

Anderson Thermal Solutions (Suzhou) Co., LTD

## VFC86 Burner Operation Manual

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This manual has been written for those who are already familiar with all aspects of nozzle mix burner and its add-on components. Main contents of the manual including safety rules, burner installation, commissioning, operation parameters, maintenance and troubleshooting, spare parts, etc.

### 1. Disclaimer Notice

Anderson Thermal Solutions (Suzhou) Co., Ltd. reserves the right to change the construction and/or configuration of our product at any time without informing customers. If the product or its individual modules are used for purposes other than the designated purpose, their effectiveness and suitability must be confirmed.

Anderson warrants that the product itself will not infringe any patents. Every effort has been made to make this manual as accurate and complete as possible. If you find errors or omissions, please contact us so we can correct them.

### 2. Liability And Warranty

Due to negligence, breach of warranty or other reasons, Anderson's liability for its products is limited to the provision of such replacement parts and will not be liable for any other injury, loss or expense, whether direct or indirect, including but not limited to Loss of or damage to the use of materials that sell, install, use, fail to use or repair or replace Anderson related products.

The warranty is void if: any operation explicitly prohibited in this manual, any adjustment or assembly process not recommended or authorized.

### 3. Safety Guide

Only those who were trained and qualified person can follow the manual to operate or adjust the combustion system. The fire was prohibited within a radius of 5 meters of the combustion system. Flame, non-covered light sources or heat sources shall not be brought to the combustion area unless it is related to the process. Welding in combustion control area shall be approved to ensure the safety in the area and also preventive measures should be taken into consideration.



Before starting, the operator must confirm whether the burner and gas pipeline are in normal working condition, and there is no flammable substance around the burner. The burner must be operated with fuel and oxygen or air. The ignition and operation of the burner must be performed at the specified position. The burner has been correctly and safely installed before ignition. The ignition of the burner needs to be performed after the

combustion chamber is purged. If it is ignited at a low temperature, it needs to be replaced with 5 times the volume of the combustion chamber to avoid explosion.

However, it is not necessary to purge when the temperature is higher than 750°C. Air pipe or gas pipe connected with burner should be tight enough with no leakage, also the periodically check air or fuel nozzles of the burners to prevent to be blocked by dust, slag or other materials.

### ATTENTION: DANGER OF BEEN BURNT



When burner in operation, combustion is severe, so the burner must be fixed. Hoses or cables in area of the combustion system must be suitable for high temperature, to prevent high temperature failure or cause safety accidents. Burners should be periodically inspected and cleaned. Copper wire brush may be used, if necessary, to clean burner head. The burner system should be checked twice a year for safety operation.

Burner commissioning shall take care of ignition position, minimum and maximum output position. Following interlocks will cause emergency stop, including gas low pressure, high pressure or low combustion air pressure, as well as emergency stop is triggered, the main power is out, UV signal failure or kiln safety conditions (such as high temperature limit, flue system opening, etc.) will cause the burner lockout. Users need to know the maintenance interval recommended by the manufacturer and the interval specified by national laws, whichever is shorter.

## 4. Fuel Information

The following table shows combustion fuel characters of natural gas and oxygen, safety rules must be obeyed when operation carried out.

Fuel	Natural gas
Low Calorific value	35,900 [kJ/m <sup>3</sup> ]
Composition	>98% CH <sub>4</sub>
Reference conditions	1,013.25 mbar, 0°C

## 5. VFC86 Series Burner Description

VFC86 burners are the patented products of Anderson Thermal Solutions (Suzhou) Co., Ltd. It is modular designed used for flue gas re-combustion. It is in-duct burner which can be located directly in the exhaust air. The burner is also suitable for fresh air operation.

VFC86 burner is made up of a frame, flame retaining plate, gas nozzle and gas supply manifold, the sheet metal size 150mmX150mm is fixed in the gas manifold. 8 Slots where cut from the sheet metal, with 2 nozzles symmetrically located in the plate.

Modules can be arranged side by side in row, each row can run separately, or it can be ignited by flame propagation. If flame propagation section is configured, the pilot burner should be in the bottom of the burner and flame monitor be at the top end of the burner. Burner frame, flame retaining plate, nozzles are all made of stainless steel. Gas fuel supplied to nozzles through gas manifold. Combustion air or process air goes through the slots in the flame retaining plate to mix with gas. VFC86 burner could be assembled separately according to special requirement. Bracket used for fixing burner or duct. As flow is adjusted by the control valve. Main fire is ignited by pilot burner, please refer to pilot burner description for more information. Process air pressure switch used to detect pressure drop of the burner.

#### **VFC86 Series Burner Advantage:**

- A turndown over 10:1 is generally obtainable across the full burner matrix without the need to isolate burner rows. This enables the burner to meet changing heat demands while maintaining uniform distribution across the duct area.
- Modular design, each model size is 150 mmX150 mm, could be assembled according to different requirements.
- Stable flame and low NOx emission, even the process air pressure drop across burner is 1mbar, the burner can also keep stable flame, so make sure low NOx emission to realize clean combustion. This is achieved by swirling the exhaust gases into the gas jets. The swirling also cools the module material.
- Reliable operation performance, once commissioning is complete, it is stable under the same condition, no need for extra adjustment or maintenance.
- Burner suit for different gas fuel such as natural gas, LPG or hydrogen.
- Operation in high temperature, as all the material of the burner is stainless steel, burner could run with high process temperature of 750°C.

## **6. Burner Component Introduction**

VFC86 burners are mainly made up of frame, flame retaining plate, gas nozzle and gas supply manifold. For different parts, they are connected by rivets or bolts to make up burner body. Burner diagram shown in Fig 1

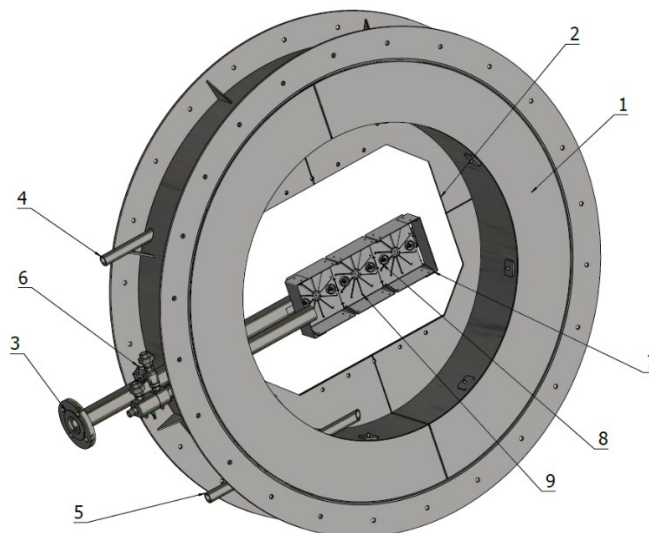


Fig 1 VFC86 Burner Diagram

Number	Name	Number	Name
1	Duct	2	Damper
3	Gas channel	4	Upstream pressure test point
5	Downstream pressure test point	6	Pilot burner
7	Side plate	8	Nozzle
9	Air distributes sheet metal		

VFS86 Series Burner has a separated ignition burner of maximum capacity 50 kW. The user needs to supply combustion air with an oxygen content of 21% for the ignition burner, so, a small air blower or compressed air needs to apply to ignition burner. According to ignition burner's manual, 5mbar combustion air and 3mbar gas pressure is necessary for ignition burner operation continually. The pressure above means in a neutral environment, if oven chamber pressure exists, chamber pressure needs to be added to the pressure value above. It should be noted that the depth of ignition burner extended to the main burner is adjustable according to site requirement. The ignition burner diagram is shown in Fig 2.

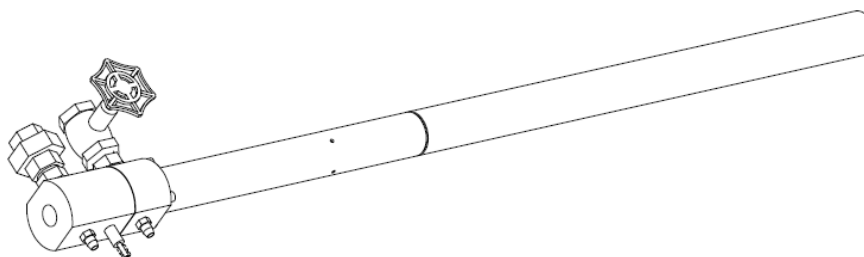


Fig 2 ignition burner

## 7. Burner Operation Data

VFC86 burner operation data shown as table 1 below:

Table 1 VFC86 Burner Operation data

Parameter	Fresh Combustion air (O <sub>2</sub> Content 21%)	Typical Operation Condition
Model maximum input (kW)	350	200
Model minimum input (kW)	15-25	20
Gas inlet pressure (mbar)	420	145
Process temperature upstream (° C)	750	500
Process temperature downstream, (° C)	1000	900
% Process O <sub>2</sub> upstream	21	At least 12
DP Across Burner, (mbar)	0.8-1.3	1
Process Velocity Across the Burner (m/s)		
Fresh air	11-15	13
Exhaust air	20-26	22
Flame Monitoring	UV Scanner	UV Scanner

### Remark:

- Emissions are dependent upon process temperature and oxygen levels.
- Natural gas pressures at high fire (measured at the inlet of the burner manifold) may increase up to 50 mbar per meter for burners over 1 meter in length.
- For higher temperatures than 750° C, please consult Anderson.

## 8. Performance Curves

VFC86 burner operation curve shown as below fig 3

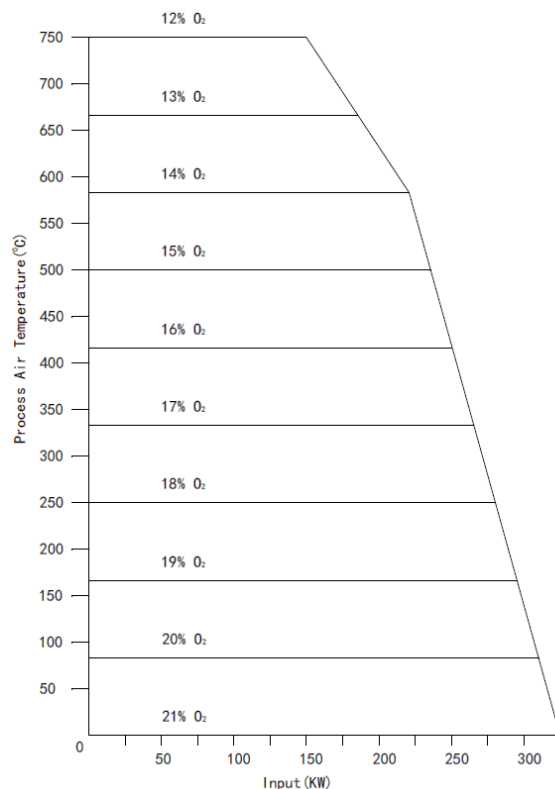


Fig3. VFC86 Burner Operation diagram

## 9. Burner Installation

### 9.1 Storage:

1. Make sure that the area is clean.
2. Store the components in a cool, clean, dry room.
3. Keep the components in the original package as long as possible

### 9.2 Handing

1. Make sure that the components are clean and free of damage.
2. Protect the components from weather, damage, dirt and moisture.
3. Protect the components from excessive temperatures and humidity.
4. Use appropriate support equipment, i.e. harnesses, straps, chains, etc. when lifting burner components.

### 9.3 Operation requirement

To make sure burner can be operated, the following issues should be checked.

1. Power voltage, frequency and stability.
2. Fuel type and pressure.

### 9.4 Burner Mounting

#### 1. Mounting method

The installation modes of VFC86 burners are in the duct, the burner surface is vertical to process air, downstream space should be long enough to avoid flame conflict with the duct wall. Provide an opening in the duct 80mm gap on 4 sides of the burner.

#### 2. Profile Plate Adjust

Profile plates are not required for good burner operation, but uniform velocity must be maintained for the full length of the burner. If velocity is not uniform, profile plates can be used to correct this condition. Profile plates should be positioned flush with the firing end of the burner. If necessary, the plates can be located up to 1/2" back from the firing end, but under no circumstances should they be in front of the burner.

#### 3. Valve train connection

Locate the valve train as close as possible to the burner to make sure gas reach the burner during the trial for ignition time. Sufficiently size shut off valves in the valve train. In order to decrease pressure lost in pipe, minimize piping elbows to be used while pipe union is recommended. Flexible hose is good optional but pressure loss must be considered.

#### 4. Flame monitoring

This type of burner is suitable for UV scanner as flame sensors, UV scanner can be installed on pilot burner, or separate UV scanner on burner side plate.

### 9.5 Checklist after installation

To verify the system was properly installed, perform the following checks:

- Be sure there are no leaks in the gas lines.
- Be sure all the components contained in the flame monitoring and control system, pressure switch and wiring are properly installed.



- Be sure all components of the spark ignition system are installed and functioning properly.
- Be sure all valves are installed in the proper location and correctly oriented relative to the flow direction.

## 9.6 Prepare for adjustment

After installation of the burner system components is complete, the following steps should be followed in order to prepare for adjustment:

- Set the air flow switch so that it drops out at 50% below the maximum pressure of the process air.
- Set the low gas pressure switch at 50% below the gas pressure measured at the inlet to the main gas valve train.
- Set the high gas pressure switch at 50% above the gas pressure measured at the inlet to the main gas valve train.
- Try to ignite the burner before the purge and other timers have finished their cycles. Make sure that the flame monitoring system indicates a flame failure.
- Trip out the pressure switches and other limit interlocks. Make sure that the main gas valve train closes.
- If the simulated limit condition or the simulated flame fault cannot be responded at the specified fault response time, the fuel system needs to be turned off to correct the existing problems.

## 10. Burner Maintenance

Preventive maintenance is the key to a reliable, safe and efficient combustion system. The core of any preventive maintenance system is a list of periodic tasks. These are guidelines only. The customer should make the final determination on maintenance intervals and tasks to be performed while considering the working environment.

System regular safety audit must be taken out, including gas leakage check no longer than every half a year. If necessary, the frequency of audit should be increased. Leak detection, control functions of the equipment must be included in the scope of audit. Only Anderson technicians or those who are been trained and qualified by Anderson, as well as other relevant professionals, can maintain the burners. All valves, especially ball valves, must be slowly open or close when switching in order to prevent pressure shock in pipe.

### 10.1 Half a year checklist

- Inspect the flame sensing devices for good condition and cleanliness.
- Check for proper air and gas pressures.
- Test all the system alarms for proper response signals.
- Check and clean igniter electrodes.
- Check valve motors and control valves for free, smooth action and adjustment.
- Check for the proper operation of ventilating equipment.
- Test the interlock sequence on all safety equipment. Manually force each interlock to intentionally fail while at the same time noting if related equipment closes or stops as specified by the manufacturer. Test the flame safeguard by manually shutting off the gas to the burner.

- Test the manual gas shut off cocks for proper operation.

### 10.2 Yearly checklist

- Leak test the safety shut-off valves and pipe for tightness of closure to make sure no leakage.
- Test the pressure switch settings by checking the switch movements against pressure settings and comparing these with the actual impulse pressure.
- Visually check igniter cable and connectors.
- Be sure the burner bodies and air wings, the igniter and the flame sensors are not damaged or distorted.

## 11. Appendix

### 11.1 Training Record

Each trained person must verify that he has read and understood the contents of the operating manual and know how to operate and maintain this series of burners correctly.

Manual Number and Revision	Date	Who (Name)	Signature

### 11.2 Bi-annual Audit Record

Routine audit must be made every 6 months. Please sign the following table.

Function Audit	Date	Inspector	Problem description	Next Audit Time
Flame sensor state				
air and gas pressure				
Alarm signals				
igniter electrode				
Control motors				
Ventilate equipment				
Interlock Function				
Shut off cock function				
Combustion air blower				

### 11.3 Annual Audit Record

Yearly audit list as follow but not only included

Function Audit	Date	Inspector	Problem description	Next Audit Time
Leak test				
Pressure switch test				
Cable and connectors				
Burner bodies and air wings				

**Attention:** Safety audit is prohibited when burner is running, otherwise, an accident could be caused!



If you have any questions. Please call us or send an e-mail to get more information

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Meanwhile, you can also visit our website [www.andtecs.com](http://www.andtecs.com) to get more product information.