Huazheng®

On-line Monitoring System of HZGC-1210 Transformer Oil Chromatography

User Manual

Huazheng Electric Manufacturing (Baoding) Co., Ltd

Dear user:

Thank you for choosingOn-line Monitoring System of HZGC-1210 Transformer Oil Chromatography.

We hope that this instrument can make your work easier and more enjoyable, so that you can get the feeling of office automation in the test and analysis work.

Before using the instrument, please read this manual, and operate and maintain the instrument according to the manual to prolong its service life. "Just a light press, the test will be completed automatically" is the operating characteristics of this instrument.

If you are satisfied with this instrument, please tell your colleagues; if you are not satisfied with this instrument, please call (0312) 6775656 to tell you to serve you at all times-Baoding Huazheng Electric Manufacturing Co., Ltd., our company will definitely make you satisfied !

Application

The on-line monitoring system of HZGC-1210 transformer oil chromatogram is used in the on-line analysis and fault diagnosis of dissolved gas in power transformer oil. It is suitable for oil-immersed high voltage equipment in all kinds of voltage grade like power oil filled transformer, electric-arc furnace transformer, reactor and transformer.

Safety Procedure

For those personnel who are responsible for the installation, operation, maintenance and repair of the equipment

◆ Must have relevant professional qualifications

◆ Must follow each line of instructions

◆ Do not play games or browse the web in the data processing server.

◆ In order to avoid unnecessary conflict, do not install additional software in the data processing server.

◆Unprofessional operations or misuse would lead to：

◆ Shorten the equipment lifespan and influence monitoring accuracy

◆ Damage the equipment and other equipment of the user

◆ Give rise to fatal damage

Brief Introduction

The on-line monitoring system of HZGC-1210 type transformer oil chromatogram can realize following functions: automatic circulatory cleaning, oil in, oil and gas separation, sample analysis, data processing and real-time alarm; It could quickly online monitor the content and growth of fault gas dissolved in the oil of oil-immersed power HV equipment transformer like transformers. Through fault diagnosis expert system, it could earlier forecast the hidden trouble of equipment failure, avoiding equipment accidents, so as to reduce the heavy losses and improve the reliability of equipment operation. As a new generation of products in the field of oil chromatogram on-line monitoring, the system will provide stable and reliable solutions for power transformer to realize on-line remote DGA analysis. Therefore, it is the forceful guarantee for the implementation of state overhaul of power system.

HZGC-1210 system is designed on the base of all the advantages of on-line monitoring of oil

chromatogram at home and abroad. So the system has obvious advantages in the aspects of the stability, reliability and accuracy.

♦ On-line testing the concentration and growth rate of H_2、CO、CO_2、CH_4、C_2H_4、C_2H_2、C_2H_6

♦ The method of quantitative cleaning and circulatory sampling could truly reflect the state of gas dissolved in oil.

♦ Oil-gas separation is safe and reliable without any pollution. The users could choose to discharge the transformer oil or not.

♦ It adopted dedicated composite chromatographic column to improve the degree of separation of gas component.

♦ It adopted imported detector to enhance the sensitivity of testing hydrocarbon gases.

♦ The gas detection technique has high stability and precision with ± 10% error range.

♦ Mature and reliable as the communication mode is, it adopted standard networking protocols and could support remote data transmission.

♦ Data collection, adopted the oversampling technology Δ - Σ analog-digital converter with 24-bit resolution and automatic calibration, is highly reliable.

♦ Diverse data display and inquiry modes could provide report and trend chart. The storage life of historical data is 10 years.

♦ It has strong environmental adaptability, widely used in cold, hot, high humidity and high altitude areas.

♦ The performance of anti-interference is outstanding. The electromagnetic compatibility could meet GB/T17626 and IEC61000 standard.

♦ It offered 2 level of alarming set. Alerting signal could spread widely.

♦ Open database could access to LAN of electric system.

In addition, HZGC-1210 system uses modular design with the application of high-performance embedded processors, making chromatography online monitoring system more stable and reliable. It has the following features:

♦ It has faster analysis cycle which can be set by users themselves. The minimum monitoring cycle is 40 to 60 minutes. We recommend setting 24 hours as an inspection cycle;

♦ It takes only 10 minutes to separate oil and gas. It uses special environmental adaptation

technology to eliminate any change of gas distribution coefficient caused by the temperature and humidity changes.

♦Analyzed oil sample adopted the technique of degassing and buffering, removing the mingled bubble in oil sample of reinjection transformer. The technique of multilayer isolated reinjection oiling (return oiling) could guarantee the carried gas would not be taken into the transformer.

♦ The minimum limit of detection of C2H2 can reach 0.1-0.5 μ L/L.

♦ It adopted double circuit and multi-mode thermostatic control with ± 0.1 ℃ temperature control accuracy. The device is equipped with industrial air conditioning which has the function of automatic constant temperature control.

♦ The embedded processor control system is multi-function, combining oil-gas separation, data acquisition, chromatographic analysis, concentration calculation, data alarming, and equipment condition monitoring. Cases like data loss would be avoided, greatly improving the reliability and stability of the system.

♦ Functional interface circuit adopted opto-isolator to further improve the ability of anti-interference.

♦ Via Ethernet, it could realize full-digital and remote data transmission, parameter setting and control.

♦ It improves the function of fault diagnosis, applying modified three ratio method, David trigonometry and cube graphic method to draw the diagnosis result;

♦ It strengthens self-inspection and adds the function of remote maintenance and alarming for equipment abnormality

♦ It supports 61850 communication protocol, providing networking for monitoring equipment of the same kind, so that it can realize concentrated remote diagnosis in a certain area.

♦ The system adopted 19 standard case and high-integrated modular design, which is easy to install and maintain with user-friendly operation.

♦ With wide expandability, it could integrate with other monitoring device conveniently.

♦ The design of non-cylinder saves the time and money to change the carrier gas every year so that after sale maintenance would be much easier. Without high pressure vessel nearby, transformers would be safer, free from any potential risk.

The composition of on-line monitoring system of HZGC-1210 transformer oil chromatography

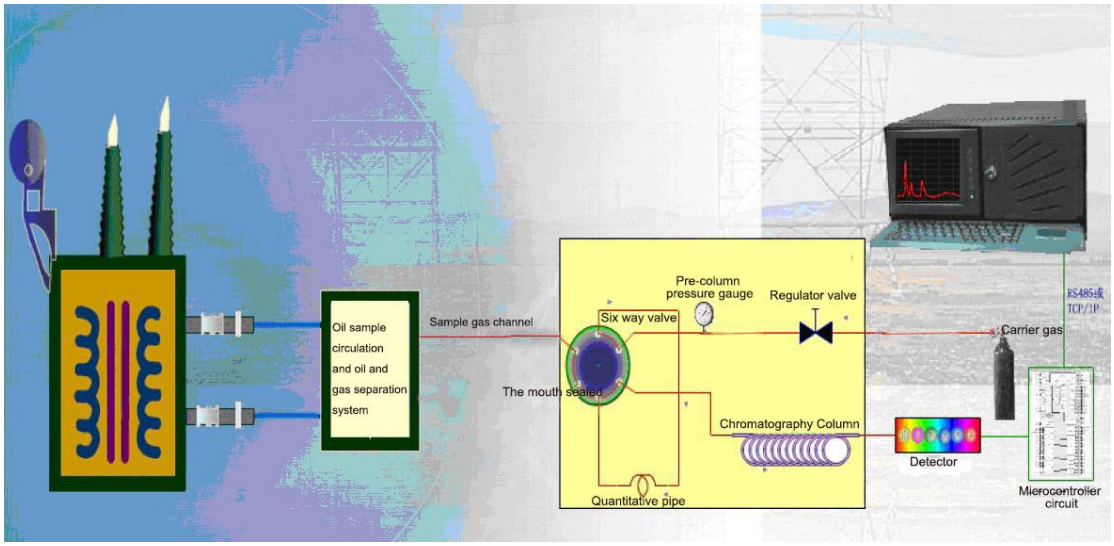
The on-line monitoring system of HZGC-1210 transformer oil chromatogram can be independently operated by the field monitoring host. The field monitoring host includes four high-integrated modules and auxiliary units. Those are chromatographic data collection and processing module, gas-oil separation module, gas detection module and air source module. The chromatograph data collection and processing module contains data acquisition unit, field control processing unit, communication control unit and 61850 communication protocol, etc.; The oil-gas separation module contains cycled sample acquisition unit, quantitative oil sample unit, return unit of oil sample processing and degassing / collecting unit, etc.; The gas detection module contains gas separation unit, constant temperature/current control unit and gas detection unit, etc.; Air source module contains gas generating unit, gas storage unit, purification unit, pressure control and alarm unit, etc.; Auxiliary units including transformer interfaces, oil pipe, communication cables and power cables.

If you do not upload data and alarm value directly by 61850 communication protocol, you shall install computer and monitoring software in master-control room so that you could directly monitor running status of equipment in the main control room.

The working principle of on-line monitoring HZGC-1210 transformer oil chromatography

When on-line monitoring system of HZGC-1210 transformer oil chromatogram is working, oil sample collection unit would start oil-way circulation to dispose the dead oil in connection pipe, then try to set the quantity of oil sample; Oil-gas separation unit would quickly separate the dissolved gas from transformer oil and deliver it to the sample loop of six-way valve for auto injection; prompted by the carrier gas, the sample gas would be separated through chromatographic column, and flow into gas detector in order; data acquisition unit shall complete conversion and acquisition of AD data. The embedded processing unit shall be responsible for the storage, calculation and analysis of the collected data. In addition, the embedded processing unit would upload the data to data procession server (installed in the master control room) via 100m

Ethernet interface. Finally, the monitoring and early warning software would start data processing and fault analysis.



Pic 2.3 Schematic diagram of HZGC-1210 system principle

2.3 The main parameter of on-line monitoring system of HZGC-1210 transformer oil chromatography

No.	Parameter name	value
1	Model	HZGC-1210
2	Working temperature	-40℃～＋70℃
3	Working humidity	Relative humidity5～95%（interior of device shall be free from condensation and ice.）
4	Atmospheric pressure	70kPa～110kPa
5	Power supply	AC 220 V±10% ， 50Hz
6	Monitoring content	Monitor H_2、 CO、 CO_2、 CH_4、 C_2H_4、 C_2H_2、 C_2H_6 in the aspects of Total hydrocarbon, relative growth rate and absolute growth value. (optional to choose the oil with few water content)
7	Analysis and diagnosis	Conduct analysis and diagnosis for the monitoring data via improved three-ratio method, Duval's triangle and cubic graphic method. Provide the original chromatography.

8	Minimum detection period	Range between 40 and 60min, up to user's settings. default 24 hours		
9	Sampling method	Circulatory sampling would reflect the air status in transformers precisely.		
10	Oil-gas separation method	vacuum degassing method		
11	Data storage life	≥ 10 years		
12	Equipped carrier gas	gas generator		
13	Monitored gas	Range of measurement	Lowest detection value	Measuring error
1）	H_2	1 ～ 10000 μ l/l	1μ l/l	±10%
2）	CO、 CO_2	5～ 50000 μ l/l	5μ l/l	±10%
3）	CH_4	0.1 ～ 20000 μ l/l	0.1-0.5 μ l/l	±10%
4）	C_2H_4	0.1 ～ 20000μ l/l	0.1-0.5 μ l/l	±10%
5）	C_2H_6	0.1 ～ 20000 μ l/l	0.1 -0.5μ l/l	±10%
6）	C_2H_2	0.1 ～ 5000 μ l/l	0.1-0.5 μ l/l	±10%
7）	H2O（optional）	1 ～ 800 μ l/l	1μ l/l	±10%
8）	Total hydrocarbon	1 ～ 8000 μ l/l		
9）	Total air content	0.2 ～ 15%		
14	Stability（measured deviation）	Under the same test condition, the deviation of test result shall be no more than 10% （ medium concentration）		
15	Electrostatic discharge immunity	Grade 4，± 8kV—± 15kV		
16	Electrical fast transient immunity	Grade 4，± 4kV		

17	Surge (shock) immunity	Grade 4，± 4kV
18	Earthquake resistance ability：seismic wave is sine wave. Time of duration: three circle wave. Safety factor:1.67	Area with grade 9 seismic intensity： Ground horizontal acceleration 0.4g, ground vertical acceleration 0.2g
		Area with grade 8 seismic intensity： Ground horizontal acceleration 0.25g, ground vertical acceleration 0.125g
		Area with grade 7 seismic intensity： Ground horizontal acceleration 0.2g, ground vertical acceleration 0.1g
19	The temperature of storage and transportation under extreme environment	-40 ℃ ～＋ 80 ℃
20	Protective property of the enclosure	Outdoor installation parts (the system and communication control unit） IP56
21	Boundary dimension	width 585mm × depth425mm × height 1010mm
22	Total weight	125kg
23	Basic size	width 700mm ×depth 380mm × height300mm

Preparations before installing the hardware of on-line monitoring system of transformer oil chromatography

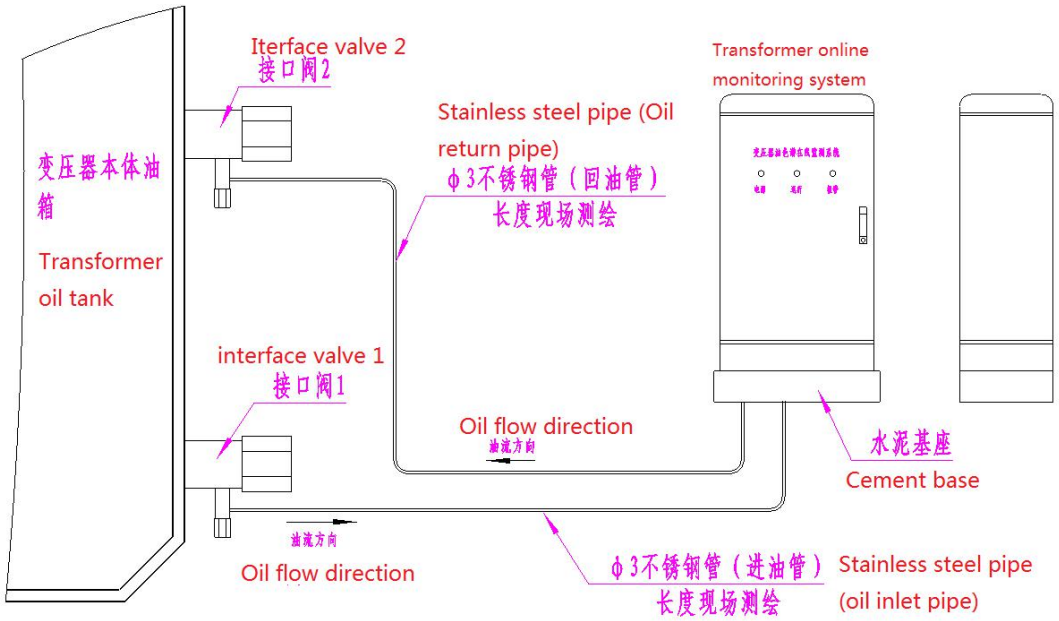
Choose appropriate oil extraction port and oil return port

The on-line monitoring system would firstly extract oil from the transformer, analyze the oil, and then send it back to the transformer. Therefore, it is very significant to choose the oil

extraction port and the oil return port for the accurate analysis of dissolved gas in oil. In order to select appropriate oil extraction port and oil return port, it usually includes the following content:

Confirm the location of oil extraction port and return port

We suggest that extract the oil from the bottom of the transformer, return from the upper part of the transformer. The oil in oil extraction port shall be able to fully represent the oil in the transformer, as shown in Pic 3.1.



Pic 3.1 Connection diagram of oil system

Note

1. It is not recommended to treat the valve in the cooling duct or pressure pipeline as oil extraction (return) port.
2. It is not recommended to share a valve for oil extraction port and oil return port.

Confirm the specification parameter of oil extraction port and oil return port

Check the type of oil extraction port, oil return port and connecting valve, other important

parameter like thread specification of connecting valve as well as valve height. Estimate the distance between chromatographic data acquisition unit and oil extraction (return) port properly so that the manufacturer could produce corresponding switch valve and oil tube with enough length.

Determination for installation location of field monitoring host

When choose the installation place of field monitoring host, the following aspects shall be taken into consideration.

① When select the installation place of field monitoring host, we prefer the spot which is convenient for transformer maintenance and remain a certain distance from other equipment.

②A space of 1.0 meters should be reserved on both sides of the field monitoring host (front and back) for its installation and maintenance. The front side (with indicator light) should face to inspection channels.

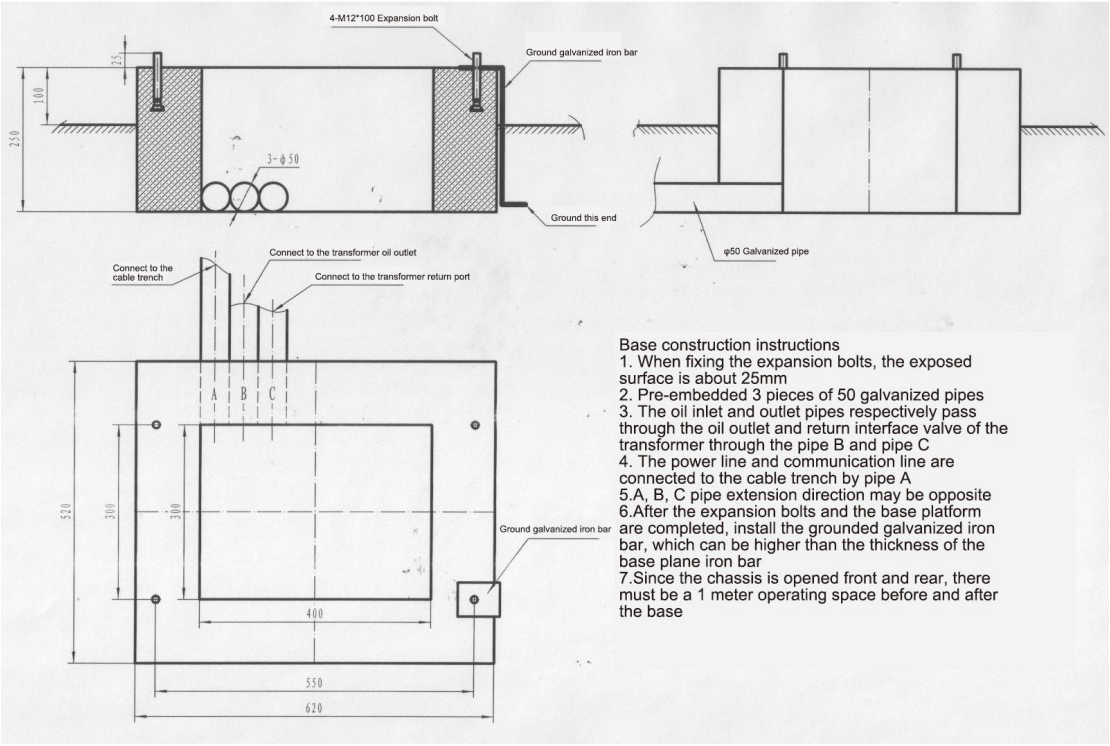
② The installation position of field monitoring host should be close to the oil extraction/return port. After the installation position of field monitoring host is determined, we could correctly estimate the distance from the installation position to the oil extraction/return port.

③ The position shall be near to the oil extraction (return) port.

④ An AC220V power supply shall be nearby.

The construction of basis platform

As shown in Pic. 3,2, install the basis platform in accordance with the requirements of picture below.



Pic 3.2 Schematic diagram of basis platform

Choose power supply for field monitoring host

The on-line monitoring system uses AC 220V power supply, less than 1000W power dissipation. Before installation, the operator shall measure the distance between the control cabinet of power supply and field monitoring host.

3.4 Choose the location for installing data processing server (computer)

It is recommended to install the data processing server in the master control room of transformer substation or electric control room of power plant (reserved AC 220V power supply and channel of telecommunication cables). The appearance of data processing server shall meet the standard of 19 "industrial case, which can be installed in the reserved space of the 19" standard industrial control panel. If there’s no spared one, you need to install an additional 19 "standard industrial control panel which needs to purchase later.

Note

We suggest using the power supply for transformer overhaul as the supply for field monitoring host.

3.6 User's Information

Please provide the following information, including the table of user's basic information and transformer's basic information. It is helpful for the future services and accurate processing in time when the problem occurs.

Company name			Address		
Factory name			Address		
Project leader		Mobile		Fax	
Installation personnel		Mobile		Fax	
Operating maintenance personnel		Mobile		Fax	
Transformer manufacturer			Module		
Ex-factory time			Commissioning time		
Picture of transformer			Voltage classes		
Transformer capacity			Type of cooling		
Total weight of oil			Type of oil		
Maintenance record of transformers					
Maintenance date			Cause		
Content			Result		
Analyze data of the gas dissolved in oil for the transformer					
Highest air temperature around the year			Lowest air temperature		

		around the year	
Relative humidity		Altitude	

The hardware installation of online monitoring system of transformer oil chromatography

The on-line monitoring system is a high-integrated instrument. So the user would be better not to dismounting it whether under the warranty or not to avoid unnecessary troubles. Before installation, the operators must read and understand all the contents of this section, which is very important to finish the installation smoothly.

Required equipment:

Field monitoring host：overall dimension： 600 （width） × 1100 （height） × 520 （depth） mm ；

Installation procedure

Cable laying

Laying communication cables/ optical cables

The data processing server of the on-line monitoring system is installed in the master control room while the field monitoring host is installed at the scene of the transformer. When using cables for data transmission, they can communicate with each other through the Ethernet. So we need to lay a 4-core multimode optical cable or unshielded twisted pair (if required). The length shall be in accordance with actual distance.

Laying power cables

The field monitoring host of the system uses 220V AC power supply. A 3×1.5mm^2 armored power cable shall be laid between the power supply panel on site and the room of field monitor host.

Laying ground wire

In order to guarantee that the field monitoring host could be effective grounded, there shall be a ground wire connecting field monitoring host cabinet and effective earth point. The grounding cable uses copper stranded wire pressured on both ends with tinned copper. The sectional area is

no less than 4 mm^2; we use a piece of flat steel with 48 mm cross-section and 4 mm thickness as the grounding conductor.

The installation of oil extraction pipe and oil return pipe

The flowing direction of oil extraction/return pipe

According to the location and direction of oil extraction/return valve, determine the flowing direction of oil extraction/return pipe in line of on the principle of short distance and beauty.

Note

once the direction of oil extraction/return pipe is determined, in order to avoid the pipe suspending in the air, we suggest fasten the stainless steel pipe when entering or leaving the protection tube.

Laying the protection tube

Along with the direction of oil extraction/return pipe, spare room for a channel of ϕ50mm protection tube in the oil pool at internal bottom of transformer, then pave the protection tube required.

Note

We suggest using ϕ 50mm galvanized steel pipe as protection pipe with the protection of a stainless steel casing inside. There's a distance of 1000mm right angle extension near the transformer.

The installation of oil extraction/return valve

Before installing the oil extraction/return valve, firstly unscrew the nut and replace it with a new oil-resistant seal ring. According to the method of drawing oil samples, receive the waste oil with a empty bucket or other containers. Then unscrew the nozzle, let the sample oil flow from the nozzle. Regulate it to moderate flow, then screw the valve rapidly until the seal ring is pressed tightly and solidly. The picture of valve is as follows.

Oil pipe laying

(1)、 The oil pipe is wrapped in a foam thermos pipe.

(2)、 Enclosed with thermal insulation pipe, the oil pipe shall thread through the protection tube. Lay the oil pipe in the direction of pre-laid protection tube.

Oil pipe connection

Connect the reserved interface in the oil extraction/return valve with the laid oil pipe.

Charge and discharge the oil, connecting the oil extraction/return pipe with the equipment

In order to prevent any foreign body falling into the oil pipe when it is coating foam thermal insulation pipe, we shall back and forth charge and discharge oil for oil extraction/return pipe.

1 、Unscrew the oil drain bolt at the side of connecting valve anti-clockwise.

2 、When the sample oil free from bubbles flows from the oil pipe rapidly, the oil pipe of chromatographic data acquisition unit shall receive the oil immediately.

Leakage detection after installation

After finishing the installation of oil extraction/return pipe in the transformer and monitoring equipment and oil pipe butt, check all the junction points of oil pipe if there's any leakage by

observing.

(1)、 Use cloth or tissue to clean all the connecting points of transformers and equipment.

(2)、 After one hour observation, if there's no oil stains in the junction point, then we assume there's no leaking.

Warning

No foreign body would be allowed to enter into the transformer during the installation of transformer valves.

Note

The oil pipes supplied have been through thorough cleaning in different ways. Since it doesn't generate any pollution for the oil of transformers, it must meet the requirements of practical application.

Note

When connecting the oil circuit, try to avoid the use of fittings. Screw the connectors with the seal rings like valves tightly in case of any leakage.

Electrical Connection

Check the connection of power cables

The power cable of field host is a armoured power wire in a length of 3×1.5mm^2. Connect AC 220V power supply with the upper terminals of power switch in the panel of field monitoring host. An overhaul is imperative after connection to confirm there's no misconnection.

Warning

Before connecting with the power cable, we shall firstly confirm that the cable is not charged, the

power switch of cabinet is in OFF state, so as to ensure the safety of the installation operators and equipment. Otherwise, it may lead to serious or fatal harm to the equipment and installation operators.

Ground Wire Connection

The ground wire could connect the field monitoring host and effective earthing point by bolt.

Communication Cable Connection

According to the drawings, connect the communication cables with the corresponding communication connectors.

Note

Make sure the internet access of field monitoring host and the communication interface of server are fixed tightly before connection.

4.2.3.7 Power up the system

After the confirmation of correct electric connection without any mistake, the data processing server and field monitoring host would separately plug into 220V AC power supply.

Once powering up, the operator shall carefully observe if there's any abnormality happened. The power light in the control panel of chromatographic data acquisition unit shall be in normal indication.

Notes for the operation and maintenance

Reminding for the operators and maintenance personnel

Daily Inspection

(1)、Related personnel shall conduct regular inspection. Check the data with the method of sampling at certain intervals.

(2)、Check if the system is running properly before power switch.

(3)、Check the leakproofness of gas circuit and oil circuit

(4)、Check if the valve of oil in/out port is normally open.

Check the valves of oil in/out

(1)、 When the system has been put into operation, the valves of oil in/out in the transformers shall be always open.

(2)、 If the operators discover any oil leakage or fracture in the oil pipe, please close the two valves in the transformers in time and then cut the power supply of data acquisition unit. Then the operator shall inform the engineer in charge as soon as possible.

The instruction for indicator lights and instrument of field monitoring host

Green indicator light： There is a green indicator light in the control board of field monitoring host. If it is on, it means the data acquisition unit is running.

Red indicator light： There is a red light in the control board of field monitoring host, indicating the status of power supply. If it is on, it means the field monitoring host is powered up.

Yellow indicator light： There is a yellow alarming light in the control board of field monitoring host. If it is on, it gives an alarm for the data acquisition unit. The specific alarming reason could be found from data processing server. The operator shall manually reset the power supply of field monitoring host for emergency handling. If it is still in the alarming state, then please ask the responsible engineers or technician of manufacture for help.