

Operating Manual for SAF Brake Testing Case



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SAF products are subject to continuous further development. We must therefore reserve the right to alter technical details compared with the contents of this operating manual.
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The SAF brake testing system is required for adjusting and testing air brake systems on vehicles and for overcoming problems related to the balancing of air brake systems between tractor and trailer or semi-trailer.

This operating manual is intended to help the user of the SAF brake testing system to achieve successful results.

The SAF brake testing system provides the optimum preconditions for testing air brake systems and, thanks to the quick and reliable diagnosis, makes a major contribution to **“customer satisfaction”**.

This manual is not, however, a replacement for the necessary knowledge of the design, function and repair of air brake systems.

Special brake tests performed on vehicles in accordance with Annex VIII to the German Regulations Authorising the Use of Vehicles for Road Traffic (StVZO) are required to test the function and efficiency of the brake system for the vehicle in both “the empty and the loaded condition”.

The means that allowing for the different systems, the correspondence of the LSV setting values with the LSV rating plate must be observed and complied with.

1. Testing of Mechanically Actuated LSV Controllers

In practice, the testing of a vehicle with mechanically actuated LSV controller requires the vehicle to be presented for testing in empty condition.

The simulated loaded condition is then achieved by disconnecting and pushing up the control rod on the LSV controller.

2. Testing of LSV Controllers when Using Air Suspension Systems

Here again, the vehicle to be tested is presented for testing in empty condition.

Simulation of the loaded condition on these systems which are being more and more widely used in practice is only possible by admitting the air bag pressure on the control side of the LSV controller using a suitable **brake testing system** specially designed for the purpose such as the SAF Brake Test Case.

Brake Testing Case

This Testing Case enables problems in the air brake systems of tractors and trailers to be solved quickly and efficiently. Thanks to its compact and sturdy design, this testing case can be used as a portable “brake test stand”.

The brake testing case is equipped with three precision control valves via which the supply pressure, brake pressure and air suspension

bag pressure can be regulated. Dual pressure gauges and single pressure gauges serve to display the required pressures.

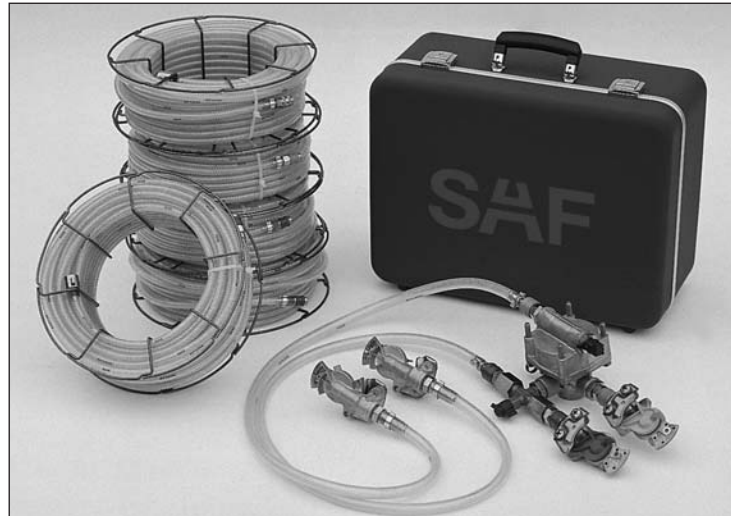
The pressure gauges and precision control valves are mounted in an aluminium housing to protect them from damage due to collisions. This housing is water-tight and lockable.



Accessories

The standard accessories supplied with the brake testing system include coupling head adapters and test hoses of various lengths. The test hoses are all fitted with a quick coupler and a wing nut and are colour coded.

Two hose adapters allow different hose connections to be made quickly and easily.



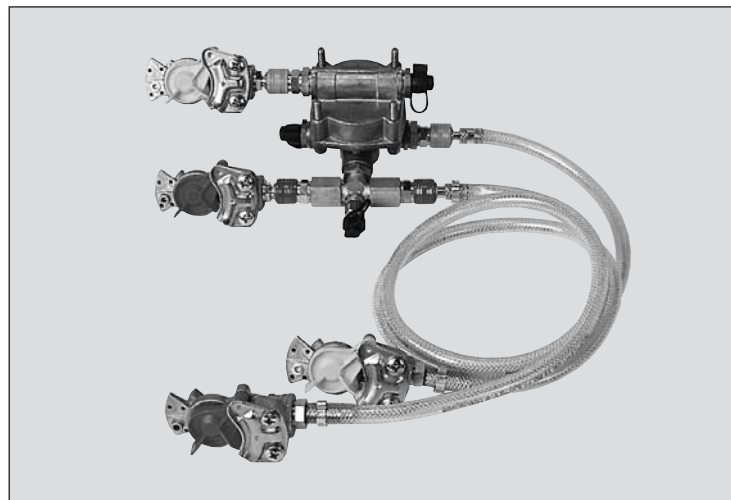
A special relay valve which is available as an option allows the brake test to be performed while driving without

endangering the road safety, as well as enabling the trailer brakes to be tested without a tractor unit.

Optional relay valve assembly:

The optional relay valve assembly is installed as an intermediate element between tractor and trailer to permit quick pressurising and venting of the air brakes on the one hand and measuring of the supply pressure for the brake testing case on the other.

Realistic temporal behaviour during trailer brake tests using the brake testing case make the use of the optional relay valve assembly essential in order to compensate the small cross-sections,



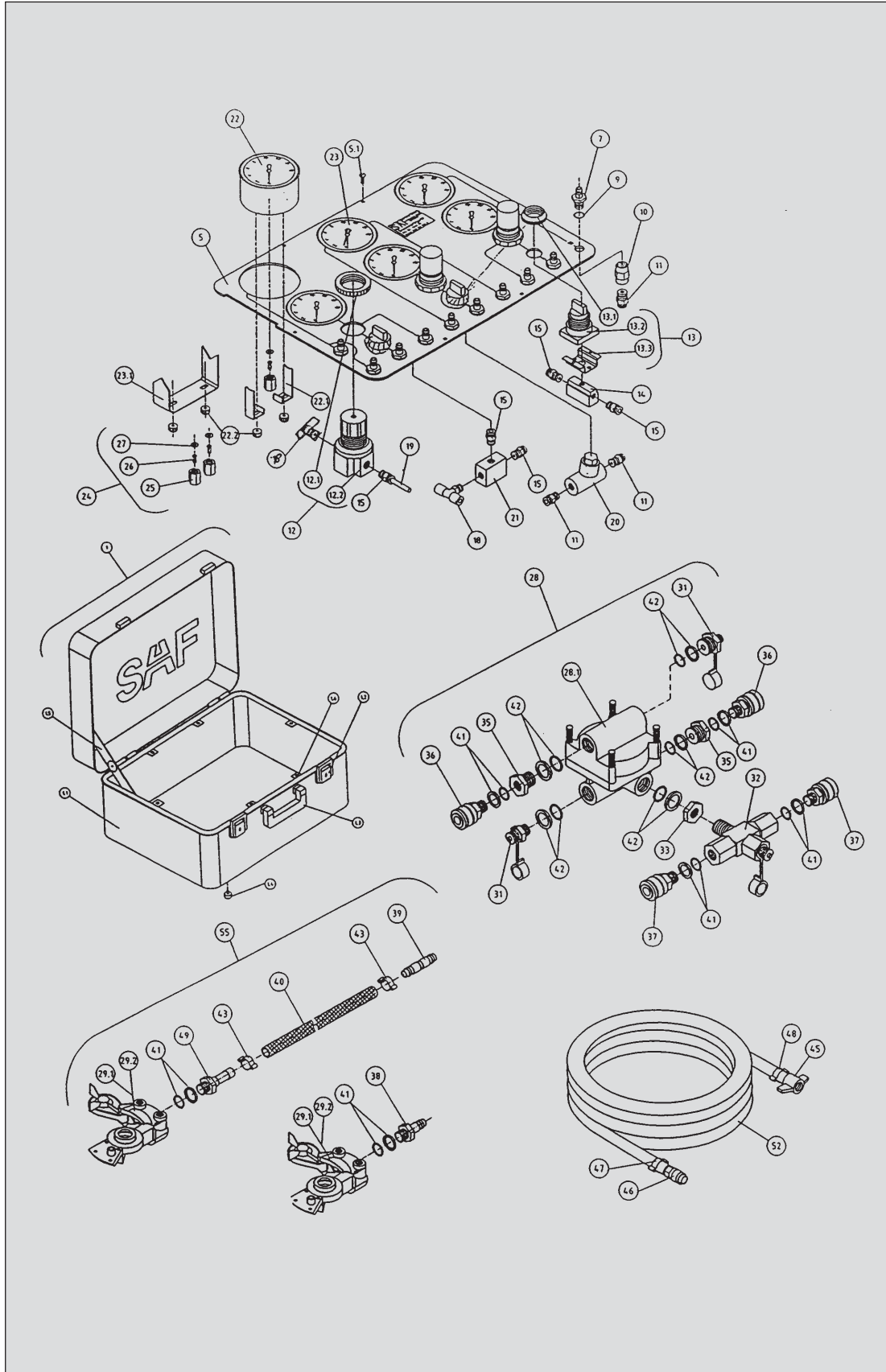
large hose lengths and lack of a trailer control valve on the tractor with this test configuration.

The optional relay valve assembly consists of the following components:

- 01 Relay valve with linear characteristic
- 02 Two-way directional control valve
- 03 Supply coupling head (red) with hose

- 04 Supply coupling head (red)
- 05 Supply pressure test port
- 06 Brake coupling head (yellow) with hose
- 07 Brake coupling head (yellow)
- 08 Brake pressure test port
- 09 Control pressure test port

Illustration of spare parts



Spare Parts Designations

Brake testing case Type 001 BW

incl. accessories

Order No. 01 00 01 0 00 1

Item				Item			
No.	Order No.	Part designation	Qty	No.	Order No.	Part designation	Qty
1	3 082 0001 00	Testing case GK 2T with parts 1.1 – 1.6	1	29.1	4 082 0037 00	Coupling head, red	2
1.1	4 082 0002 00	Case housing	1	29.2	4 082 0038 00	Coupling head, yellow	2
1.2	4 082 0003 00	Snap fastener	2	31	4 082 0039 00	Test port	2
1.3	4 082 0004 00	Carrying handle	1	32	4 082 0040 00	T-piece with test port	1
1.4	4 082 0005 00	Housing foot	8	33	4 082 0041 00	Hex. nut	1
1.5	4 082 0006 00	Lid support, left	1	35	4 082 0043 00	Reducer	2
1.6	4 082 0007 00	Bracket for front panel	6	36	4 082 0044 00	Quick coupler, yellow	2
5	4 082 0008 00	Front panel	1	37	4 082 0045 00	Quick coupler, red	2
5.1	4 082 0009 00	Mushroom-head screw	6	38	4 082 0046 00	Threaded nipple	2
7	4 082 0010 00	Threaded nipple	10	39	4 082 0047 00	Hose socket	2
9	4 082 0017 00	O-ring	10	40	4 082 0048 00	Hose 1 m	2
10	4 082 0018 00	Sleeve	10	41	3 082 0049 00	Seal with back-up ring	6
11	4 082 0019 00	Straight male fitting	12	42	3 082 0050 00	Seal with back-up ring	5
12	3 082 0020 00	Pressure controller assy. with parts 12.1 and 12.2	3	43	4 082 0051 00	Hose clamp	4
12.1	4 082 0011 00	Knurled nut	3	45	3 082 0053 00	Wing nut with seal	8
12.2	4 082 0012 00	Pressure controller	3	46.1	4 082 0156 00	Quick coupler, red	1
13	3 082 0021 00	Rotary switch assy. with parts 13.1 – 13.3	3	46.2	4 082 0256 00	Quick coupler, yellow	1
13.1	4 082 0013 00	Knurled nut	3	46.3	4 082 0356 00	Quick coupler, brown	1
13.2	4 082 0014 00	Rotary switch	3	46.4	4 082 0456 00	Quick coupler, green	1
13.3	4 082 0015 00	Mounting bracket	3	46.5	4 082 0556 00	Quick coupler, black	1
14	4 082 0022 00	Shut-off valve	3	46.6	4 082 0656 00	Quick coupler, nickel	1
15	4 082 0023 00	Straight male fitting	13	46.7	4 082 0756 00	Quick coupler, blue	1
18	4 082 0026 00	T-swivel fitting	5	46.8	4 082 0856 00	Quick coupler, olive	1
19	4 082 0027 00	RILSAN pipe 1 m	2	47	4 082 0064 00	Hose clamp	8
20	4 082 0028 00	Dirt trap	1	48	4 982 0065 00	Hose clamp	8
21	4 082 0029 00	Double check valve	2	49	4 082 0042 00	Hose fitting	2
22	3 082 0031 00	Manometer 0 – 16 bar with parts 22.1 and 22.2	5	52.1	3 082 1255 01	Test hose 12 m with parts 45, 46.1, 47, 48	1
22.1	4 082 0024 00	Mounting bracket	10	52.2	3 082 1255 02	Test hose 12 m with parts 45, 46.2, 47, 48	1
22.2	4 082 0025 00	Knurled nut	12	52.3	3 082 1255 03	Test hose 12 m with parts 45, 46.3, 47, 48	1
23	3 082 0032 00	Double manometer 0 – 16 bar with parts 22.2. and 23.1	1	52.4	3 082 1255 05	Test hose 12 m with parts 45, 46.5, 47, 48	1
23.1	4 082 0016 00	Mounting bracket	1	52.5	3 082 1255 06	Test hose 12 m with parts 45, 46.6, 47, 48	1
24	3 082 0033 00	Valve fittings with parts 25 – 27	7	52.6	3 082 1255 07	Test hose 12 m with parts 45, 46.7, 47, 48	1
25	4 082 0034 00	Connecting nut	7	52.7	3 082 2055 04	Test hose 20 m with parts 45, 46.4, 47, 48	1
26	4 082 0035 00	Back-up sleeve	7	52.8	3 082 2055 08	Test hose 20 m with parts 45, 46.8, 47, 48	1
27	4 082 0067 00	Clamping ring	7	55.1	3 082 0169 00	Intermediate hose, red with parts 29.1, 39 – 41, 43, 49	1
28	3 082 1036 00	Relay valve with parts 28.1, 31 – 33, 35 – 37, 41 and 42	1	55.2	3 082 0269 00	Intermediate hose, yellow with parts 29.2, 39 – 41, 43, 49	1
28.1	4 082 0036 00	Relay valve	1	56.1	3 082 0170 00	Coupling head red with threaded nipple and parts 29.1, 38, 41	1
				56.2	3 082 0270 00	Coupling head yellow with threaded nipple and parts 29.2, 38, 41	1

Tester components

Connections:

- 01 Supply pressure for brake testing case (neutral – chrome-plated)
- 02 Test pressure gauge (green)
- 03 Pressure control – control pressure (red)
- 04 Test pressure gauge (olive)
- 05 Test pressure gauge, red indicator (red)
- 06 Pressure control – control pressure (yellow)
- 07 Test pressure gauge, black indicator (black)
- 08 Test pressure gauge (brown)
- 09 Pressure control – control pressure (blue)
- 10 Test pressure gauge (green)



Connection instructions

The connecting instructions given below describe to the user the most efficient method of using the brake testing system, utilising all the possibilities offered.

The compressed air supply to the testing system is connected to port 1. The compressed air admitted here passes through a line filter and simultaneously to the three precision control valves. These control valves permit a stepless variation of the admitted pressure of between 0 and 10 bar. The admitted pressure is displayed on the pressure gauge directly above the control valve and can be controlled via the switching valve located under the gauge. The controlled pressures can thus be output via ports 3 (red), 6 (yellow) and 9 (black) and thus admitted to the selected connections on the vehicle via the correspondingly colour coded test hoses.

Connecting nipple, switching valve, precision control valve and pressure gauge of the three control circuits are each arranged in the testing case in a line so that the direct relationship between the valves and the displays can be clearly recognised and not confused.

For example, the supply pressure can be regulated via port 3, the brake pressure via port 6 and a control pressure (e. g. air suspension bag pressure) via port 9.

The connections 2 (green), 4 (olive), 5 (red), 7 (black) and 10 (green) are linked to their corresponding pressure gauges as indicated by the lines printed on the panel and serve to transmit the brake pressures back from the brake cylinders via the correspondingly colour coded test hoses.

When ports 4 and 8 are used, the corresponding control valve (in conjunction with 3 or 9) must be turned completely to the left so that the display is not influenced by any pressures admitted to the control valve.

All test hoses have a quick coupler (NW 5) with colour coded sleeve at one end and a wing nut with internal thread M 16 x 1.5 and a correspondingly colour coded hose clamp at the other end.

Brake Tests on Roller Dynamometers

The compact arrangement of the brake testing case and its accessories in the SAF brake testing system creates the best preconditions for the field of stationary brake tests.

The possibility of using an external compressed air supply opens up a wide variety of test and diagnostic possibilities for the user, for example the testing of trailer brakes without the use of a tractor vehicle.

The control valves permit an exact and delicate adjustment of the brake pressure or air bag pressure with a simultaneous

display of the admitted pressure via the corresponding pressure gauges.

Complete Series of valves e. g. on pneumatically controlled LSV controllers can be quickly and exactly tested with the minimum of effort. Brake tests, function tests and monitoring of the proper function of systems or individual components can be carried out using the SAF brake testing system and thus make a significant contribution to customer satisfaction.

Brake Tests on the Road

The SAF brake testing system is ideally suited to the performance of the brake tests on the road prescribed in accordance with the EC and ECE Guidelines with trailers, since it permits both a delicate metering of the brake pressure and a simultaneous display of the admitted pressure and the actual brake cylinder pressure with a constantly reproducible and realistic response time.

The necessary compressed air for the delicate metering of the brake pressure is

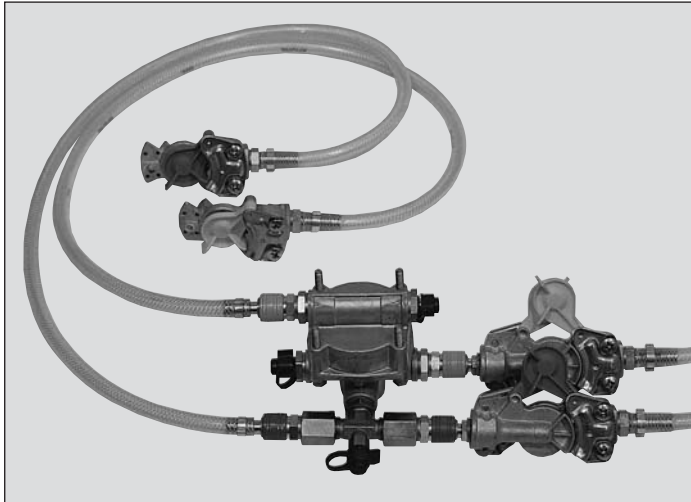
taken here via the optional SAF relay valve assembly from the supply pressure for the trailer. The compressed air is then supplied to the brake cylinders via the precision control valves in the SAF brake testing case.

The SAF brake testing system and its accessories form an essential part of brake tests on the road.

Testing Air Brake Systems on Trailers

Procedure: Example 1

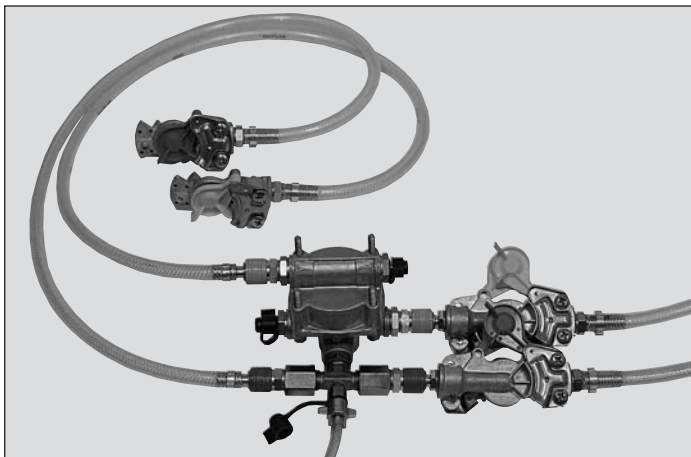
1. Connecting the Relay Valve Assembly



Connect outlet port 2 (yellow coupling head (01) to the brake line of the trailer. Connect the yellow coupling head (06) to the tractor.

Connect the red coupling head (04) of the relay valve assembly to the trailer.

Admit a supply pressure to the second red coupling head (03) of the relay valve assembly. This supply pressure can be taken either from the tractor or from a stationary workshop compressed air supply and should lie between 7.5 and 8.5 bar.



2. Connecting the Brake Testing System

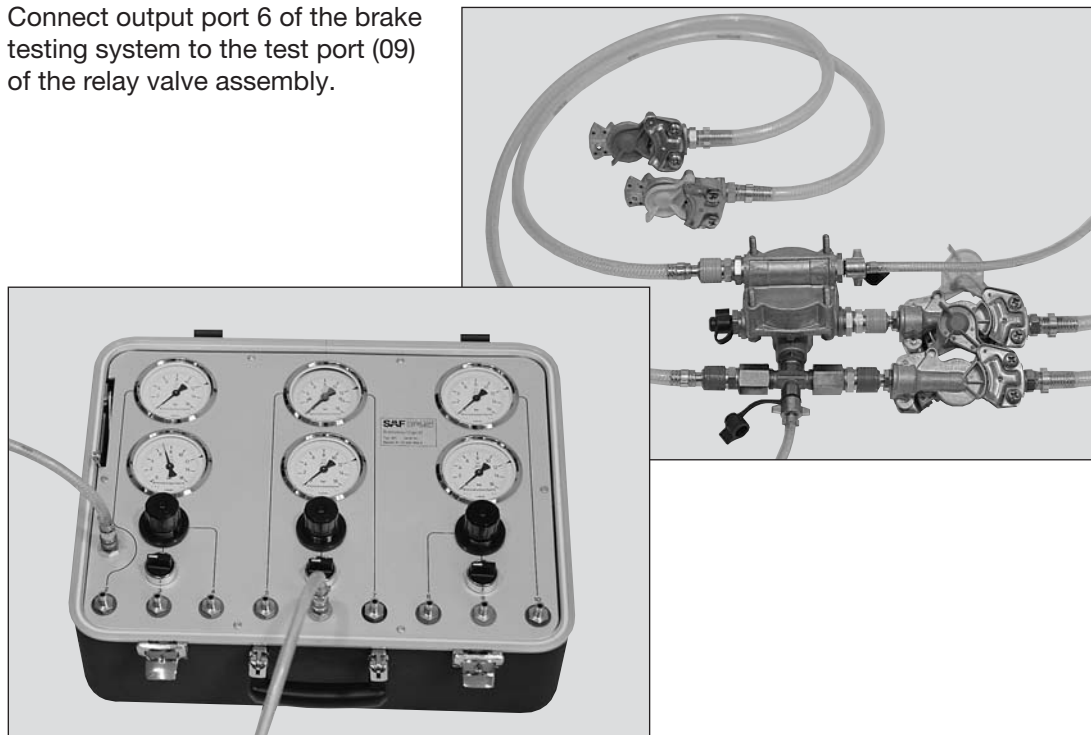
Connect the test port (05) of the relay valve assembly to port 1 of the brake testing system.

If the left-hand precision control valve is now turned completely to the right, the full supply pressure will be displayed on pressure gauge 3-4.



Testing Air Brake Systems on Trailers

Connect output port 6 of the brake testing system to the test port (09) of the relay valve assembly.



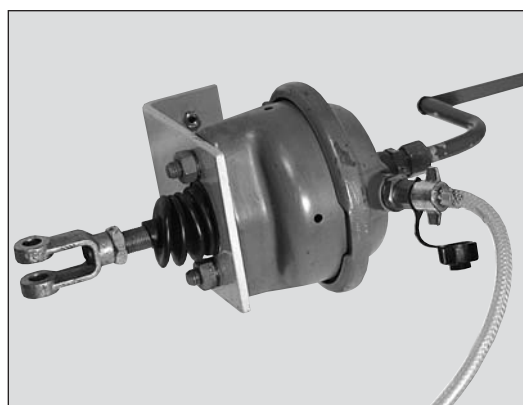
3. Connecting the Brake Cylinders

Connect port 2 of the brake testing system to the brake cylinder of the front axle and port 10 of the brake testing system to the brake cylinder of the rear axle.

The middle pressure gauge (6) displays the brake pressure which is set at the precision control valve underneath the gauge.

This brake pressure can be regulated via the switching valve (03) under the control valve and actuates the brakes of the trailer.

The pressures in the brake cylinders of the front and rear axles can then be read off at the pressure gauges 2 and 10.

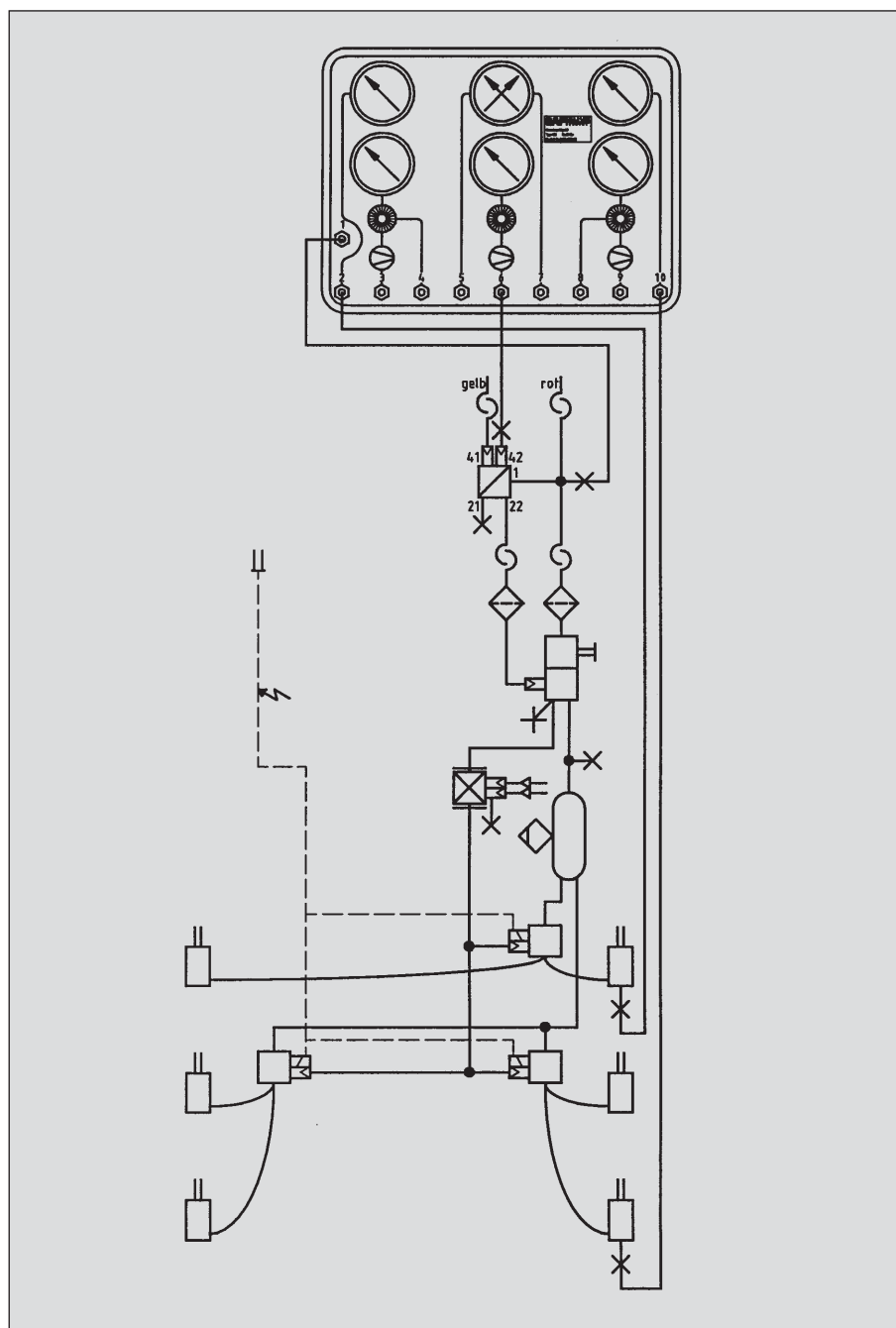


Testing Air Brake Systems on Trailers

The following connection instructions and the sketch show the necessary connections for the testing of the air brake system.

Connection instructions:

- 01 Supply pressure for brake testing system
- 02 Test pressure at brake cylinder of the front axle
- 06 Control pressure for the trailer brake line (yellow coupling head)
- 10 Test pressure at brake cylinder of the rear axle



Testing the Pressure Lead in the Trailer

Procedure: Example 2

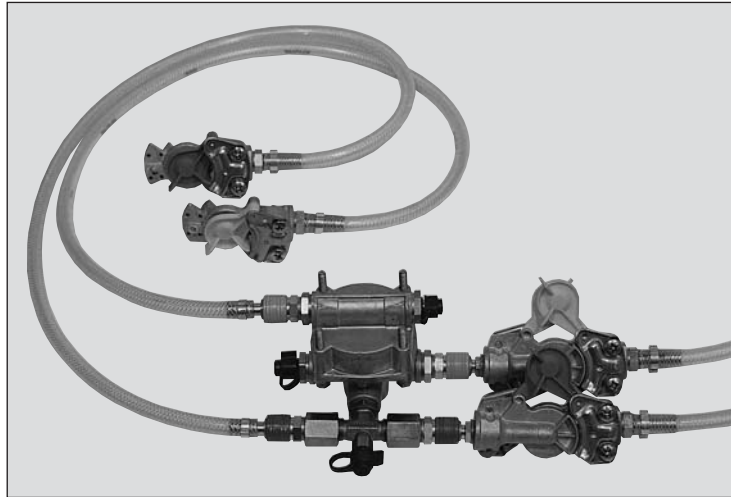
1. Connecting the Relay Valve Assembly

Connect outlet port 2 (yellow coupling head) of the relay valve (01) to the brake line of the trailer.

Connect the red coupling head (04) of the relay valve assembly to the trailer.

Admit a supply pressure to the second red coupling head (03) of the relay valve assembly.

This supply pressure can be taken either from the tractor or from a stationary workshop

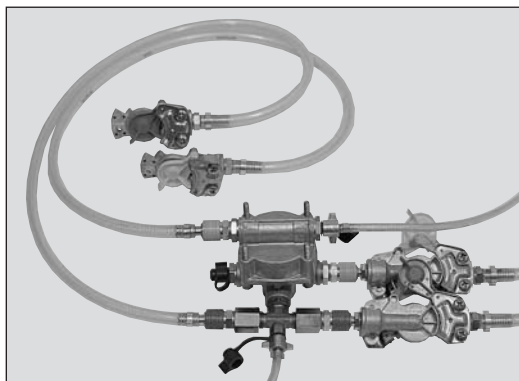
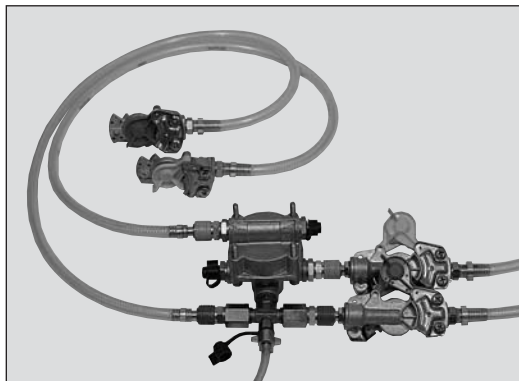


compressed air supply and should lie between 7.5 and 8.5 bar.

2. Connecting the Brake Testing System

Connect the test port (05) of the relay valve assembly to port 1 of the brake testing system. If the left-hand precision control valve is

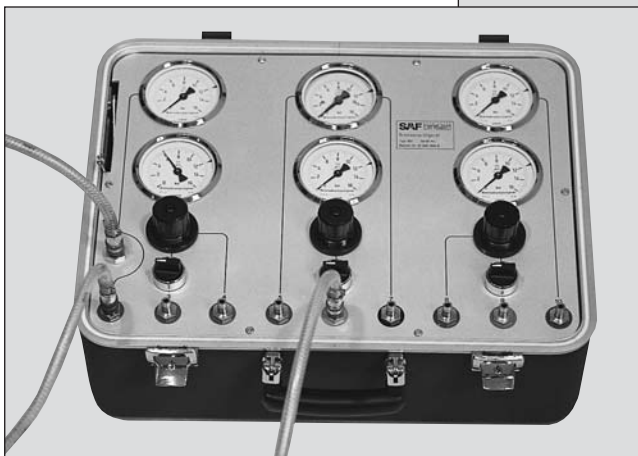
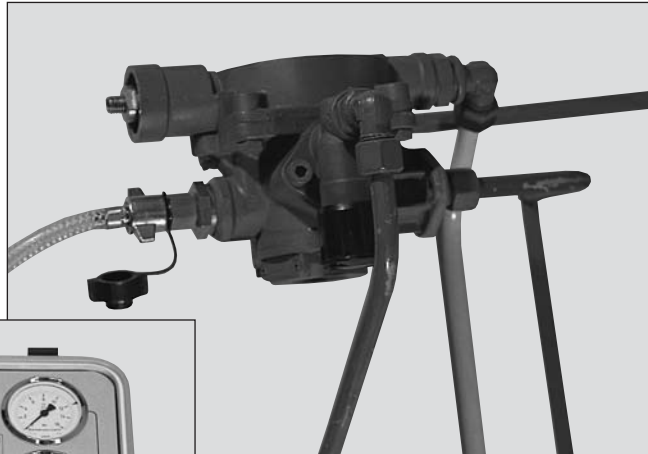
now turned completely to the right, the full supply pressure will be displayed on pressure gauge 3-4. Connect output port 6 of the brake testing system to the test port (09) of the relay valve assembly.



Testing the Pressure Lead in the Trailer

3. Connecting the Trailer Brake Valve or Brake Cylinder

Connect the test port at the outlet from the trailer brake valve to port 2 of the brake testing system. If the trailer brake valve has no test port, connect the brake cylinder of the



rear axle to port 2 of the brake testing system.

Note:

When measuring the pressure lead, the ALB controller must be set to full load.

To measure the pressure lead, now set a pressure of 2 bar (for Wabco brake systems) or a pressure of 3.5 bar (for Grau brake systems) at the middle precision control valve (02).

This pressure is displayed on the pressure gauge (6) above the precision control valve.

The preset pressure is then admitted to the trailer brake valve or brake cylinder via the switching valve (03) located under the precision control valve.

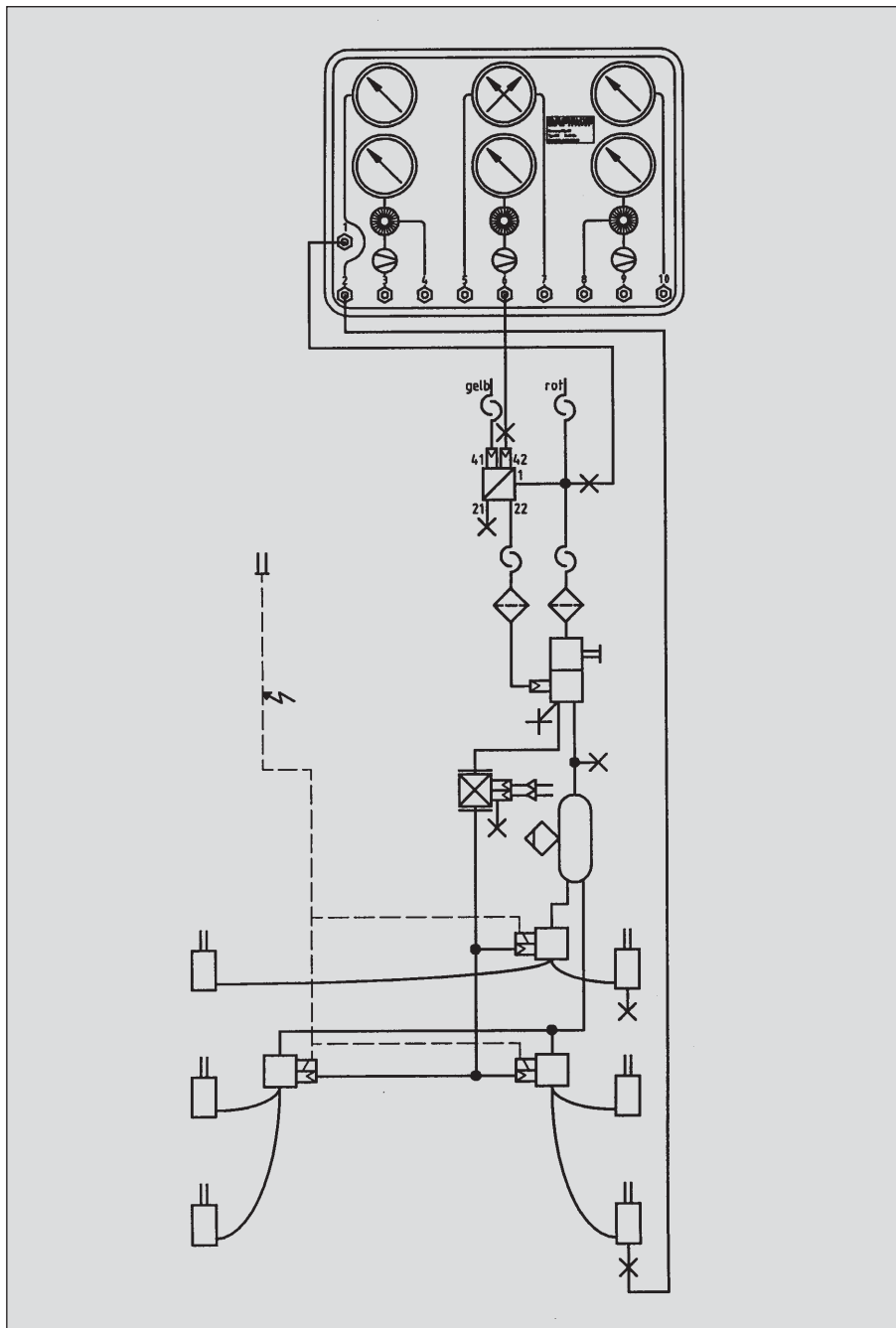
The outlet pressure from the trailer brake is displayed on pressure gauge 2 via port 2 of the brake testing system.

The difference between the inlet pressure (pressure gauge 6) and the displayed pressure (pressure gauge 2) is the pressure lead.

The following connection instructions and the sketch show the necessary connections for testing the pressure lead in the trailer.

Connection instructions:

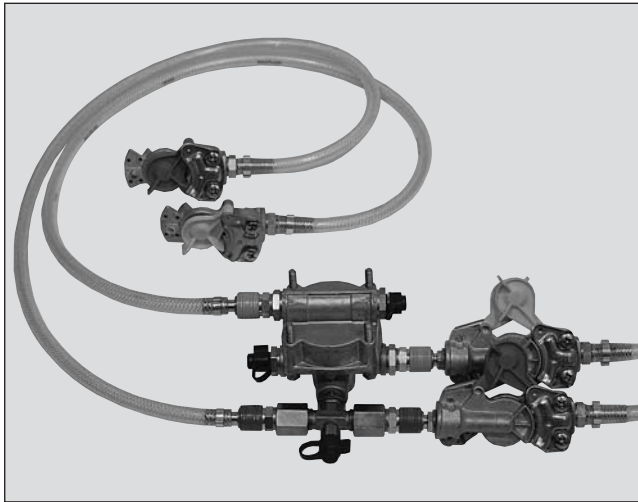
- 01 Supply pressure for brake testing system
- 02 Test pressure at trailer brake valve or brake cylinder of the rear axle
- 06 Control pressure for the trailer brake line (yellow coupling head)



Testing Pneumatically Controlled LSV Controllers

Procedure: Example 3

1. Connecting the Relay Valve Assembly



Connect outlet port 2 (yellow coupling head) of the relay valve (01) to the brake line of the trailer. Connect the yellow coupling head (06) to the tractor.

Connect the red coupling head (04) of the relay valve assembly to the trailer.

Admit a supply pressure to the second red coupling head (03) of the relay valve assembly.

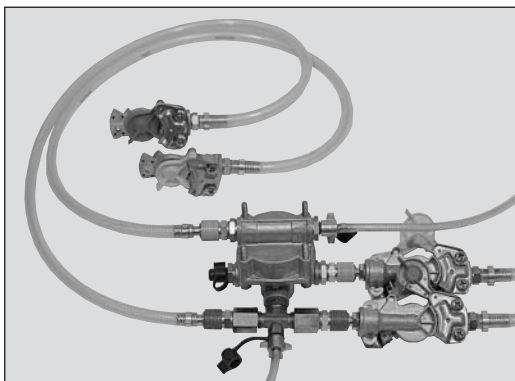
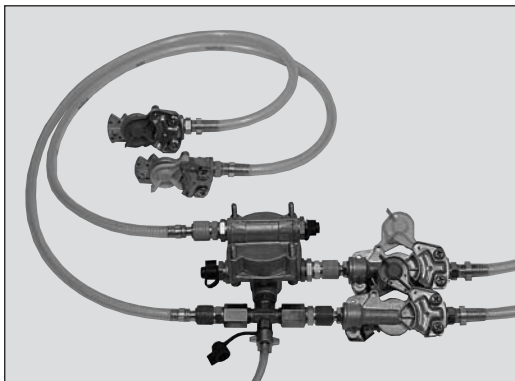
This supply pressure can be taken either from the tractor or from a stationary workshop compressed air supply and should lie between 7.5 and 8.5 bar.

2. Connecting the Brake Testing System

Connect the test port (05) of the relay valve assembly to port 1 of the brake testing system. If the left-hand precision control valve is now turned completely to the right, the

full supply pressure will be displayed on pressure gauge 3-4.

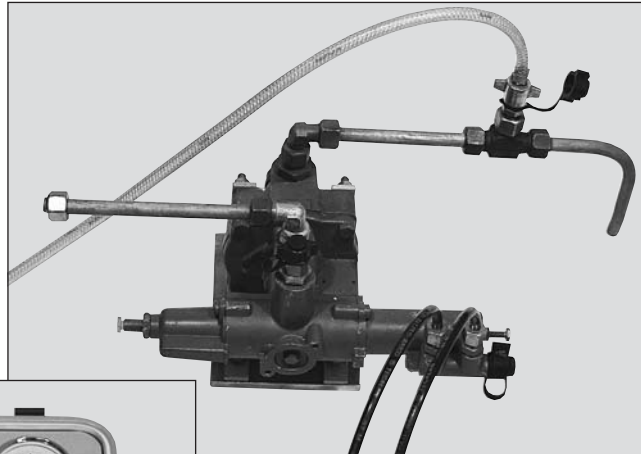
Connect output port 6 of the brake testing system to the test port (09) of the relay valve assembly.



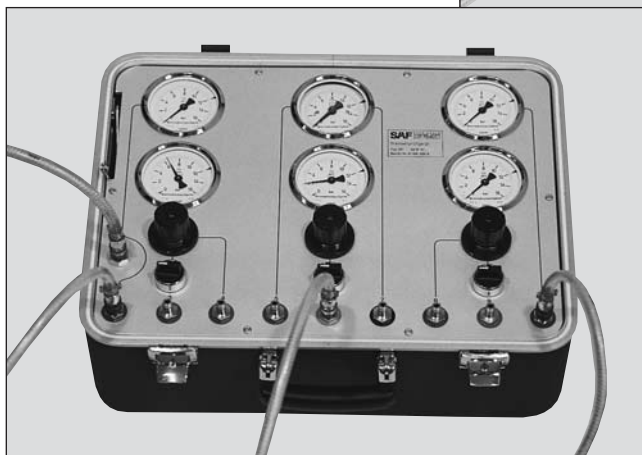
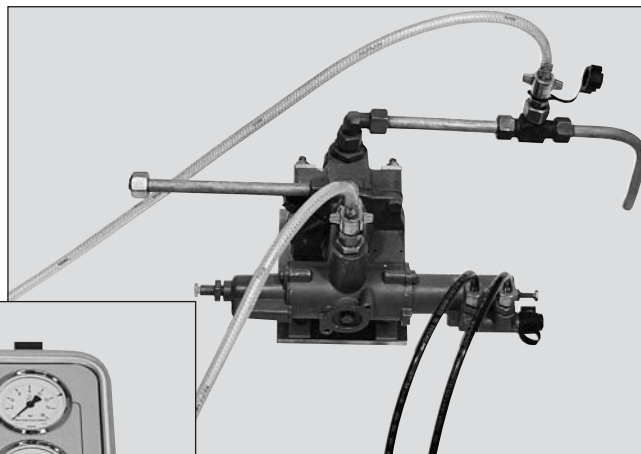
Testing Pneumatically Controlled LSV Controllers

3. Connecting the LSV Controller

Connect the test port “Input LSV controller” to port 2 of the brake testing system.



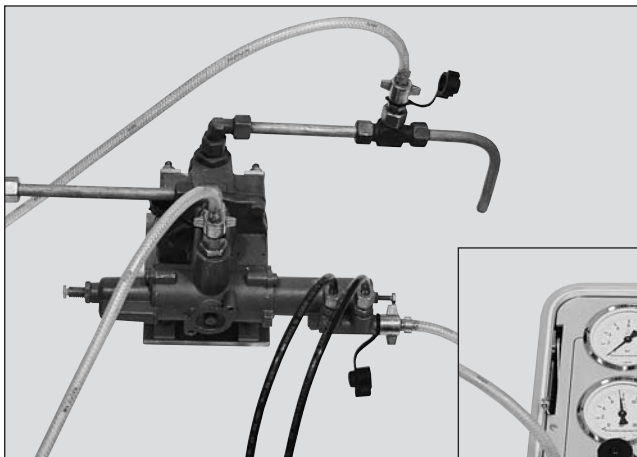
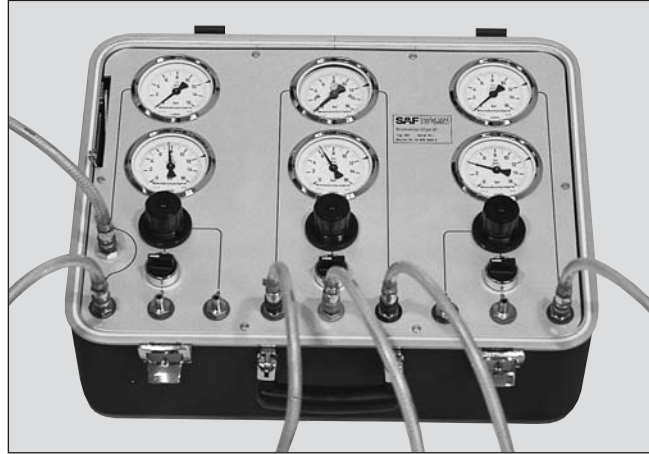
Connect the test port “Output LSV controller” to port 10 of the brake testing system.



Testing Pneumatically Controlled LSV Controllers

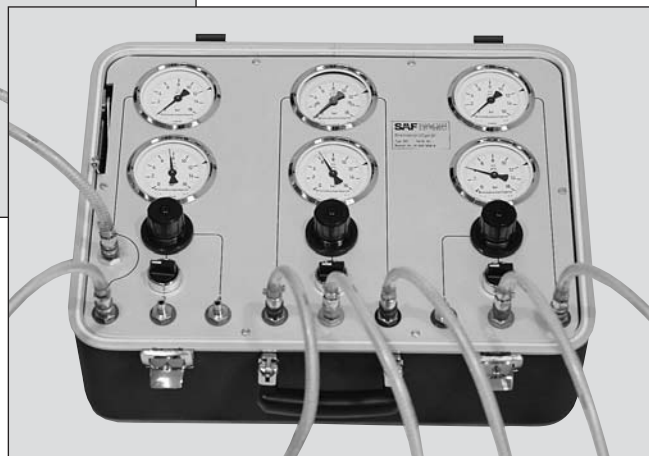
4. Connecting the Air Suspension Bags

Connect the test ports of the air suspension bags left and right to the ports 5 and 7 of the brake testing system.



5. Connecting the Test Port of the LSV Controller

Connect test port 4 at the inlet to the LSV controller to port 9 of the brake testing system.



The air suspension bag pressure can be simulated for every load condition at the right-hand precision control valve of the brake testing system. The set air bag pressure is displayed on pressure gauge 8/9 and can be controlled via the switching valve located underneath the pressure gauge.

The brake pressure can be set with the middle precision control valve. This pressure is also displayed on pressure gauge (6) located above the valve. The brake pressure is admitted to the trailer brake line with the middle switching valve.

The outlet pressure from the LSV controller is then displayed on pressure gauge 2 and the inlet pressure can be read off at port 10. Pressure gauge 5/7 shows the actual prevailing air suspension bag pressure.

Note:

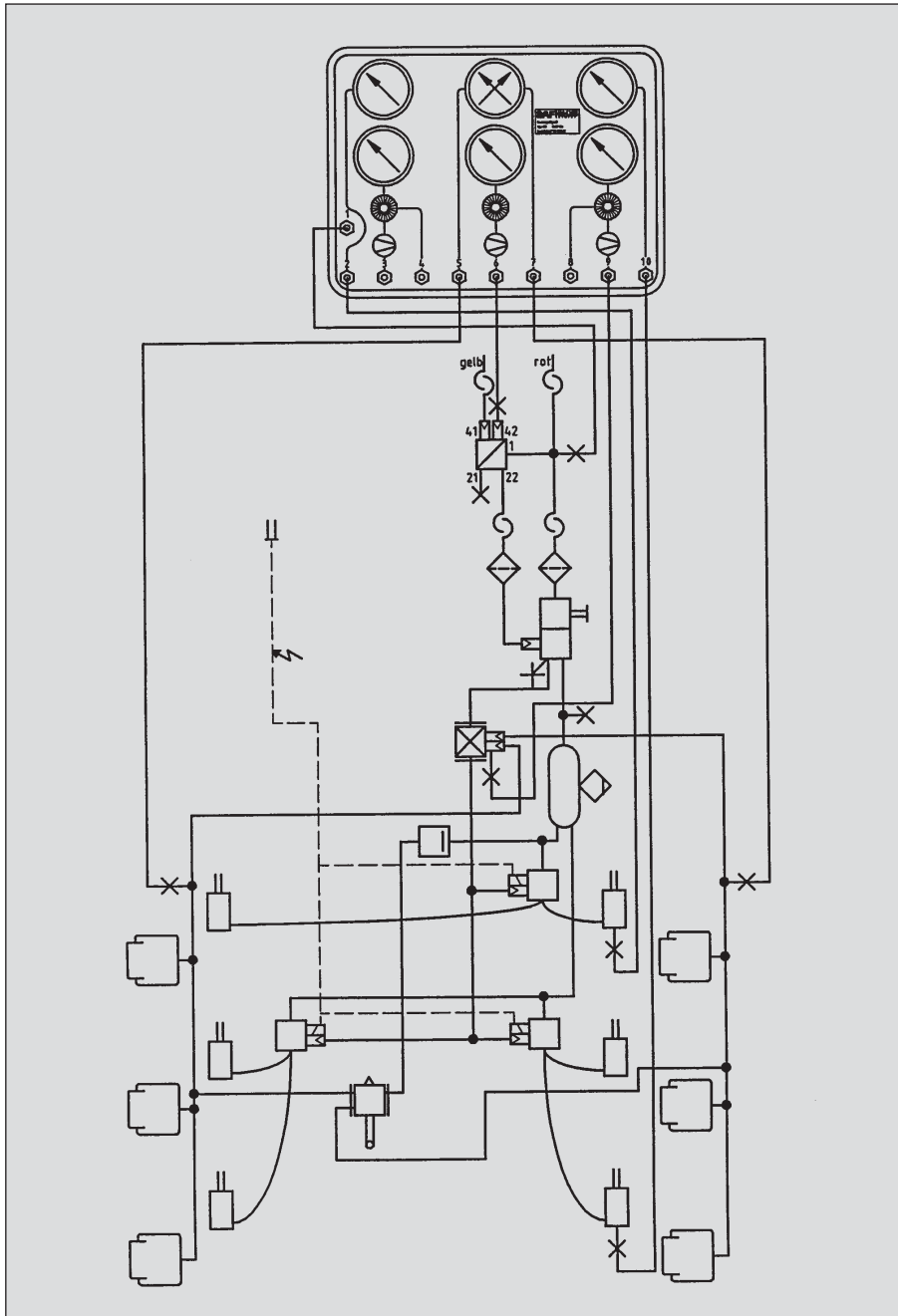
Setting and checking of the LSV controller should be carried out in accordance with the instructions of the brake manufacturer.

Testing Pneumatically Controlled LSV Controllers

The following connection instructions and the sketch show the necessary connections for testing pneumatically controlled LSV controllers.

Connection instructions:

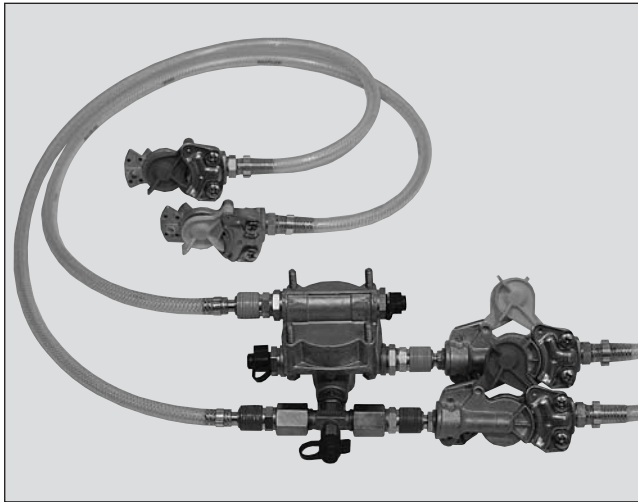
- 01 Supply pressure for brake testing system
- 02 Test pressure "Inlet LSV controller"
- 05 Test port "Air suspension bag left"
- 06 Control pressure for the trailer brake line (yellow coupling head)
- 07 Test port "Air suspension bag right"
- 09 Test port "Inlet 4 of LSV controller"
- 10 Test pressure "Outlet LSV controller"



Testing the Trailer Brakes on the Roller Dynamometer

Procedure: Example 4

1. Connecting the Relay Valve Assembly



Connect outlet port 2 (yellow coupling head) of the relay valve (01) to the brake line of the trailer. Connect the yellow coupling head (06) to the tractor.

Connect the red coupling head (04) of the relay valve assembly to the trailer.

Admit a supply pressure to the second red coupling head (03) of the relay valve assembly. This supply pressure can be taken either from the tractor or from a stationary workshop compressed air supply and should lie between 7.5 and 8.5 bar.

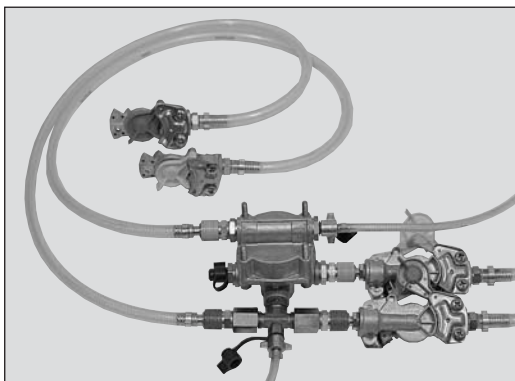
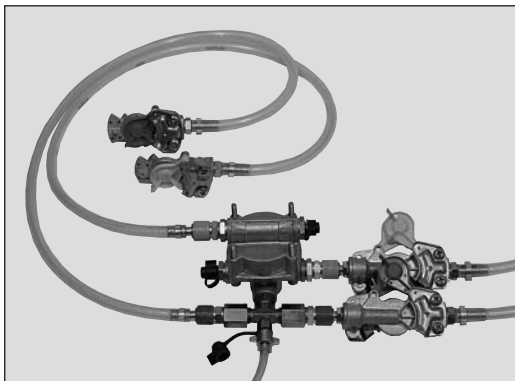
2. Connecting the Brake Testing System

Connect the test port (05) of the relay valve assembly to port 1 of the brake testing system.

If the left-hand precision control valve is now

turned completely to the right, the full supply pressure will be displayed on pressure gauge 3-4.

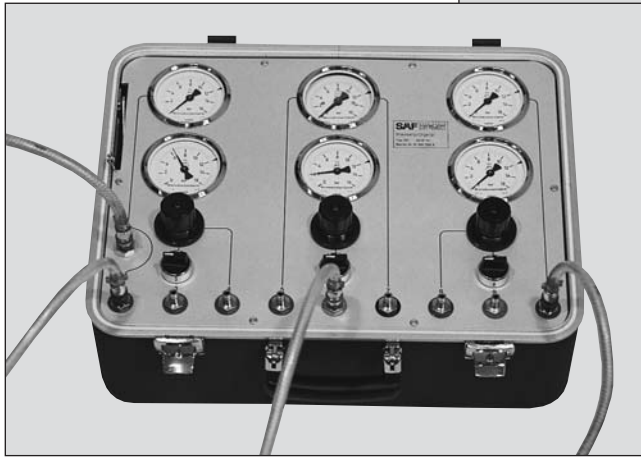
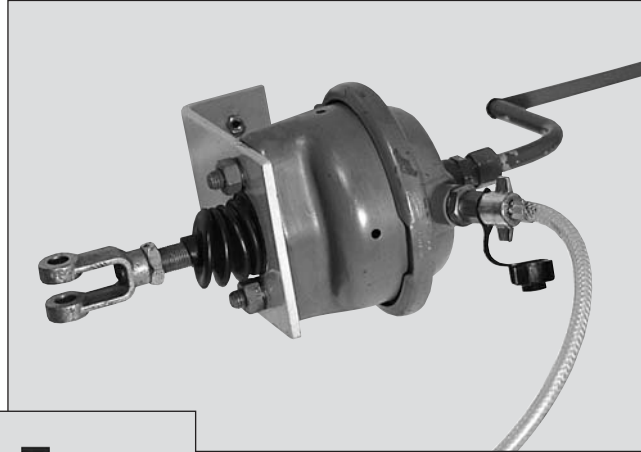
Connect output port 6 of the brake testing system to the test port (09) of the relay valve assembly.



Testing the Trailer Brakes on the Roller Dynamometer

3. Connecting the Brake Cylinders

Connect port 2 of the brake testing system to the brake cylinder of the front axle and port 10 of the brake testing system to the brake cylinder of the rear axle.



The pressure set at the middle precision control valve (02) is displayed on pressure gauge (6). This brake pressure can be admitted to the trailer brake line via port 6 by actuating the switching valve and actuates the brakes of the trailer.

When locking the wheels on the roller dynamometer, the brake pressure must be reduced accordingly via the control valve and admitted to the trailer brake valve again.

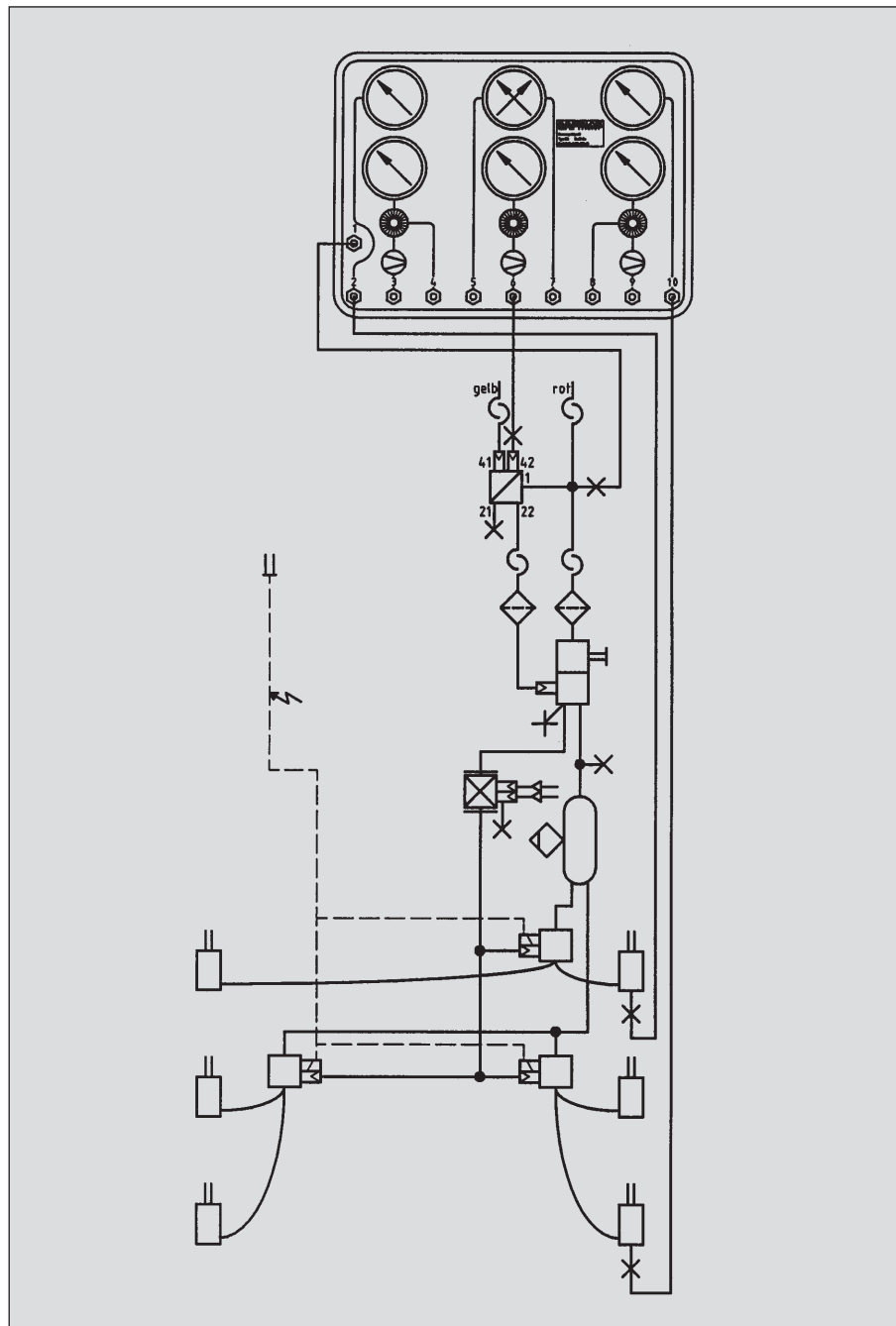
The brake cylinder pressure of the front and rear axle (displayed on pressure gauges 2 and 10) should be as equal as possible in order that the interpolation formula for the complete vehicle can be used.

Even if the brake pressure is throttled via a pressure balancing valve on the axle, equal brake cylinder pressures can be achieved by appropriate adjustment of the brake pressure at the control valve.

The following connection instructions and the sketch show the necessary connections for testing the trailer brakes on the roller dynamometer.

Connection instructions:

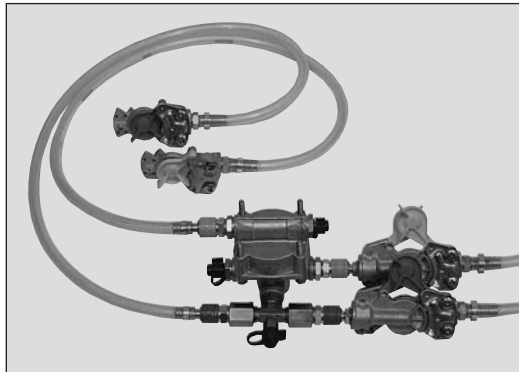
- 01 Supply pressure for brake testing system
- 02 Test pressure at brake cylinder of the front axle
- 06 Control pressure for the trailer brake line (yellow coupling head)
- 10 Test pressure at brake cylinder of the rear axle



Testing the Trailer Brakes on the Road

The EC and ECE test guidelines for trailers prescribe a compulsory brake test on the road. The deceleration values are recorded as a function of the pressures at the yellow coupling head (brake).

A recording of the brake cylinder pressure parallel to the pressure at the brake coupling head is necessary in order to also be able to check the setting of the air brake system on the road (dynamic behaviour).



Procedure: Example 5

1. Connecting the Relay Valve Assembly

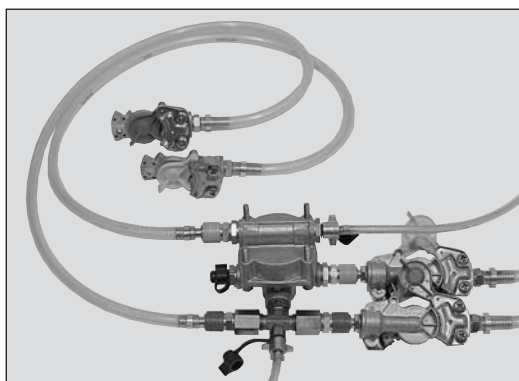
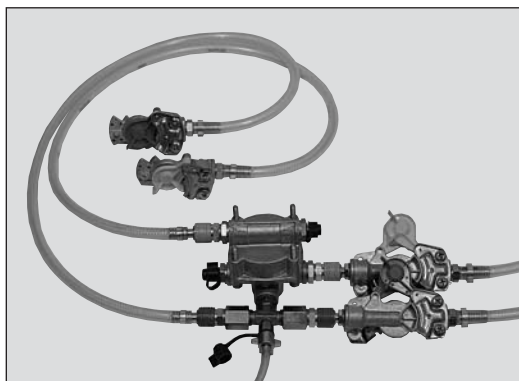
Connect outlet port 2 (yellow coupling head) of the relay valve (01) to the brake line of the trailer.

Connect the red coupling head (04) of the relay valve assembly to the trailer supply line. Then connect the relay valve assembly to the other two coupling heads on the tractor.

2. Connecting the Brake Testing System

Connect the test port (05) of the relay valve assembly to port 1 of the brake testing system. If the left-hand precision control

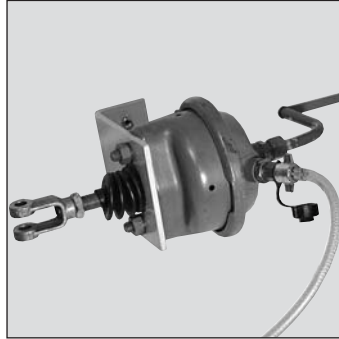
valve is now turned completely to the right, the full supply pressure will be displayed on pressure gauge 3-4. Connect output port 6 of the brake testing system to the test port (09) of the relay valve assembly.



Testing the Trailer Brakes on the Road

3. Connecting the Brake Cylinders

Connect the brake cylinder of the front axle to port 2 of the brake testing system and the brake cylinder of the rear axle to port 10 of the brake testing system.



When performing such tests on the road, the brake testing system is placed in the driver's cab.

Lay the test hoses through the window or roof hatch to the trailer.

The trailer brakes can be actuated via the relay valve assembly either by the brake testing system or from the tractor.

This two-circuit control method ensures that the service brake system of the trailer is always operational.

During the test of the trailer brakes, the clutch is disengaged at a speed of between 40 and 50 km/h and the brakes of the trailer are actuated via the brake testing system. In order to actuate the brakes in the trailer using the brake testing system, a brake pressure must be set at the middle precision control valve and admitted to the relay valve assembly via the switching valve located below. The admitted brake pressure is displayed on pressure gauge 6 of the brake testing system.

Several brake tests are generally performed with the different pressures using the following formula:

For Trailers

$$Z_A = (Z_z - k_R) \frac{G_A + G_K}{G_A} + k_R (\%)$$

For semi-trailers

$$Z_A = (Z_z - k_R) \frac{G_A + G_K + k_R}{G_A - G_S} (\%)$$

where:

Z_A : Deceleration of the trailer [%]

Z_z : Deceleration of the tractor/trailer combination with only the trailer brake [%]

G_A : Mass force of the trailer [N]

G_K : Mass force of the towing vehicle [N]

G_S : Semi-trailer force [N]

k_R : Allowance for rolling resistance (approx. 3%)

Using this formula, the deceleration of the trailer is calculated from the recorded tractor/trailer deceleration (using motometer, IfK plotter or dynameter).

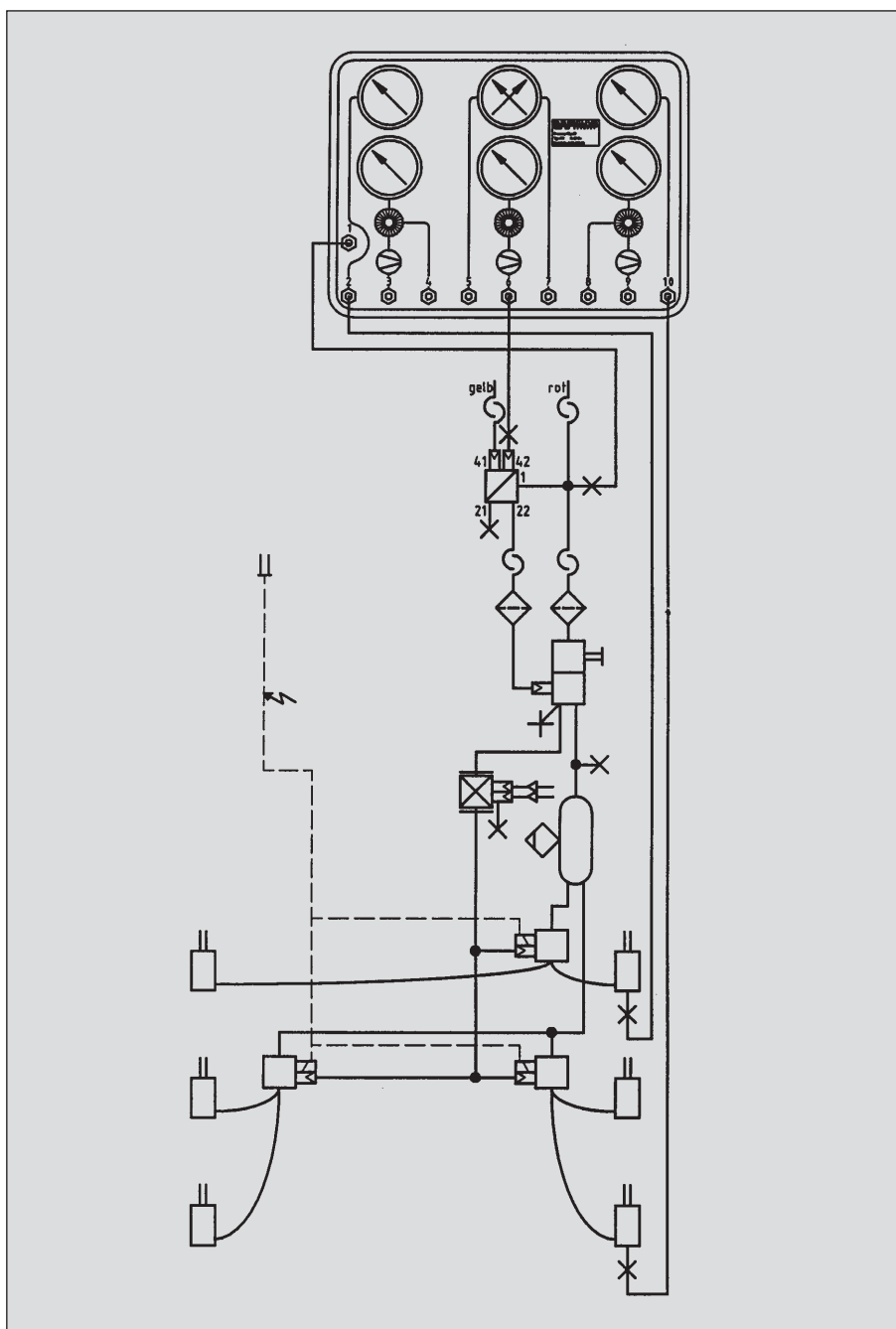
For measurements with empty or partly laden trailer or semi-trailer, the actuating pressure (P_p) must be in the same ratio to the maximum brake force (P_n) as the actual weight of the trailer or the sum of the axle loads (for semi-trailers) is to permissible total weight or the sum of the axle loads.

Testing the Trailer Brakes on the Road

The following connection instructions and the sketch show the necessary connections for testing the trailer brakes on the road.

Connection instructions:

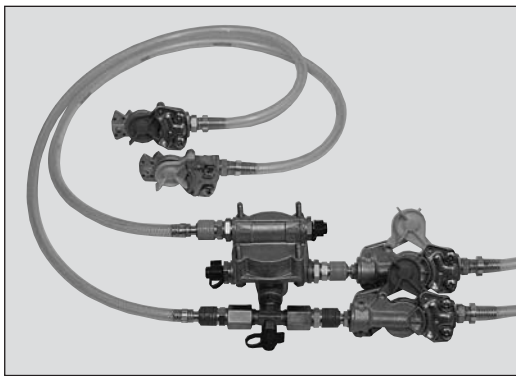
- 01 Supply pressure for brake testing system
- 02 Test pressure at brake cylinder of the front axle
- 06 Control pressure for the trailer brake line (yellow coupling head)
- 10 Test pressure at brake cylinder of the rear axle



Balancing the Braking Behaviour of Towing and Towed Vehicle

A large number of brake problems result from the fact that the brake systems of towing and towed vehicle are badly balanced. In order to be able to take the appropriate adjustment measures in such cases, extensive measurements have to be performed, particularly on the air brake system.

Starting from the maximum supply pressure (cut-off pressure), the brake pressures at all the axles – referred to the yellow coupling head of the brake line – have to be measured with the vehicle loaded, partially loaded and empty.



Procedure: Example 6

1. Connecting the Relay Valve Assembly

Connect outlet port 2 (yellow coupling head) of the relay valve (01) to the brake line of the trailer.

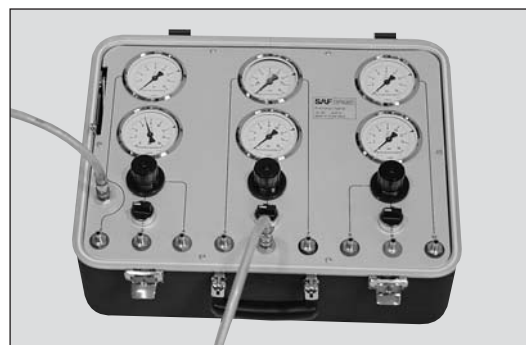
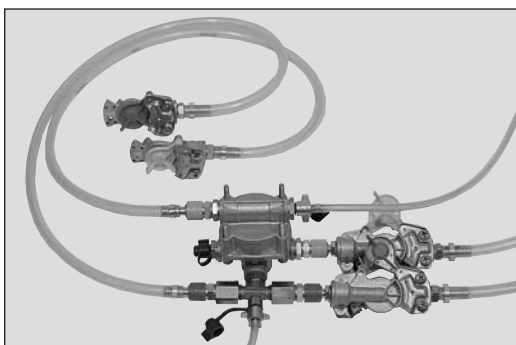
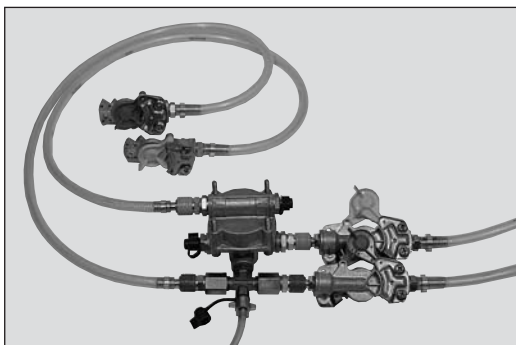
Connect the red coupling head (04) of the relay valve assembly to the trailer supply line. Then connect the relay valve assembly to the other two coupling heads on the tractor.

2. Connecting the Brake Testing System

Connect the test port (05) of the relay valve assembly to port 1 of the brake testing system. If the left-hand precision control valve is now turned completely to the right,

the full supply pressure will be displayed on pressure gauge 3-4.

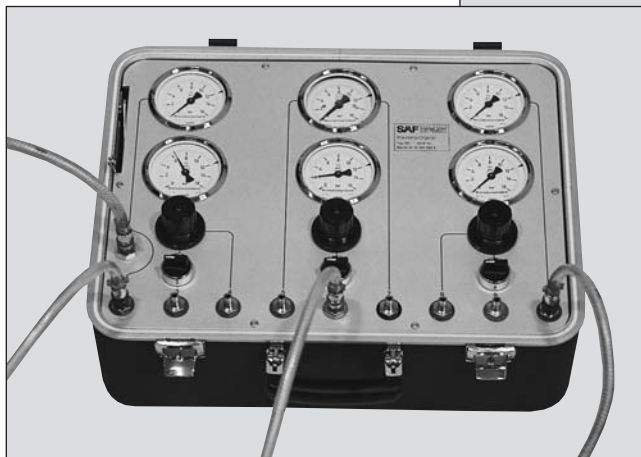
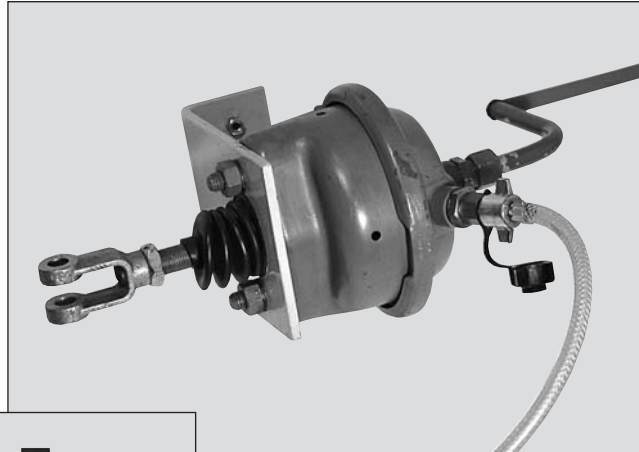
Connect output port 6 of the brake testing system to the test port (09) of the relay valve assembly.



Balancing the Braking Behaviour of Towing and Towed Vehicle

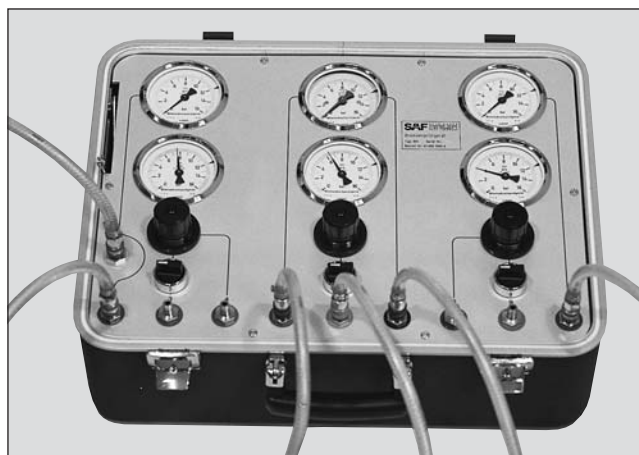
3. Connecting the Brake Cylinders

Connect port 2 of the brake testing system to the brake cylinder of the front axle and port 10 of the brake testing system to the brake cylinder of the rear axle.



4. Connecting the Air Suspension Bags

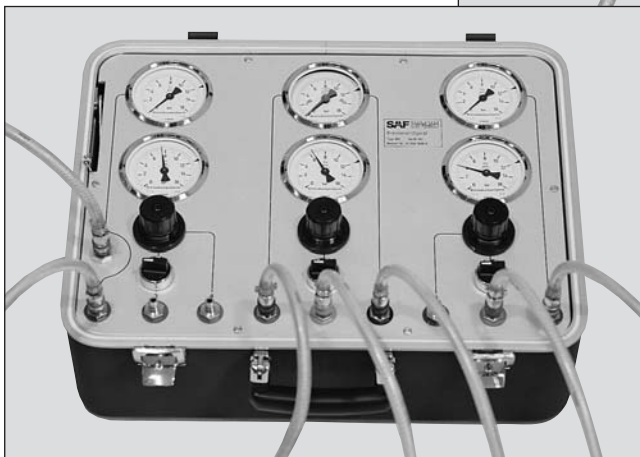
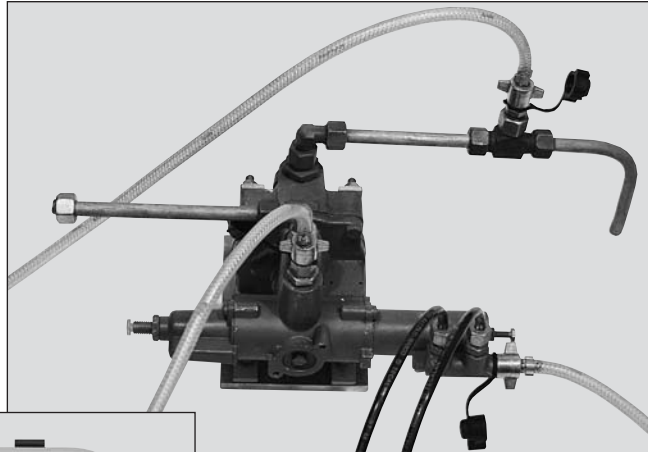
Connect the test ports of the air suspension bags left and right to the ports 5 and 7 of the brake testing system.



Balancing the Braking Behaviour of Towing and Towed Vehicle

5. Connecting the Test Port of the LSV Controller

Connect test port 4 at the inlet to the LSV controller to ports 9 of the brake testing system.



The air suspension bag pressure can be simulated for the loaded condition with control circuit 9 by setting the corresponding pressure at precision control valve 02. This pressure is displayed on pressure gauge 8/9 and is admitted to the LSV controller via a test hose from port 9 by switching over the changeover valve 03.

The brake pressure is controlled by the running board valve in the driver's cab and can be read off as the brake pressure at pressure gauge 3-4.

The corresponding brake cylinder pressure on the front axle is displayed on pressure gauge 2 and for the rear axle on pressure gauge 10.

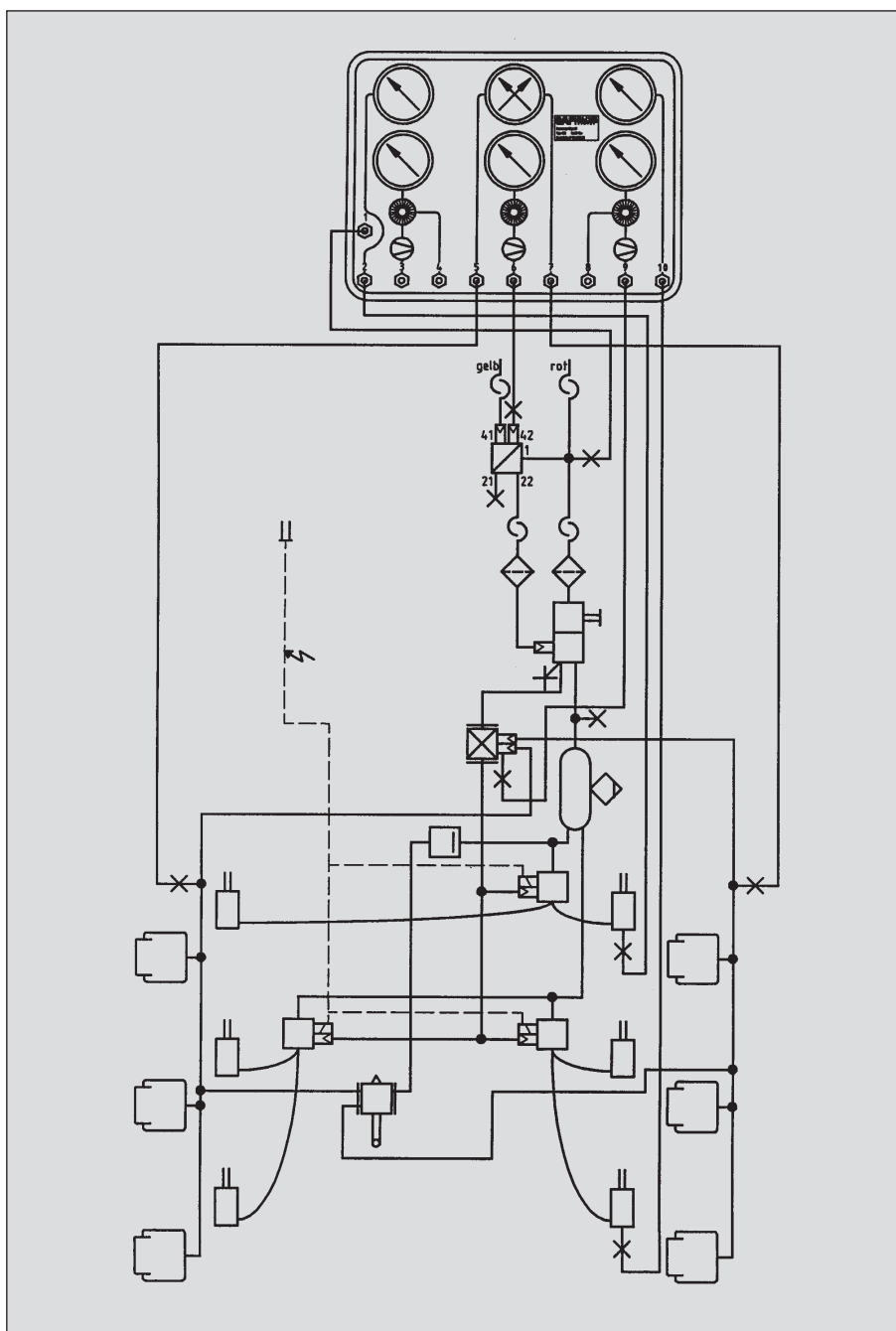
The pressure displayed at pressure gauge 6 which is admitted to port 9 of the relay valve assembly via switching valve 03 corresponds to the pressure at the yellow coupling head of the trailer brake line.

The actual prevailing air suspension bag pressures are displayed on pressure gauge 5/7.

The following connection instructions and the sketch show the necessary connections for balancing the braking behaviour of towing and towed vehicle.

Connection instructions:

- 01 Supply pressure for brake testing system
- 02 Test pressure at brake cylinder of the front axle
- 05 Test port "Air suspension bag left"
- 06 Control pressure for the trailer brake line (yellow coupling head)
- 07 Test port "Air suspension bag right"
- 09 Test port "Inlet 4 of LSV controller"
- 10 Test pressure at brake cylinder of the rear axle




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