

Controllers for gas valve leakage testers DK 2F series 2

8.20

DUNGS®



Technical description

Leakage testers DK 2 test for leaks in two series-connected gas solenoid valves in conjunction with one or two gas pressure switches.

The DK2 program sequence controls a synchronous gear motor fitted with switching cams via microswitches. The gas inlet valve is tested by discharging the test section and monitoring the pressure rise; the burner-side valve is tested by filling the test section and monitoring the pressure drop. If the pressure rises excessively during the first test phase or if the pressure drops excessively during the second test phase, the DK2 interlocks in fault position and prevents the burner from starting.

Application

The DK 2 leakage testers are designed to perform an automatic leakage test between two solenoid valves in gas-consuming devices.

The proving system can be used as an independent leakage test or in connection with all automatic burner controls. The power supply is connected to the regulator and switching circuit so that burner operation is only released after the leakage test. For use in gas automatic burner controls for heating and industry, gas combustion motors, etc., with or without venting lines outdoors.

Approvals

EC type test approval as per EC Gas Appliance Directive:

DK 2F CE-0085 AQ 0808

EC type test approval as per EC Pressure Equipment Directive:

DK 2F CE0036

Approvals in other important gas consuming countries

Leakage testers of types DK 2F

The DK 2 leakage testers are contained in a plastic housing with plug-in base. The illustrations show the component side with the hood removed. The controller and synchronous gear motor, switching cams and micro-switches are mounted on a PCB which controls and monitors the test sequence and releases operation. All safety-critical components are subject to a self-monitoring routine on starting. A bistable remanence relay is used as the fault interlocking element. Self-monitoring of fault winding is performed because the current for the synchronous motor flows through this winding during the test.

The test pressure switch P 1/2 is included in start monitoring so that circuit interruptions or jumpers do not release the program. The test sequence "depressurewise/presswise must be followed.

Visual operating and fault display in housing top part.

DK2F with connection for external alarm are DIN-tested and DIN-DVGW-registered in the 50 Hz, 230 V AC, 110 V and 24 V DC versions.

The **24 V version** is equipped with an AC/DC transformer which provides the motor drive of the cam control unit with a 50 Hz AC voltage.

Functional and program sequence

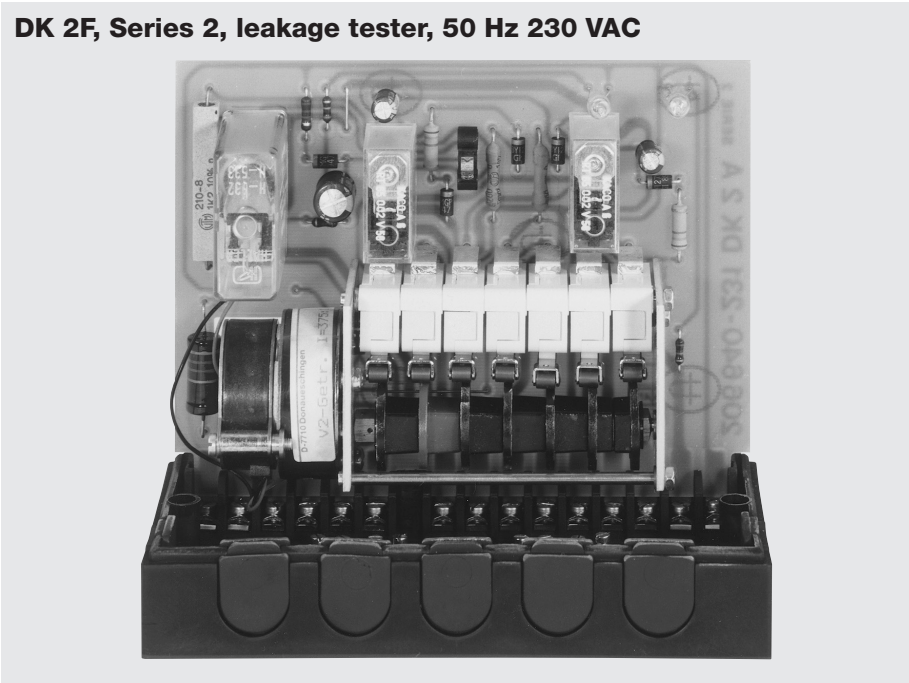
The section between the two gas valves (from valve seat to valve seat) is designated as "test section". DK 2 checks before each burner start, i.e. on regulator heat request or after switch-off due to power supply failure, loss of gas supply, etc. in two phases:

1. Test of gas inlet valve (V1).
2. Test of burner-side valve (V2).

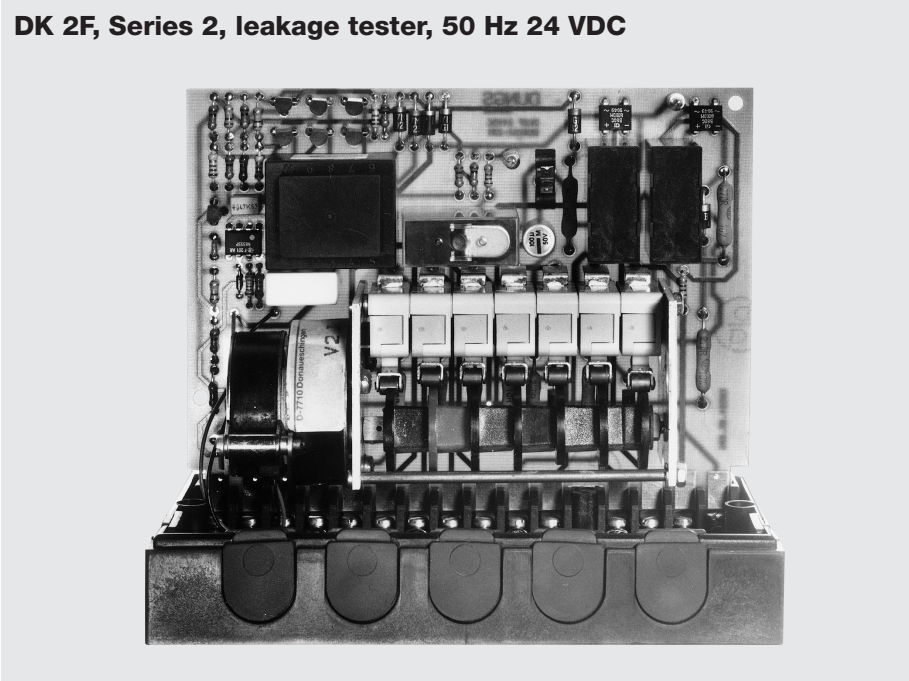
On heat request, the regulator circuit is closed and voltage is applied to the DK 2. The program sequence starts.

The leakage test process lasts approx. 60 s for DK 2F, Series 2, and approx. 90 s for DK 2 F, Series 3. At the beginning of the first test phase, the discharge solenoid valve (V4) is opened for about 5 s. The pressure in the test section must drop to atmosphere pressure, i.e. after the pressure relief procedure, the test pressure switch

DK 2F, Series 2, leakage tester, 50 Hz 230 VAC



DK 2F, Series 2, leakage tester, 50 Hz 24 VDC



Equipment overview

Type	Total test period	Pressure rise	Pressure drop	Remote unlocking
DK 2F Series 2*	approx. 60 s	approx. 22 s	approx. 22 s	yes
DK 2F Series 3	approx. 90 s	approx. 33 s	approx. 33 s	yes

* Versions in 50 Hz, 230 V AC, 110 V and 24 V DC

contact (P1/2, or P-2) must close for a short period of time. If the test section cannot be discharged, the pressure relief procedure must be repeated after 60 s until the contact switches.

Instead of a discharge solenoid valve (V4), a de-energised when open vent gas solenoid valve (LGV) can reduce the pressure in the test section during regulator switch-off.

The electrical connection of the leakage gas valve must be made at terminal 10. During the subsequent test period, no pressure must build up in the test section or exceed the switching point P 1/2 and/or P1 of the test pressure switch.

If this takes place due to leaks in the safety solenoid valve (V1), DK2 interlocks in fault position and prevents the burner from start.

The red fault LED lights up.

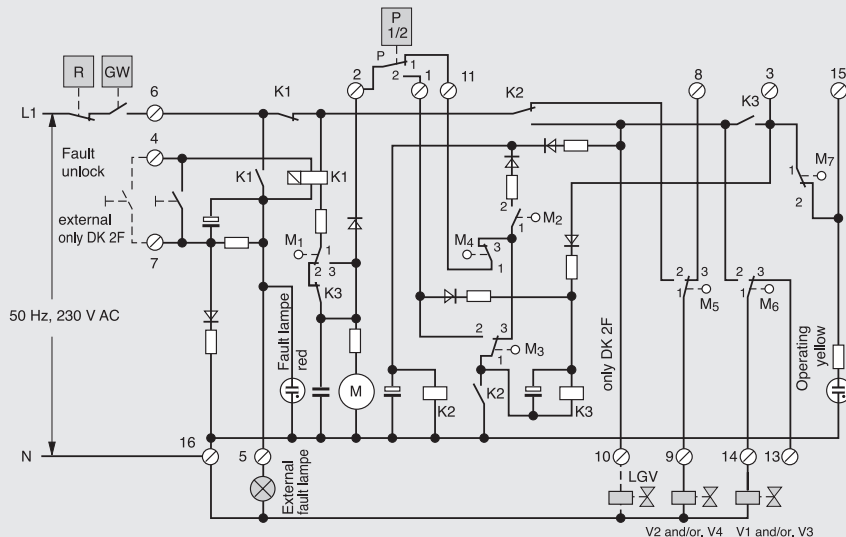
Voltage is applied for remote message of the fault (230 V AC and/or 24 V DC) at terminal 5 of the unit.

Before the second test phase, DK 2F opens the auxiliary valve (V3) for approx. 3.5s. The test section is then under gas pressure and the second test phase starts.

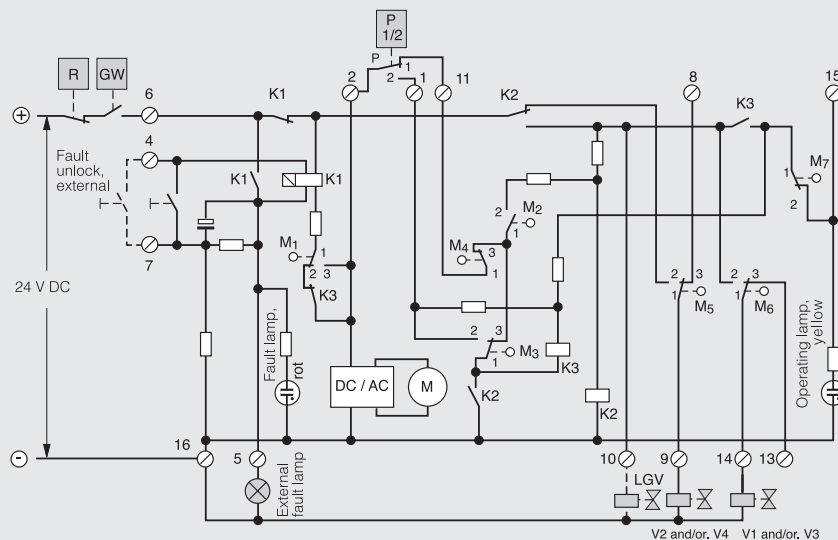
During the subsequent test period, the pressure in the test section must not undershoot switching point P 1/2 and/or P2 of the pressure switch. Pressure switch P 1/2 and/or P 2 signals when the pressure drops due to leaks in the burner-side valve (V2) and the vent tester interlocks in fault position. All parts within the test section, e.g. pressure switches, tubes, screw unions, etc. are tested for leakage at the same time. If a leakage gas valve is fitted, it is also checked.

Only when the second test phase results in "tight", the DK 2 switches through the regulator circuit and releases the program sequence for burner start.

Circuit diagram DK 2..., Series 2, 50 Hz, 230 V AC



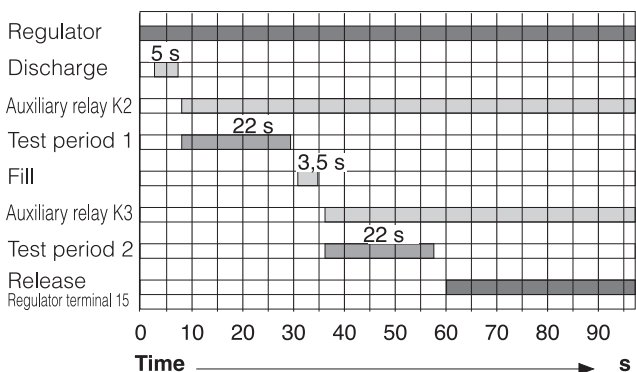
Circuit diagram DK 2..., Serie 2, (DC) 24 V



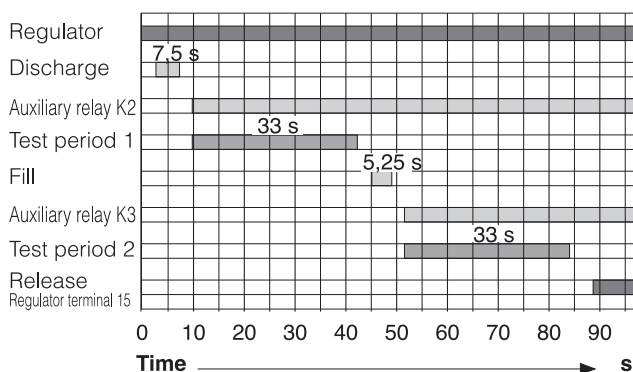
Legend

V1	Safety solenoid valve	R	Regulator
V2	Burner solenoid valve	K1	Fault relay
V3	Test solenoid valve	K2	Auxiliary relay 1
V4	Vent solenoid valve	K3	Auxiliary relay 2
LGV	Leakage gas solenoid valve	M	Synchronous motor
P 1/2	Check pressure switch	M1..7	Microswitch
GW	Gas pressure switch		

Flowchart DK 2F Series 2



Flowchart DK 2F Series 3



Valve proving systems: function requirements and application

The leakage tester must stop the burner program sequence in case of leakages in the burner solenoid valves, i.e. when the limit value is exceeded.

The safety-related requirements concerning Leakage testers for automatic actuators for gaseous fuels (EN DIN 3447, currently as draft only) determine the following guidelines:

Relief into firing chamber

When using a tester, the non-hazardous discharge (relief) of the gaseous fuel into the firing chamber may take place during the program sequence if the maximum relief volume does not exceed 0.05 % of the burner gas consumption for each switching sequence related to the burner nominal rating (see Explanations).

The main actuators (main solenoid valves) for the test sequence may only be activated when one of the actuators in series has been pretested for leakage.

For main actuators > DN 65, the use of bypass valves should be preferred.

Limit value

The tester must prevent ignition release and actuator opening for a limit value of < 0.1 % of the burner gas consumption (related to burner rating) but not smaller than 50 l/h.

The relief volume of 0.05 % is derived from the permissible safety period of two seconds with the actuator open and the gas volume flowing into the firing chamber. The maximum volume flowing into the firing chamber is 55.6 litres in two seconds for a burner gas consumption of 100 m³/h. The maximum permissible relief volume for each switching sequence of 0.05 % is 50 litres.

Avoiding leakages

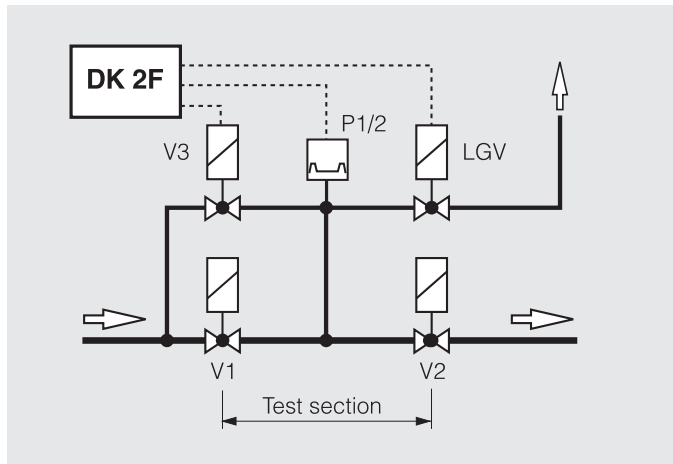
The main reason for leaky actuators is fouling. For this reason, the gas filter upstream of the gas train must be of sufficient size. Pay special attention to the pressure loss of the filter, i.e. check and clean the filter at regular intervals.

Nominal diameter

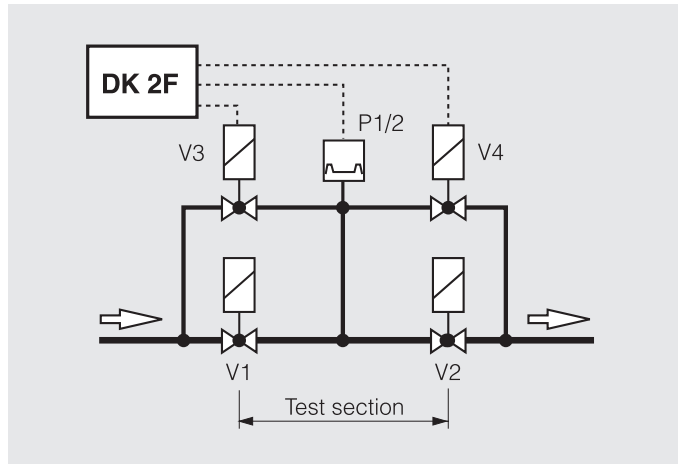
Explanations

Schematic diagrams

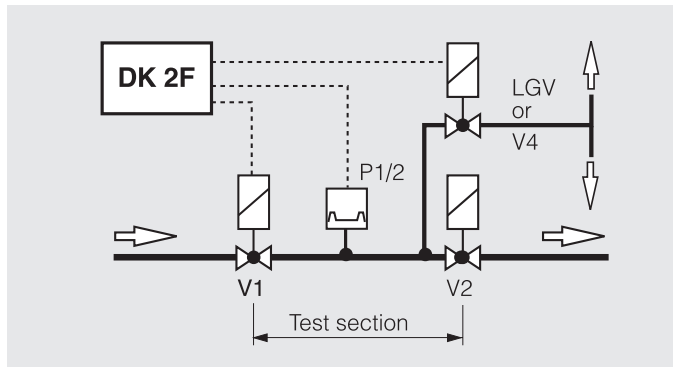
1. Valve test using auxiliary valves V3, LGV



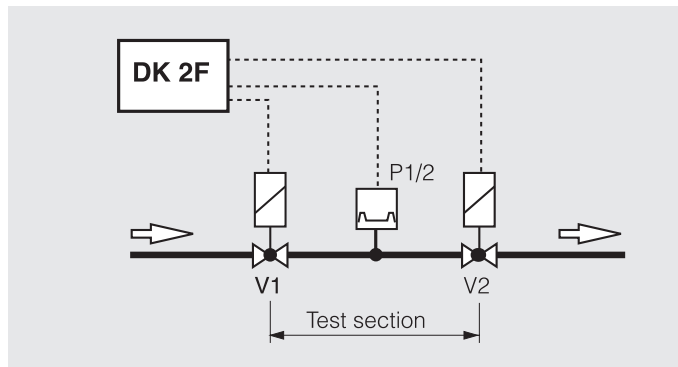
2. Valve test using auxiliary valves V3, V4



3. Direct valve test V1 using auxiliary valve V4 or LGV



4. Direct valve test V1, V2



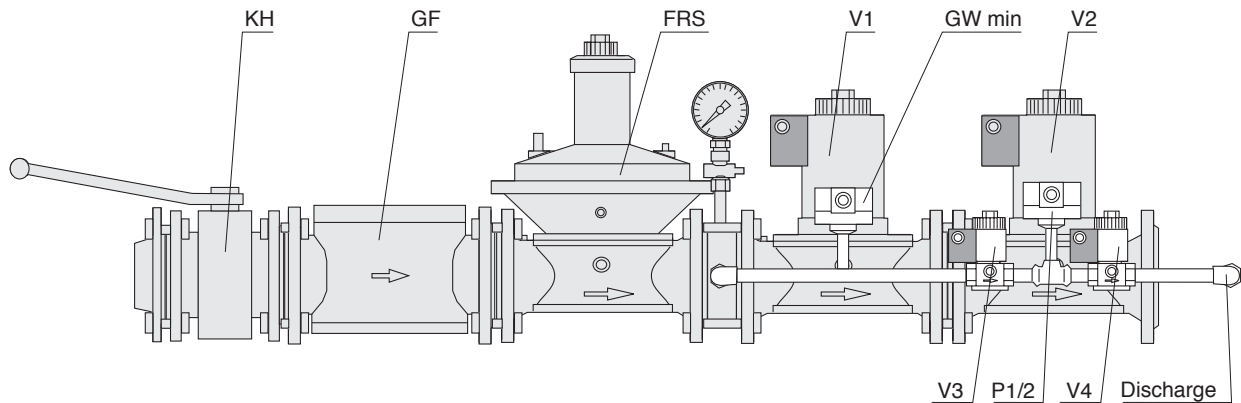
Legend to schematic diagrams

V1	Safety solenoid valve
V2	Burner solenoid valve
V3	Test gas solenoid valve
V4	Vent solenoid valve
LGV	Vent gas solenoid valve
P 1/2	Test pressure switch

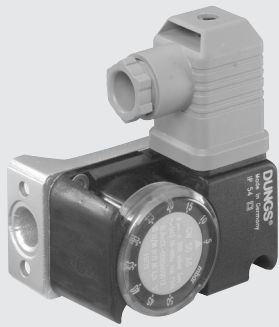


Select the functional principle in accordance with the locally prevailing regulations.

Basic regulator section layout with DK 2... valve test and auxiliary valves



Test pressure switch

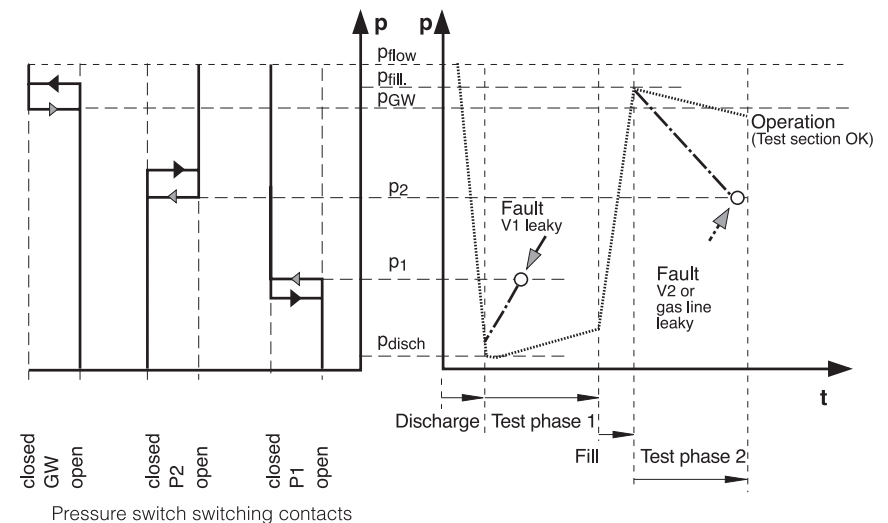


GW... A6 gas pressure switch

One or two pressure switches can be used for pressure monitoring in the test section:

A common pressure switch for test phases 1 and 2 (P 1/2) requires a switch-over contact. The switching point of the pressure switch must be set to half the gas flow pressure. Two

Check pressure switch switching points



pressure switches detect relatively small leakage gas volumes if set appropriately. The leakage gas volumes can be set individually to the required value for: Test phase 1 (safety solenoid valve) with

pressure switch P1 and Test phase 2 (burner solenoid valve) with pressure switch P 2.

Leakage gas rate

The leakage gas rate can be checked using the following equation and the switching points of the check pressure switches can be changed, if necessary.

Example calculation:

° V_{L1} = Leakage rate of inlet valve

$$\dot{V}_{L1} = \frac{(p_1 - p_{\text{Disch}}) \cdot V_P \cdot 3600 \text{ s/h}}{p_{\text{atm}} \cdot t_{\text{Test}}} \text{ dm}^3/\text{h}$$

° \dot{V}_{L2} = Leakage rate of burner-side valve

$$\dot{V}_{L2} = \frac{(p_{\text{Fill}} - p_2) \cdot V_P \cdot 3600 \text{ s/h}}{p_{\text{atm}} \cdot t_{\text{Test}}} \text{ dm}^3/\text{h}$$

Test volume

Nominal diameter Rp DN	dm ³ Valve	dm ³ /m pipe line
1/2	0.07	0.20
3/4	0.12	0.30
1	0.20	0.50
1 1/2	0.50	1.40
2	0.90	2.00
40	0.70	1.40
50	1.20	2.00
65	2.00	3.40
80	3.80	5.00
100	6.50	8.00
125	12.50	12.40
150	17.50	17.80
200	46.00	31.40

Example: Q_{L2} calculation of DN 100 test section

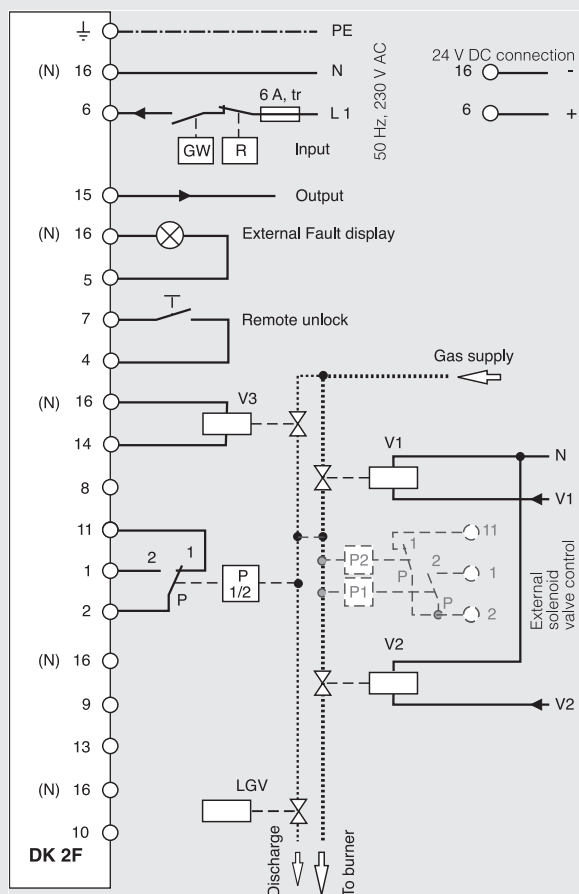
V1 and V2 DN 100
DN 100 , length 1.5 m
V3 and V4, Rp1/2
V3/V4 1/2", 2 m line
Test section volume
Test period DK 2F Series 2

$V = 6.50 \text{ dm}^3$
 $V = 12.00 \text{ dm}^3$
 $V = 0.07 \text{ dm}^3$
 $V = 0.40 \text{ dm}^3$
 $V_{Pr} = 18.97 \text{ dm}^3$
 $t_{\text{Test}} = 22 \text{ s}$
 $p_{\text{Fill}} = 18 \text{ mbar (measured)}$
 $p_{\text{Disch}} = \text{Gas pressure after discharge}$
 $p_2 = 10 \text{ mbar (pressure switch setting)}$

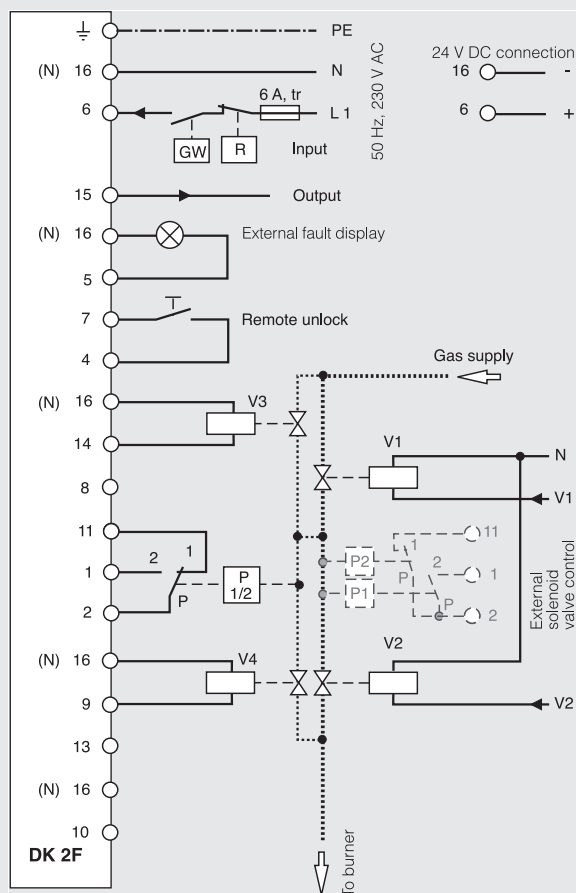
Leakage rate \dot{V}_{L2} on testing burner-side valve (V2):

$$\dot{V}_{L2} = \frac{(18-10) \cdot 18.97 \cdot 3600}{1013 \cdot 22} = \underline{\underline{24.51 \text{ dm}^3/\text{h}}}$$

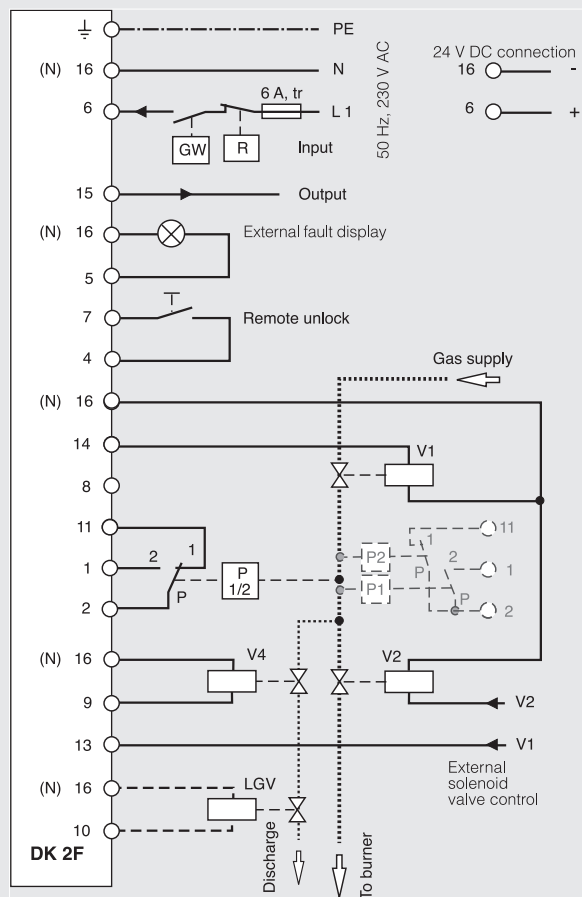
Wiring diagram DK 2F for valve test using auxiliary valves V3, LGV (part of schematic diagram 1)



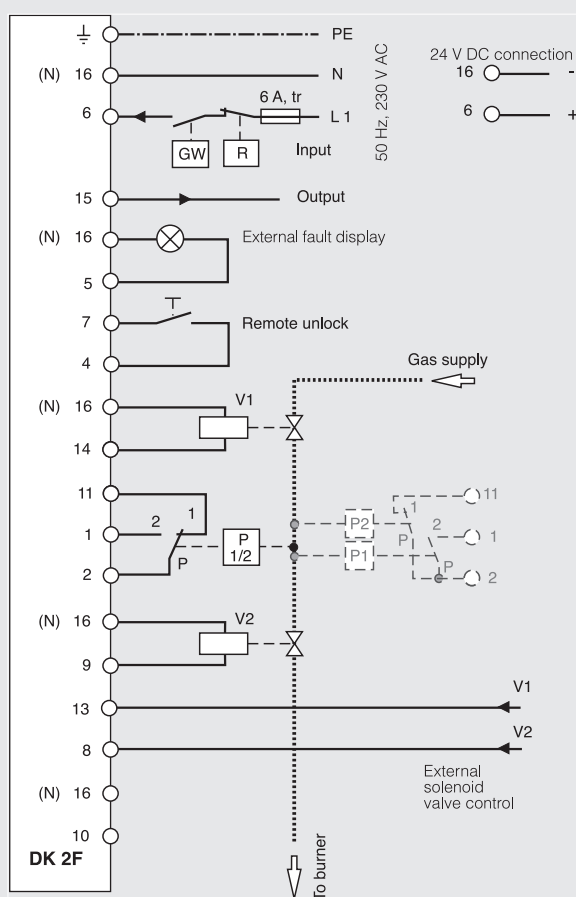
Wiring diagram DK 2F for valve test using auxiliary valves V3, V4 (part of schematic diagram 2)



Wiring diagram DK 2F for direct valve test V1 using auxiliary valves V4 or LGV (part of schematic diagram 3)



Wiring diagram DK 2F for direct valve test V1, V2 (part of schematic diagram 4)



Installation and operating instructions

Electrical connection

The terminal connection and safety grounding must be carried out in accordance with locally valid regulations and the terminal connection plan DK 2F. See the cover plate of the upper part of the device for the terminal connection plan.

The leakage tester is integrated in the control circuit via terminals 6 and 15; voltage is applied from regulator to terminal 6.

After a correct leakage test sequence, switch-through to terminal 15 takes place.

The two valve outputs of terminal 9 and terminal 14 are independent.

When installing in control cabinet, an external fault unlock button can be connected to DK 2F at terminals 4 and 7.



Important: The external fault unlock button must be in the visual range of the burner.

Electrical connection when using two check pressure switches:

1. Monitor the rising gas pressure in test phase 1 (if gas-side valve is leaky). Pressure switch P 1 with low switching pressure, connection of closing contact to DK terminal 1 and 2. The switch-on point of the pressure switch P 1 must undershoot half the gas flowing pressure.

2. Monitor the falling gas pressure in test phase 2 (if burner-side valve is leaky). Pressure switch P 2 with high switching pressure, connection of idle contact to DK terminals 2 and 11.

The switch-on point of the pressure switch P 2 must undershoot the switch-off pressure GW_{\min} (no gas supply).

Legend to wiring diagrams

V1	Safety solenoid valve
V2	Burner solenoid valve
V3	Test gas solenoid valve
V4	Vent solenoid valve
LGV	Vent gas solenoid valve
P 1/2	Check pressure switch
GW	Gas pressure switch (no gas supply)
R	Regulator

Functions of terminals 8 and 13 (Schematic diagram 4)

The valves (V2 and V1) connected to terminals 9 and 14 can be controlled via these terminals if they are not required for the leakage test sequence. The terminals have no backflow.

Connection DK 2F, 24 V DC

Connect the negative pole to terminal 16 and the positive pole to terminal 6. Diodes are installed as incorrect polarity protection.

Fuse protection

The DK 2 is protected using an external 6A (average slow-blow) and/or 10 A fast-blow fuse.

Keep to the permissible switching capacities. The current drain of all solenoid valves, motors, etc. switched via the regulator circuit may not exceed 4 A.



Check the safety-related function of the leakage tester in case of defective fuse since the contact may fuse together in case of short-circuit.

Installation

The leakage testers DK 2 can be installed in any position.

For assembly, remove the top part and secure the plug-in base using two screws.

7 rubber cable entries and 5 cut-out PG 9 openings are provided on the plug-in base.

Changing over from DK 2A to DK 2F

Before replacing a DK 2A by a DK 2F, the coding element of terminal 7 in the plug-in socket must be replaced by the terminal element of terminal 12. Re-wiring is not necessary. Observe the terminal connection plans on page 6.

Startup

Check all connections for correctness before startup. Then plug on the top part, screw tight and start up the system.

Set the check pressure switch P 1/2 to half the gas flow pressure expected.

Important

The P 1/2 and/or P 2 setting must always be lower than the gas pressure switch GW (gas failure switch) otherwise the leakage test interlocks in fault position.

Check proper functioning of leakage testers on startup by simulating a leakage.

Maintenance

The DK 2 leakage testers are basically maintenance-free since all safety-critical parts are subject to self-monitoring on start.

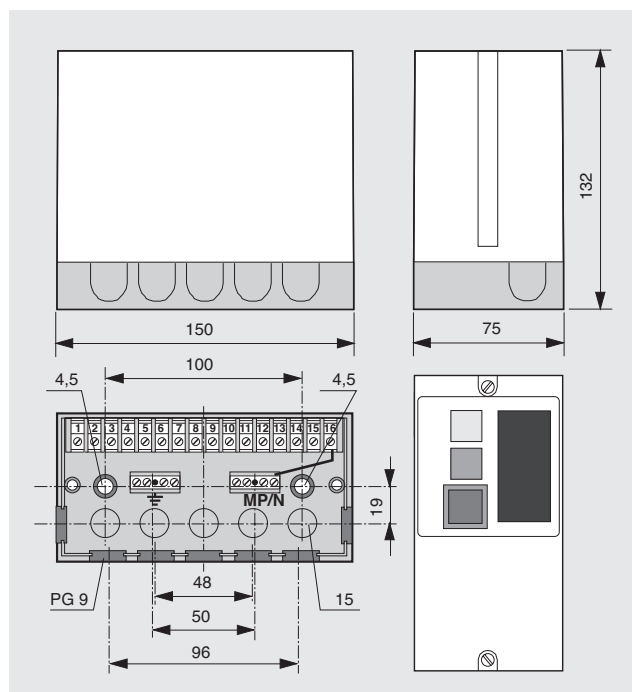
Check proper functioning of leakage tester and of the pressure switch(es) during burner inspection by simulating a leakage.



Important: If you do not observe these installation and operating instructions, it may result in personal injury or material damage. For this reason, strictly keep to the instructions.

The warranty for the equipment will expire on any attempt to access the electronic circuits, i.e. automatically when the seal is broken.

Dimensions



Specifications

Nominal voltage	~ 230 V AC - 15 % / + 10 % or ~ 110 V AC - 15 % / + 10 % = 24 V DC (20 to 30 V range)
Frequency	50 Hz
Power consumption	ca. 5 VA
Back-up fuse	max. 6 A slow-blow or 10 A fast-blow
Contact load	max. 4 A switching capacity max. 1 A for fault signal min. 1 A for pressure switch min. 0.2 A for fault unlock
Test period DK 2F Series 2	approx. 60 s
Test period DK 2F Series 3	approx. 90 s
Degree of protection	IP 40
Ambient temperature	0 - 60 °C
Weight	0.69 kg

Order details

Leakage tester	Order No.
DK 2F Series 2 - 50 Hz, 230 V AC	197 930
DK 2F Series 2 - 50 Hz, 110 V AC	209 892
DK 2F Series 2 - 24 V DC	216 455
Equipment for 60 Hz	on request
Gas pressure switch	depending on operating pressure
Refer to data sheets	LGW...A4 (5.08) GW...A6 (5.01)
Auxiliary solenoid valves	standard design
Refer to data sheets	MV 502 (6.21) MVD, MVD/5, MVDLE/5 (6.20) LGV/5 (6.24)

We reserve the right to make any changes in the interest of technical progress.

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