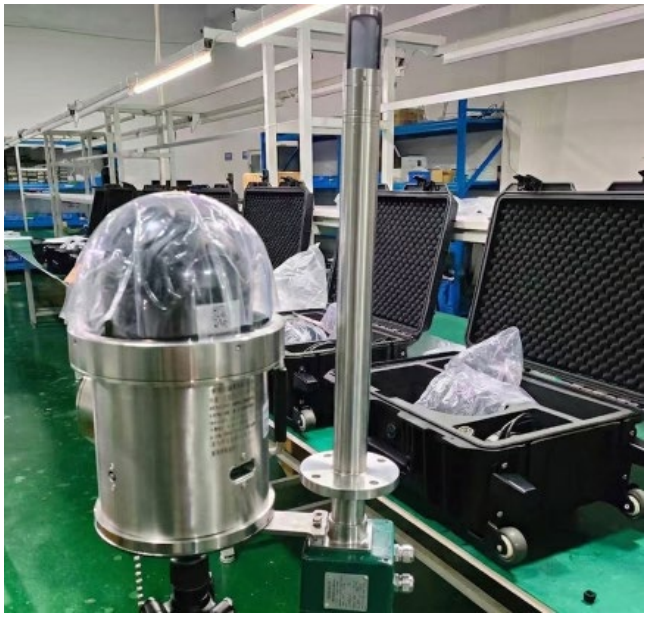
Zirconia Oxygen Analyzer

APT-EX6000 Series

Product Operation Manual

Accumtek Corporation Limited

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Preface

The APT-EX6000 series zirconia oxygen analyzer is an industrial-purpose oxygen analyzer developed and manufactured by Accumtek Corporation Limited. It can be widely used for oxygen content measurement in high-temperature working conditions in the power, metallurgy, petrochemical, environmental protection, heating, ceramic, glass and metal heat-treatment industries. The instrument features a split-type structure with a variety of configuration accessories; different configuration combinations can be selected according to different working conditions.

The manufacturing process of the instrument has passed the ISO-9001:2008 specification certification.

The instrument has passed the EU CE safety certification.

The explosion-proof model of the instrument has passed the EXdIICT4 Gb specification certification.

The testing of the instrument fully complies with the national standards of the People's Republic of China: Verification Regulation of Zirconia Oxygen Analyzers (JJG535-2004) and Technical Conditions for Zirconia Oxygen Analyzers (JB/T8281-1999).

Before using the instrument, please read the contents of this manual carefully.

This manual consists of 7 chapters. For information on installation, operation and maintenance of the product, please refer to the relevant chapters in this manual.

Safe Use of the Instrument

✪ Warning

- The zirconia sensor at the tip of the zirconia probe is made of ceramic material. Do not let the probe fall, be knocked, or bear heavy pressure!
- When installing the zirconia probe, do not knock the tip of the probe!
- When installing the zirconia probe, be sure to prevent water from dripping directly onto the tip of the probe and into the junction box!
- When introducing standard gas for calibration of the instrument, be sure to follow the calibration steps (Section 6.3.3.3 of this manual). Do not let liquid enter the standard gas, so as to avoid damage to the oxygen sensor!
- When the zirconia probe is working, its surface temperature is very high; please wear protective gloves and handle it carefully!
- Avoid installing the zirconia probe and the smart electronic transmitter in working environments with strong vibration, to avoid damage!
- Avoid installing the smart electronic transmitter in working environments with high ambient temperature (≥85℃), to avoid damage!

☢ Danger

- Only when it is confirmed that the power supply matches the rated voltage of the instrument may the power cord be connected. When connecting the power supply, be sure to confirm that no personnel are performing wiring operations before energizing. Be sure to confirm that all connecting wires are correctly connected before energizing.
- When replacing the zirconia probe online, toxic and harmful process gas may escape; please

wear a protective mask and a harmful-gas alarm.

- The APT-EX6000 series zirconia oxygen analyzer is relatively heavy. When carrying, installing and moving it, handle it carefully, pay attention to safety, and do not cause harm to the human body.

◆ About This Manual

- One manual is supplied with each set of instruments, and this manual should be delivered to the end user.
- If the contents of this manual change, please contact the regional manager of our company.
- Without the permission or authorization of our company, no part or all of the contents of this manual may be copied or reproduced.
- This manual does not cover special technical specifications and requirements; if users have relevant needs, they may contact our company.
- When using the instrument, be sure to observe the safety tips in this manual to ensure the safety of personnel, equipment and the system containing this product.
- Some marking symbols appear in this manual; please read the text or pictures under the marking symbols carefully. ✪: Warning mark; ●: Key point mark; ☞: Note mark; ✖: Prohibition mark; ★: Caution mark; ☢: Danger mark.
- Special note on icons: Electronic transmitter panel operation keys: ▲, ▼, ►, Enter, Exit. Flashing icon: The flashing position is the value that can be operated. For example: 5.35. Here "3" is the adjustable digit.

◆ Caution

- When the instrument arrives, please check whether the outer packaging of the instrument is intact. Open the package carefully and check whether the instrument is damaged during transportation. Please check whether the technical specifications match those at the time of ordering, and whether the required accessories are missing.
- When the APT-EX6000 series zirconia analyzer arrives at the user's location, the setting parameters of the instrument should be those at the time of ordering. When installing the instrument, please confirm whether the installation conditions and working conditions match the relevant conditions at the time of ordering. If the installation conditions and working condition parameters change significantly, please contact our company in time.
- If the user needs to change the setting parameters of the instrument, please be sure to make the modifications according to the contents of this manual.

◆ After-Sales Service and Warranty

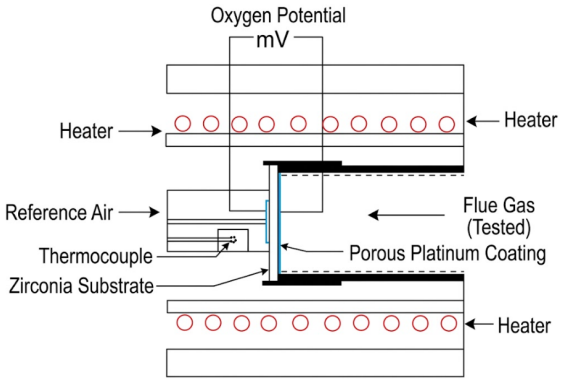
- Our company undertakes to assume the quality assurance obligations in accordance with the warranty terms in the contract.
- The quality assurance obligations assumed by our company include telephone guidance, on-site service, and free replacement of faulty instruments, and our company will bear all corresponding costs.
- The following situations are not covered by the quality assurance:
    - Instrument faults caused by the use of accessories, attachments and auxiliary equipment not provided by our company.
    - Significant conflicts between the on-site working condition parameters and the parameters agreed at the time of ordering.
    - Instrument faults caused by human factors.
    - Instrument faults caused by operation not in accordance with the requirements of this manual.
    - Instrument damage caused by force majeure, such as earthquakes, fires, floods, radiation, war, riots, etc.

Chapter 1 Overview

The APT-EX6000 series zirconia oxygen analyzer is a gas analysis instrument used to measure and control the oxygen concentration in combustion gases, boilers and industrial furnaces. It is widely used in industrial fields that require large amounts of energy, and features high-temperature resistance, corrosion resistance, fast response and high precision that other oxygen concentration analyzers do not have. It is an indispensable and important analytical instrument in the industrial field.

1.1 Measuring Principle of the Zirconia Analyzer

Zirconia material is a zirconia solid electrolyte; it is a stable zirconia ceramic sintered body formed by mixing pure zirconia with a certain amount of calcium oxide or yttrium oxide and sintering at high temperature. Because its cubic lattice contains oxygen ion vacancies, it is a good oxygen ion conductor under high-temperature conditions.



The oxygen sensor is composed of a zirconium dioxide substrate the size of a (pentagonal) coin, with nanoporous platinum electrode coatings on both sides, encapsulated using a unique platinum welding process, and firmly and hermetically welded to the top of an alloy steel sleeve. A special granular substance is placed in the middle section of the sleeve, effectively solving the interference of water vapor and combustible gas in the measured flue gas during oxygen measurement. Taking advantage of this characteristic, at a certain temperature, when the oxygen contents on both sides of the sensor are different, it behaves as a typical oxygen concentration cell. If pure platinum electrodes are coated on the inside and outside of the zirconia tube, and the zirconia tube is heated by an electric furnace so that its inner and outer walls contact gases with different oxygen partial pressures, the zirconia tube becomes an oxygen concentration cell, and the following reactions occur on the two platinum electrodes:

- On the air side (reference side) electrode: $O_2 + 4e \rightarrow 2O^{2-}$
- On the low-oxygen side (measured side) electrode: $2O^{2-} \rightarrow O_2 + 4e$

When these two migrations reach equilibrium, a potential signal E related to the oxygen concentration difference is generated between the two electrodes.

The oxygen potential value E conforms to the Nernst equation: $E = (RT / 4F) \times \mathrm{Ln}(PA / PX)$

Where: R — gas constant; T — absolute temperature of the zirconia wafer; F — Faraday constant; PX — oxygen concentration percentage of the measured gas; PA — oxygen concentration percentage of the reference gas, generally 20.6%.

Chapter 2 Technical Specifications

2.1 Features of the APT-EX6000 Series Zirconia Oxygen Analyzer

- It adopts the American Westinghouse 218 technical process standard, the nanoporous platinum electrode coating technology for the oxygen sensor substrate, and full coverage with porous platinum coating. This effectively eliminates the erosion of harmful components in the flue gas on the oxygen sensor, greatly increasing the service life of the zirconia probe.

- The zirconia probe is made of SUS316L\SUS904L stainless steel, which provides good protection against high-temperature flue gas and corrosive atmospheres. The zirconia sensor is placed directly at the front end of the probe, providing a fast response.
- The zirconia sensor adopts a unique platinum welding encapsulation process, effectively ensuring the airtightness of the sensor; the substrate is not easily broken and does not leak, and it is more robust against mechanical vibration and temperature gradients. It ensures the zirconia probe measures normally and stably under a pressure of ＜±10KPa.
- The smart electronic transmitter uses a highly integrated imported SoC chip, intelligent PID temperature control, and a fully isolated signal circuit. The Chinese-menu operation interface is simple and clear to operate. It provides a standard 4-20mA analog output and can be extended with RS485 communication and upper/lower limit node outputs. Heating temperature (750℃ or 820℃), output, range, etc. can be set quickly and conveniently. The two-point oxygen calibration can more accurately calibrate the oxygen content at the zero point, span point and working point.
- The APT-EX6000 series zirconia oxygen analyzer has powerful functions and can accomplish:
  - ☞ Online calibration of oxygen content
  - ☞ Calibration of the 4-20mA analog output
  - ☞ Setting of upper/lower limit alarm nodes
  - ☞ Setting of the range corresponding to the analog output
  - ☞ Setting of the zirconia probe heating power
  - ☞ Setting of the data acquisition frequency
  - ☞ Setting of the data hold function
  - ☞ Setting of the communication mode and communication address
  - ☞ Setting of user-side parameters
- The reference gas uses the natural air diffusion method; no separate reference gas circuit is required, so installation is simple and maintenance is convenient.
- The internal components of the zirconia probe can be easily disassembled and replaced, effectively reducing the user's maintenance cost.
- It uses an alloy steel / ceramic filter, which has the advantages of high through-flow rate, good thermal conductivity and easy cleaning.

Chapter 3 Instrument Selection

The APT-EX6000 series adopts a split-type structure, consisting of a smart electronic transmitter and a zirconia probe.

The APT-EX6000 series can meet the oxygen measurement requirements under various complex working conditions. Users need to select the corresponding instrument model and configuration according to their on-site working condition parameters and technical requirements.

★The following table is the selection comparison table of the relevant models and suffix codes of the APT-EX6000 split-type zirconia oxygen analyzer.

1. Smart Electronic Transmitter Selection

Item	**Model: APT-EX-**	**X**	**X**	**X**	**X**	**X**
Enclosure	Cast aluminum display enclosure (IP66)	J				
Basic unit	LCD screen two-line display, Chinese menu	1				
Power supply voltage	198~242VAC/50～60Hz	1				
Output interface	Isolated 4～20mA signal output	1				
Output interface	485 communication interface output	2				
Mounting method	External bracket mounting	1				
Mounting method	Lug mounting	2				

2. Zirconia Probe Selection

Item	**Model: APT-EX-**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Junction box	Cast aluminum junction box (IP66)	T						
Probe material	316L	A						

Item	**Model: APT-EX-**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Probe material	904L (for severely corrosive areas)	B						
Insertion depth	0.30m	A						
Insertion depth	0.60m	B						
Insertion depth	1.00m	C						
Insertion depth	1.50m	D						
Insertion depth	2.00m	E						
Insertion depth	User-specified	F						
Filter	Ceramic flat filter	A						
Filter	Alloy steel cup-shaped filter	B						
Filter	Ceramic cup-shaped filter	C						
Filter	Alloy steel flat filter	D						
Filter	Alloy mesh filter (recommended for desulfurization outlet)	E						
Mounting (adapter) flange	Standard	A						
Mounting (adapter) flange	AMETEK	B						
Mounting (adapter) flange	ROSEMOUNT	C						
Mounting (adapter) flange	User-specified	D						
Flue welding flange	None	0						
Flue welding flange	A3 steel flange	A						
Flue welding flange	SS304 stainless steel flange	B						

Item	Model: APT-EX-	X	X	X	X	X	X	X
Anti-wear protection sleeve	None	0						
Anti-wear protection sleeve	With SS316 stainless steel sleeve	A						
Anti-wear protection sleeve	With alloy-treated protection sleeve	B						
Anti-wear protection sleeve	With ceramic protection sleeve	C						

- ☞Special-requirement zirconia oxygen analyzers can be customized according to user requirements; please ask our company for the relevant model descriptions.
- ☞The APT-EX6000 smart electronic transmitter provides an analog 4～20mA two-wire output (load ≤750Ω).
- ☞When selecting the instrument, please make the selection according to the description in the "Description" column of the above table, so as to avoid production scheduling and delivery errors.
- For example: APT-EX-T-A-C-A-A-0-0 corresponds to the following instrument parameters: a zirconia probe with 1 m insertion depth, for a measuring point flue gas temperature ≤700℃, equipped with a cup-type silicon carbide ceramic filter protective sleeve.
- ☞The insertion depth of the APT-EX6000 zirconia probe refers to the dimension from the zirconia probe flange to the top of the filter.

Chapter 4 Instrument Composition

4.1 APT-EX6000 Series Split-Type Zirconia Oxygen Analyzer

- The APT-EX6000 split-type zirconia oxygen analyzer can be roughly divided into 3 parts: the smart electronic transmitter, the zirconia probe, and the probe adapter.
- Features of the split-type zirconia oxygen analyzer:
  - Convenient maintenance: Because of the split-type design, maintenance and operating personnel do not have to be in the relatively harsh probe installation environment to perform setting and calibration operations on the instrument.
  - Reduced cost: The harsh use environment makes the oxygen probe essentially a consumable; after several years of use, the zirconia probe generally needs to be replaced.

The split-type structure allows users to avoid replacing the smart electronic transmitter part of the analyzer, effectively reducing the user's cost of use.

- Flexible application: The split-type structure allows users to flexibly configure zirconia probes and smart electronic transmitters among multiple measuring points; after reconfiguration, only one calibration operation is needed before putting it into use.

- In the split-type zirconia oxygen analyzer, the smart electronic transmitter and the zirconia probe are separated and connected by a cable. On the zirconia probe part, depending on the working conditions, related accessories such as filters, anti-wear protection sleeves, and high-temperature flow-guide devices need to be installed, so that the oxygen probe can operate stably under different working conditions. The split-type zirconia oxygen analyzer + adapter can be applied in the following forms:

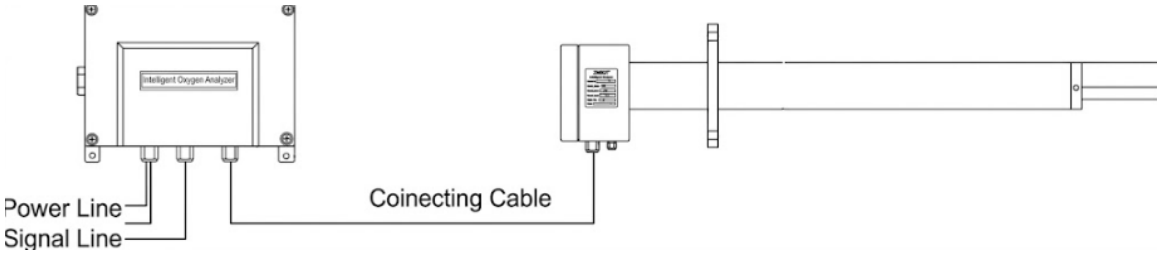


Figure 4-1 APT-EX6000 zirconia oxygen analyzer direct-insertion application (suitable for working conditions where the measured medium temperature is < 700℃ and there is no severe scouring)

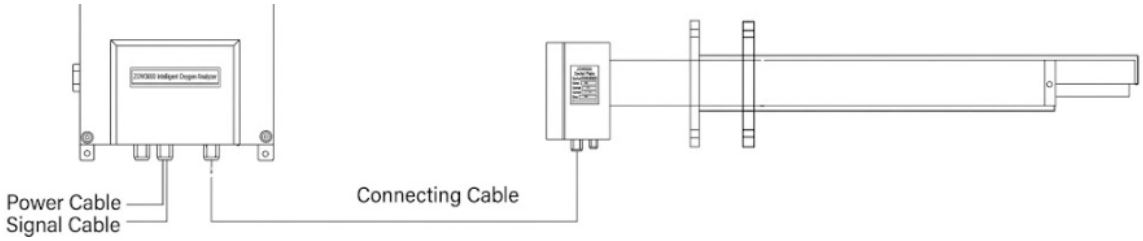


Figure 4-2 APT-EX6000 zirconia oxygen analyzer + anti-wear protection sleeve application (suitable for working conditions with severe scouring)

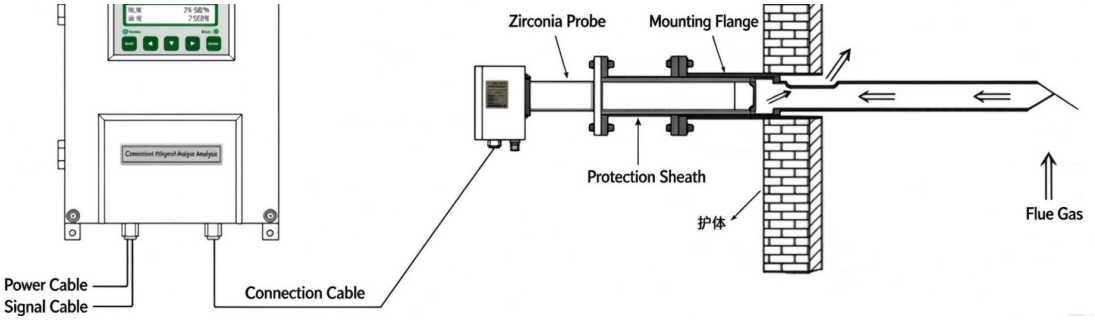


Figure 4-3 APT-EX6000 zirconia oxygen analyzer + natural flow-guide device application (suitable for working conditions where the measured medium temperature is < 1150℃ or with high humidity and a negative pressure ≤500Pa)

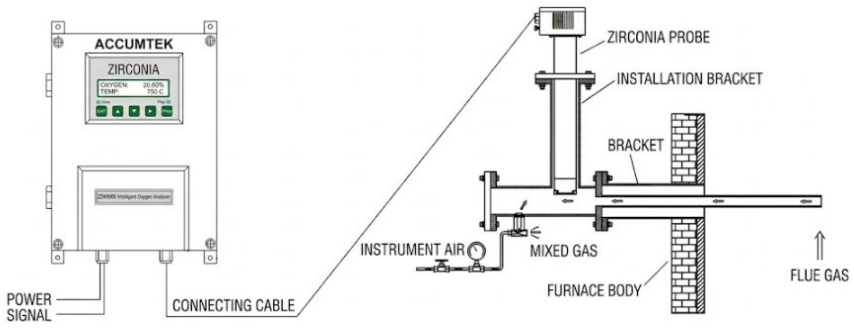


Figure 4-4 APT-EX6000 zirconia oxygen analyzer + extraction-type drainage device application (suitable for working conditions where the measured medium temperature is < 1400℃ or with high humidity and a negative pressure ≥500Pa)

4.1.1 APT-EX6000 Split-Type Zirconia Probe

- The zirconia probe, as the most important part of the instrument, mainly functions to complete the measurement of the oxygen content in the target medium.
- The zirconia probe needs to be selected after clarifying the relevant parameters of the working conditions according to the different working conditions. Users need to provide the composition, temperature, pressure, flow rate and humidity of the measured medium, and then select different insertion depths according to the wall thickness and diameter of the flue or pipe. We generally recommend a probe length of wall thickness + 400mm. For special working conditions, it can be extended.
- For different working conditions, the probe material can be selected from suitable materials such as SUS316\SUS316L\SUS310S\Monel alloy and Hastelloy. The material of the standard APT-EX6000 zirconia probe is SUS316L.
- Each zirconia probe must be equipped with adapters such as a filter at the measuring end according to the working conditions, so as to avoid damage to the zirconia probe under harsh working conditions.
- The zirconia probe must be inspected, maintained and calibrated at least once within 6 months.
- When replacing the zirconia cell in the zirconia probe or performing maintenance work, please be sure to proceed in accordance with the requirements of this manual, so as to avoid damage to the zirconia probe.
- The zirconia probe contains many glass and ceramic parts; do not knock them during maintenance, handling or installation!
- The front end of the zirconia probe and the terminals must not get wet!
- For the zirconia probe model and suffix code description list, please refer to Chapter 3.

4.1.1.1 APT-EX6000 Zirconia Probe Technical Specifications

- Probe material: 316L or 904L (customizable)
- Protection class: IP66
- Plug-in structure: oxygen sensor, filter, heating furnace and thermocouple can all be replaced individually on site
- Ambient conditions: ambient temperature -40～85℃
- Flue gas temperature: flue gas temperature ≤700℃
- Flue gas flow rate: 0~55m/s
- Flue gas pressure: -10KPa ~ +10KPa
- Mounting method: flange mounting (customizable)
- Response time: ≤0.5S; (T90) ≤5S
- Heating time: about 20min
- Insertion depth: 0.3, 0.6, 1.0, 1.5, 2m; special requirements can be customized.
- Accuracy: ±1% of range or ±0.1% of reading
- Average life: 4-7 years

4.1.1.2 Appearance and Dimension Drawing of the Zirconia Probe

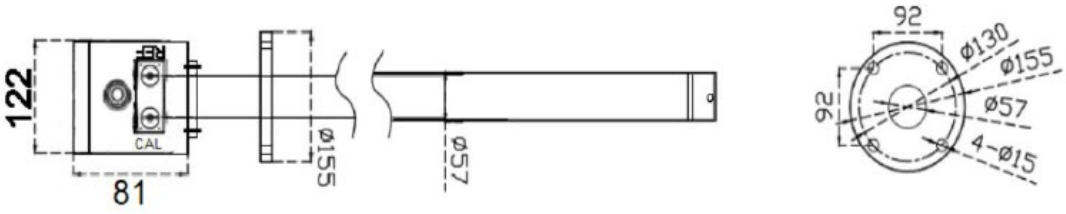


Figure 4-5 Appearance and dimension drawing of the zirconia probe

4.1.1.3 Zirconia Probe Ordering Instructions

- When ordering a zirconia probe separately, if no requirements for accessories are raised, the zirconia probe will be equipped with 1 standard flue gas filter and sealing gasket.

- When ordering a zirconia probe separately, if no requirements for accessories are raised, the standard gas inlet of the zirconia probe will be provided with a standard φ8 connector.
- When ordering a zirconia probe separately, if no requirements for accessories are raised, the mounting flange of the zirconia probe will be provided as a standard PN0.6 DN65 flange.
- When installing the zirconia probe or performing calibration operations on the oxygen probe, be sure to check whether the standard gas inlet of the zirconia probe has been closed after the work is completed.
- When ordering a zirconia probe separately, be sure to confirm that the required zirconia probe model matches the user's working conditions, and be sure to provide the accurate model, or provide the operating temperature, humidity, pressure, flow rate and measured medium under the working condition environment.

Each zirconia probe is equipped at the factory with the accessories in the following table.

Table 4-1

Name	**Quantity**	**Description**
Filter	1	Installed at the tip of the zirconia probe
Sealing gasket	1	Inside the packing box
Certificate of conformity	1	Attached to the surface of the instrument
Nameplate	1	Attached to the surface of the instrument

4.1.2 Zirconia Probe Adapter

The zirconia probe needs to operate in harsh environments for a long time; for different working condition environments, the zirconia probe needs to be equipped with different adapters so that it can operate stably and reliably.

The APT-EX6000 zirconia probe adapters can be divided into: filter, anti-wear protection sleeve, natural flow-guide measuring device, extraction-type drainage measuring device, and sealing gasket.

4.1.2.1 Probe Filter

- The filter is suitable for, for example, ordinary power plant boilers and heating furnaces, where the medium temperature is ≤700℃. It prevents the zirconia sensor from being abraded and attached by dust.

- If the filter is not cleaned in time, it may cause the negative effect of a slow response; users had best clean the filter at least once within 4 months after the zirconia probe is put into use.
- The filter can be replaced very conveniently; it is recommended to replace it once a year.
- Each zirconia probe is equipped with at least one filter at the factory.

4.1.2.2 Anti-Wear Protection Sleeve

- The zirconia probe anti-wear protection sleeve is mainly used in working condition environments with severe gas scouring, effectively ensuring that the zirconia probe will not be damaged by scouring.

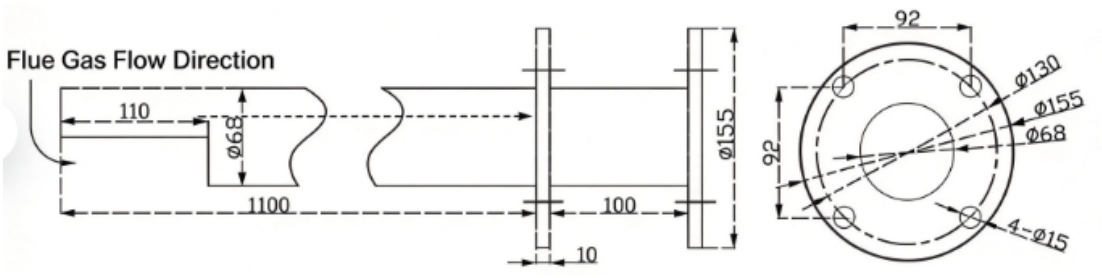


Figure 4-6 Structure and dimension drawing of the anti-wear protection sleeve

4.1.2.3 Natural Flow-Guide Measuring Device

- The zirconia probe flow-guide tube is generally used in working condition environments where the measured gas temperature is greater than 700℃ and less than 1000℃. When used in this temperature range, the zirconia probe will be shortened to a position flush with the inner wall, effectively avoiding the possible impact of high-temperature gas; the flow-guide tube can guide the gas at the target position of the measuring point to the detection position of the zirconia probe for oxygen concentration measurement. The ash leakage port facing away from the flue gas flow direction can return most of the ash and dust to the flue gas.

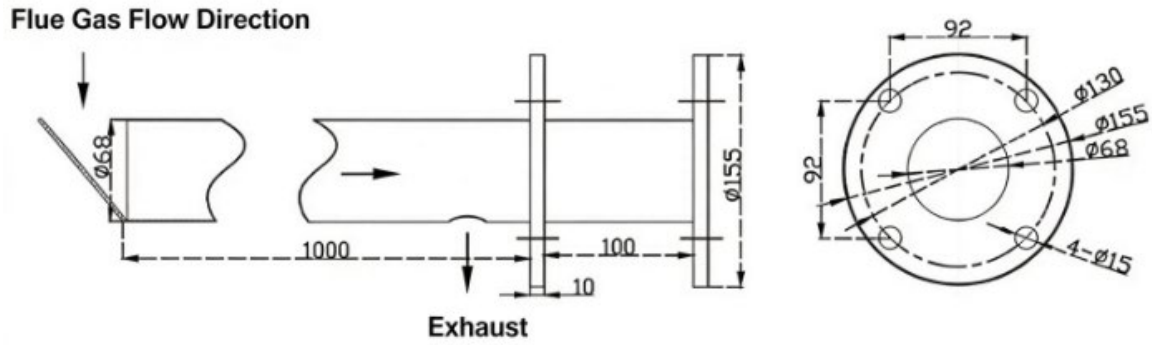


Figure 4-7 Structure and dimension drawing of the natural flow-guide measuring device

4.1.2.4 Extraction-Type Drainage Measuring Device

- The extraction-type drainage measuring device is used in working condition environments where it is not suitable for the zirconia probe to directly enter the gas for measurement, such as when the gas temperature is > 950℃ or the humidity in the measured gas is relatively high.
- The extraction-type drainage measuring device can be equipped with a jet pump, suitable for working condition environments with a relatively large gas negative pressure (> 500Pa). The use of a jet pump requires a site supply of > 200Kpa of filtered compressed air or instrument air.
- The drainage tube of the extraction-type drainage measuring device can be optionally made of materials such as silicon carbide, SUS316L, SUS310S and Hastelloy, suitable for working condition environments such as high temperature, high humidity and high corrosion.
- The extraction-type drainage measuring device has 3 functional holes, allowing users to clean the sampler without disassembling it. After cleaning, be sure to seal them firmly.

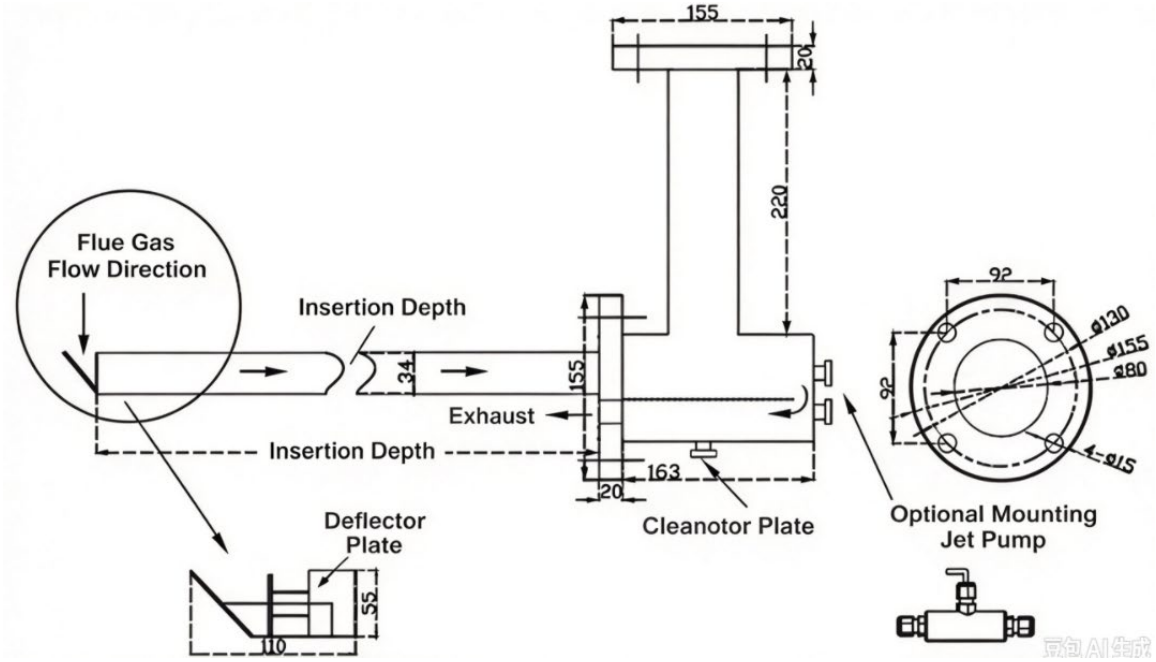


Figure 4-8 Structure drawing of the extraction-type drainage measuring device

4.1.3 APT-EX6000 Smart Electronic Transmitter

- The smart electronic transmitter is an important part of the instrument, with the important functions of completing the acquisition and calculation of the oxygen signal, parameter setting, temperature control, transmission output and data display, instrument calibration, and alarm output.

- The APT-EX6000 zirconia oxygen analyzer has powerful functions and can complete the following operations to meet different user needs. For the specific operations and function descriptions, please refer to Section 6.3 of this manual.
    - ☞ Two-point parameter online calibration of oxygen content
    - ☞ Calibration of the 4-20mA analog output
    - ☞ Setting of upper/lower limit alarm nodes
    - ☞ Setting of the range corresponding to the analog output
    - ☞ Setting of the zirconia probe heating power
    - ☞ Setting of the data acquisition frequency
    - ☞ Setting of the data hold function
    - ☞ Setting of the communication mode and communication address
    - ☞ Setting of user-side parameters
- The APT-EX6000 operation adopts a convenient menu-style operation. Whether it is calibration or setting of the instrument, it can be carried out very conveniently.
- When installing the APT-EX6000 smart electronic transmitter, be sure to avoid installing it in harsh environments such as high temperature, high humidity and vibration. For outdoor installation, a rainproof box must be added.

4.1.3.1 Technical Specifications of the APT-EX6000 Smart Electronic Transmitter

- Dimensions: 251 (H) × 192 (W) × 127 (D) mm
- Protection class: IP66
- Display: LCD screen two-line display; Chinese menu interface
- Measuring range: 0～21 vol% (0～30% settable)
- Calibration operation: single-point, two-point parameter online calibration
- Power supply: 198~242VAC/50～60Hz
- Heating power: average 50W (up to 200W can be provided)
- Heating temperature: 750℃ or 820℃
- Temperature control accuracy: ±1℃

- Ambient conditions: ambient temperature -40～85℃, relative humidity ≤97%
- Output signal: 4～20mA DC (maximum load 750Ω)
- Digital communication: optional RS485
- Measurement accuracy: displayed value ±0.1%
- Average life: 6-10 years

4.1.3.2 Appearance, Dimensions and Terminals of the APT-EX6000 Smart Electronic Transmitter

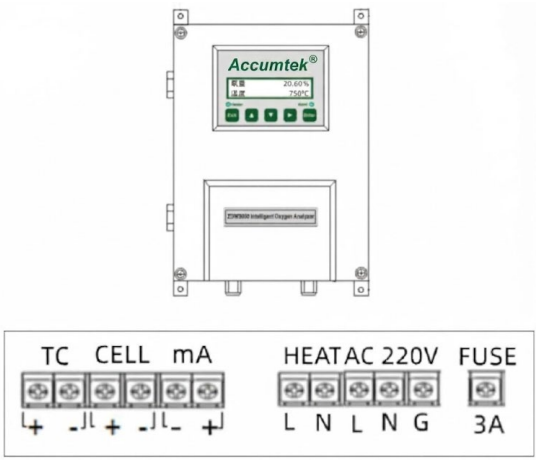


Figure 4-9 Appearance, dimension and terminal drawing of the APT-EX6000 smart electronic transmitter

Each smart electronic transmitter is equipped at the factory with the accessories in the following table.

Table 4-2

Name	**Quantity**	**Description**
Mounting bracket	1	Placed inside the packing box
Certificate of conformity	1	Attached to the surface of the instrument
Nameplate	1	Attached to the surface of the instrument

Chapter 5 Instrument Installation

This chapter describes the installation of the following types of equipment:

- 5.1 Installation of the furnace body opening and furnace body flange
- 5.2 Installation of the zirconia probe adapter
- 5.3 Installation of the zirconia probe
- 5.4 Installation of the smart electronic transmitter
- 5.5 Wiring and piping
- 5.6 System connection mode

5.1 Measurement Point Selection and Furnace Body Flange Installation

5.1.1 Measurement Point Selection

- The selection of the oxygen measuring point should follow these principles: whether the measured medium is representative of the monitoring purpose, whether the working conditions of the measuring point meet the detection conditions of the instrument, whether the measuring point can be installed and maintained as simply and conveniently as possible, and whether the working condition environment of the measuring point will have a significant impact on the life and reliability of the instrument. Do not select positions with relatively large eddies in the measured medium, and do not select corner positions where the measured medium flows poorly.
- Recommended measuring point position: medium temperature between 300℃～600℃, medium pressure ±0～3000Pa, medium flow rate 1～25m/s. For general power plant boilers, it is generally more appropriate to select the inlet and outlet of the secondary economizer and the inlet and outlet of the air preheater.
- Because the reference gas of the zirconia probe uses naturally convected air, the ambient air around the measuring point is required to be a constant value without corrosive gas.
- The measuring point is free of vibration.
- The ambient temperature of the measuring point is ≤85℃.
- The measured medium at the measuring point has no relatively large pressure fluctuations.

5.1.2 Measurement Point Opening and Mating Flange Installation

- The measuring point needs to have an opening with a diameter of Φ80mm to fix the mating flange.
- If the length of the zirconia probe exceeds 1.5 m (or the length of the flow-guide tube or anti-wear tube exceeds 1.5 m), the opening needs to be selected in the vertical direction of the measuring point, so as to avoid abnormal measurement of the equipment caused by an excessive shift of the center of gravity.

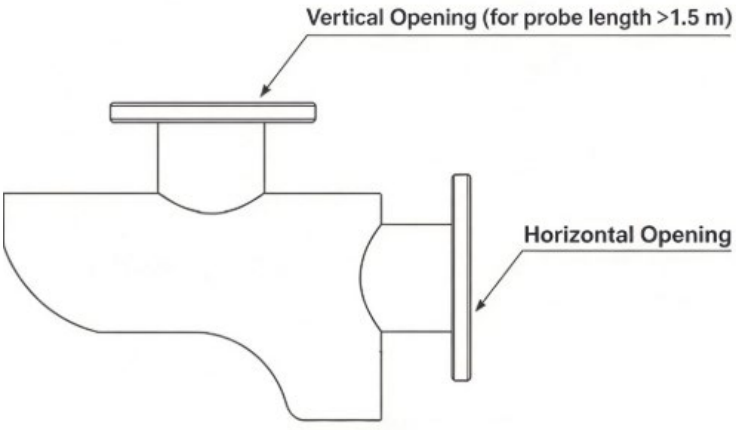


Figure 5-1 Horizontal and vertical opening drawing,

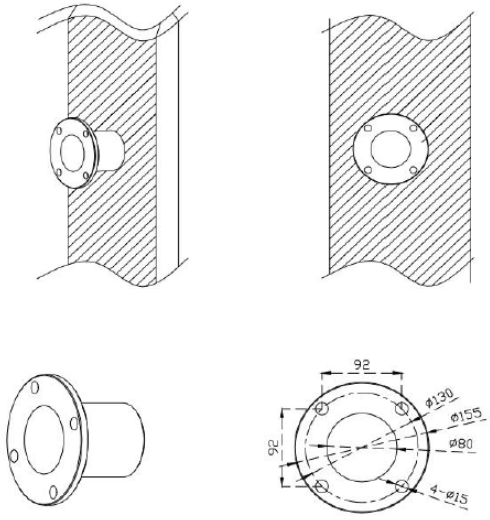


Figure 5-2 Welding and embedding drawing

- If the furnace wall mating flange provided by our company is selected, a short tube with a height of 100mm has already been welded on the flange; users only need to weld the flange onto the outer steel plate of the furnace wall. If the outer furnace wall has no outer protective

steel plate, please lengthen the flange short tube on site and embed the short tube into the opening for fixing.

- The mating flange is a 4-hole PN0.6 DN65 flange. Considering that the APT-EX6000 zirconia probe may be equipped with various sleeves, our company has modified the center hole diameter of the PN0.6 DN65 flange to φ80, with a material of SUS316. To facilitate on-site welding, the flange short tube provided by our company is made of ordinary carbon steel (customizable).
- When fixing the flange, please ensure that the 4 bolt holes of the flange are arranged in the horizontal direction.

5.2 Installation of the APT-EX6000 Zirconia Probe Adapter

The installation forms of the zirconia probe can be divided into: direct-insertion installation, flow-guide installation, anti-wear installation and sampling installation.

Regardless of which installation form is adopted for the zirconia probe, a filter or dust cover needs to be installed at the front end of the probe.

5.2.1 Filter Installation

- When installing the filter, place the filter at the tip of the probe and tighten it clockwise with a hook wrench. To remove it, unscrew it in the reverse direction with a hook wrench.
- There are 2 types of filter structures: cup-type filter and flat filter.
- The filter material includes alloy steel and silicon carbide ceramic.

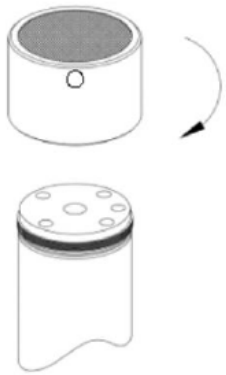


Figure 5-3 Filter installation drawing

5.3 Installation of the APT-EX6000 Zirconia Probe

- Under different working condition environments, the zirconia probe needs to adopt different

installation forms, so as to better adapt to the working condition environment and ensure that the instrument operates stably and reliably.

- According to the differences in parameters such as the medium temperature, flow rate, pressure, abrasion and humidity of the working condition measuring point, the zirconia probe can be roughly divided into ①direct-insertion installation; ②anti-wear protection sleeve installation; ③natural flow-guide measuring device installation; ④extraction-type drainage measuring device installation.

5.3.1 APT-EX6000 Zirconia Probe Direct-Insertion Installation (Medium Temperature ≤700°C)

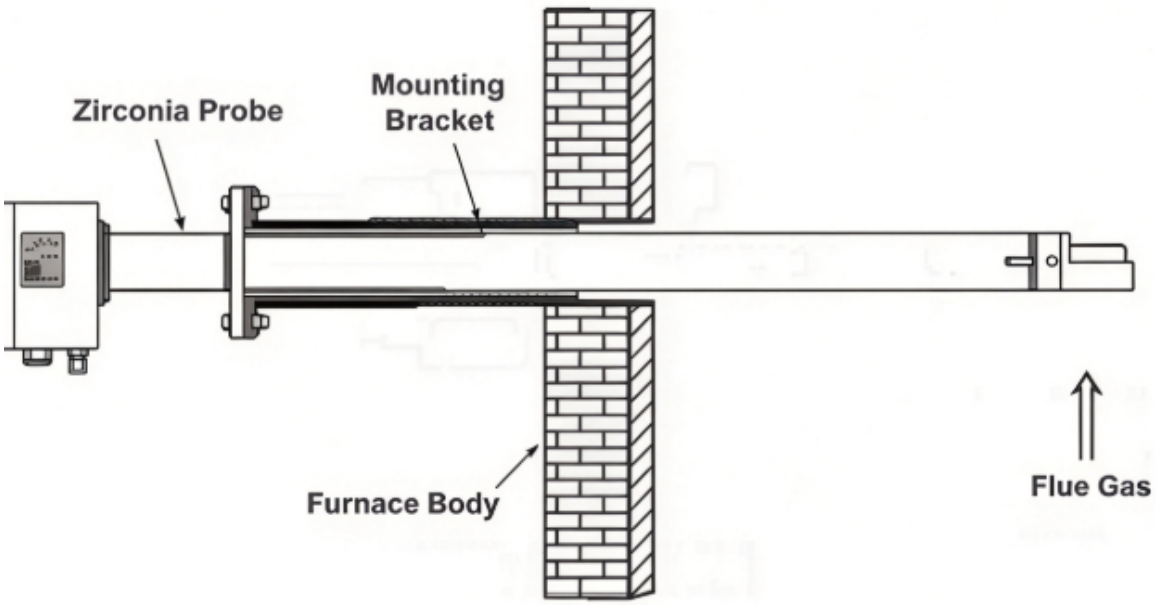


Figure 5-4 Direct-insertion installation of the zirconia probe

5.3.2 APT-EX6000 Zirconia Probe Anti-Wear Protection Sleeve Installation (used with an anti-wear protection sleeve. Working conditions with severe scouring)

- The material of the anti-wear protection sleeve differs according to the length of the zirconia probe. For an oxygen probe length within 800mm, a silicon carbide / corundum protective tube is used. For a zirconia probe length of 800mm～1500mm, a molybdenum-vanadium alloy protective tube is used. It is applied to working condition environments with relatively large medium scouring.
- Because the anti-wear protection sleeve has a relatively large specific gravity, for horizontal

installation, it is recommended to use a DN80 or DN100 mounting flange, so as to avoid the probe sinking caused by a shift of the center of gravity. This is not necessary for a vertically installed zirconia probe.

- The length of the anti-wear protection sleeve is selected as: zirconia probe length + 200mm. A slot with a width of 20mm is opened at the front end of the anti-wear protection sleeve. When installing, the slot must face away from the gas flow direction.

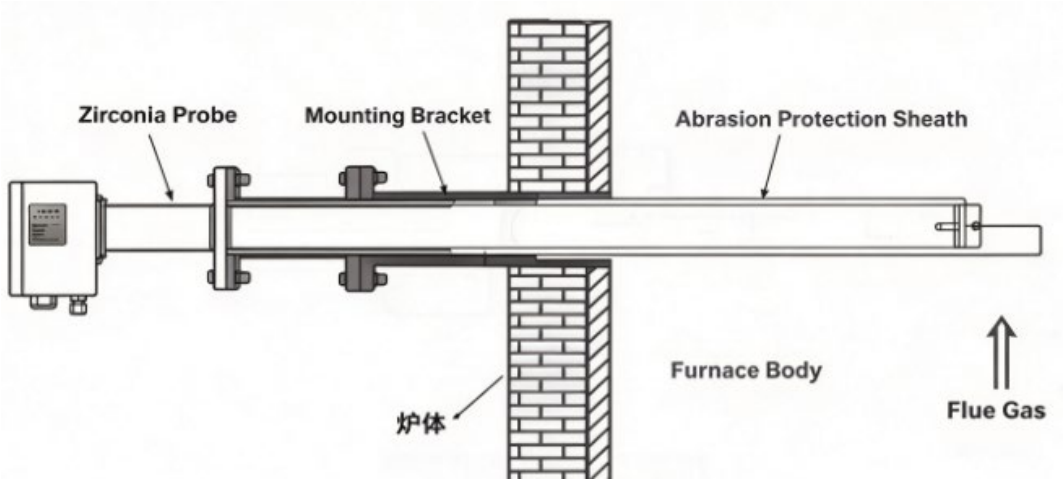


Figure 5-5 Dimension and installation drawing of the anti-wear protection sleeve

5.3.3 APT-EX6000 Zirconia Probe Natural Flow-Guide Measuring Device Installation (used with a flow-guide tube, 700℃ ≤ medium temperature ≤ 1000℃)

- The opening direction when installing the flow-guide tube is very important; be sure to face the opening of the front-end baffle of the flow-guide tube toward the airflow direction.
- The material of the flow-guide tube is SUS310S, and the length can be customized according to user requirements.
- Although an ash leakage hole is opened on the flow-guide tube, because the opening of the flow-guide tube faces the airflow direction, there is a great possibility of dust accumulation. It is recommended that users clean it at least once within 3 months after putting it into use.
- When using the flow-guide tube under negative-pressure working conditions, be sure to ensure that the mounting flange bolts are tightened and sealed, so as to prevent the outside atmosphere from entering the zirconia cell at the tip of the zirconia probe along the flow-guide tube under the action of negative pressure, causing an increase in oxygen concentration.

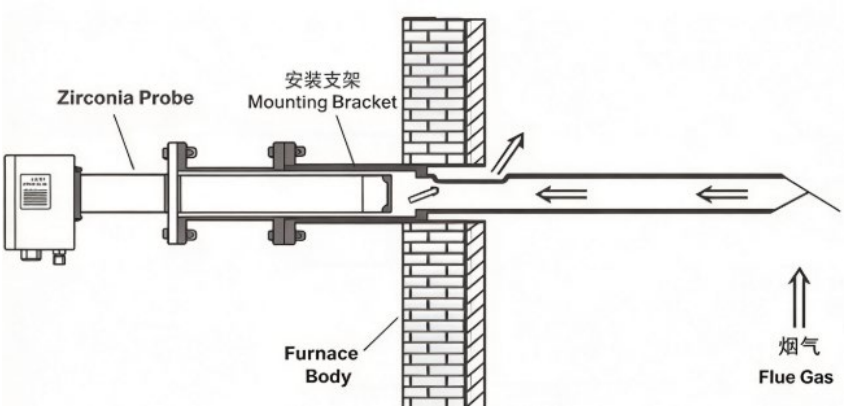


Figure 5-6 Natural flow-guide measuring device installation of the zirconia probe

5.3.4 APT-EX6000 Zirconia Probe Extraction-Type Drainage Measuring Device Installation (1000℃ ≤ medium temperature ≤ 1450℃ or high-humidity working conditions)

- In the vast majority of cases, the flue gas sampler is used with a 200mm-long zirconia probe. When the measured medium is under positive pressure or negative pressure ＜500Pa, the measured gas can be directly introduced into the measuring chamber for measurement through the baffle installed at the front end of the drainage tube.
- The zirconia probe must be installed vertically downward on the flue gas sampler.
- When the flue gas sampler is applied to a measured medium temperature ≥1000℃, the sampling tube needs to be made of silicon carbide or corundum material.
- If the negative pressure of the measured medium is ＞500Pa, a flue gas sampler containing a jet pump needs to be selected; the installation position needs to be equipped with clean compressed air or instrument air with a pressure of not less than 2Kg, and a valve body that can adjust pressure and flow needs to be installed on the pipeline. The exhaust of the jet pump has two modes: internal exhaust and external exhaust. The external exhaust mode is not affected by the pipeline pressure, and its sampling reliability is higher than that of the internal exhaust mode.
- The airtightness when installing the flue gas sampler is very important; be sure to firmly tighten the sealing bolts on the sampler.
- The outer surface temperature of the flue gas sampler is relatively high; on-site personnel must not touch it for a long time. A "High Temperature" warning sign should be hung. Alternatively, when ordering, a dedicated external insulation sleeve can be customized.
- At the front end of the sampling tube of the flue gas sampler, a baffle or filter can be installed according to the on-site working conditions (it is recommended to install a filter if the on-site working conditions have relatively high humidity and relatively high positive

pressure. It is mostly used for the desulfurization inlet under positive pressure and a small part of the positive-pressure outlet).

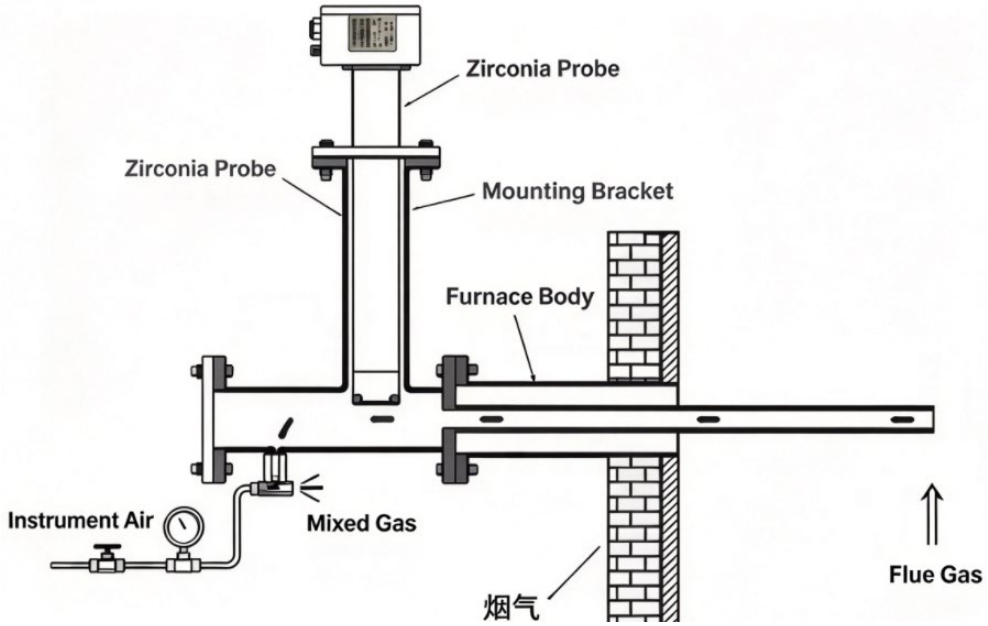


Figure 5-7 Dimension and installation drawing of the sampler with a jet pump

◆Caution: The zirconia probe must be installed vertically on the flue gas sampler, and be sure to point the head of the zirconia probe downward (as shown in the above figure); otherwise, it is very likely that the instrument will be damaged due to severe ash accumulation or water deposition!

◆Caution: When installing the sampler and the zirconia probe in cold regions and environments, please use insulation material to insulate the outside of the sampler, so as to avoid the measured medium condensing into water and damaging the zirconia probe.

- The selection of the zirconia probe adapter needs to be made according to the working conditions. For the characteristics and functions of several adapters, please refer to Sections 4.1.2.1, 4.1.2.2, 4.1.2.3 and 4.1.2.4 of this manual.

5.3.5 Sealing Gasket

- The standard configuration of the sealing gasket uses asbestos material. If the medium temperature is relatively high, it is recommended to use a stainless steel gasket.
- An asbestos sealing gasket will harden and crack after long-term use; if this problem is found during the routine inspection of the instrument, please replace it with a new asbestos sealing gasket in time.

5.4 Installation of the APT-EX6000 Smart Electronic Transmitter

The installation position of the smart electronic transmitter should meet the following installation conditions:

- The surrounding ambient temperature is ≤60℃, and the temperature change is not severe.
- The surrounding ambient humidity is ≤90%RH, free of corrosive gas, and free of condensation.
- Free of vibration.
- For outdoor installation, add a rainproof box.
- As close to the probe as possible.
- Convenient for maintenance and inspection.
- Try to avoid direct sunlight on the display panel, which would cause difficulty in observation.
- Try to stay away from equipment such as large motors, contactors and excitation relays that may cause interference to the instrument.
- The external smart electronic transmitter can be mounted on a wall or a metal bracket.

5.4.1 Installation of the APT-EX6000 Smart Electronic Transmitter

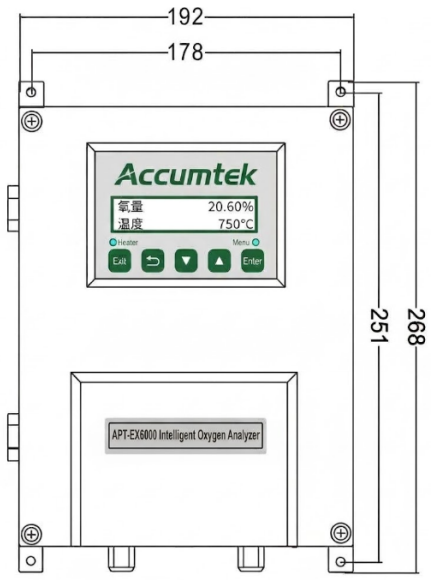


Figure 5-8 Installation schematic diagram

5.5 Wiring and Piping

5.5.1 Precautions for Wiring and Pre-Piping

Applicable to the split-type zirconia oxygen analyzer system under our company's designation.

- The protective tube of the system connection cable can use a standard 4-fen or 6-fen steel pipe. Try to lay it through a cable tray.
- Between the terminal box of the instrument and the cable protective tube, it is recommended to use an M25 metal hose for connection.
- For the installation method of the sampler, if instrument air needs to be introduced, please lead the on-site instrument air outlet as close to the equipment as possible, and install a valve body at the instrument air outlet so as to adjust the pressure and flow of the instrument air.
- At cable turning positions, be sure to use a junction box for transfer, for the convenience of future maintenance and inspection.
- Try to lay the power cable and the signal cable separately, so as to avoid interference with data measurement.
- Try to keep the cable laying path away from positions such as large electrodes, contactors and excitation relays that may cause signal interference.
- After all lines are connected, be sure to perform a line check operation; otherwise, do not supply power to the equipment.
- An air switch or circuit breaker should be installed for the power supply of the instrument.
- Be sure to connect the shielding wire of the cable to the "G" of the instrument terminal.
- When laying cables, please consider future maintenance and replacement, and be sure to leave sufficient length margin.
- When laying cables, be sure to avoid high-temperature areas (≥85℃), so as to avoid cable damage.

5.5.2 Wiring Specifications of the APT-EX6000 Zirconia Oxygen Analyzer

The connection cables of the APT-EX6000 series split-type zirconia oxygen analyzer are configured according to the following specification table.

Table 5-1

Transmitter terminal name	Zirconia probe terminal name	Name	Shielding required	Cable type	Number of conductors	Remarks
CELL + \CELL -	CELL + \CELL -	Oxygen potential signal	●	RVVP	2	If the cable laying path cannot avoid high-temperature areas (≥85℃), please use high-temperature fire-resistant special cable
TC + \TC -	TC + \TC -	Thermocouple signal	●	RVVP	2	Same as above
HEAT	HEAT	Heating furnace power supply	○	RVV	2	Same as above

Remarks: RVVP conductor cross-section 0.5-1mm. RVV conductor cross-section 0.75-1.5mm. It is recommended that the outer sheath of the conductor have a heat-resistant polyvinyl chloride protective layer.

5.6 System Connection

- The smart electronic transmitter and the zirconia probe of the zirconia oxygen analyzer need 3 groups (6 wires) of connections.
- The external connections of the zirconia oxygen analyzer need 1 group (2 wires) of power cord and 1 group (2 wires) of 4-20mA output wire. If the communication function of the instrument is required, the corresponding communication cable also needs to be laid.
- Be sure to make the connections firm when wiring.
- When wiring, be sure to operate according to the system connection diagram below. Be sure to see clearly the symbol markings on the terminals of the zirconia probe and the smart electronic transmitter.
    - CELL + \CELL - : Oxygen signal
    - TC + \TC - : Thermocouple signal

- HEATER/HEATER: Heating furnace power supply

System wiring between the smart electronic transmitter and the zirconia probe

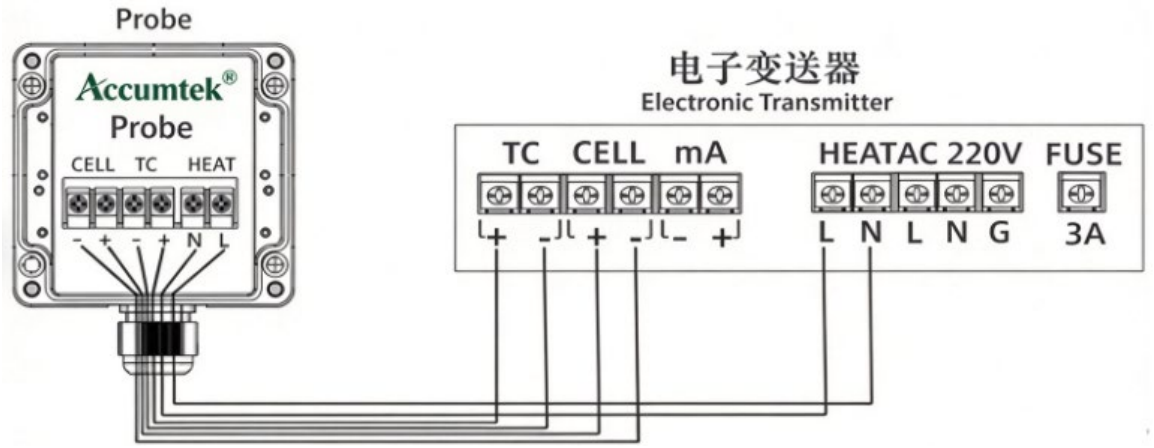


Figure 5-9 System connection diagram of the APT-EX6000 zirconia oxygen analyzer

Table 5-2 Probe terminal block

Item	**Zirconia cell signal**	**Thermocouple signal**	**Heating furnace**		
Terminal No.	1	2	3	4	5	6
Polarity	-	+	-	+	N	L
Wire color	White	Red	Green	Yellow	Blue	Black

- After wiring is completed, be sure to perform calibration work, so as to avoid damage to the instrument due to connection errors.

Chapter 6 Instrument Operation and Calibration

- Before the instrument is powered, be sure to perform calibration operations on the system connection. Ensure that the wiring is correct before powering on, so as to avoid damage to the instrument!
- To avoid the zirconia sensor experiencing too many temperature changes, it is recommended to supply power to the analyzer continuously during the use cycle.
- Each zirconia analyzer has undergone aging tests and calibration at the factory before shipment and can be put into operation directly. If only the zirconia probe is replaced, the user needs to perform an "air calibration" operation on the new probe (refer to Section 6.3.2.3 of this manual) before putting it into use.

6.1 Basic Instructions for Instrument Operation

6.1.1 Structure and Function Description of the APT-EX6000 Zirconia Probe

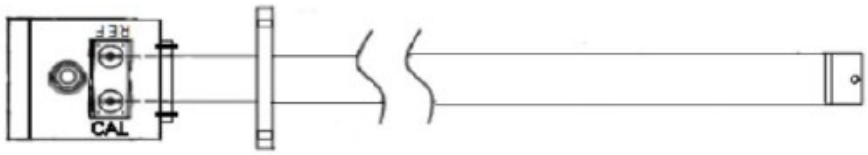


Figure 6-1 Diagram of the structure and functions of the zirconia probe

6.1.2 Basic Description of the APT-EX6000 Smart Electronic Transmitter Panel

(Figure 6-2 APT-EX6000 smart electronic transmitter panel; please refer to the accompanying drawings or ask our company for them.)

Button functions on the instrument panel:

- ▲: Page up interface; 0~9 digit increment
- ▼: Page down interface; 0~9 digit decrement
- ►: Move the cursor to the right
- Enter: Confirmation of options / data.
- Exit: Each press returns to the previous menu level.
- Heater: Status light.
- Maint: Fault light.

6.2 Energization and Commissioning of the APT-EX6000 Instrument

1. After the instrument is powered, the company logo is displayed, with about 3s of self-check operation.
2. After the self-check is completed, the instrument automatically enters the heating state; at this time, the temperature can be observed to start rising. At the same time, the "Heater" status light on the instrument panel lights up ☀.

3. The heating process of the instrument lasts about 20min; when the temperature rises to 600℃, the instrument automatically enters the "oxygen content" display. At the same time, the "Heater" status light on the instrument panel flashes ☀.
4. At this time, observe the heating temperature until it heats stably and controls the temperature to 750±1℃, entering the normal operating state, maintaining the "oxygen content and temperature" display interface; at the same time, the "Heater" status light on the instrument panel stays on ☀.

(Figure 6-3 Instrument energization and commissioning; please refer to the accompanying drawings or ask our company for them.)

6.3 Instrument Calibration and Setting

6.3.1 Description of Instrument Calibration and Setting

- Before shipment, each instrument has been set with the corresponding parameters according to the user's ordering requirements. In addition to routine calibration of the oxygen content, it is not recommended to modify the other setting parameters of the instrument, because such modifications, if operated incorrectly, can easily cause abnormal measurement of the instrument and even damage the instrument.
- To avoid instrument measurement faults caused by user operation errors, our company has specially set a "maintenance password" for the instrument. The maintenance password (set to 0000 at the factory) is for the user to set other parameters of the instrument. The maintenance password can be changed to a new password known to the user.
- The calibration operation of the instrument adopts a menu form, and the display is in the form of "menu content".
- The 2 status indicator lights of the instrument indicate the current display content and working status of the panel.

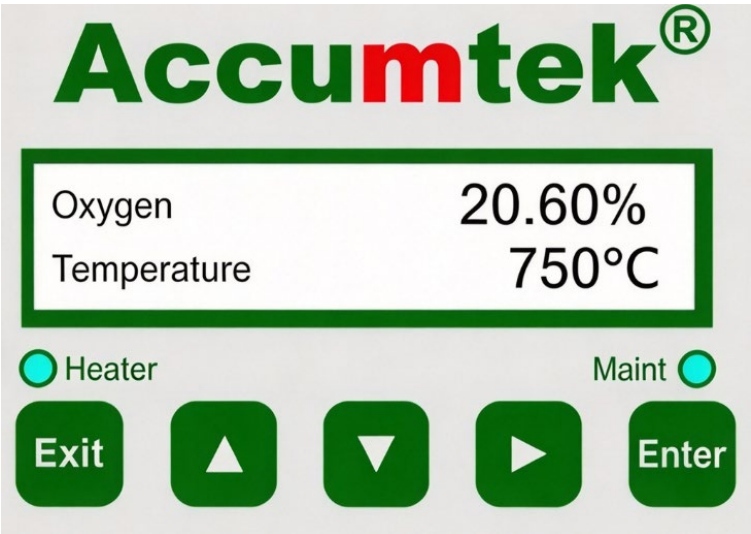


Figure 6-4 Display of the instrument panel

- The APT-EX6000 has powerful operating functions. The following operations can be carried out through the instrument panel. The instrument operation adopts an easy-to-use menu mode, so the instrument can be operated very conveniently. The following table is the description of the relevant functions and menus of the APT-EX6000 zirconia oxygen analyzer.



Figure 6-5 Interface display of the instrument panel,

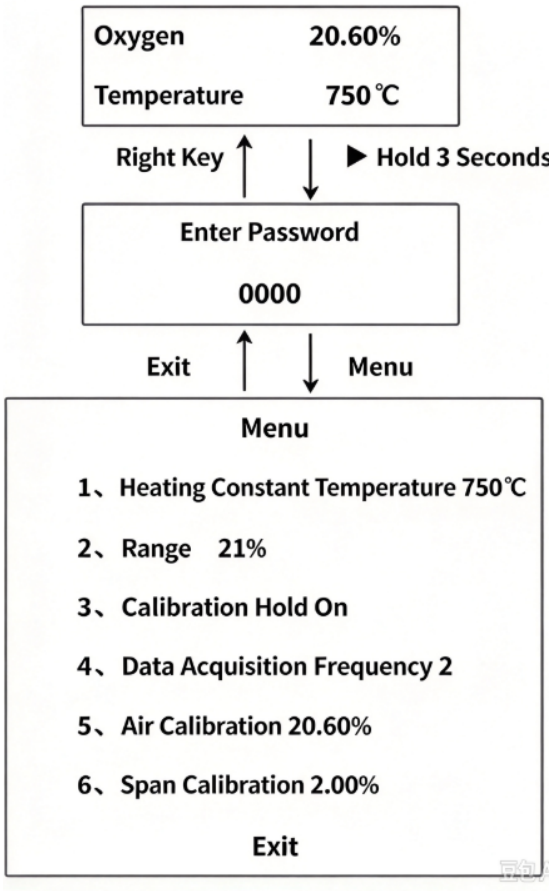


Figure 6-6 Parameter setting display in the menu

Table 6-1 Parameter setting

No.	Parameter name	Description
1	Constant heating temperature	Factory default: 750℃ (can be set to "750℃" or "820℃")
2	Range	Factory default: 21% (settable range 0-30%)
3	Calibration hold	Factory default: On (can be set to "On" or "Off")
4	Data acquisition frequency	Factory default: 2 (settable range 0-9)
5	Air calibration	Factory default: 20.60%
6	Standard gas calibration	Factory default: 2.00% (calibratable range 1~10)

- Each instrument is set with parameters according to the user's ordering requirements at the factory. The factory default settings in the above table refer to the parameters before setting according to the ordering parameters.

6.3.2 Instrument Operation Methods and Steps

6.3.2.1 Online Calibration of Oxygen Content

- In this instrument, menu "5" or "6" is used to calibrate the oxygen content. Menu 5 is air calibration and menu 6 is standard gas calibration.
- When performing online calibration of the oxygen content, be sure to first confirm that the temperature-controlled heating of the instrument is normal (750℃±1℃).
- When performing online calibration of the oxygen content, the user needs to prepare at least one bottle of standard gas. The standard gas uses an O2/N2 composition (nitrogen as the balance gas).
- When introducing the standard gas into the zirconia probe, be sure to follow the order below: open the gas cylinder → adjust the flowmeter output flow to 200ml/min → insert the conduit into the standard gas inlet of the zirconia probe. Never insert the conduit first and then open the gas cylinder, or insert the conduit into the zirconia probe without adjusting the flow properly; because the temperature of the oxygen sensor is 750℃, an excessively severe temperature shock will cause damage to the zirconia sensor!
- When the measured medium is under positive pressure, it is recommended to take out the zirconia probe and perform the calibration operation in ambient air.
- Each time the oxygen content is calibrated, two-point calibration or single-point calibration can be performed as needed.
    1) The two-point calibration sequence is to first introduce the low-point standard gas for calibration, then introduce the high-point standard gas for calibration; after calibration is completed, the curve is automatically corrected and regressed.
    2) The single-point calibration sequence is to introduce the standard gas or air and then perform calibration; after calibration is completed, the curve is automatically corrected and regressed.
- The steps for online calibration of oxygen content are as follows:
    - 1. Air calibration

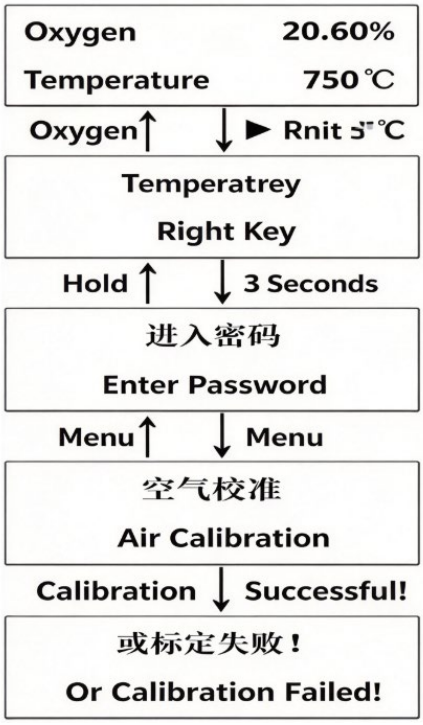


Figure 6-4 Two-point calibration operation steps

○ 2. Standard gas calibration



Figure 6-4 Single-point calibration operation steps

- After the oxygen content calibration is completed, please remember to re-close the "standard gas inlet" of the zirconia probe.

Chapter 7 Instrument Inspection, Maintenance and Troubleshooting

7.1 Inspection and Maintenance of the APT-EX6000 Zirconia Probe

- ★Before inspection or cleaning, please ensure that the probe has cooled naturally, so as to avoid burns.
- ★Do not let the probe cool rapidly or vibrate severely. The zirconia cell is made of ceramic material; extremely rapid cooling and severe vibration will cause damage to the zirconia cell.
- The working conditions of the zirconia probe are generally relatively harsh, mostly in high-temperature or high-humidity, high-dust and corrosive working condition environments. Therefore, the zirconia probe can be regarded as a consumable, and its performance will gradually decline with the use cycle until the end of its life.
- The routine maintenance and inspection of the zirconia probe is very important. It is recommended that users inspect and maintain the zirconia probe at least once within 6 months. Maintain and inspect the various components of the zirconia probe to ensure the normal operation of the instrument.
- The zirconia cell in the zirconia probe is a component that can be disassembled and replaced; users can clean or replace aged or faulty components. The calibration gas pipe of the probe also needs to be cleaned at least once within one use cycle.

7.1.1 Performance Inspection and Judgment of the APT-EX6000 Zirconia Probe Components

- Performance judgment of the zirconia cell: When the instrument is under normal temperature-controlled heating (750℃), open the "standard gas inlet" of the zirconia probe, and the outside air will be drawn into the zirconia cell by negative pressure (under positive pressure, the user needs to take out the oxygen probe and place it in an external air environment). At this time, use a digital multimeter to measure the "CELL±" terminal of the zirconia probe; the resistance value of a normal zirconia sensor should be ＜1KΩ, and the resistance value is relatively stable. The resistance value of a newly shipped zirconia cell is ≤40Ω.
- Performance judgment of the furnace wire: Cut off the power of the instrument, and use a

digital multimeter to measure the resistance value across the "HEAT" terminals of the zirconia probe; the resistance of a normal heating furnace should be about 70Ω～90Ω and stable.

- Performance judgment of the thermocouple: Cut off the power of the instrument; after cooling, use a digital multimeter to measure the resistance value across the "TC±" terminals of the zirconia probe; the resistance value of a normal thermocouple should be 1～5Ω; in the hot state, the resistance value of the thermocouple will increase somewhat.

7.1.2 Performance Judgment of the Adapter

For the filter, check whether there is difficulty in ventilation. For the anti-wear protection sleeve and the high-temperature drainage device, check whether there is dust accumulation and whether there is severe scouring. For high-humidity working conditions, also check whether there is water accumulation and corrosion.

7.1.3 Performance Judgment of the Calibration Gas Pipeline

When introducing the calibration gas, confirm whether an obvious change in oxygen content can be observed. Alternatively, check whether the normal calibration gas flow can be obtained using the previous calibration pressure.

7.1.4 Maintenance of the Zirconia Probe

- The routine maintenance of the zirconia probe is very important. A well-maintained zirconia probe can have a maximum service life of more than 4 years, while a zirconia probe without any maintenance can have a service life of even less than 1 year. The maintenance of the zirconia probe is carried out periodically; do not wait until the measurement of the zirconia probe is abnormal to carry it out, because some components of the probe are irreversible once damaged. It is recommended that users inspect and maintain the zirconia probe at least once within 6 months. The maintenance of the zirconia probe is mainly carried out in the following aspects:
  - ① Inspection and maintenance of the probe as a whole.
  - ② Inspection and cleaning of the zirconia cell.

7.1.4.1 Inspection and Maintenance of the APT-EX6000 Probe as a Whole

- Extract the zirconia probe out of the measured medium, observe whether there are obvious scouring, corrosion and peeling phenomena on the surface of the probe rod, observe whether the filter at the front end of the probe has phenomena such as severe blockage, dust

accumulation, damage and corrosion, and observe whether the sealing gasket has aging and cracking phenomena.

- The probe rod of the APT-EX6000 zirconia probe is made of SUS316L stainless steel as a whole; if scouring phenomena on the surface of the probe rod are observed, such as the surface being cut or damaged, be sure to install an anti-wear protective tube. If the corrosion phenomenon is severe, it is possible that the medium composition described by the user at the time of ordering conflicts with the actual situation; please contact the manufacturer as soon as possible to replace the zirconia probe with a better material. If the measured medium temperature is ≦200℃, the surface of the probe rod can be coated with high-temperature anti-corrosion resin + wrapped with asbestos cloth. If the surface of the zirconia probe has bluish discoloration (tempering color) or peeling of the skin caused by high temperature, check whether the medium temperature at the measuring point exceeds the temperature range at the time of ordering, and contact the manufacturer to help solve it.

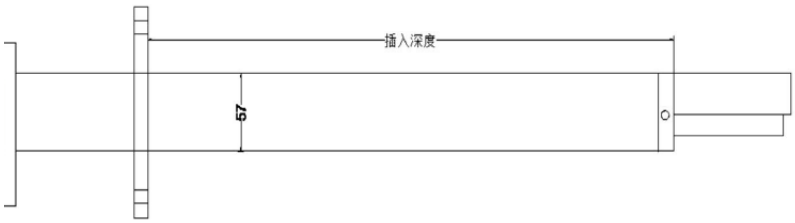


Figure 7-1 Inspection and maintenance drawing of the zirconia probe

- If the filter of the zirconia probe has phenomena such as severe blockage, dust accumulation, damage and corrosion, please replace it as soon as possible.
- If the sealing gasket has aging and cracking phenomena, please replace it as soon as possible.

7.1.4.2 Inspection and Maintenance of the Zirconia Cell

- First, please check and judge the performance of the zirconia cell according to the method in Section 7.1.1 of this manual.
- If the performance of the zirconia sensor is normal, please disconnect the power of the instrument; after the zirconia probe cools naturally, remove the filter at the front end of the probe, and check whether there is ash accumulation and corrosion, and check whether there are drying water marks or sulfur powder residues.
- If there is ash accumulation, clean it. If there is corrosion, water ingress or sulfur powder residue, please contact the manufacturer as soon as possible so as to replace the customized probe adapter that matches the working conditions.
- During the inspection and maintenance of the zirconia cell, be sure to follow the requirements of this manual for the use of the zirconia probe; do not cool too quickly and do not knock it.

7.1.5 Replacement of the APT-EX6000 Zirconia Probe Sensor and Internal Components

- The zirconia cell is a component that can be disassembled and replaced. It will gradually age and fail with the use cycle. Users can replace or repair it according to the following instructions.
- When replacing the zirconia cell, allow enough time for the zirconia probe to cool naturally.
- When storing and handling a new zirconia cell, please be sure not to knock or scratch the outer surface of the zirconia cell!
- When replacing the zirconia cell, the sealing gasket and fixing screws need to be replaced at the same time. If there is any corrosion or oxidation at the tip of the zirconia probe, please use 1500-grit sandpaper to polish it until the surface returns to a smooth and clean state.
- Disassembly and installation steps:
    - ① Remove the filter at the front end of the probe.
    - ② Remove the 4 fixing screws and the related sealing gaskets from the probe.
    - ③ Replace with a new sealing gasket, evenly coat both sides of the gasket with high-temperature sealing paste, and place it at the tip of the zirconia probe.
    - ④ Carefully place the new zirconia cell into the opening at the tip of the probe, aligning the screw holes.
    - ⑤ Tighten the 4 new screws and sealing gaskets evenly by hand, then use a wrench to tighten the screws stably and sequentially in the diagonal direction. Note: be sure to tighten sequentially in the diagonal direction! Be sure that the tightening force of each screw is consistent, 1/8 turn each time! After fixing, observe whether the zirconia cell flange is flush with the end face of the oxygen probe.
    - ⑥ Install the filter at the tip of the probe.

At this point, the disassembly and replacement of the zirconia cell are completed; the user can install the zirconia probe and start the instrument. Be sure to perform at least one air calibration of the oxygen content on the instrument during normal measurement.

(Figure 7-2 Disassembly and replacement diagram of the zirconia cell; please refer to the accompanying drawings or ask our company for them.)

- ★The zirconia cell is made of ceramic material; when disassembling and replacing it, be sure not to use excessive force!
- ★The external electrode of the zirconia cell is a porous platinum electrode; do not scratch or cut it!

7.2 Common Problems

1. Temperature reading low

Inspection item	Inspection method	Normal state	Fault state	Solution	Remarks
TC+/TC- terminal of the transmitter	Use a multimeter to measure whether the DC millivolt voltage is a "negative" signal	"Positive" signal	Thermocouple signal connected in reverse.	Restore the normal connection	If the transmitter only displays the ambient temperature and does not change, it is mostly because the "thermocouple" signal is connected in reverse.
Measure "the two terminals of the furnace" after power off	Use a multimeter to measure the resistance value	70-90Ω	The furnace is open-circuited.	Replace the zirconia probe or return to factory for repair	

2. Temperature reading high

Inspection item	Inspection method	Normal state	Fault state	Solution	Remarks
TC+/TC- terminal of the transmitter	Use a multimeter to measure the DC millivolt voltage of the TC+/TC- terminals	1mvdc signal; the instrument reading corresponds to 25℃ (excluding cold-junction temperature)	Not corresponding. Check whether the internal wiring of the transmitter is loose or disconnected. Abnormal software	Reconnect the cable or return to factory for repair	

Inspection item	Inspection method	Normal state	Fault state	Solution	Remarks
			operation of the instrument.		
TC+/TC- terminal of the transmitter	Use a multimeter to measure the resistance	About 2-5Ω in cold state; the resistance value increases in hot state and should not be > 100Ω	Check the cable connection. Check whether the "thermocouple ±" of the zirconia probe is open-circuited	If the thermocouple is open-circuited, return to factory for repair	

3. Oxygen reading high

Inspection item	Inspection method	Normal state	Fault state	Solution	Remarks
Whether the instrument temperature control is normal	Press the ▲ button and observe the temperature	750℃	Difference from 750℃ exceeds ±50℃	Carry out inspection and treatment according to the temperature fault	
Connecting flange	Whether it is fastened	Fastened	Loose	Press the flange tight	
"Standard gas inlet" of the zirconia probe	Whether it is loose. If a gas circuit is connected, whether the gas circuit has a leak point.	Sealed	There is a leak point	Re-fasten. Eliminate the gas circuit leak point	
Filter of the zirconia probe	Whether it is blocked	Ventilatable	Blocked	Replace the filter	
Open the "standard gas inlet" of the	Use a multimeter to measure the resistance value	≤1KΩ	≥1KΩ	Replace the zirconia cell or the zirconia	

Inspection item	Inspection method	Normal state	Fault state	Solution	Remarks
zirconia probe	across "CELL+" and "CELL-"			probe	
Take out the sensor after the probe cools naturally	Whether it is cracked	Intact	Cracked	Replace the zirconia cell	

4. Oxygen reading low

Inspection item	Inspection method	Normal state	Fault state	Solution	Remarks
Whether the instrument temperature control is normal	Press the ▲ button and observe the temperature	750℃	Difference from 750℃ exceeds ±50℃	Carry out inspection and treatment according to the temperature fault	
Whether the gas humidity is relatively high	On-site observation	No condensation	Relatively high humidity and condensation	Convert the humidity value. Install a sampling-type adapter to reduce the influence of humidity.	
Open the "standard gas inlet" of the zirconia probe	Use a multimeter to measure the resistance value across "CELL+" and "CELL-"	≤1KΩ	≥1KΩ	Replace the zirconia cell or probe	
Understand the working conditions	Whether there is a situation of too small blast volume and	Calibration is normal but the measured value is low. The	Increase the blast, or reduce the fuel, or replace the	Observe the measured value of the oxygen measuring point	

Inspection item	Inspection method	Normal state	Fault state	Solution	Remarks
	relatively high CO content in the flue gas	oxygen content is mostly ≤1%	measuring point	at the rear of the process.	
Take out the sensor	Whether it is cracked	Intact	Cracked	Replace the zirconia cell	

5. Analog 4-20mA output not corresponding

Inspection item	Inspection method	Normal state	Fault state	Solution	Remarks
"4-20mA±" terminal of the transmitter	Use a multimeter to measure the DC milliampere value	Corresponds to the displayed value	Deviates from the displayed value	Enter the menu to adjust	Enter password 0000
"4-20mA±" terminal of the transmitter	Use a multimeter to measure the DC milliampere value	Corresponds to the displayed value	No output	Contact the manufacturer	
Enter the menu	Check the value of the set range	Consistent with the range setting of the host computer	Inconsistent with the range setting of the host computer	Enter the menu to adjust. Or correct the range setting of the host computer	Enter password 0000

◆Caution: When the oxygen content reading deviates, please first perform "oxygen content calibration" according to Section 6.3.2.1 of this manual. When the oxygen content calibration fails, then carry out inspection and treatment according to the methods above.

Maintenance Record

Technical Service Contact Information

- Contact person: Manager Han
- Mobile: 18820905031
- Company email: info@accumtek.com
- Company website:https://accumtek.com/en
- Company address: Fl.2,Bldg.5,Huizhong Industrial park, Daxing Group, Zhongkai High-tech District, Huizhou City,Guangdong Province, China