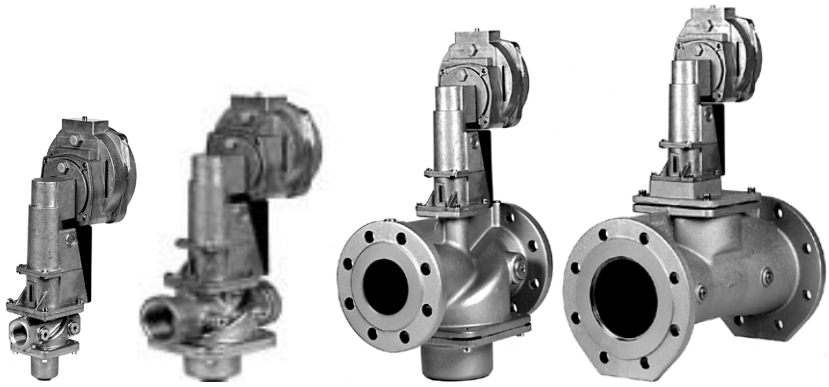
SIEMENS

7651

ISO 9001

CE



SKP70... VGG... / 1" | SKP70... VGG... / 2" | SKP70...VGF... | SKP70...VGH...

Air / Gas Ratio Controllers SKP70...

Air / gas ratio controllers with integrated safety shutoff function for natural gas, town gas or liquid gas in the low pressure range.

Electro-hydraulic actuator for delayed opening and rapid closing.

The SKP70... and this data sheet are intended for use by OEMs which integrate the air / gas ratio controllers in their products.

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Siemens Building Technologies
Landis & Staefa Division

Use

The VG… gas valves with their electro-hydraulic SKP70... actuators are designed for use with gas families I, II, III and with air. They are used primarily in gas-fired combustion plant. The actuators open slowly and close rapidly.
All types of VG… gas valves can be combined with the SKP70... actuators which are fitted to the valve body by means of 4 screws contained in the terminal compartment. The square flange can be turned in steps of 90°, thus offering a choice of 4 different mounting positions. The actuator can be mounted or replaced while the valve is under pressure. Sealing materials are not required.
The SKP70... features an integrated precision gas pressure controller. This type of actuator with its integrated controller not only reduces the length of the gas train, but usually also permits the selection of a smaller valve size (refer to «Flow chart» in the valve´s data sheet).
The actuator can also be supplied with limit or auxiliary switches, e.g. for indicating the fully closed position.

The SKP70... for use with forced draught gas burners controls the pressure of the combustion air so that the gas to air ratio remains constant over the entire output range (shifting the setpoint by the static pressure of the combustion air).
Changes in the air volume caused by voltage fluctuations, dirty fan wheels and the like have therefore no impact on the quality of the combustion process – in contrast to conventional ratio control. Using the SKP70..., deviations from the correct gas to air ratio caused by varying pressures in the combustion chamber can be eliminated in a straightforward manner. To accomplish this, the SKP70... can be connected to the combustion chamber via an additional impulse pipe, using the combustion chamber pressure as a disturbance value (refer to «Function»).

Warning notes

To avoid injury to persons, damage to property or the environment, the following warning notes should be observed.

It is not permitted to open, interfere with or modify the ratio controllers.

- Before performing any wiring changes in the connection area of the SKP70…, completely isolate the ratio controller from the mains supply
- Ensure protection against electric shock hazard by properly mounting the SKP70… and by providing adequate protection for the connection terminals
- Check wiring and all safety functions

Considering the pressure in the combustion chamber

If the resistance value of the system «Combustion chamber – flueways – stack» is constant, the combustion chamber pressure changes in proportion to the gas and combustion air pressure as the burner's output changes.
If, however, the combustion chamber pressure does **not** change in proportion to the gas or air pressure – which is the case in plants using a flue gas fan or a modulating flue gas damper, for instance – a compensating circuit is required.
In that case, the combustion chamber pressure must be fed to the SKP70… as a disturbance value, enabling the ratio controller to automatically offset pressure changes.
The compensating circuit should also be used if pressure shocks or vibrations, which adversely affect burner startup, occur in the combustion chamber during the startup sequence.
It must always be taken into account that the burner's output decreases as the combustion chamber pressure increases, and vice versa.
Since the majority of boilers do not have a test point for the combustion chamber pressure, it is recommended to design the burner such that the pressure can be picked up at the burner's head.

Installing the impulse pipes

In the case of unsafe combustion chamber pressure pipes (e.g. resulting from potential leaks), the setting (refer to «Commissioning notes») must be checked during operation without having the combustion chamber pipe connected, especially with respect to maximum burner capacity.

- To achieve a correct and even gas to air ratio over the entire control range, the gas and air pressure signals must be picked up at points where there is no turbulence

Recommendations:

- The gas pressure should be measured at a distance 5 times the nominal pipe size downstream from the valve. With inlet pressures ≥ 100 mbar, even greater distances may be required
- Do not use the lateral test points on the valve body for picking up the pressure signals
- Impulse pipes should not protrude in the flow. They must be flush with the inner wall of the housing
- If required, a flow stabilizer can be used, e.g. in the form of a W-shaped piece of sheet metal which is to be placed in the pipe

- Minimum inside diameter of impulse pipe: 6 mm
- With gas to air pressure ratios > 3, the impulse pipes for the combustion air and the combustion chamber pressure must have an inside diameter of least 8 mm
- All impulse pipes leading to the controller must be as short as possible, thus enabling the controller to respond quickly to sudden burner output changes

- The impulse pipe for the combustion chamber pressure must be fitted such that the gases will cool down in the area of the impulse pipe and condensing gases cannot enter the controller but will return to the combustion chamber. If necessary, a water separator must be fitted

- In the pressure chambers «Air» and «Gas», the pressure over the entire control range must be higher than that in the pressure chamber «Atmosphere». This requirement is satisfied in the majority of applications. However, if negative air and / or gas pressure against atmospheric pressure occurs – due to excessive stack draughts in low-fire operation, for instance – the pressure chamber «Atmosphere» must be connected to an even lower (more negative) pressure level. This is usually ensured by the connection to the combustion chamber

Gas train layout

- If the available gas pressure exceeds the valve's maximum permissible operating pressure, the gas pressure must be reduced by a controller installed upstream of the valve. Apart from that, no additional pressure controller is required
- It is recommended to install a pressure monitor on the outlet side of the SKP70... and to connect it to the burner control in such a way that the burner control will initiate lockout if – due to a fault – the maximum permissible gas pressure is exceeded
- The pressure monitor for the minimum gas pressure – when used in connection with the SKP70... – must always be mounted upstream of the valve
- The measures usually required to ensure the minimum amount of air is delivered must also be taken when using the SKP70...

Mounting notes

The relevant national safety regulations must be complied with.

Installation notes

- Installation and commissioning work may only be carried out by qualified staff

Adjusting the controller on modulating burners

- Set the gas to air ratio to the required value (coarse setting) using setting screw ① / «PGAS / PAIR» on the left, and scale to zero using setting screw ②
- Start the burner and run it up to about 90 % of the nominal load
- Measure the CO_2 or O_2 content of the flue gas and fine-tune the setting with setting screw ① / «PGAS / PAIR»
- Return to low-fire operation, check the CO_2 or O_2 content of the flue gas and, if necessary, readjust the working characteristic with setting screw ② / until the measured values are at their optimum
- Limit the air damper position for low-fire operation

The markings on the setting screws have the following meaning:

\+ more gas

\- less gas

If a significant parallel displacement of the working characteristic was necessary to attain optimum CO_2 or O_2 values in low-fire operation, the adjustment of the pressure ratio at nominal load or at 90 % of the nominal load must be checked again and corrected if necessary.

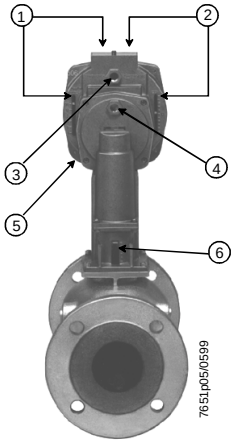
- Run the burner to the required output and limit the air damper position for the nominal output
- Check the flue gas values at several levels of the output range

If readjustments are necessary:

- In the nominal output range, use setting screw ① / «PGAS / PAIR»
- In low-fire operation, parallel displacement of the characteristic using setting screw ② /

Due to reciprocal physical actions in the air and gas flow in the burner head, it may be necessary to move the controller's working characteristic into the area of excess air although the flue gas analysis proves that, in reality, there is excess air.

If the gas to air pressure ratio lies outside the setting range, the pressure at the test point can be increased by means of an orifice fitted in the gas or air flow. To be able to do this, a sufficiently large gas or air pressure reserve at the inlet must be available.



① Adjustment and indication of gas to air ratio

② Adjustment and indication of working characteristic's parallel displacement

③ Test point for combustion chamber pressure

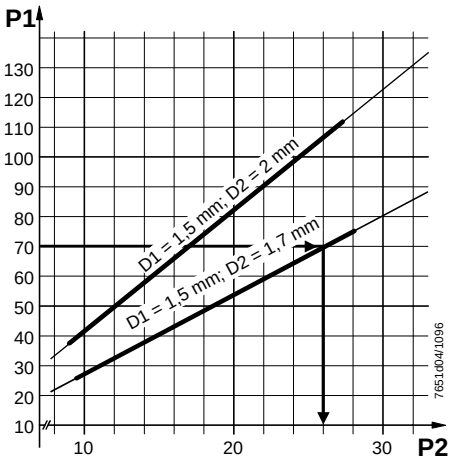
④ Test point for gas pressure

⑤ At rear: test point for combustion air pressure

Indication of stroke

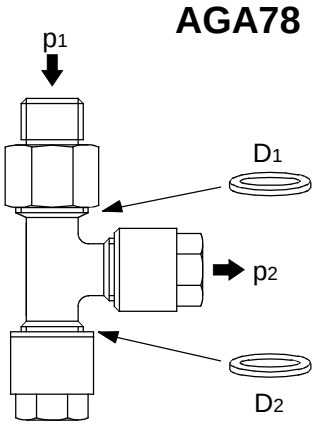
Function

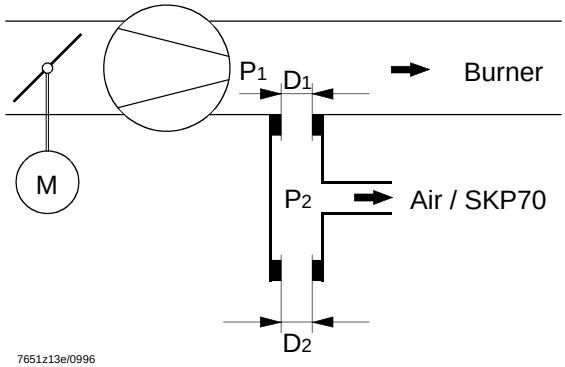
If the air pressure exceeds the maximum value of 30 or 50 mbar permitted by the controller, the pressure can be lowered by means of a reducing T-fitting (AGA78) (also refer to «Technical data»).



Air is continuously released to the atmosphere via restrictor «D2». Then, the pressure of the medium drops across restrictor «D1». The correlations are shown in the chart.

Example:
p1 = 70 mbar
D1 = 1.5 mm
D2 = 1.7 mm
Find: pressure signal «p2» to the SKP70...
p2 = 26 mbar





The reducing T-fitting AGA78 is supplied ready for mounting, complete with
D1 = 1.5 mm and
D2 = 1.7 mm
D2 with a dia. of 2 mm is also included

Technical data

SKP70...

General unit data

Mains voltage (refer to «Type summary»)	AC 220 V –15 %...AC 240 V +10 % AC 100 V –15 %...AC 110 V +10 %
Mains frequency	50...60 Hz ±6 %
Power consumption	9...13.5 VA (depending on mains voltage)
Min. time required for changing from nominal load to low-fire	5 s
Switching capacity of auxiliary switch IV	6 (2) A, AC 250 V (if fitted)
Setting range of auxiliary switch	4...96 % stroke
On time	100 %
Opening time for full stroke approx. 2 mm / s	depending on the nominal size 6...12 s (extended opening times below 0 °C)
Max. perm. pressure on air and combustion chamber side	refer to perm. control pressure
Mounting orientation	horizontal or vertical, with actuator at the top
Degree of protection	IP 54
Weight - Without pressure controller - With pressure controller	 approx. 1250 g approx. 1650 g

Norms and standards

Environmental conditions	
Transport	IEC 721-3-2
Climatic conditions	class 2K2
Temperature range	-15...+60 °C [1] [1]) extended opening time at temperatures below 0 °C
Humidity	< 95 % r.h.
Mechanical conditions	class 2M2
Operation	IEC 721-3-3
Climatic conditions	class 3K5
Temperature range	-15...+60 °C [1] [1]) extended opening time at temperatures below 0 °C
Humidity	< 95 % r.h.

⚠ **Condensation, formation of ice and ingress of water are not permitted!**

CE conformity	
According to the directives of the European Union	
Electromagnetic compatibility EMC	89 / 336 EEC incl. 92 / 31 EEC
Directive for gas-fired appliances	90 / 396 EEC

Ratio controller

General unit data

Control class	A to DIN EN 88	
Control mode	proportional	
Control accuracy	< 10 % at «Pmin» < 2 % at «Pmax»	
Parallel displacement of working characteristic	**SKP70.11...**	**SKP70.12...**
Excess gas	1 mbar	1 mbar
Excess air	1 mbar	4.5 mbar
Closing time in the event of a power failure	< 0.8 s	
Setting range pressure ratio	refer to «Type summary»	
Vent pipe	not required at inlet pressures up to 100 mbar (according to DIN)	
Compensating variable	pressure of combustion air ≥ 0.5 mbar	
Max. inlet pressure	same as valve	
Perm. test pressure «PG»	1 bar	
Perm. vacuum «PG»	200 mbar	
Perm. pressures the controller can be subjected to during operation		
Gas pressure	min. 1 mbar / max. 100 mbar	
Air pressure at «PGAS / PAIR» - ≥ 2 - ≤ 2	 max. 30 mbar max. 50 mbar for higher pressures, refer to AGA78	

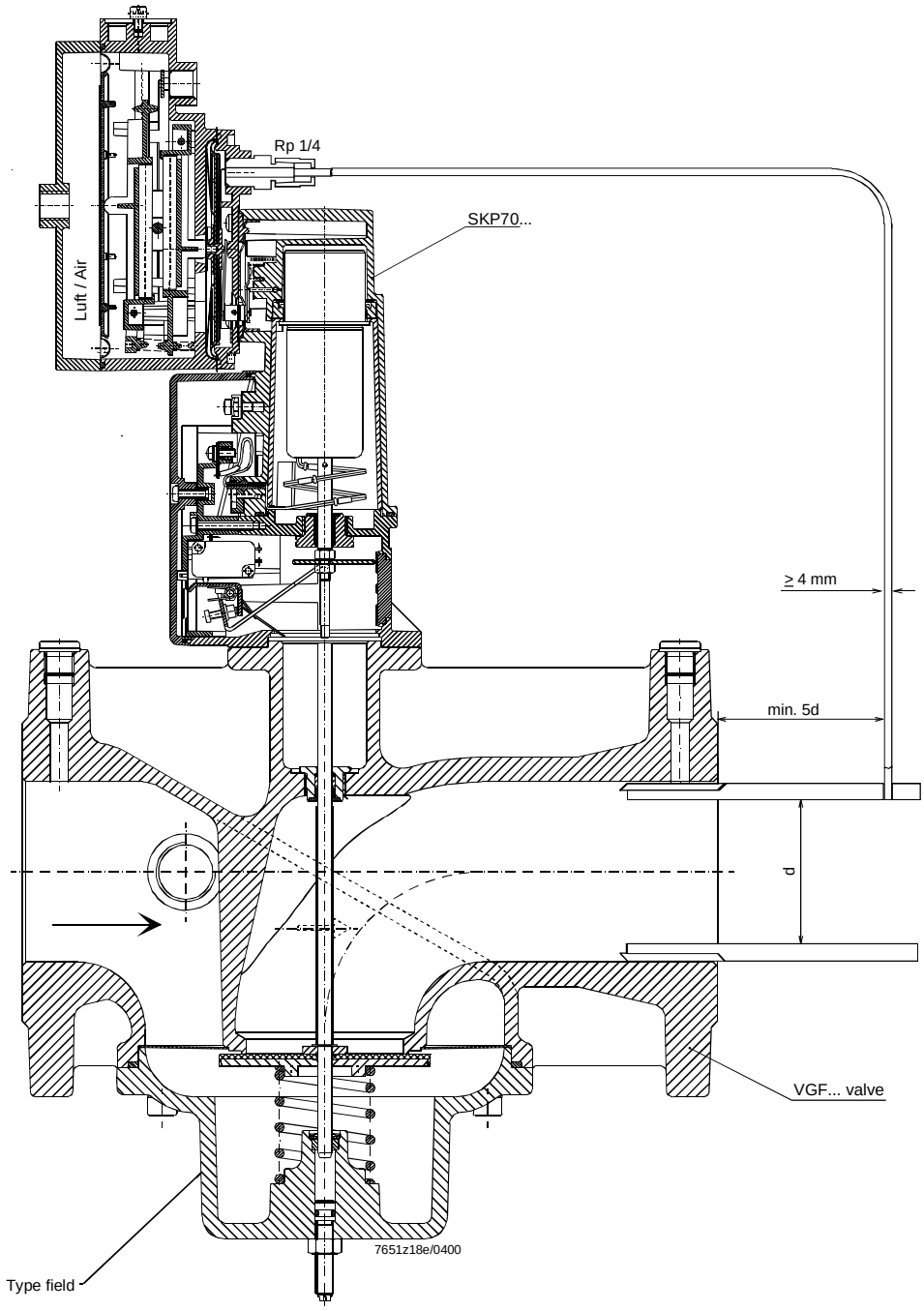
Mechanical design

SKP70... ratio controller

The controller is attached to the housing of the valve actuator and has 2 diaphragms which, via a lever system, act on a ball valve located in the bypass between the pump's suction and pressure side. The combustion air pressure acts on one diaphragm, the gas pressure downstream from the valve on the other. The selected gas to air pressure ratio is indicated in a viewing window of the SKP70… The selected working characteristic for the pressure ratio can also be displaced parallel, either towards «excess air» or «lack of air», to slightly increase the amount of air in low-fire operation, for instance. The extent of the parallel displacement is indicated in another viewing window.

Functional diagram

Sectional view of SKP70... and VGF...



Type summary

SKP70... and VG... valves

The complete air / gas ratio controller consists of actuator and valve.

Actuators (all B-series types)		
Mains voltage	AC 100...110 V	AC 220...240 V
Standard versions for the usual amount of excess air in low-fire operation		
Without auxiliary switch IV	Not in the range	SKP70.110B27
With auxiliary switch IV	SKP70.111B17	SKP70.111B27
Versions for large amounts of excess air in low-fire operation		
Without auxiliary switch IV	Not in the range	Not in the range
With auxiliary switch IV	SKP70.121B17	SKP70.121B27

Accessories for actuators

Damping throttle (see 7651d03)	**AGA75**
Damping throttle	**AGA75E**
Pressure reducing T-fitting (see 7651z13)	**AGA78**

Valves

The SKP70... can be used with the following types of valves		
Type reference	Medium	Data sheet
VGG... / VGF... / VGH...	Natural gas, gas families I, II, III	7641
VGD20...	Natural gas, gas families I, II, III	7631
VRF... / VRH...	Biogas	7633
VLG... / VLF...	Cold or hot air	7637

All information on the valves given in the above mentioned data sheets also applies to the SKP70...

Exception: minimum flow rate required (see 7651d03).

Ordering

When ordering, please give name and type reference of the ratio controller.

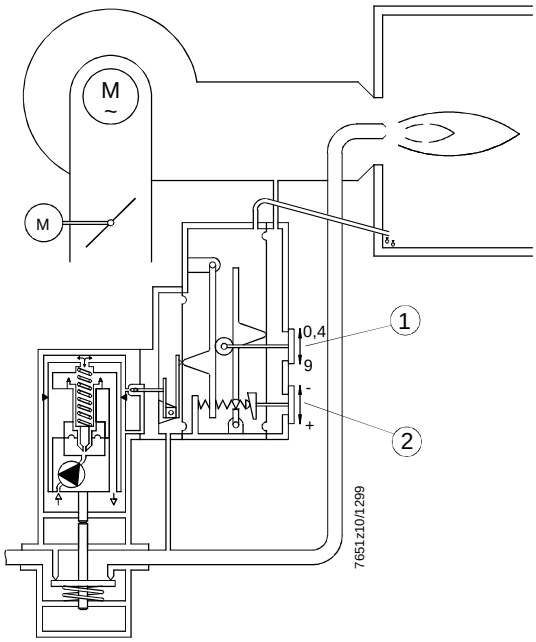
For example:

SKP70.111B27
- Air / gas ratio controller complete with actuator
- AC 230 V / 50 Hz
- With auxiliary switch

Function

Air / gas ratio controller complete with actuator.

When the gas valve is closed, that is, during the pre-purge and pre-ignition time, only the pressure of the air supplied by the fan acts on the controller.
It pushes the diaphragm on the air side to the left, thus closing the ball valve in the actuator's bypass via the lever system.
This means that the actuator can open the gas valve if, at the beginning of the safety time, the burner control delivers the appropriate command.
As the gas valve opens, the pressure downstream from the valve immediately increases, and thus the pressure at the controller's diaphragm on the gas side as well.
As soon as the forces acting on both diaphragms are in balance (taking into account the lever ratio), the ball valve in the bypass is opened to such an extent that the return flow through the bypass valve and the flow supplied by the pump are identical.
This means that the piston of the actuator and thus the disk of the valve remain in the position reached.
If the heat demand increases and the burner's air damper opens further, or the fan's speed increases, the controller closes the ball valve again – due to the greater pressure acting on the air diaphragm – so that the actuator will open the gas valve further until the forces acting on the air / gas ratio controller are in balance again.
The gas to air pressure ratio and thus the gas to air volume ratio remain constant over the entire output range, provided the orifices in the burner head do not change during output variations, neither for the combustion air nor for the gas.
Because of the small mixing energy in low-fire operation, it is often necessary to deliver somewhat more air in order to achieve optimum combustion. The characteristic of the controller can therefore be displaced parallel.

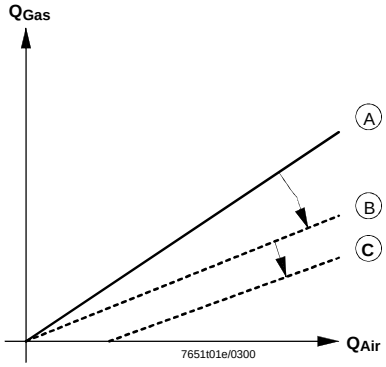


Legend

① Adjustment and indication of gas to air ratio

② Adjustment and indication of working characteristic's parallel displacement

Very simplified sectional view



Controller's working characteristic

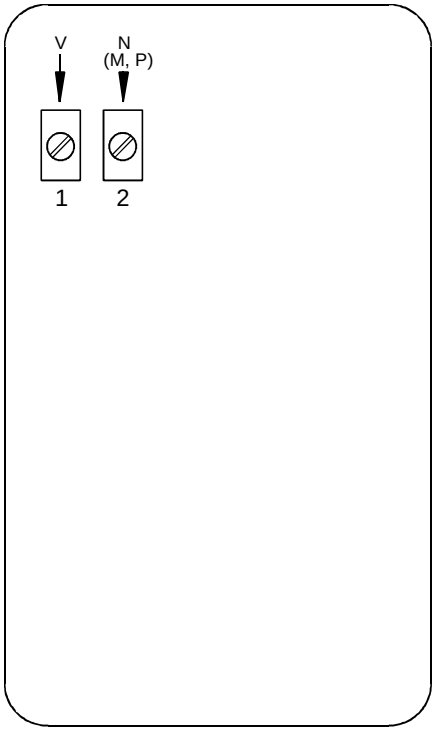
A Gas to air ratio for stoichiometric combustion

B Adjusted gas to air ratio for burner operation with excess air
The excess air in percent is constant over the entire range

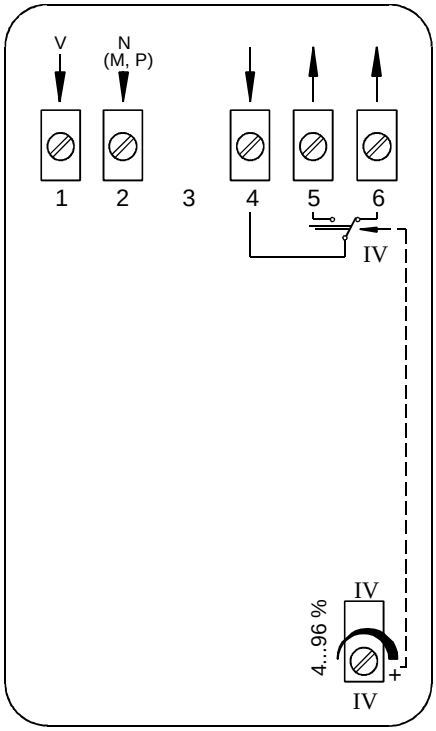
C **When the working characteristic is displaced parallel, the amount of excess air in percent in low-fire operation is greater**
The controller permits a parallel displayement either towards «excess air» or «lack of air»

Terminal markings

Version without auxiliary switch



Version with auxiliary switch



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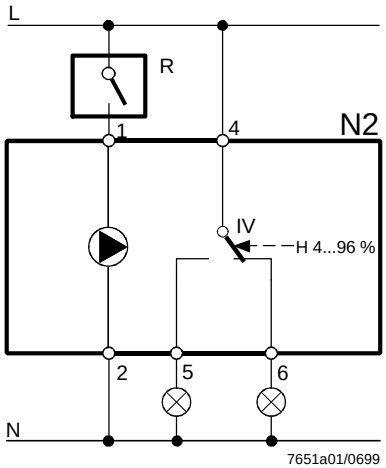
Legend

V	Control input
IV	Screw for adjusting the switching point of auxiliary switch IV
⚠	Fuses, etc., must be in compliance with local regulations

Connection diagram and internal diagram



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Legend

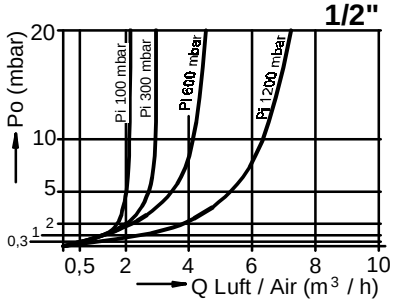
IV	Potential-free auxiliary switch, adjustable, refer to «Technical data» (only with actuators using an auxiliary switch, refer to «Type summary»)
H	Stroke
R	Controller, switch, etc.
N2	SKP70...

Minimum flow rate required

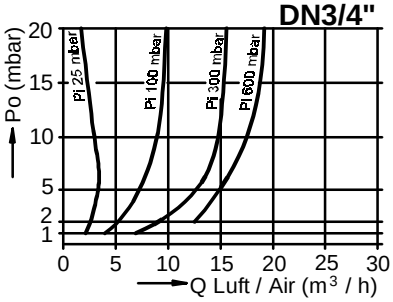
The charts below show the minimum flow rate «Q» required as a function of the inlet pressure «Pi» and the resulting outlet pressure «Po».
These minimum flow rates must be observed since high inlet pressures along with too small flow rates cause the pressure control to oscillate.
By screwing the **AGA75** damping throttle into the controller's combustion chamber connection, control oscillations can be suppressed to a certain extent (startup behaviour in low-fire operation). This means that the limit values are lower than those shown in the charts below.

All curves of the VGG... and VGF... valves only apply to the profiled versions (VG...P)

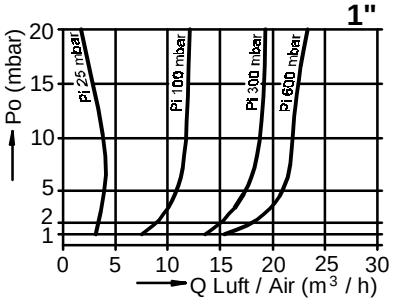
1/2"



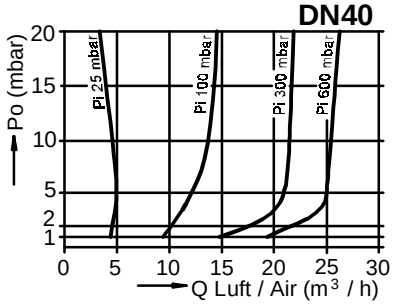
DN3/4"



1"



1 1/2"
DN40

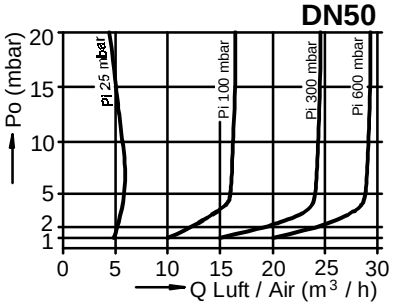


Example for 2" valve:

Pi = 100 mbar
Po = 7 mbar

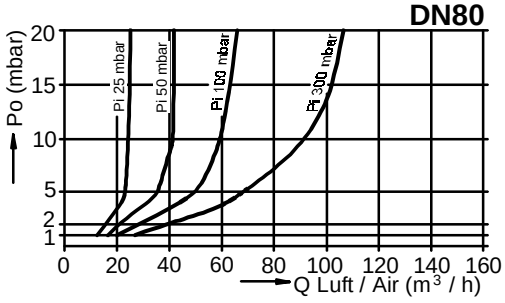
Qmin = approx. 17 m³ / h air
= 17 x 1.24 m³ / h natural gas
= 21.1 m³ / h natural gas

2"
DN50

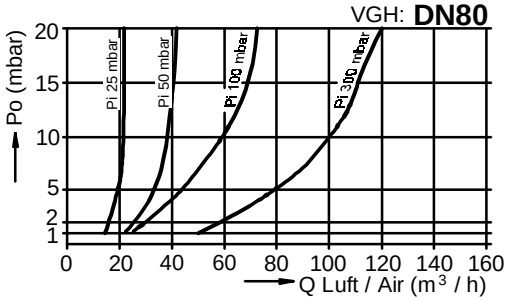


DN65

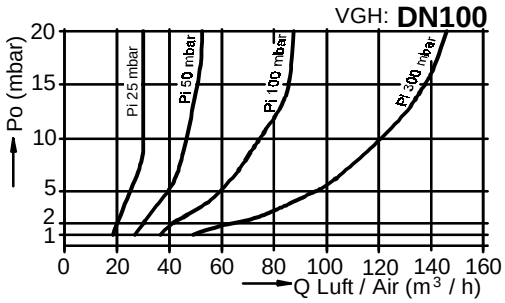
VGG / VGF: **3"**
DN80



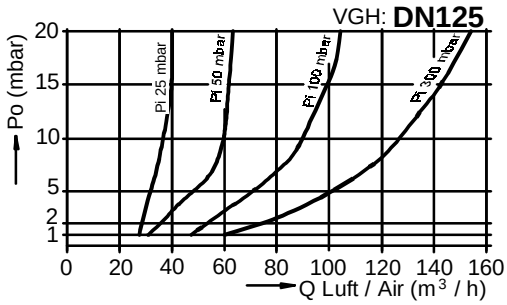
VGH: **DN80**



VGH: **DN100**



VGH: **DN125**



Dimensions

Dimensions in mm

SKP70...