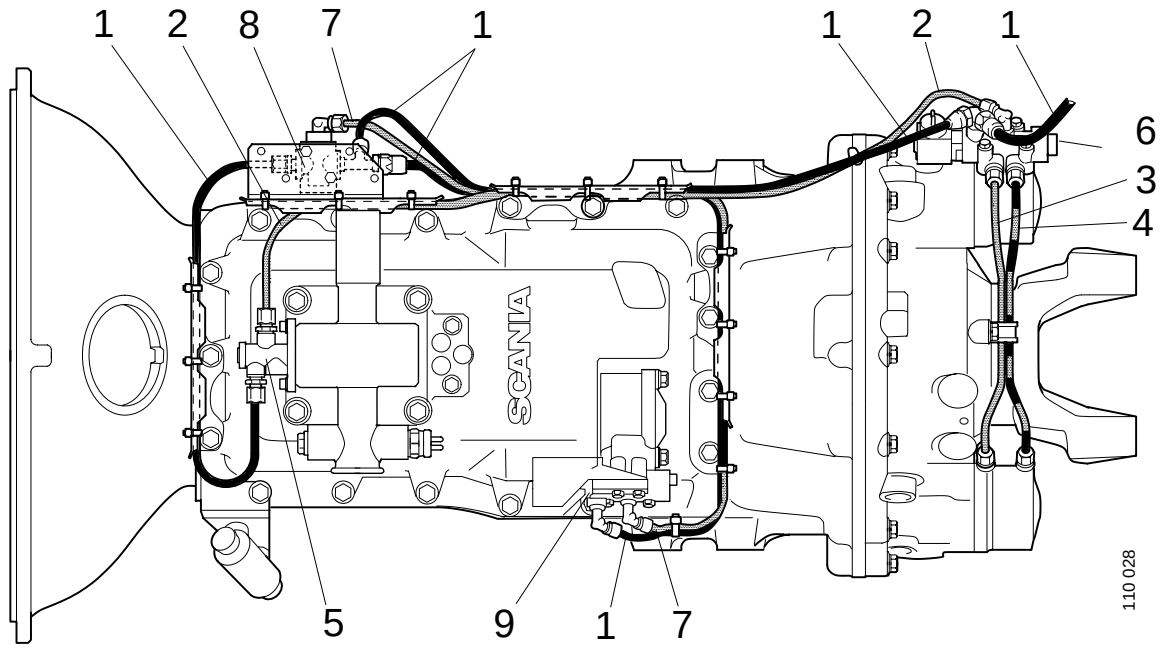
GR900



Component locations and hose routing are the same as for GR801.

1 *Feed pipe, pressurized*
2 *Pressurized when the gear is in neutral*
3 *Pressurized in low range and the gear in neutral*
4 *Pressurized in high range and the gear in neutral*
5 *Neutral position valve*
6 *Control valve, range*

GRS890/900



1 Feed pipe, pressurized

2 Pressurized when the gear is in neutral

3 Pressurized in low range and the gear in neutral

4 Pressurized in high range and the gear in neutral

5 Neutral position valve

6 Control valve, range

7 Pressurized when the clutch pedal is depressed

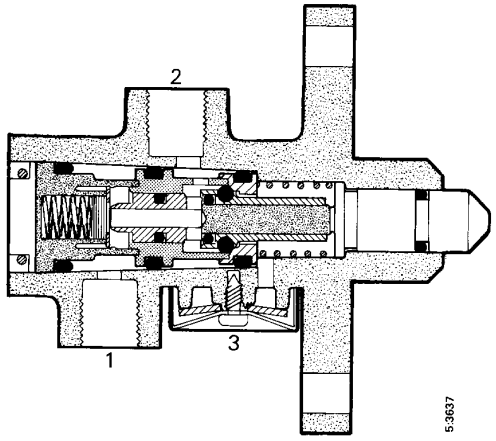
8 Interlock valve, splitter gear

9 Control valve, split

Neutral position valve

Operation

The neutral position valve is a mechanical valve. It supplies the control valve for range with operating air. The valve is actuated automatically by the selector fork in the gearbox housing. When the gear is in neutral, the operating air passes from connection 1, through the valve, out through connection 2 and on to the control valve for range. When a gear is engaged, the plunger in the valve is pressed in and stops the supply of air. Simultaneously, the circuit is vented through air vent 3. With that, the line for operating air will be without pressure.



Neutral position valve

1 *Air, in*
2 *Air, out*
3 *Venting*

Interlock valve, splitter gear

Operation

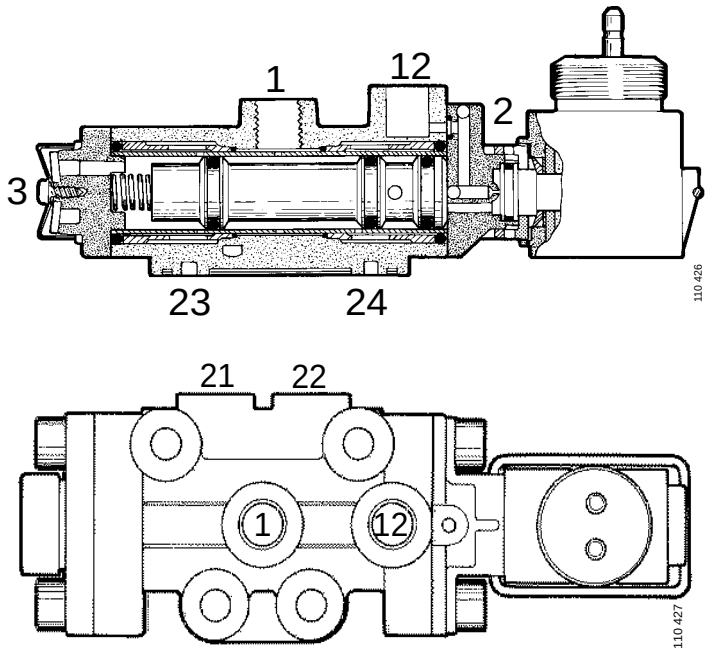
The interlock valve for the splitter gear is a solenoid valve, a 3/2 valve. Mounted on the clutch pedal is a switch which sends a current to the interlock valve when the pedal is depressed below the engagement position. The interlock valve then admits operating air to the control valve and only then can shifting in the splitter valve take place. When the clutch pedal is released, the line for operating air is not pressurized.

Control valve, splitter/ range

Operation

The control valves for split and range are identical and of 4/2 type. This means that the valve has 4 connections and can switch the pressure between two of them. The valve consists of two parts, the valve housing with air connections and the solenoid coil with electrical connection.

The valve housing contains a spring-loaded valve plunger which controls the output air to the control cylinder.

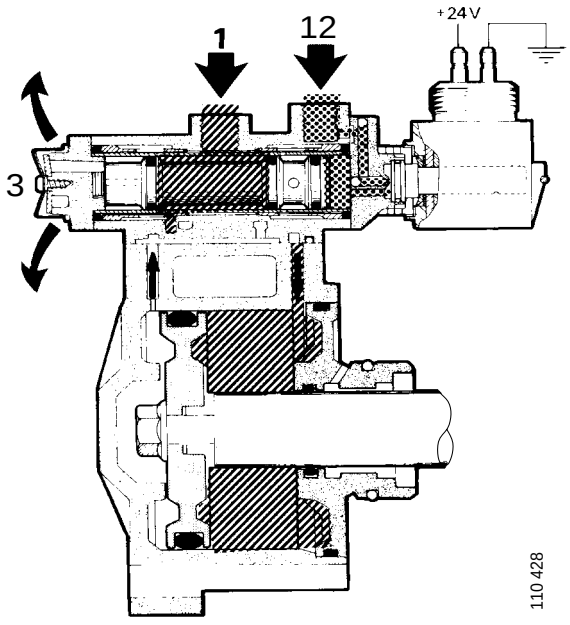


1 Supply air, in
2 Venting
3 Venting
12 Operating air, pressure in
21 Operating air, pressure out
22 Operating air, pressure out
23 Operating air, pressure out
24 Operating air, pressure out

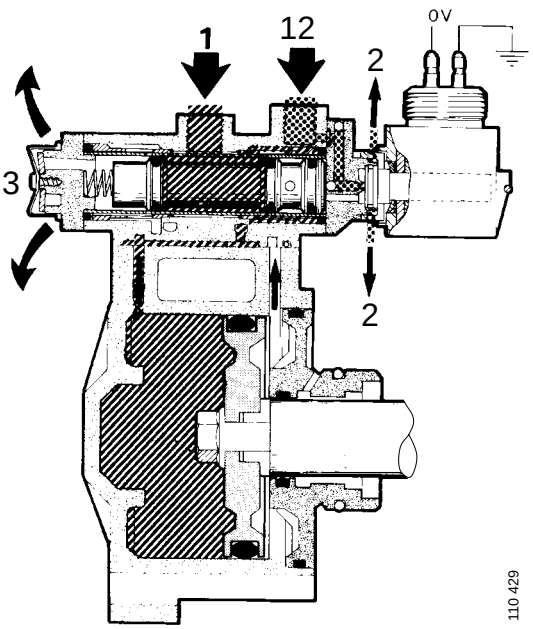
In high range and high split position no current is applied to the solenoid coil. The spring presses the valve plunger against the side of the housing where the solenoid coil is located. Supply air passes out to the cylinders via connections 21 and 23. Simultaneously, the other side of the control cylinder is vented via connections 22 and 24 on the valve housing and out through vent 3 on the control valve. Operating air is vented through vents 2 on the solenoid part.

In low range and low split position the electric coil is activated with 24 V. Operating air, which is controlled by the solenoid part, moves the valve plunger towards the evacuation side of the housing. The valve needs a pressure of up to 5 bar in connection 12 in order to change over when the electric coil is activated. The supply air passes out to the cylinders via connections 22 and 24 and the cylinder vents via connections 21 and 23.

In the split circuit, valve connections 21 and 22 are plugged.



Low gear position



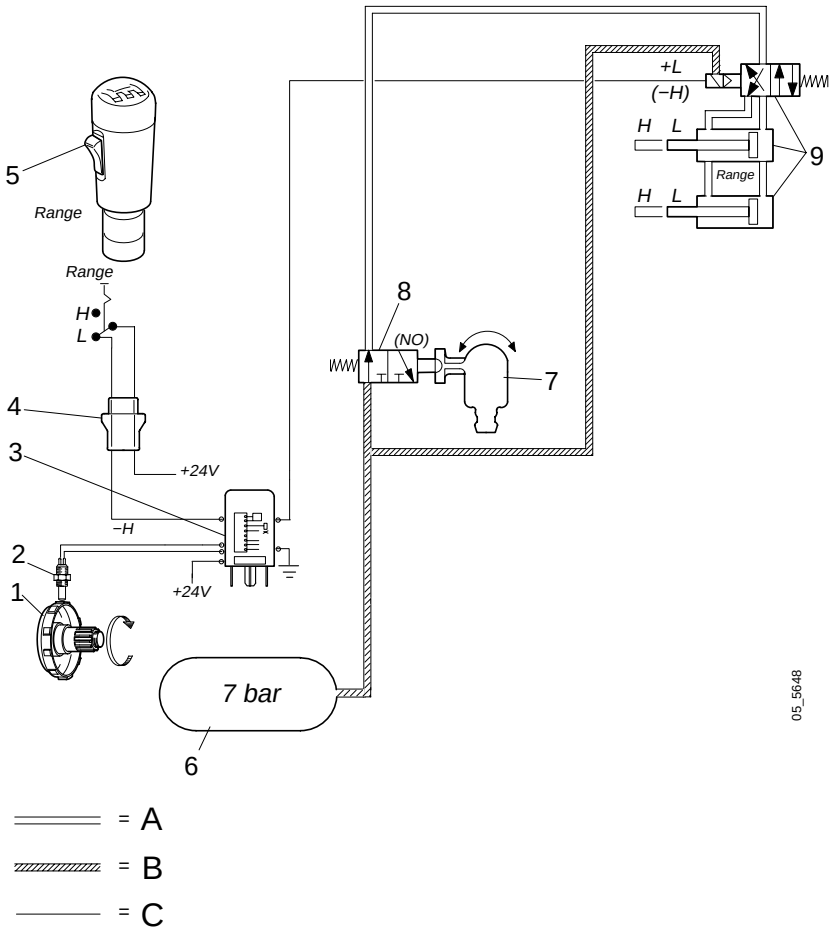
High gear position

Control circuit

General

The components of the range circuit and its operation are the same as for GR801/900 and GRS890/900. The sections dealing with the split circuit and its components applies only to GRS890/900.

Wiring and compressed air diagram for GR801/900



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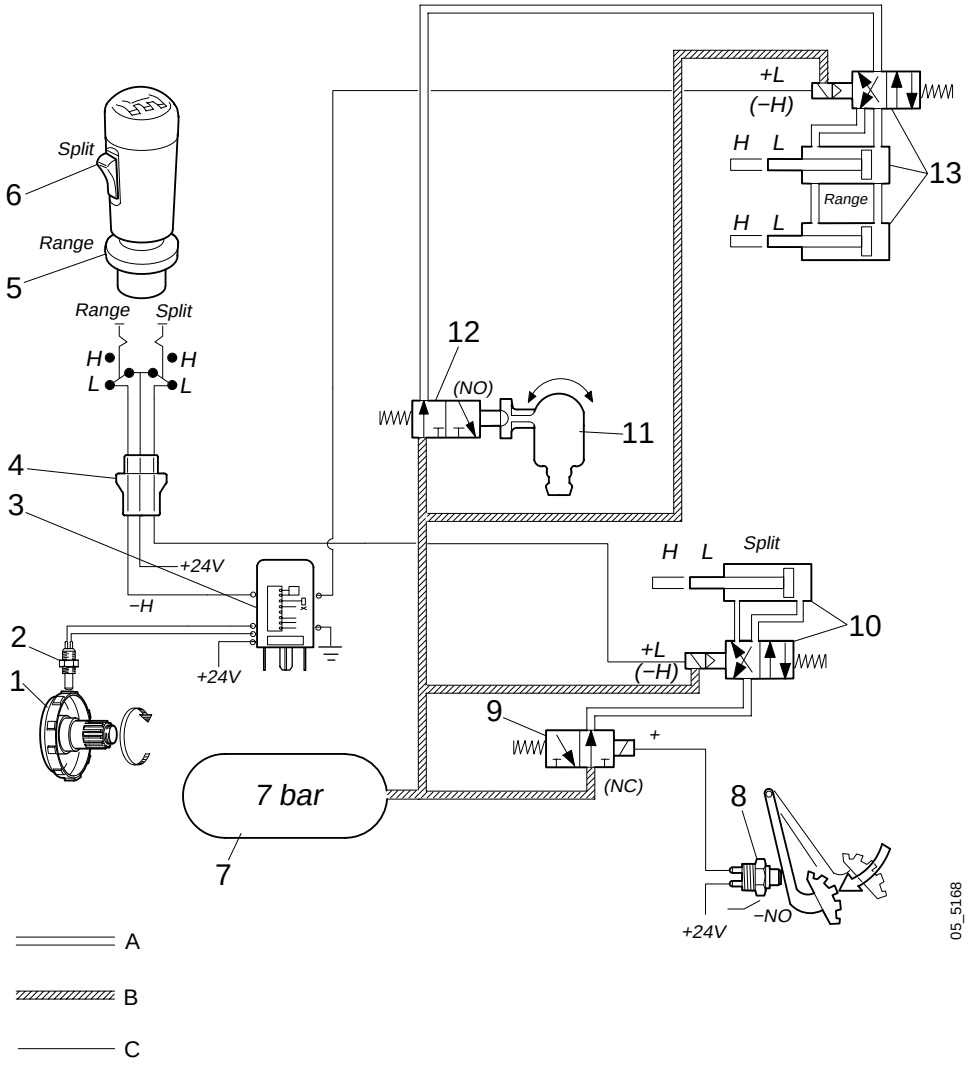
2 *Engine speed sensors*
3 *Overrevving protection*
4 *Splice*
5 *Range switch*
6 *Air tank*
7 *Selector fork*
8 *Neutral position valve*
9 *Range cylinders with control valve*

Wiring and compressed air diagram for GRS890/900



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B = Air line, pressurized

C = Electric lead

1 *Output shaft*
2 *Engine speed sensors*
3 *Overrevving protection*
4 *Splice*
5 *Range switch*
6 *Split switch*
7 *Air tank*
8 *Clutch pedal switch*
9 *Interlock valve, split*
10 *Splitter control cylinder with control valve*
11 *Selector fork*
12 *Neutral position valve*
13 *Two range cylinders with one control valve*

References

Relevant wiring diagrams are included in the following literature:

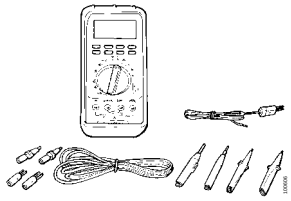
Wiring diagram GR801/GR900 16:04-22

Wiring diagram GRS890/900 16:04-23

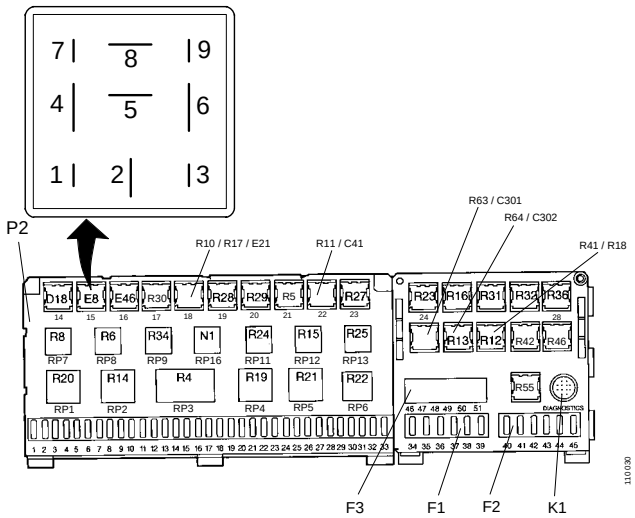
Electric circuit, range

Troubleshooting

Tools

Number	Designation	Drawing	Tool board
588 094	Multimeter		

Mounting, relay position, RP 15



1 *Engine speed sensor lead 1*
2 *Lead to solenoid valve, low range*
3 *Engine speed sensor lead 2*
4 *Supply voltage (15)*
5 *Not connected*
6 *Earth (31)*
7 *Output signal, speed to retarder*
8 *Lead from low range switch in gear lever*
9 *Signal pin, operational test*

Checking the power supply

The power supply for range and split circuits is common to both. Check that fuse number 5 is intact.

Take a reading of the supply voltage across pins 4 and 6 with overrevving protection device E8 removed and the ignition key in the drive position. The voltage reading obtained should be the same as battery voltage.
In the event of a fault, check the wiring.

Checking the range switch

Overrevving protection device E8 should be removed and the ignition key should be in the drive position.

1 Take a voltage reading across pins 8 and 6. The reading obtained should be:

- Same as battery voltage in the low range position.
  Twirl the switch in the low range position to check for a possible open circuit.
- 0 V in the high range position.

In the event of a fault, check the range switch and wiring.

Checking the solenoid valve circuit for control valve, range

Overrevving protection device E8 should be removed and the ignition should be switched off.

1 Take a resistance reading across pins 2 and 6. If correct, the reading obtained should be 195-250 ohms.

In the event of a fault, check the wiring, connectors and solenoid valve.

Checking the engine speed sensor circuit

Overrevving protection device E8 should be removed.

1 Take a resistance reading across pins 1 and 3. If correct, the reading obtained should be 950 - 1150 ohms.

2 Take a reading across pin 6 (earth) and pins 1 and 3. There should be no short circuit or shorting to earth.

In the event of a fault, check the wiring, connectors and sensor.

The following method can be used to check the sensor signal.

1 The overrevving protection device should be in place.

2 Take a voltage reading. Set the multimeter for a.c. and take a reading across pins 1 and 3. Drive the vehicle in top gear at an engine speed of about 1000 rpm. The signal should be 2.5-3.5 V.

If the voltage differs from this, check that the pulse wheel is not slipping on the shaft.

Checking the overrevving protection device, E8

The overrevving protection device should be in place and the ignition key should be in the drive position.

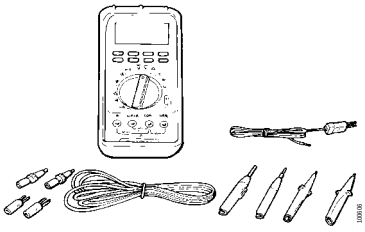
1 Take a voltage reading across pins 9 and 6.

- If a reading of 0 V is obtained, the overrevving protection device is OK.
- If a battery voltage reading is obtained on pin 9, the overrevving protection device is OK if the sensor circuit is also OK.
- Battery voltage is present on pin 9 for up to three seconds after the ignition is switched on, which is normal.

Electric circuit, split

Troubleshooting

Tools

Number	Designation	Drawing	Tool board
588 094	Multimeter		-

Checking the power supply

The power supply for the range and split circuits is common to both. Check that fuse number 5 is intact.

Checking the split switch

1 Remove the split switch and turn the ignition key to the drive position.

2 Take a voltage reading across pin 1 of the switch and earth.
The reading obtained should be the same as battery voltage.

3 Operate the switch. Take a reading across pin 2 of the switch and earth. The reading obtained should be:

- The same as battery voltage in the low split position.
- 0 V in the high split position.

In the event of a fault, check the switch and wiring.

Checking the solenoid valve circuit for the split control valve

1 The ignition should be switched off.

2 Set the switch in the high split position.

3 Take a resistance reading across pin 2 of the switch and earth.
A correct reading is 195-250 ohms.

In the event of a fault, check the wiring, connectors and control valve.

Checking the clutch switch

The ignition key should be in the drive position.

1 Take a voltage reading across the pins of the interlock valve's connector.
The reading obtained should be:

- Same as battery voltage with the clutch pedal depressed.
- 0 V with the clutch pedal released.

Checking the solenoid valve circuit for the split interlock valve

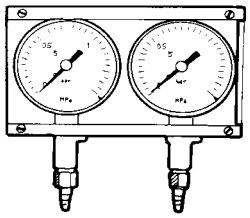
1 Take a resistance reading across the pins of the interlock valve. A correct reading is 53 64 ohms for the latest version of the valve and 36-46 ohms for the earlier version.

In the event of fault, check the wiring, connectors and interlock valve.

Air circuit, range

Troubleshooting

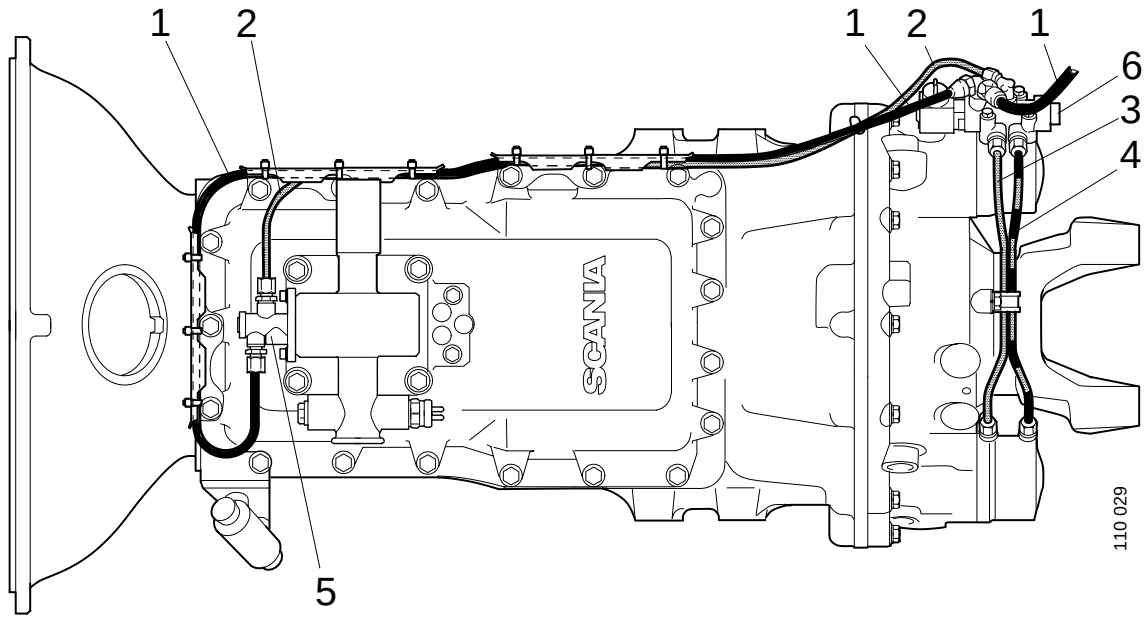
Special tools

Number	Designation	Drawing	Tool board
98 601	Pressure gauge		

To enable pressure gauge 98 601 to be used, the connectors must be suitably prepared.

Use the following parts, for example:
Test connection 303498 (1)
T-pipe 303467 (1)
Unions 307257 (2)

Air circuit, GR900



Component locations and hose routing also apply to GR801/GRS890/900

1 *Feed pipe, pressurized*
2 *Pressurized when the gear is in neutral*
3 *Pressurized in low range and the gear in neutral*
4 *Pressurized in high range and the gear in neutral*
5 *Neutral position valve*
6 *Control valve, range*

Neutral position valve

When troubleshooting, the compressed air system must have working pressure and the ignition key should be in the drive position.

Operational test

1 Engage a gear, rendering control line 2 to the range valve pressureless. On engaging a gear, the neutral position valve should vent (make a hissing sound), otherwise it should be tight. The neutral position valve's breaking position (venting) should occur before the synchronization position.

2 Disconnect control line 2.

3 Put the gear in neutral. The valve should allow air to pass when the valve is in the neutral position.

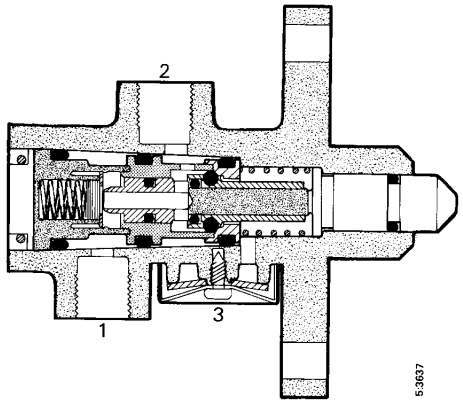
4 Measure the pressure after the neutral position valve using pressure gauge 98 601. The pressure after the neutral position valve should be the same as the supply pressure.

5 Engage a gear. The valve should not allow air to pass through when a gear is engaged.

If the operational test has to be carried out while the vehicle is being driven, pressure gauge 98 601 can be connected to line 2.

Note that range changing takes longer because there is a comparatively large volume of air in the pressure gauge hose. There is also a certain degree of hysteresis in the pressure gauge reading, particularly when venting (pressure decrease). It is thus perfectly normal for it to take up to a few seconds before the gauge shows a zero reading when the gear is engaged.

If the gear lever is moved from the neutral position before range changing is completed, the range gear will remain in neutral.



1 Supply air, in
2 Supply air, out
3 Venting

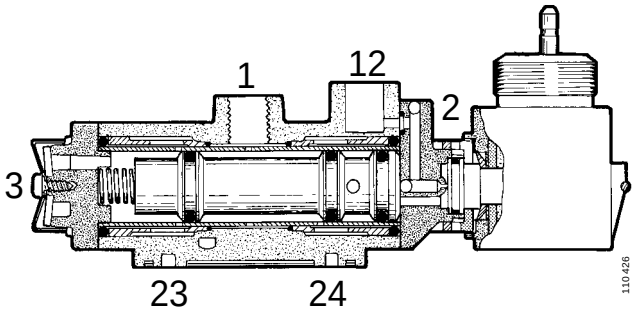
Control valve, range

When troubleshooting, the compressed air system must have working pressure and the ignition key should be in the drive position.

Operational test

1 Engage a gear.

2 Move the gear lever control from low to high range. Check that the valve vents in connection 2. If the valve fails to vent, the solenoid coil is probably faulty.



Checking range valve operation.

1 Engage a gear, rendering control line 2 to the range valve pressureless.

2 Disconnect control lines 3 and 4.

3 Put the gear in neutral. In high range the valve should pressurize line 4. In low range the valve should pressurize line 3. Both lines should not be pressurized at the same time.

4 Measure the pressure after the control valve, using pressure gauge 98 601. The pressure should be the same as supply pressure.

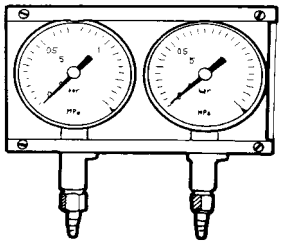
If the operational test has to be carried out while the vehicle is being driven, pressure gauge 98 601 can be connected to lines 3 and 4.

Note that range changing takes longer because there is a comparatively large volume of air in the pressure gauge hose. There is also a certain degree of hysteresis in the pressure gauge reading, particularly when venting (pressure decrease). It is thus perfectly normal for it to take up to a few seconds before the gauge shows a zero reading when the gear is engaged.

Air circuit, split

Troubleshooting

Special tools

Number	Designation	Drawing	Tool board
98 601	Pressure gauge		

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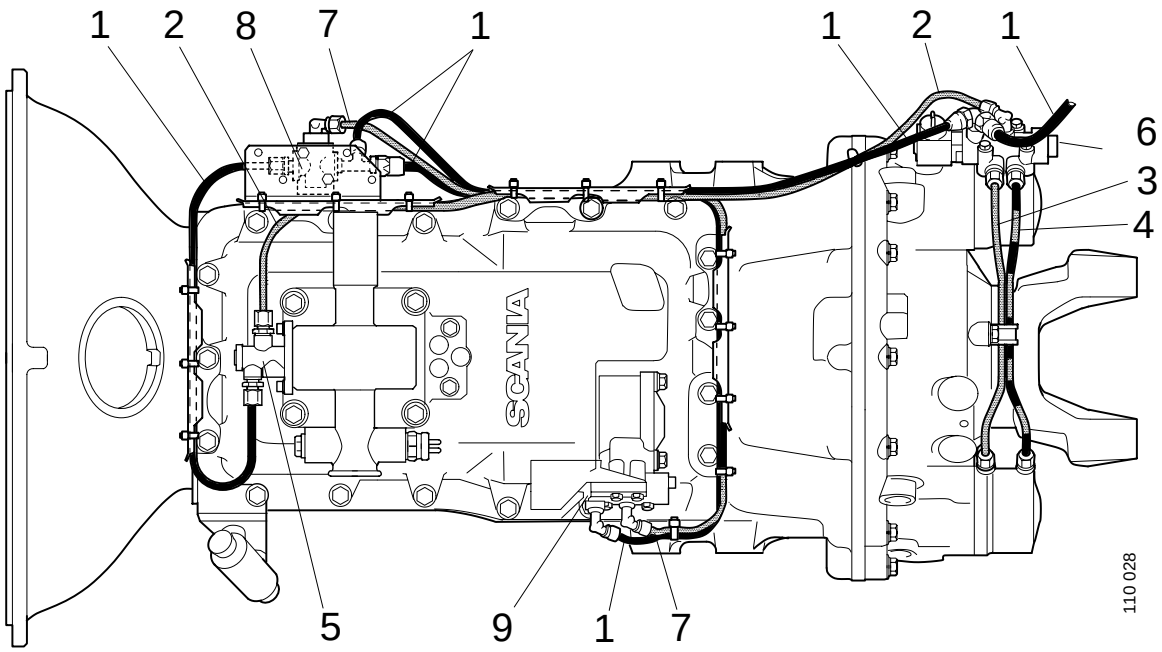
Air circuit GRS890/900



1 Feed pipe, pressurized

2 Pressurized when the gear is in neutral

3 Pressurized in low range and the gear in neutral

4 Pressurized in high range and the gear in neutral

5 Neutral position valve

6 Control valve, range

7 Pressurized when the clutch pedal is depressed, pressureless when the pedal is released.

8 Interlock valve, split

9 Control valve, split

Interlock valve, split

When the clutch pedal is released, the valve should vent (make a hissing sound). Otherwise it should be tight.

Operational test

1 Disconnect control line 7.

2 When the clutch pedal is depressed, the valve should allow air to pass through to the control valve.

3 The valve should not allow air to pass through when the clutch pedal is released.

If the operational test has to be carried out while the vehicle is being driven, pressure gauge 98 601 can be connected to line 7.

Note that gear changing takes longer because there is a comparatively large volume of air in the pressure gauge hose. There is also a certain degree of hysteresis in the pressure gauge reading, particularly when venting (pressure decrease). It is thus perfectly normal for it to take up to a few seconds before the gauge shows a zero reading when the clutch is released.

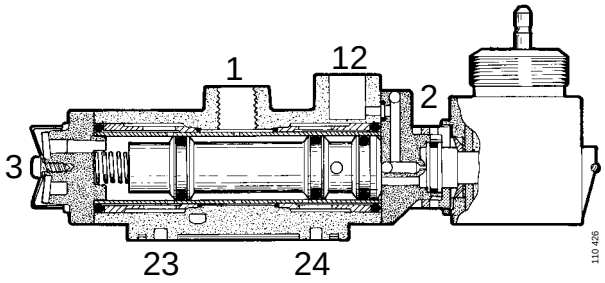
Control valve, split

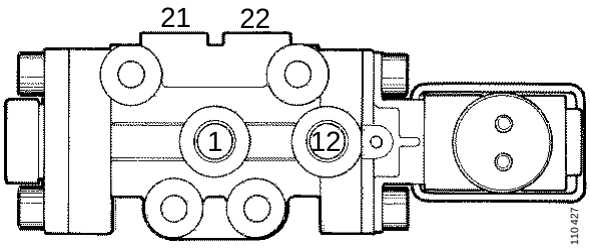
When troubleshooting, the compressed air system must have working pressure and the ignition key should be in the drive position.

Operational test

1 The clutch pedal should be in the released position.

2 Move the gear lever control from low to high range. Check that the valve vents in connection 2. If the valve fails to vent, the solenoid coil is probably faulty.





Checking split valve operation.

1 Slightly undo the plugs in connections 21 and 22.

2 Depress the clutch pedal.

3 In the high split position the valve should pressurize connection 21. In the low split position the valve should pressurize connection 22. Both connections must not be pressurized at the same time.

An operational test of the split valve cannot be carried out while the vehicle is being driven. Accessibility for connecting the hoses to the valve is restricted.