

VK4405V / VK8405V SERIES

RAMBLER GAS CONTROLS FOR PREMIX COMBUSTION SYSTEMS

PRODUCT HANDBOOK



APPLICATION

The Rambler gas control family is targeted for combustion heating applications up to 150 kW suitable for a broad range of gases including Natural gas and LP gases.

Through the well proven 1:1 pneumatic gas and air regulation control principle the **Rambler** gas control family VK4405V / VK8405V is suitable for gas appliances with fully premixed burners.

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GENERAL

DESCRIPTION

Rambler gas control

The **Rambler** or VK44 / VK84 series gas control-family includes a 1:1 gas/air regulator that has been specially developed for fully premixed gas appliances. The gas/air regulator provides the function of regulating/modulating the gas pressure drop equal to the air pressure.

The VK44 / VK84 series gas control comprises a standard body in two versions, with or without pressure switch.

The pressure switch can be laid out to monitor inlet pressure or with a connection between the valves to enable a VPS control system (Valve Proving System).

Besides the pressure switch several options can be factory included. These functional options are: line or low voltage coils, pressure feedback nipple and a pilot outlet. The gas control has a first direct on/off operator for opening the class C or class B valve according to EN161 and a second electric on/off servo operator for control of the main valve of class C according to EN161. The regulator is designed for accurate control in gas air ratio systems.

The control is in accordance with EN 12067-1: Pneumatic Gas/air ratio controls for gas burners and gas burning appliances.

The gas control can handle the 1st, 2nd and the 3rd family gases.

Description of gas/air 1:1 system

In a boiler with a fully premixed burner, the air flow is controlled by a fan. In an air restriction or across a venturi the air flow generates an air pressure drop. The high air pressure is supplied to the gas control. In the working mode the gas pressure drops across the main burner injector is regulating and/or modulating equal to the air pressure drop across the air restriction. (see principle in fig. 1) The system is electronically controlled to provide programmed safe light up and is in supervision of the main burner.

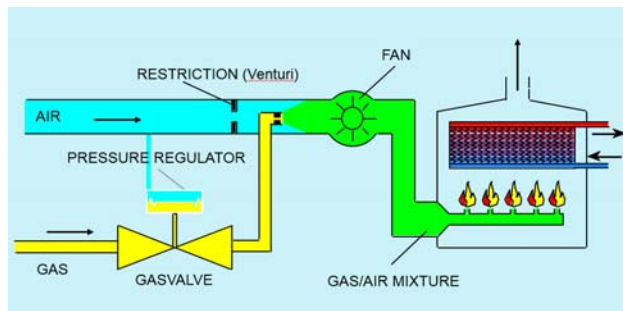


Fig. 1 principle gas air control 1:1

Description of 1:1 gas/air regulator

The 1:1 gas/air regulator is based on the servo regulation principle. The 1:1 gas/air regulator assembly has an air pressure connection and an offset adjustment screw. The 1:1 gas/air regulator equals the gas pressure to the supplied air pressure. With the offset adjustment screw it is possible to adjust the offset. (Offset = $P_{\text{gas}} - P_{\text{air}}$)

General

All measurements are carried out under standard conditions, as listed below unless otherwise is indicated.

Standard conditions

- P_{inlet} 20 mbar nominal pressure, dry air of 20°C
- P_{ambient} 1013 mbar
- T_{ambient} 20°C
- Outlet orifice 10 mm
- Flow indication in m^3/h
- Recording of outlet pressure with a transducer connected to a 3/4" pipe with a length of 10 times the diameter of the pipe with a short hose at a length of 5 times the diameter of the pipe.
- Nominal voltage
- Sideward position, i.e. the position when the operators are $90^\circ \pm 1^\circ$ from straight up in any direction.

Quality level of specifications

Unless otherwise specified the performance values correspond to $C_{pk} > 1.17$ (short term) and $C_{pk} > 0.7$ (long term) quality levels.

FEATURES

Rambler Gas Control

- Inlet and outlet gas connections are straight through.
- The closing force of the valve is class: C+C or class B+C..
- Low noise actuators assure quiet operation.
- 24 Vdc/rac, 120 Vrac and 230 Vrac powered versions are available.
- Gas air servo pressure regulator provides stable outlet pressure in 1:1 gas air control systems.
- Air pressure connection M5 threaded.
- All adjustments are accessible from the top.
- 9 mm diameter pressure taps on top face for checking pressures.
- Pressure taps, for inlet pressure, outlet pressure at zero test point.
- An internal fine mesh screen is incorporated at the inlet of the gas control.
- Three mounting holes for thread forming screws are at the bottom side of the gas control for rigid attachment to the appliance.
- Mounting orientation may be within 90° in any direction from the electric on/off operator upright position.
- Pressure switch can be available for inlet pressure monitoring or monitoring intermediate pressure between the valves for VPS function.

Functional option

Versions with incorporated series C60VR(T)40xxx pressure switch function are available.

Gas connections

Gas control has straight through inlet and outlet with Ø 23 mm bore and can receive flanges (see table 5).

Main gas outlet flange connection can be pre-assembled with a Resideo VMS venturi.

Fittings for 4 or 6 mm tube can be mounted in the M5 thread in the regulator to feed the air signal to the gas air regulator.

Electrical connection options

The coil is equipped with a Molex 1.1 square pin header with 5 positions. Available options are:

- 2 wire plug for 24 Vdc/rac connection
- 2 wire rectifier plug for 24 Vac connection.
- 3 wire plug for line voltage dc/rac connection.
- 3 wire rectifier plug for line voltage ac connection.

DIMENSIONAL DRAWING

Dimensional drawing VK4405V / VK8405V
 Tolerances according to installation drawing 32319814

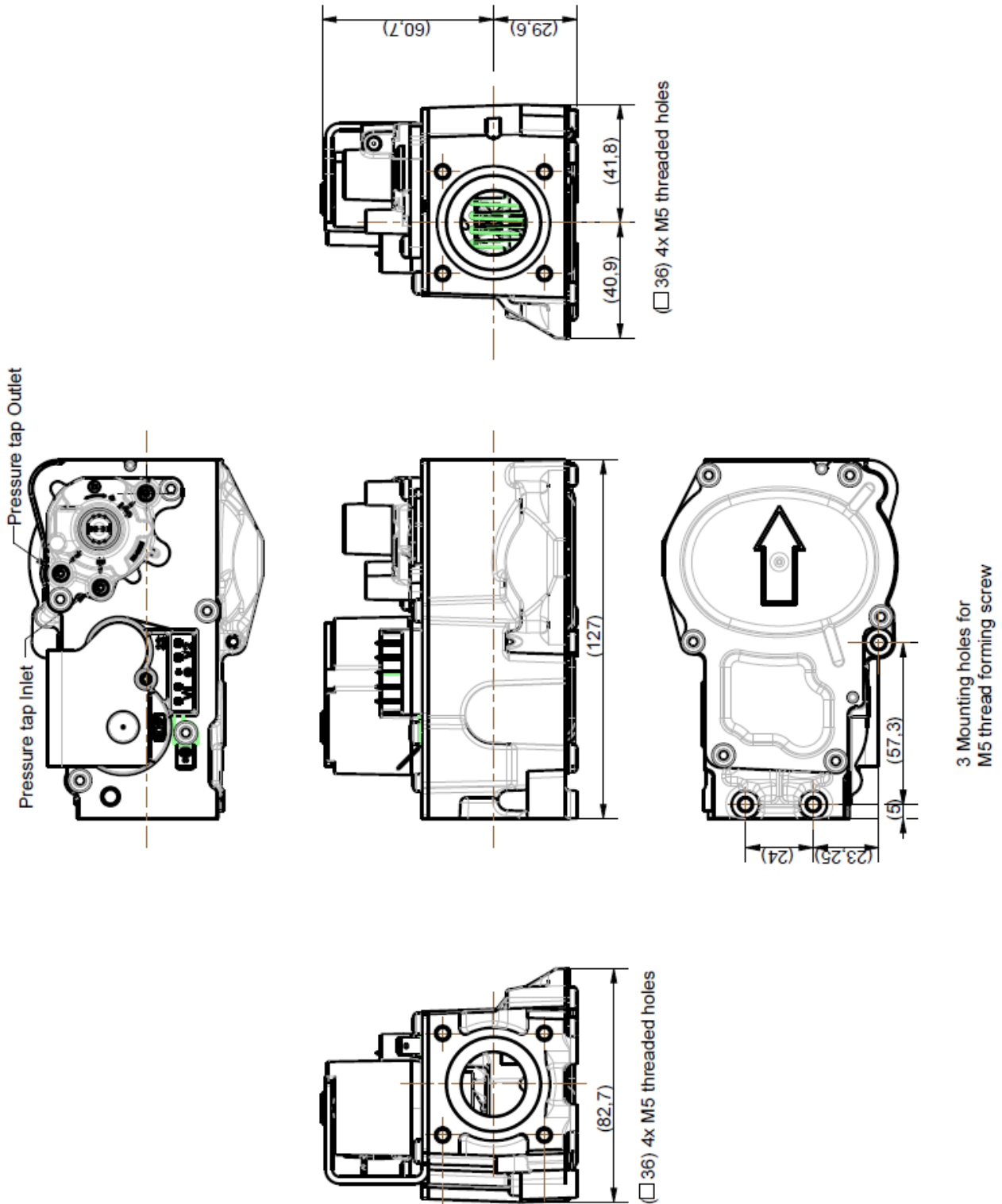


Fig. 2 dimensional drawing

TECHNICAL

APPLICATION

The VK4405V / VK8405V series gas control have been specially developed for application in domestic and light commercial appliances.

The VK4405V (230 Vrac) series gas control can be used in a system in conjunction with any ignition controller according EN298 with a 230 Vrac or Vac output.

The VK8405V series gas control can be used in a system in conjunction with any ignition controller according EN298 with a 24 Vdc or Vrac output.

The ignition controller must be of a construction that does not supply any residual voltage to the coil when it is switched off.

SPECIFICATIONS

Models

See model number chart figure 6 on page 13.

Valve classification

First valve class C or class B; Second valve class C

Main gas connection

The valve body length is 127 mm.

Gas connections are fitted with 4x M5 thread to accept straight or elbow flanges with up to 3/4" internal thread. The control will withstand the torsion and bending stress of EN 126 group 1 and 2.

Ambient temperature

-15 ... 70 °C.

Humidity

95% RH max. at 40°C

Storage

-30 ... 70°C in original packaging

Air signal connection

The gas air servo pressure regulator has an M5 thread connection for the air signal feedback.

Feedback fittings for 4 or 6 mm (silicon) tube can be mounted as an option.

To prevent water entering when the air connection is in upward position a protective cap can be mounted as an option.

Pressure taps

Two pressure taps are located at the top side of the control:

"IN" test point for inlet pressure

"R" test point for outlet pressure at regulated (zero) pressure

"OUT" test point is not functional.

Dimensions

See page 4, fig 2 dimensional drawing and installation drawing 32319814

Offset range for gas air regulator

±30 Pa with coils in sideward position.

46 Pa to -14 Pa with coils on top.

Minimum regulation capacity

1 m³/h air

Minimum gas orifice diameter : 4mm for Natural gas

5 mm for LP-gas.

Minimum differential pressure

5 mbar between gas inlet and outlet of the valve.

Maximum operating Inlet pressure

60 mbar with LP gas.

30 mbar with Natural gas

Maximum delta pressure air-outlet gas

The maximum pressure difference between the inlet air and the gas outlet pressure point (in OFF position) is:

8 mbar without outlet gas pressure (before ignition);

20 mbar without outlet gas pressure (during post purge)

Mounting holes

Three mounting holes for thread forming M5 screws (acc. DIN 7500) are located at on the bottom side of the gas control.

Over pressure resistance

In "OFF" condition, the gas control will withstand 1 Bar (air) inlet pressure without damage. Attempts to operate the gas control, while in this fault condition will not damage it.

Operable voltage range

The gas control will function satisfactory between 85% and 110% of the rated voltage.

Main valve opening characteristics (measured with gas)

Fast opening versions

Under conditions where the supply pressure is at least 5 mbar above the outlet pressure setting, the dead time is 0.5 seconds maximum. The outlet pressure will reach 80% of the rated flow within 1 second from start of flow. Full outlet pressure will be reached within 5 seconds.

Oscillation

Maximum oscillation is 20% of pressure delta over injector or throttle.

Design life

500.000 cycles for safety and main valve operator.

Cycle frequency maximum 300 cycles /hour.

Lifetime 10 years

PERFORMANCE CHARACTERISTICS

CAPACITY CURVES

In m³/h air at pressure drop as shown in table 1. See also the capacity curve fig 3.

Table 1. Capacity

Model	Delta P (mbar)	Capacity (st m ³ /h air)
VK4405V./ VK8405V	5	5,3
	10	11,3
	15	13,9
	20	16,2
VK4415V./ VK8415V	5	4,3
	10	9
	15	11,8
	20	13,7

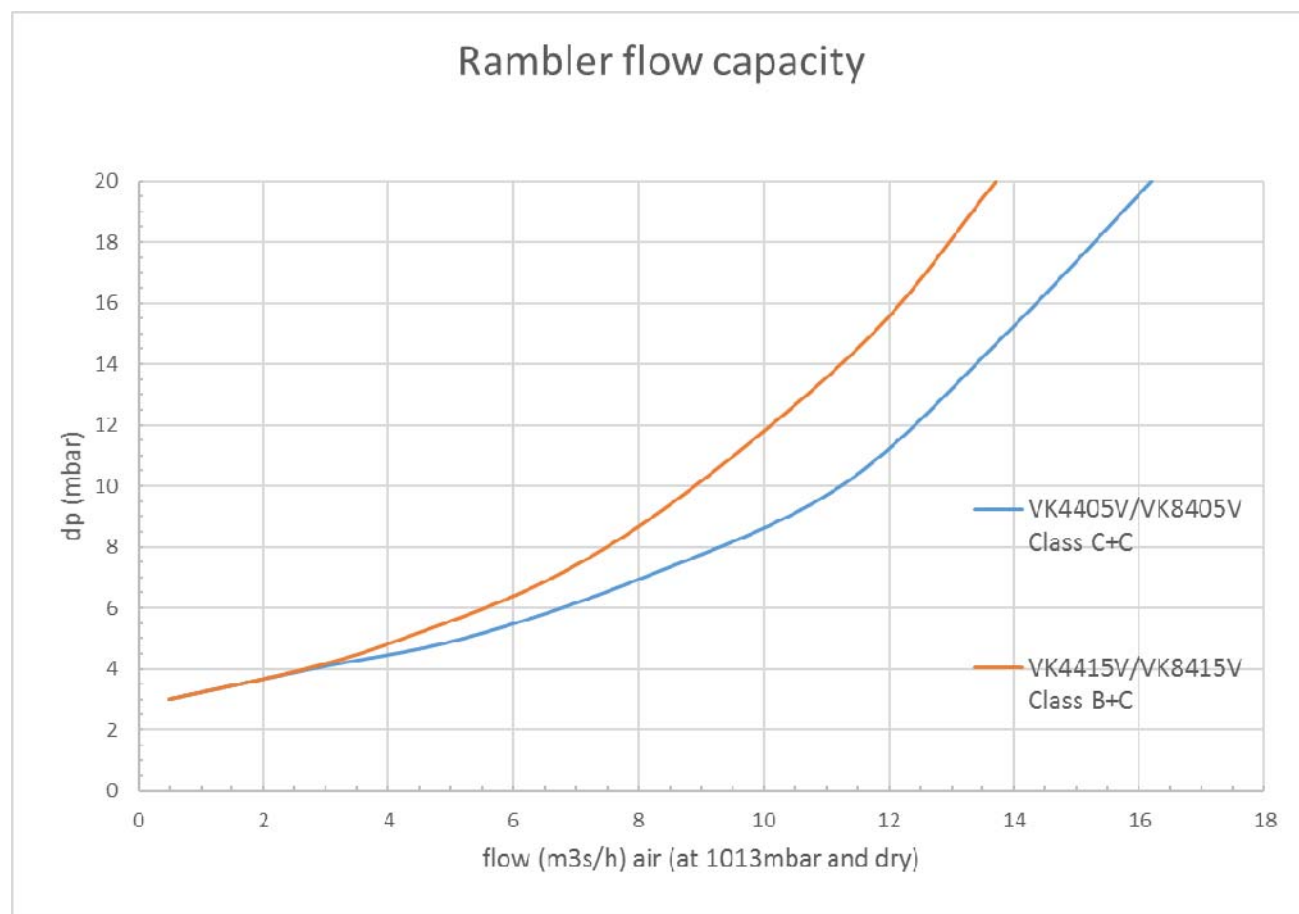


Fig. 3 Capacity curve in air flow

OFFSET ACCURACY

Conditions for factory setting of offset are:

- Inlet pressure (IN) 2000 Pa.
- Outlet pressure (Po) 100 Pa measured on the “OUT” pressure tap on the gas valve.
- Sideward position, i.e. the position when the operators are $90^\circ \pm 1^\circ$ from straight up.
- Outlet orifice; \varnothing 10 mm.

Setting accuracy

Setting accuracy of the offset as supplied is ± 4 Pa. This includes transportation (acc. ASTM D4169), tap sensitivity and repeatability, but excludes the effect of leak testing of the valve.

Inlet pressure dependency

The inlet pressure dependency for a typical inlet pressure range of 10 mbar is 2 Pa max.

Temperature Sensitivity

Maximum offset shift due to temperature change from ambient temperature to one of the temperature extremes is 3 Pa.

Accuracy over life

Maximum offset shift over life (500k cycles) is +5.5 Pa

Modulation Speed

Time to modulate from max. to min. flow rate or vice versa must be more than 1 s.

ELECTRICAL DATA

Electrical connection**Table 2.**

Supply Voltage	Rectifier circuit position	Coil Connection	Valve	Coil color
24 Vrac or 24 Vdc	External	Pin 1 and 5 or plug 45900441-029	VK84	blue
24 Vac 50/60Hz	In plug	select plug 45900441-with rectifier	VK84	blue
120 Vac 50/60Hz	External	Pin 1 and 5	VK44	black
120 Vac 50/60Hz	In plug	select plug 45900441-039 with rectifier	VK44	black
230 Vac 50/60Hz	External	Pin 1 and 5	VK44	black
230 Vac 50/60Hz	In plug	select plug 45900441-with rectifier	VK44	black

Connection will comply to IEC60695 with Resideo supplied plug.

Ground connection: 1/4" spade tab located at top plate of the control, connected to pin 3 in the coil assembly, see fig.4.

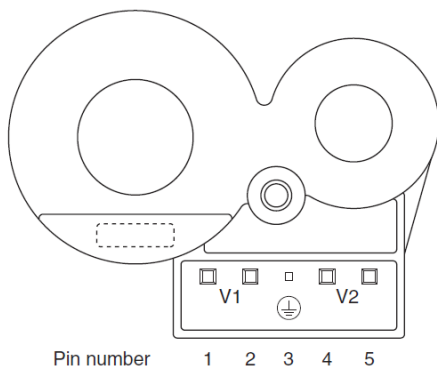


Fig. 4, coil connection

Power consumption**Table 3**

Supply Voltage	Power Consumption (W) @ voltage		Current (mA) @ voltage:	
	nominal	110%	nominal	110%
24 V	9.2	11.0	424	466
120 V	9.6	11.6	93	102
230 V	10.3	12.5	50	55

Rectifier plug

The 230 V, 120 V and 24 V versions of the VK4405/VK8405 series gas controls can be connected to any standard DBI control with a 230 Vac, 120V or 24 Vac output by using a rectifier plug 45900441- See table 6.

Electrical protection of gas control with rectifier plug

IP 40

Plug mounting screw

Torque: 40 Ncm max.

INSTALLATION

IMPORTANT

Take care that installer is a trained experienced service person.

Turn off gas supply before starting installation. Disconnect power supply to prevent electrical shock and/or equipment damage. Take care that dirt cannot enter the gas control during handling.

IMPORTANT

When installing this product.....

Read these instructions carefully and make sure these are understood. Failure to follow them could damage the product or cause a hazardous condition.

Check the ratings given in the instructions and on the product to ensure the product is suitable for your application.

Installer must be a trained, experienced service technician.

After installation is complete, use these instructions to check out product operation.

Mounting position

The gas control can be mounted 0 to 90 degrees in any direction from the upright position (from the position when the coil is on top).

Main gas connection

Take care that dirt cannot enter the valve during the handling. Ensure the gas flows in the same direction as the arrow on the bottom of the gas control.

Ensure the sealing areas at the gas-inlet and outlet are clean and not damaged.

Ensure the seals used for sealing the inlet and outlet connections are of approved material, clean and not damaged. Ensure the screws are screwed in tight according to the manufacturer's instructions to ensure proper sealing.



WARNING

Never apply any force or torque on the coil before, during or after installation of the valve.

Pressure feedback or signal pressure connection



WARNING

Make sure that the air signal connection cannot get blocked in any condition. To prevent water entering when the air

connection is in upward position a protective cap can be mounted.

In applications with a tube connection:

To avoid decreasing of performance of pressure regulator by pinching off the pressure feedback tubing, it is recommended to use a tube material which will not kink.

Install flanges to control

- Choose the appropriate flange for your application.
- Assure that the "O"-ring is fitted in the groove of the flange. If the "O"-ring is not attached or is missing, do not use the flange.
- With "O"-ring facing the valve, align the screw holes on the control with the holes in the flange. Insert and tighten the screws provided with the flange.
- Tighten the screws to 3 Nm of torque to provide a gas tight seal.

Complete instructions below for installing piping, installing gas control and wiring. Make certain the leak test you perform on the control after completing the installation includes leak testing the adapters and screws. If you use a wrench on the gas control after flanges are installed, use the wrench only on the flange, not on the control.

Choose gas control location

The gas control is mounted in the appliance on the gas manifold. If this is a replacement application, mount the gas control in the same location as the old gas control.

Do not locate the gas control where it may be affected by steam cleaning, high humidity, dripping water, corrosive chemicals, dust or grease accumulation, or excessive heat.

To ensure proper operation, follow these guidelines:

- Locate gas control in a well-ventilated area.
- Mount gas control high enough above cabinet bottom to avoid exposure to flooding or splashing water.
- Respect the ambient temperature ratings for each component.
- Cover gas control if the appliance is cleaned with water, steam, or chemicals to avoid dust and grease accumulation.
- Avoid locating gas control where exposures to corrosive chemical fumes or dripping water are likely.

Install gas control

- Mount the gas control 0 to 90 degrees in any direction from the upright position. Upright position is position with the coil on top.
- Mount the gas control in such a way that gas flows in the direction of the arrow on the bottom of the gas control.
- Connect the flange to the gas control afterwards. Max. torque on flange screws: 3 Nm (see fig. 9)
- Ensure the "O" ring is properly placed in the groove of the flange.
- Connect M5 air pressure nipple to air pressure connection. Max. torque: 1 Nm (optional)
- Connect air pressure signal tube to M5 air pressure connection nipple. (optional)

Mounting of rectifier plug (See fig. 9)

Do not overtighten the screw.
Tighten to 0.4 Nm

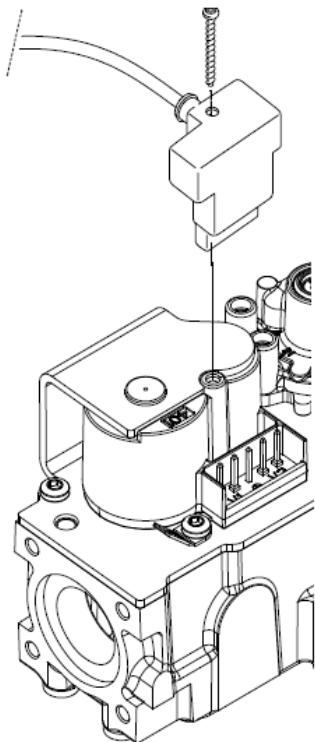


Fig.9 Connect rectifier plug

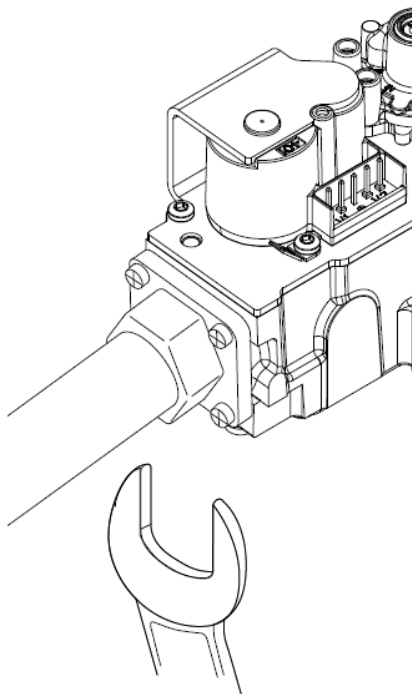


Fig.10 Proper use of wrench

Perform gas leak test**WARNING**

FIRE OR EXPLOSION HAZARD CAN CAUSE. PROPERTY DAMAGE, SEVERE INJURY OR DEATH

Check gas connections for leaks with a rich soap and water solution any time work is done on a gas control.

Gas leak test

- Paint all pipe connections upstream of the gas control with a rich soap and water solution. Bubbles indicate a gas leak.
- If a gas leak is detected, tighten the pipe connection.
- Stand clear while lighting the main burner to prevent injury caused from hidden gas leaks, which could cause flashback in the appliance vestibule. Light the main burner.
- With the main burner in operation, paint all pipe joints (including adapters) and gas control inlet and outlet with an approved leak detection fluid.
- If a gas leak is detected, tighten adapter screws, joints and pipe connections.
- Replace the part if gas leak cannot be stopped.

**CAUTION**

Keep water solution away from electrical connections.

ELECTRICAL CONNECTIONS AND WIRING**IMPORTANT**

Wiring must be in accordance with local regulations. The appliance manufacturer's instructions should always be followed. Before installing or replacing any control check that type number is correct for the application. Ensure combustion chamber is free of gas before start up. Conduct a thorough check out when installation is completed. At the first start the ignition control can be in lock out; depress reset button (when available) to free control.

Do not bring extreme magnetic field in valve neighborhood.

**WARNING**

Take care that installer is a trained experienced service person. Turn off gas supply before starting installation. Disconnect power supply to prevent electrical shock and/or equipment damage.

IMPORTANT

Warranty claims are not accepted if the specified circuit is not used.

Wiring

Use cable which can withstand 105°C ambient temperature.
Use cable which is proven against moisture.

Assembling of the cable connector(s)

Make sure the correct connector is available.
Follow the instructions of the supplier of the cable connector for assembly of the cables.
Mount the connector on the coil with the wires on the top side.
Snap the connector in place on the coil.

IMPORTANT

Make sure no stress is put on the connecting wires and connection in any way after the installation
Make sure the ground connector is assembled correctly, when applicable.
Do not apply excessive force on the ground terminal.

ADJUSTMENTS AND CHECKOUT

IMPORTANT

Adjustments must be made by qualified persons only. If the appliance manufacturer supplies checkout and/or service and maintenance instructions carefully follow them. If these instructions are not provided then use the procedure outlined below.

Pressure tap

The gas control is provided with pressure taps of 9 mm outer diameter at inlet (In) and at Regulated pressure (R).
When checking the pressure undo the screw a half turn with a Torx T-10 driver and slip tube over nipple.
Ensure that screw is closed leak tight after making a test. To seal tighten screw with 0.1 - 1 Nm torque.

Offset adjustment

- Remove cap screw with a torque bit T40 to expose offset adjustment screw.
- Check gas supply pressure to the appliance using a pressure gauge connected to the inlet pressure tap.
- Start fan and check air flow.
- Energize both electric operators in order to have gas input to burner and ignite boiler.
- Adjust CO₂ % at the desired value at minimum output of the burner with offset adjustment screw using a T40 Torx bit. Turn offset adjustment screw clockwise to increase CO₂ %. Do not apply torque over 1Nm when screw is bottoming out.
- Operate boiler on high output. (Only modulating applications).
- Replace cap screw and tighten pressure taps.



CAUTION

Do not exceed the input rating stamped on the appliance nameplate or manufacturer recommended burner orifice pressure for the size of orifices used.

Assure the main burner primary air supply is properly adjusted for complete combustion (refer to the appliance manufacturer instructions).

Checking gas input by clocking the gas meter:

- Assure that the only gas flow through the meter is that of the appliance being tested.
- Assure that other appliances are turned off and their pilot burners are extinguished (or deduct their gas consumptions from the meter reading).
- Convert the flow rate to Kw (form 70-2602) and compare to the kW input rating on the appliance name plate.

Check safety shutdown performance



WARNING

FIRE OR EXPLOSION HAZARD CAN CAUSE. PROPERTY DAMAGE, SEVERE INJURY OR DEATH

Perform the safety shutdown test any time work is done on a gas system

Final checkout of the installation

Set appliance in operation after any adjustment and observe several complete cycles to ensure that all burner components function correctly and that cap screw and plug are fitted and secured and all pressure taps are closed and leak tight.

MAINTENANCE

Maintenance and service

Under normal circumstances no maintenance or service is required.

Do not disassemble the gas control; it contains no replaceable components.

Attempted disassembly or repair may damage the gas control. Screws on the gas control must never be removed.

The designed lifetime* of this product is 10 years, based on date code, according to

a) the standard EN 126

b) the table on designed lifetime as stated on the Afecor website <http://www.afecor.org/>

We cannot assume that the product can be safely used beyond the mentioned designed lifetime.

This lifetime is based on use of the control according manufacturer's instructions.

Regular inspection of the control by authorized personnel in accordance with guidelines of the appliance manufacturer is required.

After reaching the designed lifetime the product has to be replaced by authorized personnel.

Note: * Warranty as opposed to designed lifetime is described in the delivery terms.

CONSTRUCTION AND WORKING PRINCIPLES

Servo pressure regulation

The VK4405V/VK8405V series gas controls features the positive servo system, i.e. the main gas valve is closed by spring pressure in the normal shut down position and can only be opened when gas pressure is sufficient to overcome the spring force. This valuable built in safety feature ensures the main valve will automatically close in the event of power or gas supply failure.

The heart of the system is the servo pressure regulator which consists of a pressure relief valve integrated in a regulator diaphragm which is fitted above and controls the main valve. When the direct on/off operator and servo on/off operator are energized, inlet gas flows through the servo orifice and through the open operator valve into the servo system and the regulator. This servo gas moves the main valve diaphragm upwards enough to open the main valve. As soon as the main valve has opened, the outlet pressure will be sensed by the regulator diaphragm via the feedback channel. When the force

operated by the pressure is greater than that preset by the adjustment screw and the actual air signal on the diaphragm, the regulator valve opens relieving some of the working pressure. This reduces the force against the main valve spring allowing the main valve to close proportionally. Thus the main valve limits the outlet (or burner) pressure to the preset level. As a result, outlet pressure is continuously maintained by comparing it to the preset pressure and adjusting the position of the main valve accordingly. This means that a constant outlet pressure is maintained regardless of inlet pressure variations. At shut down, the small volume of working gas in the regulator and the diaphragm chamber is dumped into the main outlet chamber.

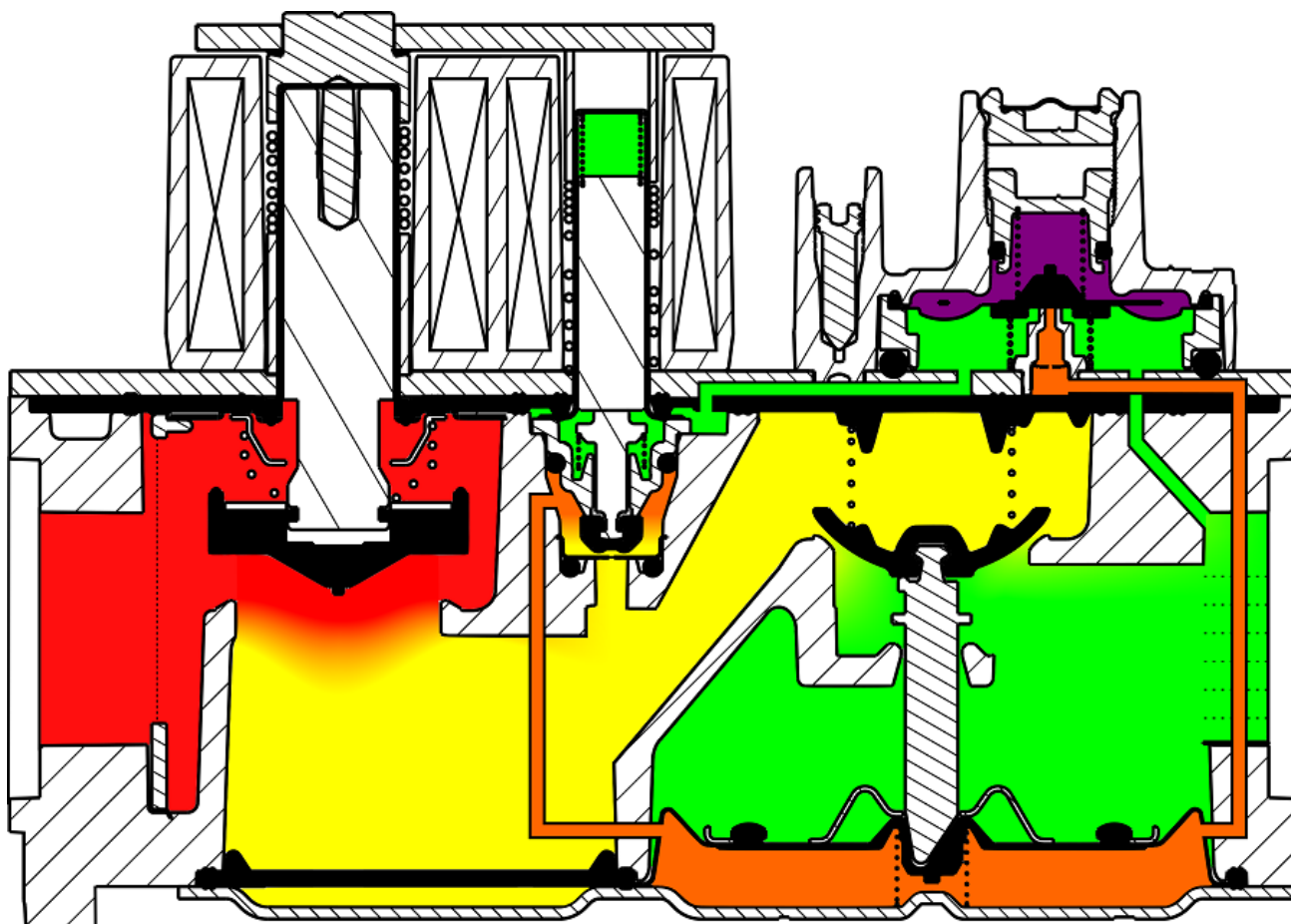


Fig. 5. Servo pressure regulation working

QUALITY ASSURANCE STATEMENT

Products are manufactured under an ISO 9001 and ISO 14001 certified Quality System.

The quality system is described in the Resideo ECC Global Management System and its related operational procedures and instructions.

The quality system is approved by QMI.

The product and processes are designed under 6 sigma and lean principles.

The quality organization is responsible for defining, maintaining, improving and verification of the quality systems in the field of design, production process and field quality service.

All processes are guided by work instructions. At the end of the assembly phase, **all** gas controls are leakage and performance tested/adjusted.

All people involved in the production process have received training for their job. New people are trained until they reach the correct level of skill.

ORDERING INFORMATION

When ordering specify:

Model number of **Rambler** gas control component required: see model number chart below.

NOTE: Complete gas control, replacement parts and accessories will be available under "After Market" label. Ask your wholesaler for details.

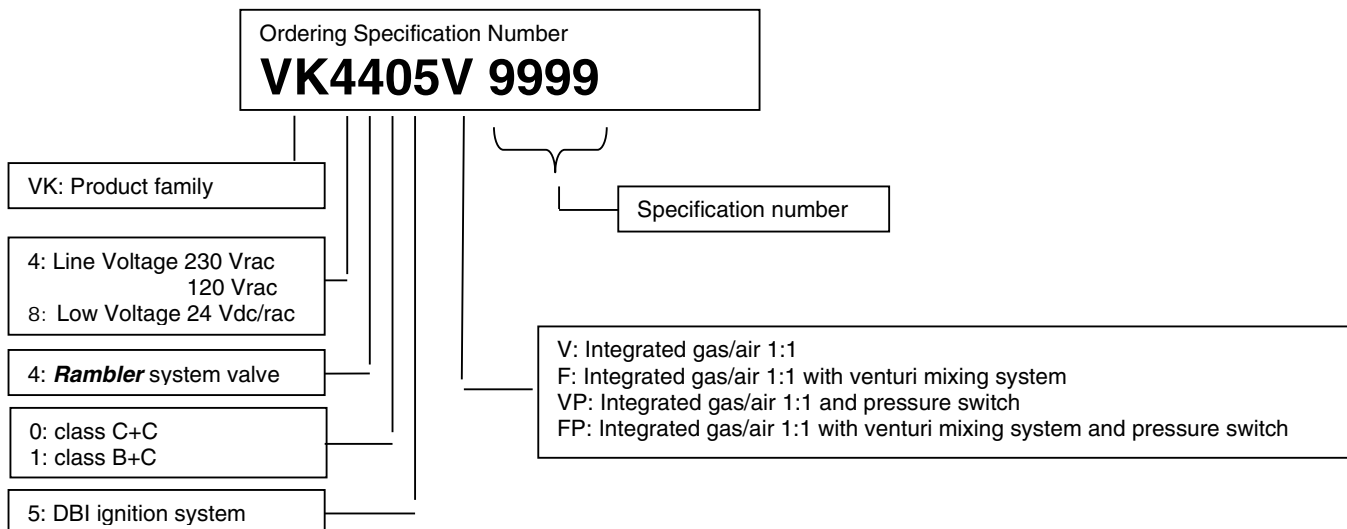


Fig. 6. Model number chart VK series gas controls

REPLACEMENT PARTS AND ACCESSORIES

Fitting

Fitting for application on M5 regulator pressure connection. A fitting can be factory installed by O.S. number

Table 4

Description	Material	Packing quantity	Order number	Color
Pressure feedback fitting for 4 mm tube	Polyamide 6.6	100	45900402-031B	Natural
Pressure feedback fitting for 6 mm tube	Polyamide 6.6	100	45900402-034B	Blue

Protective cap

When outlet is mounted upwards the signal pressure connection should be protected for water entry. A protective cap can be added the order number is 45900431-015B (packing quantity 1000 pcs)

Seal Plate

To protect the offset setting a seal plated can be added on the cap screw. This will cover the bit hole. It is for one time placement, so tampering will be indicated.

Flanges

Main gas in and outlet are designed to receive straight or elbow flanges:

Table 5

Description	Type	Packing quantity	Order number
3/4" BSP.PL +screws + O-ring	straight	200	45900400-139B
3/4" BSP.PL +screws + O-ring	straight	10	45002776-004
3/4" NPT + screws + O-ring	straight	200	45900400-138B
3/4" BSP.PL +screws + O-ring	elbow	200	45900400-125B
3/4" BSP.PL +screws + O-ring	elbow	10	45002776-006
3/4" NPT + screws + O-ring	elbow	200	45900400-144B

Rectifier plug

Table 6

Order number	Supply voltage	Wire	Cable length (mm)	Plug			Cable end		
				Config	Rectifier	Screw	Config	strip length (mm)	Finish
45900441-013B	230	3	500	fig. 8	yes	in bag	fig. 7	50	splices
45900441-015B	24	2	500	fig. 8	yes	in bag	fig. 7	50	splices
45900441-018B	230	3	800	fig. 8	yes	in bag	fig. 7	40	solder dip
45900441-029B	24 Vdc	2	500	fig. 8	no	in bag	fig. 7	50	splices
45900441-033B	120-230 Vdc	3	500	fig. 8	no	inserted	fig. 7	50	splices
45900441-039B	120	3	500	fig. 8	yes	in bag	fig. 7	50	solder dip

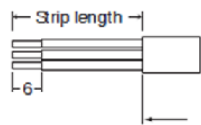


Fig. 7

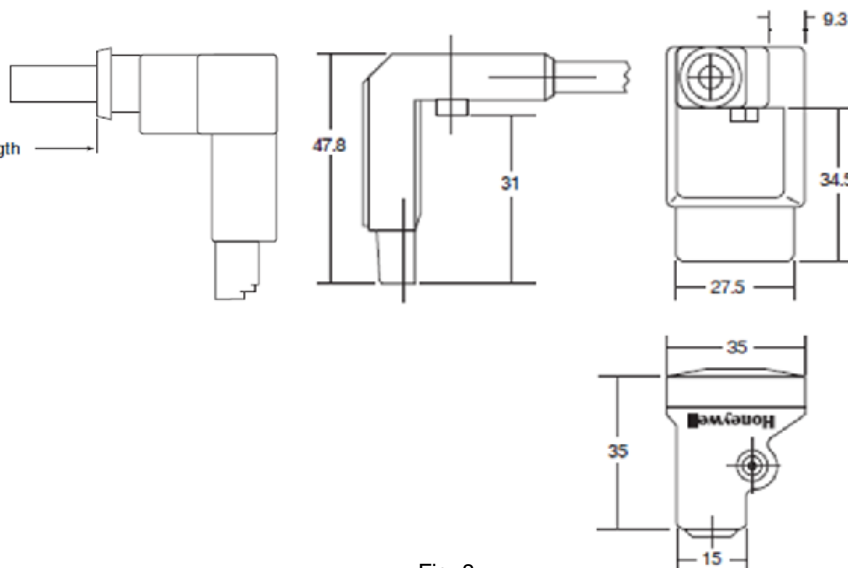


Fig. 8

END OF PRODUCT LIFE STATEMENT

The product should not be disposed of with other household waste. Check for the nearest authorized collection centers or authorized recyclers. The correct disposal of end-of-life equipment will help prevent potential negative consequences for the environment and human health.

resideo
Pittway Sàrl
Z.A. La Pièce 4
1180 Rolle
Switzerland