



Anderson Thermal Solutions (Suzhou) Co., LTD

ANM76 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

Following table shows combustion fuel specification of natural gas, safety rules must be obeyed when operation carried out.

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

5. ANM76 Series Burner Description

ANM76 series burner is a patented product of Anderson Thermal Solutions (Suzhou) Co., Ltd. This series of linear burners adopts a modular structure design concept and can be configured to match shapes according to site requirements. It is an ideal choice for generating large amount of clean and hot air. Applications include ovens, dryers, flue gas incinerators and similar industrial equipment, and are widely used in heating industries such as gypsum board. This type of burner is designed based on the proportional control of gas and combustion air. Under normal operating conditions, the excess air is about 15-20%.

This type of burner can provide great temperature uniformity. The burner body is cast iron, other parts are stainless steel. Combustion air and gas in the burner body flow to the surface through different channels, and part of the combustion air and gas are premixed before exiting the surface to optimize emissions and efficiency.

The combustion air is connected the burner through the air duct, by providing the correct air volume and pressure to the burner. Brackets are used to support the burner or air duct, and fuel flow adjustment is achieved through a flow control valve. Ignition is ignited by a separate point burner. Flame monitoring equipment can be placed at both ends of the burner. The air pressure switch can be installed on the burner to detect whether the pressure of the combustion air meets the requirements.

ANM76 Series Burner Advantage:

- Excellent emission: NO_x and CO emissions are very low.
- Compact structure, with large heat input.
- High turn down ratio to 10:1 to match different requirement.
- The modular assembly is adopted; length of each module is 150 mm or 300 mm. Output of 300 mm module can get as high as 300 kW, different modules can be installed with shape of line shape, "I" shape, "T" shape according to customer requirement.
- On ratio control design conception.
- Reliable operation performance, once commissioning is complete, it is stable under same condition, no need extra adjustment or maintenance.
- Suit for different gas fuels such as natural gas, LPG or hydrogen, etc.
- Special use for middle-high temperature application of heating 400°C process air to 850°C

6. Burner Component Introduction

ANM76 series burners are mainly made up of burner body, fire plate as flame shield, diffuser plate. Different parts were connected by rivets, screws and bolts.

Shown as below Fig 1 is the diagram of the burner, in which the air wing and outer connectors are made of stainless steel, gas channels and connectors are also stainless steel.

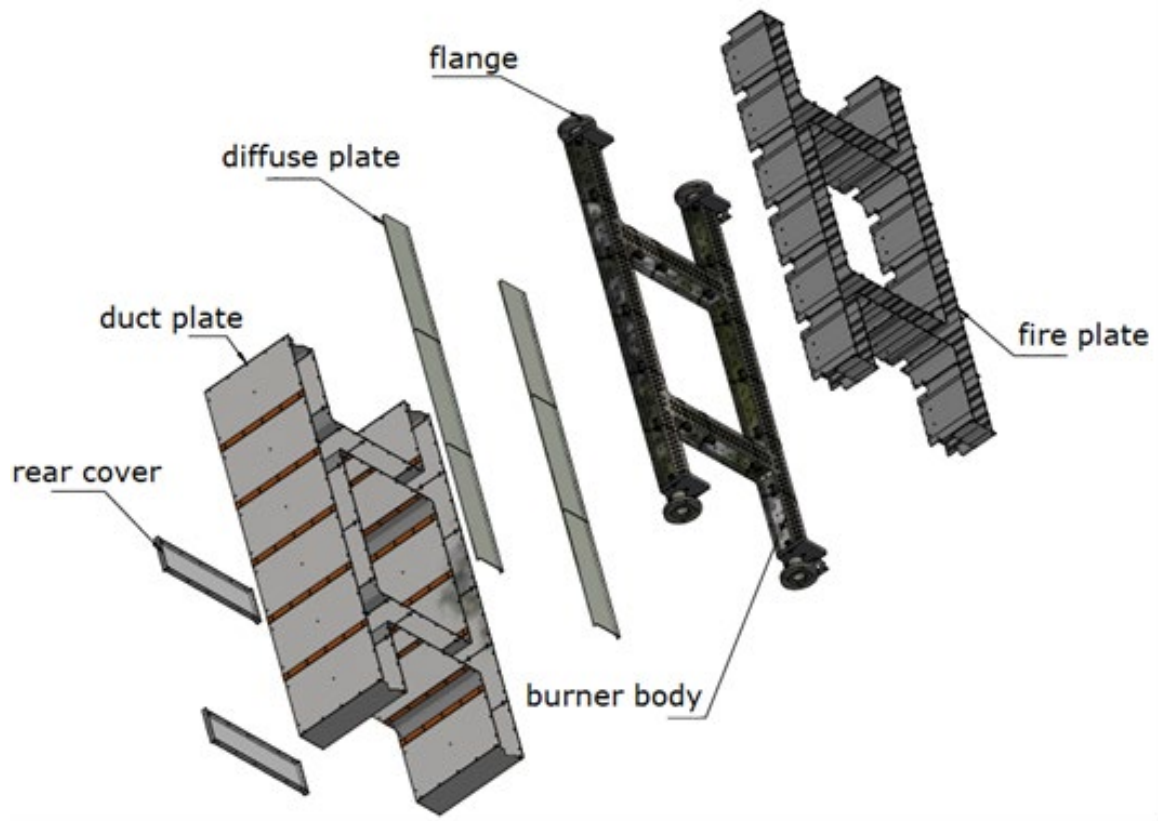


Fig 1. ANM76 Series Burner Explosion View

7. Burner Operation Data

- Maximum input: 1000 kW/m (when air differential pressure across burner is 2.5mbar)
- Minimum input: 100 kW/m
- Fuel inlet pressure: 3-85 mbar。
- High fire flame length: 800mm. (when air differential pressure across burner is 2.5 mbar, the lower air different pressure, the longer flame)
- Upstream temperature limit: -30°C to 400°C
- Downstream temperature limit: 850°C

Remark: Air differential pressure means the air pressure difference between burner inlet combustion air pressure and chamber; gas differential pressure means gas pressure difference between burner inlet gas pressure and chamber.

8. Performance Graphs

The operation and emission curves of the ANM76 series burners are shown in Fig 2 and 3.

ANM76 Series Operation Performance Graphs

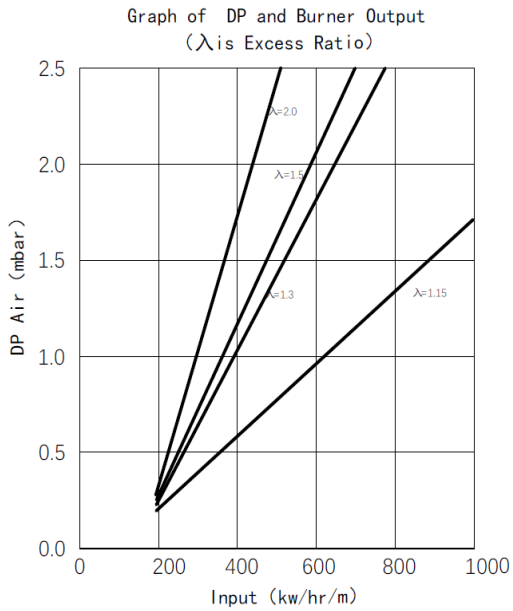


Fig 2. ANM76 Series Burner Operation Curve

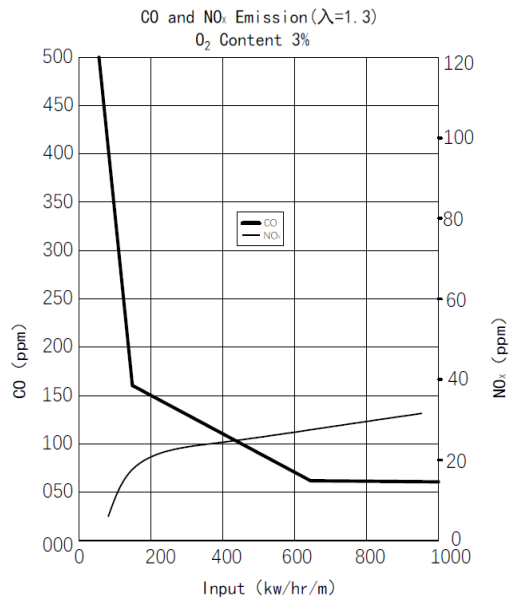


Fig 3. ANM76 Series Burner Operation Emission Curve

9. Burner datasheet

The input and flame length curves of the ANM76 series burners are shown in Fig 4 and Fig 5

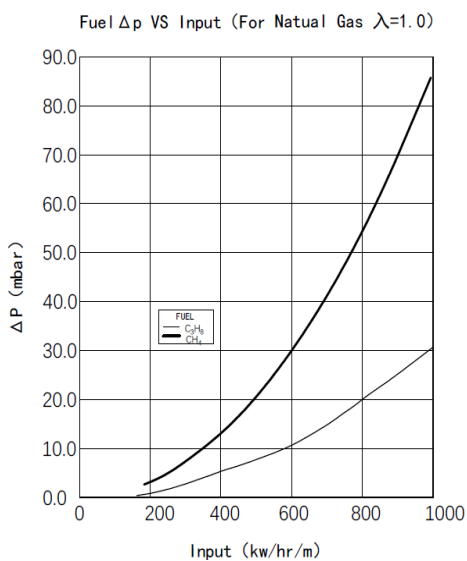


Fig 4. ANM76 Series Burner Input Curve

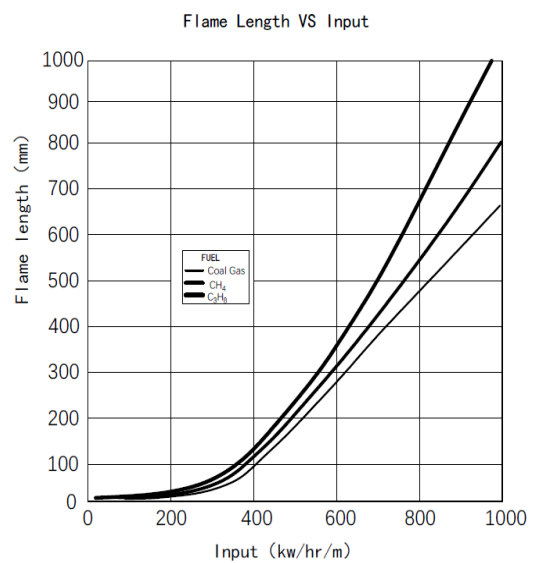


Fig 5. ANM76 Series Burner Flame Length

10. Burner Installation

Check before mounting:

- Burner body modules are connected securely with no obstruction.
- Remove dust and other particles inside burner if any
- Check if any obstructions in burner air duct
- Gaskets between burner and duct flanges
- Check alignment of system.
- Install UV-scanners on burner

11. Burner start

Special attention:

The ANM76 Series burners, described herein, are designed to mix fuel with ai. All fuel burning devices are capable of producing fires and explosions, if improperly applied, installed, adjusted, controlled, or maintained. Do not bypass any safety logics; Never try to light a burner if it shows signs of damage or malfunction.

11.1 Pre-commissioning Requirements

Gas supply pipework up to the isolating ball valve should be pressure tested and purged.

Gas to be available at a pressure between 80% and 100% of supply pressure at system inlet.

If pneumatic shut off valves are used, make sure the compressed air inlet pressure is at least 4.0 bar.

Electrical supply to the Burner Management System should be supplied at specified voltage and frequency.

All field wiring from the burner management panel to the equipment should be installed and tested according to the wiring diagrams.

All three phase power cables to electrical motors should be installed. Combustion air fan, auxiliary air fan should be checked for correct rotation direction. Thermal overload devices should be preliminary set.

Process air temperature should follow this manual technical description. The mentioned process flow should be available for extended periods adequate for burner commissioning to continue. Make sure no impurities flow into the combustion air chamber.

11.2 Commissioning Procedure

1. Visual inspection of the burner equipment, paying particular attention to the support structure of the gas pipe work. Inspect internal duct, looking for mechanical damage to the burner.
2. Set and adjust the position of the auxiliary profile plate of process air across burner, measure the pressure in the air duct with a pressure gauge, and ensure that the DP before and after the profile plate reaches the required value, thereby determining the maximum position of the profile plate. In actual operation, the differential pressure switch is usually set to detect the process air pressure

- difference before and after the burner profile plate.
3. Start the combustion air fan, adjust it to 100% of the flow rate, measure the pressure difference between the combustion air and the downstream of the burner, the design DP is 2-2.5 mbar.
 4. Modulate through full range of burner input capacity, check the air DP and combustion air flow.
 5. For dry run test, first close the manual valve closest to the burner, then start the control program, and start the dry test of the burner. Doing such a dry test can check all the interlocking conditions in the combustion system, such as gas pressure switches, air pressure switches, and leak test system.
 6. Then carry out the pilot burner commissioning; procedure is carried out until reliable ignition is achieved and the flame signal of the pilot ignition can feed back to the flame controller with stable flame signal. During ignition test, the gas valve before burner should be closed.
 7. After the stable ignition is established, open the gas valve before burner.
 8. First, setup low fire. At this time, the control system should be set in the manual mode, which is set by adjusting to the minimum firing position. The gas volume at this position requires the flame to propagate across sectional area of the burner, that is, all modules will be firing. The flame detector detects the far end of the burner. Since the flame propagate to the far end of burner will take time, the time setting of the flame relay can be adjusted at this moment, to make sure both flame detectors will be active to monitor flame after the delay time is over.
 9. The relevant pressure and gas flow values need to be recorded during the commissioning process.
 10. Then set the high fire rate. This is achieved by using the manual control of the process controller driving the modulating gas valve open step by step. Each step of the ramp up to the maximum rate being monitored, gas flows recorded as not to exceed the required rate. On reaching the fully open position, the main gas pressure regulator can be set to give the required heat capacity.
 11. After the high fire is set, low fire position should be checked again for fire rate and reliable ignition. This can be cycled couple times to ensure low fire-high fire-low fire-high fire firing stable.
 12. All pressure switches shall also be tested by reducing or increasing the setpoints until system trip. Relevant alarm procedures and control logic checked. Trip positions recorded and normal operation setpoints selected and set.

Note: The above procedure will be carried out by using the process air flow.

11.3 Start Burner

After all firing rate is setup, the burner gets into operation mode, the gas flow control valve is controlled by 4-20 mA from temperature controller. The pilot burner could be closed or run continuously according to the design requirements.

11.4 Stop Procedure

Do not turn the combustion air blower off until the chamber temperature is below 80°C. This will prevent hot gases from back flowing into the burner and blower, which may cause damage to the burner.

- Stop the burner through the burner control system.
- Run the combustion air blower until the chamber temperature drops below 80°C.
- Turn off the combustion air blower.
- Close all manual gas valves to the burner.

12. Burner Maintenance

Preventive maintenance is the key to a reliable, safe and efficient system. The good habit of any preventive maintenance system is setup and follow up the periodic checklist. Customer should make the final determination on maintenance intervals and tasks to be performed while considering the working condition and environment.

System routine safety audit must be taken including gas leak test at least half a year. If necessary, the frequency of audit should be increased. Leak detect, control functions of the equipment must be included in the scope of audit. Only Anderson technicians or those who are 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 in order to prevent pressure surge in pipe. Please pay more attention to the following items as consider preventing maintenance

- Examine and, if necessary, clean, replace any gas or air filter elements
- Check all bolts tightness.
- Check all piping connections for leaks.
- Inspect the flame monitoring device and maintain in accordance with manufacturer's instructions.
- Check the function of all pressure switches.
- Check function of all limit switches.

12.1 Half year checklist

- Inspect the flame sensing devices for good condition and cleanliness.
- Check for proper air and gas pressures.
- Test all the system alarm signals for proper response.
- Check and clean igniter electrodes.
- Check valve actuators and control valves for free, smooth movement.
- 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.
- Inspect and clean the combustion air blower rotor. Clean and/or replace the combustion air blower filter if applicable.

12.2 Yearly checklist

- Leak test the safety shut-off valves and gas train 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 pressure.
- Visually check igniter cable and connectors.
- Be sure the burner bodies and air wings, the ignitor and the flame sensors are not damaged or distorted.

13. Troubleshooting Procedures

Several reasons can cause burner failure, below a few frequent or typical common component failures are listed that can cause burner trip.

Failure source	Possible causes:
High gas pressure	Defective gas pressure regulator
Low gas pressure	Incorrectly adjusted gas pressure regulator or shortage of gas supply
High gas pressure at burner inlet	Limit switch or end switch not setup inside control valve (flame length becomes excessive)
Gas control valve not in start position	Electric or pneumatic signal for opening the control valve fails. Control from DCS
Process flow or combustion air flow too low	The inlet of the air pressure switch is blocked or the port connecting the three-way valve to the fan is blocked
Pilot/cooling air pressure too low	Blower inlet blocked Air pressure regulator malfunction, if used
Pilot flame does not light	Ignition transformer defect Spark plug defect Pilot gas, solenoid or the shut-off valve defect allowance Pilot trial for ignition time is too short
Main flame does not light	Amount of start gas flow is too low Main gas valve defective Pilot trial for ignition time too short
Pilot flame failure after ignition	Pilot flame is unstable and requires re-adjusting
Failure during operation	UV tube defective Shortage of combustion air Shortage of process air Shortage of gas supply Customer other interlocks

14. Appendix

14.1 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

14.2 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				

14.3 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 to get more product information.