## **SDS350 Infrared Sulfur Analyzer**

**Operating instructions** 

Hunan Sundy Science and Technology Co., Ltd

## Attention

- Read this instruction book carefully before using Sundy Company's instrument.
- > Matters need attention when using the instrument.
  - Only high-temperature power cable provided with the instrument can be used.
  - Make sure that the electrical parameters of outlet and knife switch meet the requirement of the instrument.
  - Power of the instrument shall be cut off when not use them for a long time.
  - Before using the instrument, the filling materials in it, such as foam and others shall be taken out and instrument' cover cloth shall be taken off and the inflammable and explosive materials are forbidden to be place near the instrument.
  - After use, cover cloth covering the instrument is forbidden until inside and outside temperature of the instrument cools to room temperature.
  - The instrument shall be ground connected reliably.
  - Repair and dismantle to the instrument are forbidden when it is electriferous.
  - **Contain filled with liquid is forbidden to place on the instrument.**
- For ensuring stable and reliable operation of the instruments, the instrument parts and consumables provided by Sundy Company shall be used. Sundy Company will not provide service and guarantee for problems such as performance decreasing, unstable test result and failure rate rising etc. which caused by using parts and consumables not provided by Sundy Company.

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## **Chapter 1 Instrument Properties and Features**

## **1.1 Range of Application**

The instrument is widely applied for the measurement of sulfur content in coal, coal water slurry, coke and other substances in coal, electricity, metallurgy, petrochemicals, geological exploration, environmental protection, school and other industries and sectors.

## **1.2 Property Index**

- > Analytical method: infrared absorption method
- Sulfur measuring range:  $(0.01 \sim 50)$  %.
- Analysis time for single sample: 2min30s.
- ► Furnace temperature: (1250-1350) °C. Recommended temperature: 1350°C
- Range of sample weight:  $(100 \sim 300)$  mg, the proposed weight is 100 mg.
- Number of placed samples: 50 samples can be placed one time.
- Instrument Dimension:860x630x670mm

## **1.3 Main Features of the Instrument**

- Superior performance, highly automated, highly humanized.
- The ultra-low drift infrared cell with internationally advanced level, the optimal gas circuit design and combustion processing are adopted to ensure the excellent stability, precision and accuracy of the equipment.
- With functions of automatic sample sending and throwing, the operation is simple and safe, and the testing efficiency is high.
- Rapid test speed with Analysis time for single sample: 2min30s.
- 50 samples can be placed at a time; the test process is fully automated and truly unattended.
- > UDP communication is used, which is reliable.
- Samples can be added, deleted, or inserted during the analysis process.
- With balance on-line function, the weighing results can be transmitted automatically.
- ▶ With functions of automatic fault alarm and simple self-recovery.

## **Chapter 2 Composition and Working Principle of the Instrument**

## 2.1 Composition of the Instrument

SDS350 infrared sulfur analyzer consists of host, gas supply device, computer (with display), printer, electronic analytical balance (need to be purchased), and the schematic diagram is shown in Fig. 2-1:



Fig. 2-1

## 2.1.1 Host Structure

Mainly consists of samples placing platform, combustion furnace, infrared cell, three-stage filter unit and two-stage drying, control valve and air pump, and sample sending rod.

- Samples placing platform: is used to place the samples that are waiting for measurement.
- Sample pushing platform: is used to push sample placing platform crucible to furnace mouth.
- Sample sending rod: actuating mechanism for automatic samples taking and sending.
- Combustion furnace: makes the samples fulfill sufficient combustion and secondary combustion under the condition of peroxide.
- > Infrared cell: detects the molecular concentration of  $SO_2$ .
- Three-stage filter unit and two-stage drying apparatus: filter out the dust and moisture generated during the combustion process of the samples, enable the infrared cell to gain clean SO<sub>2</sub> gas, improve the precision of the test and protect the infrared cell as well.
- Control valve and air pump: control the gas flow and sequences during the test.

## 2.1.2 Gas and Auxiliary Equipments

- > Oxygen: with purity  $\geq$ 99.5% and total gas source pressure  $\geq$  1MPa.
- Reducing valve: range of high pressure gauge is 25MPa; and range of low pressure gauge is 0.4MPa; the proposed type is 152X -40-V (oxygen).
- ➢ Gas transmission duct :PU pipe

## 2.1.3 Auxiliary Reagents

- Silica wool
- > Dehydrite

#### 2.1.4 Printer

Samsung series laser printer.

#### 2.1.5 On-line Balance

The measuring range is 100g, the inductance is 0.0001g, and Sartorius BS224S is recommended.

## 2.2 Working Principle and Process

SDS350 infrared sulfur analyzer is an instrument scheduled to analyze the sulfur content in coal or other substances by infrared spectroscopy.

For a complete analysis made by SDS350 infrared sulfur analyzer to a sample, three steps: gas circuit cleaning, combustion and analysis shall be experienced. First, the tester shall place the samples in matching box by sequence, input the interrelated parameters, and click the "start test", then place the samples on the platform by sequence according to the system prompt. The system will automatically analyze the sulfur element content in the sample according to the specified procedures and show the test results on the main interface window of the measurement & control software.

In the combustion process, the sample is delivered into the combustion furnace for peroxide combustion, and the gases generated therefrom shall be conveyed into combustion tube for secondary combustion, after multi-stage filtration and drying, the gases go into the infrared cell for real-time analysis in the form of  $SO_2$  by the infrared sensor.

The final analysis results are shown on the main interface window of the measurement & control software in the form of percentage by the samples quality.

## **Chapter 3 Installation and Commissioning of the Instrument**

## **3.1 Environmental Requirements**

## **3.1.1 Working Conditions**

- Ambient temperature:  $(15 \sim 30)$  °C.
- ▶ Humidity:  $\leq 85\%$ .
- The working environment shall be clean and tidy, with no smoke and raise dust.
- The environment shall be stable, with no strong interference source, vibration source and corrosive gases.

## 3.1.2 Requirement of Power Source

- > Power source:  $(220\pm10\%)$  VAC,  $(50\pm1)$  Hz
- > Be equipped with reliable ground wire.

## 3.1.3 Requirement of Gases

Combustion gas: oxygen with purity of more than 99.5%, the pressure of low pressure oxygen gauge is (0.20±0.01) MPa, and the total pressure of gas source shall be not lower than 1MPa. The electrolytic oxygen is forbidden and the oxygen with purity of 99.99% is recommended.

## 3.1.4 Reagents

- Silica wool.
- > Dehydrite

## 3.1.5 Software Environment

1. Operating system: Windows 7 (Home or Professional version)

## 2. Basic configuration:

- ➢ CPU: above Pentium 2.0GHz;
- Internal memory: above 1G;
- ▶ Display card: standard VGA1024×768 display mode;
- ➢ Hard disk: 80GB or higher level;
- > Driver:  $32 \times CD$ -ROM or above  $8 \times DVD$ -ROM;
- > Other devices: USD interface, mouse, keyboard and so on.

## **3.2 Installation of the Instrument**

## **3.2.1 Preparations before Installation**

- > Prepare appropriate laboratory according to the requirements of 3.1.
- > Prepare crucible, standard samples, and related equipments.
- > Prepare dehydrite, silica wool and oxygen.

## **3.2.2 Installation Precautions**

- Carefully remove the instrument from the packaging box, put in place to facilitate the operation of the tester, meanwhile, pay attention that the back and both sides of the instrument shall be 0.4m~0.5m from the wall, and shall not close to the wall.
- After the unpacking, the users shall check the instrument, accessories and consumables, and properly keep the balance, computer, display, printer and related data, packaging box and packaging protective materials.
- Carefully check if all wearing parts are intact, and carry out dust removal for various components before they are available for use.

## **3.2.3 Installation of Instrument Parts**

**3.2.3.1** Open the instrument enclosure and take the sponge and other fillings out of the instrument.

# **3.2.3.2 Install silicon-carbon tube, ceramic jacket, inner and outer combustion tube**

- **1.** Take silicon-carbon tube, ceramic jacket, inner and outer combustion tube out of the packaging box.
- 2. Put the ceramic jacket from the end of the furnace into the furnace until the ceramic jacket and the furnace are tight fit. Remember not to force too much during the installation.
- **3.** Then put the silicon-carbon tube from the end of the furnace into the furnace, make sure that the front-end of the silicon-carbon tube is placed at the forefront of the furnace steps, and remember not to force too much during the installation so as to prevent damage to silicon-carbon tube.
- **4.** After the installation of the silicon-carbon tube, insert the inner and outer combustion tube into the furnace through the silicon-carbon tube until they reach the base of the sample sending mouth.
- 5. After the installation, the ohms range of multimeter shall be used for

short-circuit inspection of two terminals of the silicon-carbon tube. The silicon-carbon tube shall not achieve conduction with the instrument enclosure or furnace shell; otherwise, the power-on test cannot be conducted.

6. The detailed installation diagram is shown in Fig. 3-1:



Fig. 3-1 Installation Diagram of Inner and Outer Combustion Tube and

Silicon-carbon Tube

## **3.2.3.3** Install combustion supporting gas tube and output gas tube.

- 1. Fix combustion supporting gas tube and its fixed block gas bracket on the side plate of combustion furnace mouth. Pay attention to adjust position of combustion supporting gas tube. Make combustion supporting gas tube be on the top right of inner tube by adjusting vertical position of gas bracket. Make sure that inner tube movement will not be affected while pushing crucibles.
- **2.** Install output gas tube hose O ring on the fixed base of outer and inner tube and connect fluorine rubber tube.
- **3.** Installation position details are shown as Fig.3-2.



Fig.3-2 Combustion supporting gas tube and output gas tube installation position

## diagram

## 3.2.3.4 Silicon-carbon tube bracket, loose wool

- 1. Connect silicon-carbon tube terminal properly. Pay attention to tighten its screw, otherwise, it will cause abnormal phenomenon such as electric arc while heating due to overlarge contact resistance, which will finally affect the use life.
- 2. Install end cover septa and end cover casing on the silicon-carbon tube bracket. Insert them into furnace from furnace end and make them hitch outer tube, then tighten silicon-carbon tube support bracket, and fill the round hole on silicon-carbon tube support bracket with loose wool.
- **3.** After finishing installation, do short circuit inspection of silicon-carbon tube and furnace end with ohmmeter mode of multi-meter.
- **4.** Details are shown as Fig.3-3.



Fig.3-3 Silicon-carbon tube bracket installation diagram

## 3.2.3.5 Install drying tube and filter

The detailed installation, placing and dosage of the reagents are shown in Fig.

3-4. Filter installation refers to Fig.3-5



Fig. 3-4 Placing of Desiccant



Fig.3-5 Bastonge filter installation diagram **3.2.3.6 Gas circuit of the instrument is shown as below:** 



Fig. 3-6 Gas Circuit of the Instrument

## **3.2.3.7 Install thermocouple**

Thermocouple is used as thermometric element of the instrument. Before the installation of the thermocouple, the multi-meter shall be used to detect the thermocouple. If there is any damage, please contact with after sales service department or on-site commissioning staff of Sundy Company

The thermocouple shall be installed as follows (Fig.3-7):

- 1. Remove the iron bar out of the temperature measuring hole of the combustion furnace, and insert the thermocouple into the hole until the front end of the thermocouple touches the inner wall of the furnace and can not move forward.
- Connect the red wire of the compensating lead wire of the thermocouple with "+" (positive) pole of the thermocouple, and connect the blue wire with the "-" (negative) pole of the thermocouple.
- **3.** Slightly tighten the anchor screw in the installation position of the thermocouple
- **4.** Fasten the connecting wire of the thermocouple, and check if the compensating lead wire is installed correctly. The compensating lead wire shall not close to the surface of the heating furnace so as to avoid scorch.



Thermocouple compensating lead wire

Fig.3-7

## 3.2.3.8 Gas circuit connection

The end of the high pressure gauge of the reducing value is fixed to the oxygen cylinder, and the end of the low pressure gauge shall be connected to " $O_2$ " interface of the back cover plate of the instrument through the gas transmission duct.

(Fig.3-8)



Fig.3-8

**3.2.3.9** Check whether there is a drape of the air tube, or whether the air tube is close to the surface of the high temperature furnace, if the phenomenon exists, timely adjustment should be made.

3.2.3.10 According to the identification on the back plate of the instrument, connect the control power wire and heating power wire well accordingly. Shown as Fig.3-9





## 3.2.3.11 Software Installation and Un-installation

## 1. Software installation

1) Check whether the computer has been installed with "Message Queue". (Method: Start  $\rightarrow$  Control Panel  $\rightarrow$ Programs  $\rightarrow$ Select "Microsoft Message Queue(MSMQ) server" from components list  $\rightarrow$  click "Ok".

- Put the CD that is marked with "SDS350 infrared sulfur analyzer software" into the CD-ROM drive, start the CD drive and find "Sundy.exe" in the root directory.
- 3) Double click "Sundy.exe" icon and follow the prompts to install "SDS350 infrared sulfur analyzer" program, after the installation, the system will automatically create a shortcut icon called "SDS350 infrared sulfur analyzer" on the desktop.

## 2. Software un-installation

Click the "Start" in the taskbar  $\rightarrow$  "Control Panel"  $\rightarrow$  Click "Remove Programs" to open the window  $\rightarrow$  Click "SDS350 infrared sulfur analyzer" in the program group  $\rightarrow$  Click "Delete" button to perform the un-installation. Follow the onscreen prompts to safely and efficiently remove SDS350 infrared sulfur analyzer software and shortcut icon. But the related parameter files, data base files of SDS350 infrared sulfur analyzer software will not be uninstalled, they still remain in the operating system.

### 3.3 Instrument Commissioning

After the hardware and software of the instrument have been installed, turn on the power, start the program, and enter "Manual Detection" for on-line commissioning, the contents and precautions of the commissioning are as follows:

#### 3.3.1 Adjusting principle of sample pushing components I

1.Adjust the fixing position of the 4 Waist-shaped holes , align sample sending guide block and combustion furnace mouth, sample sending guide block can be a little higher than the lowest point of the combustion furnace mouth, keep same height for the crucible when crucible is on the guide block or on the furnace mouth . After fixed sample pushing components 1, put a crucible on sample sending guide block, then push it into furnace and pull it out by manul, make sure all the procedures are smooth and stable, without stuck. Shown as Fig.3-10.



Fig.3-10

## 3.3.2 Sample placing platform adjustment principle

- Sample placing platform cannot be close to the sample pushing platform, need to keep the space(about 5mm), so that sample placing platform can move smoothly.
- 2. Sample placing platform can be a little higher than the sample pushing platform, not too much, make sure when crucible gos into the sample pushing platform, it is smooth and stable. Shown as Fig.3-11
- Adjust the position of the 4 sample placing platform supporting feet, when sample placing platform is at initial position, channel 1 and crucible entrance are aligned. Shown as Fig.3-12
- In "manul detection", move the sample placing platform to check the other
   4 channels and the crucible entrance are aligned or not, make sure crucible
   can be pushed into sample pushing platform initial position smoothly.









## 3.3.3 Sample pushing platform components II adjustment principle

- Adjust the fixing position of the Waist-shaped holes(at the bottom of pushing plate transfer block2),make sure pushing plate can be in the center of the sample placing platform channel when pushing plate components follows the linear guides to move.
- 2. Adjust the fixing position of the Waist-shaped holes (at the front of pushing plate transfer block2), when pushing plate components follows the linear guides to move, make sure there is at least 1mm space between the push plate and sample placing platform upper apex, put a crucible on sample

pushing platform, make sure there is more than 2 mm space between push plate bottom and crucible upper apex. Shown as Fig.3-13

- 3. Adjust the position of left/right positioned switch on the push plate components, make sure when push plate components are at left positioned, push plate can move to the outside of sample placing platform, when at right positioned, push plate can completely push crucible to initial position on the sample pushing platform. Shown as Fig.3-14
- 4. Adjust the position of photoelectric sensor switch on the push plate components 1,let the photoelectric sensor switch spot positioned at the crucible front bevel, make sure when crucible is completely pushed into initial position on the sample pushing platform, the photoelectric sensor switch can detect the position of the crucible. Shown as Fig.3-14



Fig.3-13





## 3.3.4 Sample sending components adjustment principle

1. Adjust vertical position of sample sending components guide shaft fixed plate ,right and left fixed position of traction board, let the sample sending rod in the Up-center of the furnace mouth, parallel with the inner tube, do not interfere with the combustion gas tube when the sample sending rod is sending in and returning. Shown as Fig.3-15



Fig.3-15

- 2. Firstly put a crucible on the sample pushing platform, in "manual detection" click to initial position" move the sample sending rod to initial position, turn on SV3,let sample sending rod rotate 90°,adjust fastening screws on sample sending components, let the bottom of the rod is lower than crucible and when sending in, do not scratch with sample pushing platform. Then click" to testing position", can send crucible into testing position smoothly. Shown as Fig.3-16
- Push sample sending rod to move about 100mm,maintain gap of the rod bottom and crucible up surface, when sample sending rod moving, do not scratch with crucible Shown as Fig.3-17
- 4. Click "take crucible" in "manual detection", sample sending rod can automatic take the crucible out from "testing position", watch position situation between sample sending rod and crucible when the rod is moving in inner tube. If the sample sending rod is too high, cannot take crucible out or too low, scratch with crucible up surface, need to adjust the fastening screws a little, make sure when sample sending rod passing by "crucible test position", there is enough maintain gap between the rod bottom and crucible up surface, when taking crucible out, after turn 90°, the rod can take crucible out successfully. Shown as Fig.3-18.



Fig.3-16



Fig.3-17



Fig.3-18

## **3.3.5** Check limited protection switches

There are limited protection switches for two ends of movement, make sure when movement is operating, moving part can reach position card, not hit the limited protection switches, but when position card is broken, it can hit the limited protection switch.

## 3.3.6 Gas tightness check

Click "Gas tightness detection" in "Manual Detection" window, then cover furnace mouth with rubber plug slowly. Observe whether the SO2 flow of aspitation flow meter drops to 0L/min: if the SO2 flow fails to return to 0L/min, this means there is a gas circuit leakage in the subsequent section of drying tube, please conduct trouble shooting and carry out gas circuit detection again until there is no leakage; If the SO2 returns to 0L/min, this means that the system has no gas leakage.

Note:

- $\diamond$  If system has no leakage, test can be done.
- $\diamond$  If system has leakage, test is prohibited to do.
- 3.3.7 Pressure of low pressure gauge of oxygen bottle, gas supply test flow O<sub>2</sub>, Aspitation flow SO<sub>2</sub>
  - O<sub>2</sub> pressure: Adjust pressure of low pressure gauge of oxygen bottle to be 0.20MPa in the situation of total gas pressure of oxygen bottle not less than 1MPa.
  - Gas supply test flow O<sub>2</sub> and aspitation flow SO<sub>2</sub>: carry out the blank test, and adjust the O<sub>2</sub> flow of SV2 valve to 3.5L during the test; and adjust the flow-limiting valve to adjust SO<sub>2</sub> flow of aspitation flow valve to 2.5L

#### 3.4 Check and Calibration of the Precision and Accuracy of the Instrument

- > Please refer to Chapter Six for detailed test operations.
- The precision and reproducibility shall be in line with the requirements listed as follows: (refer to GB/T214-2007

Mass fraction of	Repeatability limit St,ad%	Reproducibility critical		
total sulfur St, %		difference St,d%		
≤1.50	0.05	0.15		
1.50 (excl.) ~ 4.00	0.10	0.25		
>4.00	0.20	0.35		

Provisions of Measuring Total Sulfur Precision in Coal by Coulometric Titration)

## **Chapter 4 Use of System**

## 4.1 Start and Exit of the Measurement & Control Software

## 4.1.1 Start of the Measurement & Control Software

**Method 1:** on the taskbar, click "Start"  $\rightarrow$  "Program"  $\rightarrow$  select "Sundy"  $\rightarrow$  click "SDS350 infrared sulfur analyzer", and enter into main interface shown in Fig. 4-1.

**Method 2:** double click "SDS350 infrared sulfur analyzer" icon on desktop, also can enter into measurement state as shown in Fig. 4-1.

## 4.1.2 Exit of the Measurement & Control Software

Click "X" on top right corner on the main interface or click on main menu bar "Setup"  $\rightarrow$  "Exit"  $\rightarrow$  "Yes", exit SDS350 infrared sulfur analyzer measurement & control software and return to desktop.

## 4.2 Functions of the Main Forms

The main forms of the measurement & control software of SDS350 infrared sulfur analyzer consist of title bar, menu bar, shortcut button, status bar, data sheet Integrogram etc. Shown in Fig. 4-1:





Among of it, displayed columns of data sheet can be configured and sorted in "Column setting". Also data sheet has function of insert new row/delete selected roe, automatically adjusting column width, hide and display all columns, and freely dragging and placing columns. When cursor moves to data bar, and click the right mouse button, Fig. 4-2-1 menu will popup and the below will introduce its functions in details.

Insert new row
Delete the selected row
Drift correction by using selected records
Recalculate the selected records
Colunm Setting
Hide selected column
Display all columns
Automatically adjust column width

Fig. 4-2-1

- Insert new roe: Click this button at the position which need to insert new sample to generate a blank row. Then input corresponding sample weigh, number etc. then put the new sample in the position with corresponding number.
- Delete the selected row: click this button to delete the selected sample. Then take away the corresponding crucible from sample placing tray.
- Drift correction by using selected records: select certain record in data bar on main interface of this program to create drift coefficient to conduct drift correction of the instrument.

#### Note:

Drift correction is an objective reality in infrared absorption method. SDS350 infrared sulfur analyzer only needs one drift correction in a day if the test condition is relatively stable.

Drift coefficient will directly influence accuracy of the instrument, so the selection of records will be of vital importance. The drift records must be selected according to the following principles:

- Drift records, must be standard sample or standard substance and all of them can be queried in standard substance bank.
- ♦ Precision of the drift records must meet the national standard of coulometry.
- Recalculate the selected records: After modifying correction curve, drift coefficient, Mad%, sample weight and sample number, "Recalculate the selected records" must be clicked for the recalculation of record result and storage in data base, otherwise, the record cannot be updated and stored into data base.

#### Note:

After modifying the sample weight or sample number or Mad% of a certain record, when click "Recalculate the selected records" or "Recalculate", the system will prompt "Whether replace the correction formula, drift coefficient with latest parameters or not?", it indicates that the correction formula and intraday drift coefficient of the test method of this record have been changed. If you want to calculate by latest parameters, please click "Yes', otherwise, click "No".

Column setting: Click this menu to pop up Fig.4-2-2 to set columns in this window.



Fig.4-2-2

- Hide selected column: hide the selected column.
- > Display all columns: show all configuration display columns.
- Automatically adjust column width: all data columns' width will be adjusted to be suitable.

## 4.3 Functions of Each Menu Bar

## 4.3.1 Setup Menu

As shown in Fig. 4-3-1:



## Fig. 4-3-1

**1. System setting:** select this item or click "System Setting" icon in shortcut icon bar, setting windows as shown in the Fig. 4-3-2 will popup.

Setting[1#]								
High tempera	ture furnace	setting						
Test User	information	Serial port setting	Standard s	substance	Test method			
	Counting							
		Gas tube countin	ng: 100	00 Clea	ring			
		Bastogne countin	ng: 100	00 Clea	ring			
		Dehydrite countin	ng: 600	0 Clea	ring			
	Crucibl	le accumulator countin	ng: 50	Clea	ring			
	-Maximum cou	int value setting						
		Gas tul	be: 100	0				
		Bastog	ne: 100	10				
		Dehydri	te: 600	0				
		Crucible accumulate	or: 50	I				
		Result Di;	gs: 2	•				
🔲 Modify sp	ecial parame	ters		Sav	re Ba	ick		

Fig. 4-3-2

- Save: save modified parameter.
- Back: exit the current window and return to main interface window of the program.
- Gas tube counting: record how many samples the gas tube can analyze next, click "clear" on the right, can know the maximum counting number.
- Bastogne counting: record how many samples the Bastogne can continue to analyze and click "clear" on the right can know the maximum counting number
- > Dehydrite counting: record how many samples dehydrate can continue to

analyze and click "clear" on the right can know the maximum counting number.

Crucible accumulator counting: record how many crucibles the crucible accumulator can continue to contain and click "clear" on the right can know the maximum counting number.

Note:

- After changing gas tube, Bastogne or dehydrite, or clearing away the crucibles in the crucible accumulator, click corresponding clear icon and manual refreshing count are necessary.
- Maximum count value setting: record how many samples the gas tube, Bastogne, dehydrite can analyze respectively, and how many crucibles the crucible accumulator can contain. It's general to keep factory setting.
- Decimal places reserved for test results: decimal places can be set according to actual needs.
- Weather to use single sample sending function: If it is selected, the system will carry out single sample sending test. Manual sample placing and sample taking operations shall be done in this mode.

1-1. User: Click "User Information" on "Setting Window", window shown in Fig.4-3-3 will popup.

Setting[1#]
High temperature furnace setting
Test User information Serial port setting Standard substance Test method
User information UserName Sundy Delete
Tester: Set current tester
-Password setting
Original password: Yes New password: Modify New password confirm:
☐ Modify special parameters Save Back

Fig. 4-3-3

- User information tab:
  - Directly input the name of tester in the list box and the program will automatically add blank record row.
  - Set current tester: after selecting record on table column on the left, click this icon, the program will automatically display the selected record on the tester's label.
  - Delete the selected records: Click this icon, the program will automatically delete the selected records in the tables on the left.
  - Tester: Select displaying name of the tester.
- System password tab:
  - Original password: input original password
  - New password: input new password.
  - New password confirm: confirm new password.
  - Modify: click the button, activate the three textboxes on the left modify password, otherwise, the password cannot be modified.

• Yes: click the button to save new password.

**1-2. Serial port setting:** click tab "Serial Port Setting" of "Setting Window", the window shown in Fig. 4-3-4 will popup.

Setting[1#]				
High temperature f	Curnace setting			
Test User infor	mation Serial port settin	ng Standard subs	tance   Test π	ethod
JEST USET INTO	- Serial port setting	COM1 19200 7 Even parity chev Sartorius		le thoa
🗖 Modify special	parameters		Save	Back

Fig. 4-3-4

Serial port setup tab: set communication parameter of the balance.

- Communication port: setting value of this item according to the practical situation.
- Baud rate: set value of this item according to the parameter of the balance's own.
- Data bit: set value of this item according to the parameter of the balance's own.
- > Check: set value of this item according to the parameter of the balance's own.
- Synchronous code: set value of this item according to the parameter of the balance's own.
- Stop bit: set value of this item according to the parameter of the balance's own.
- 1-3. Standard substance: Click "Standard Substance" tab of "Setting Window",

the window shown in Fig. 4-3-5 will popup.

Satting[1#]							
High temperature furnace	setting						
Test User information	Serial port setting Standard substance Test method						
-Standard substa	nce						
Name	Sulfur dry basis value(%)						
10i	4.30						
26b	0.26 Delete						
Modify special parameters Save Back							

Fig. 4-3-5

- Delete: Click this icon, automatically delete the selected record row in table on the left.
- Add standard sample: directly input related parameter in the table, and the program will automatically add blank record row.
  - Name: input name of standard sample into text box on the left.
  - Sulfur dry basis value (%): input sulfur standard value of the standard sample.
  - If the name column of a record has numbers, but the sulfur dry basis value column is empty, or if the name column is empty, but the sulfur dry basis value has numbers, this record is recognized as invalid record, click "Save", and it will be deleted automatically.
  - Inputting two records with the same name is not allowed, and the system will delete these records automatically.

**1-4. Test method:** click tab "Test Method" of "Setting Window", the window shown in Fig. 4-3-6 will popup.

Setting[1#]					
High temperature t	furnace_setting				
Test User infor	mation Serial po	rt setting Standa	rd substance Te	st method	
Name of method	nt temperature:tes	st integration time	comparatively a	s cleaning ti	fur cor:
Default method	1350	80	50	E	Y=0+1X
		1			
	Add		Delete		
🗆 Modify special	parameters		Save	Ba	ck

Fig. 4-3-6

- Add: Click the icon, automatically add new test method. After click "Save", the adding method can be successfully saved.
- > Delete: Click this icon, delete the selected records.

Note:

- ♦ Can directly edit parameters in the table, but if the method has been selected and used in test data, the name of the method can't be edited.
- ◇ If there is only one method on test method page or a method has been selected and used in test data, these method records cannot be deleted, and the system will give relevant prompts.
- ☆ The methods with empty name or with the same name are invalid methods and cannot be saved.

**1-5. High temperature furnace setup:** click "High Temperature Furnace Setting" tab of "Setting Window", the window shown in Fig. 4-3-7 will popup.

Setting[1#]
Test User information Serial port setting Standard substance Test method High temperature furnace setting
Temperature setting of high temperature furnace
Thermocouple coefficient: 1000
Cold end temperature (°C): 26.8
Hibernation
Hibernation time (min): 30
Hibernation temperature (°C): 1000
Automatic hibernation
Modify special parameters Save Back

Fig. 4-3-7

> Temperature setting of high temperature furnace:

- Thermocouple coefficient: set thermocouple coefficient of high temperature furnace.
- Cold end temperature: show current cold end temperature of the high temperature furnace.

Note:

- ♦ It's not permitted to modify parameter value of the high temperature furnace before changing high temperature furnace thermocouple; otherwise the instrument may be damaged.
- Hibernate: if the samples that to be analyzed is less and the wait time is relatively long, to prolong the service life of the instrument, this function is recommended.
  - Hibernation time: set hibernation time.
  - Hibernation temperature: set hibernation temperature.
  - ◆ Automatic hibernation: after it is selected, the instrument will

automatically hibernate according to the set time.

2. Log window: click this item, open log window as shown in Fig. 4-1.

**3. Exit:** click "X" at the top right corner of main interface of this program or this item, window show in Fig. 4-3-8 will popup.

Pr	rompt Hessage	×
	Sure to exit measurement control program?	
	Shut down computer	
I	$\square$ Wait for temperature dropping to 1000°C and exit	
	Yes No	///

Fig. 4-3-8

- Shut down computer: after selecting it, the system will firstly exit SDS350 infrared sulfur analyzer program, then shut down computer automatically.
- ➤ Wait for temperature dropping to 1000°C and exit: after selecting it the system will wait the temperature of combustion furnace dropping to ≤1000°C and exit SDS350 infrared sulfur analyzer program, and then back to the Windows desktop.
- Yes: click the item and exit measurement & control program of SDS350 infrared sulfur analyzer.
- No: click the item, close "Prompt Message" window and return to the main interface of measurement & control program of SDS350 infrared sulfur analyzer.

## 4.3.2 Temperature Menu

Shown in Fig. 4-3-9:



Fig. 4-3-9

**1. Start heating up:** click this menu or shortcut icon of shortcut icon bar, the program will automatically make the instrument heating and keep constant temperature.

**2. Stop heating up:** click this menu or shortcut icon of shortcut icon bar, the program will automatically make the instrument cool.

**3. Hibernate:** Click this menu, the system will automatically hibernate according to the given parameters to protect the instrument

## 4.3.3 Test Menu

Shown in Fig. 4-3-10:

Tes	st	Detection	Data	management	Register	manage
$\bigcirc$	St	art test				
$\odot$	St	op test				
	Drift correction by using selected records					
	Recalculate the selected records					
	Ba	alance weighi	ng			

Fig. 4-3-10

- **1. Start test:** click this menu or shortcut icon of shortcut icon bar, the system open sample placing window to prompt user to place sample. Shown in Fig. 4-3-11:
- 2. Stop test: click this menu or shortcut icon of shortcut icon bar to stop next test. Current test is still valid.
- 3. Drift correction by using selected records: refer to Section 4.2
- 4. Recalculate the selected records: refer to Section 4.2
- 5. Balance weighing: Click this item, the program will realize online weighing.

Notice:

- Balance data output condition shall be set as: non-function save, print
   by single step after sample being stabilized. (613)
- ♦ After sample being stabilized, it needs press "print" key on the balance manually to conduct weight transfer.

## 4.3.4 Detection Menu

As shown in Fig. 4-3-11



Fig. 4-3-11

1. Manual detection: Click this item or "Manual Detection" icon, the
| ∎anually detection[1#]                         |   |  |   |  | <u> </u> |
|--|---|--|---|--|----------|
|  | Input   | State  |   |  | <b>_</b> |
| Take crucible                                  | Heating power s<br>Temperature pro<br>Heating state o   | Unconnected<br>Colse<br>Colse  |   |  |          |
| Send crucible                                  | Crucible detection<br>Throw crucible<br>Sample plan's p<br>Sample sending<br>Push plate of s  | No crucible<br>No crucible<br>Initial position<br>Initial position<br>Initial position |   |  | -<br>-   |
| Gas circuit cleaning                           | OutPut  |  | Function  | ns   |          |
| Clear away crucible<br>Move SamplePlan to No.1 | <ul> <li>Air pump</li> <li>Floodlight</li> <li>SV1</li> <li>SV2</li> <li>SV3</li> <li>SV4</li> <li>To initial position</li> <li>To cooling position</li> <li>To crucible test</li> <li>To crucible takin</li> <li>Push plate of sam</li> <li>To initial position</li> <li>To ready position</li> <li>To ready position</li> </ul> | ion<br>n<br>position<br>mple plan forward<br>mple plan back<br>ion<br>n                | Air pum<br>Flowmet<br>Master<br>Combust<br>Block v<br>Combust<br>Sample<br>Sample<br>Sample<br>Sample<br>Sample<br>Push pl<br>Push pl<br>Push pl<br>Push pl | p(On/Off)<br>er floodlight(<br>valve(SV1)<br>ion-supporting<br>alve(SV3)<br>ion-supporting<br>sending rod to<br>sending rod to<br>sending rod to<br>sending rod to<br>ate of sample<br>ate of sample<br>ate of sample<br>ate of sample<br>ate of sample<br>ate of sample |          |
| E Permit single unit o                         | control   |  |   |  |          |

detection window shown in Fig. 4-3-12 will popup.

Fig. 4-3-12

- > Take crucible: click this item, perform operation of taking crucible.
- Send crucible: Click this item, perform operation of sending crucible.
- Gas circuit cleaning: Click this item, start gas circuit cleaning, until click "stop gas circuit cleaning"
- Gas tightness detection: click this item and carry out gas tightness detection, press the gas tightness detection strut bar according to system prompt, of the SO<sub>2</sub> flow of aspitation flowmeter can return to 0L, it means there is no gas leakage, and the test can be conducted; otherwise, there is a gas leakage and the test cannot be carried out, and trouble shooting shall be made.
- Clear away crucible: click this item, perform operation of clearing away crucible on the sample placing platform. The number of crucible cleared away will be recorded into counting of crucible accumulator.
- Move sample placing tray to: select any position of dropdown box, click this item to move sample placing tray to this position.

Permit single unit control: select this item, after inputting password, can control certain single unit manually. Service technicians not from Sundy Company shall not do the said operation to avoid that disoperation influencing normal operation of the instrument.

**2. Sample tray initialization:** Click this button to adjust the sample tray to the initializing position manually.

#### 4.3.5 Data Management Menu

Detail introduction refers to Chapter 5

#### 4.3.6 Help Menu

Shown in Fig. 4-3-13

Hel	lp
	About(A)

Fig. 4-3-13

**1. About:** click this item, you can get the program's version information. Click "Yes", return to main interface of the program.

### **Chapter 5 Data Management**

Click "Data Management" on the main interface menu of SDS350 infrared sulfur analyzer, popup the indicated window as Fig 5-1, and then enter into Data Management window

#### **5.1 Functions of the Main Forms**

The main forms of the data base of the SDS350 infrared sulfur analyzer consist of title bar, menu bar, shortcut button and data sheet etc. Every line in the data sheet can be dragged and placed at will for convenient viewing. The detailed introduction to the menu as follows.

	🚹 SDS350 Data 🛙	anagement										
itle bar	System setting	g Edit Searching	View	Data base Help								
	🍤 📋 🚺	N) 🔍 🔮 🛸 🔗										
	Auto No. po	Sample weight(mg)	Mad(%)	St, ad(%)	St, d(%)	Test date	Begin time	End time	Tester			
	120140317104	100.3	2.15	2.07	2.12	2014-03-17	17:53:57	17:55:19				
Aenu bar	120140317105	99.3	2.15	2.17	2.22	2014-03-17	17:55:57	17:57:40		_ Unire	cord view	window
	120140317106	99.6	2.15	2.04	2.08	2014-03-17	19:00:19	17:59:41				
	120140317107	100.1	2.15	2.16	2.21	2014-03-17	18:00:19	18:02:04			annle	100.0
	120140317108	100.8	2.10	2.18	2.23	2014-03-17	18:02:44	18:04:28			T	
	120140317109	100.1	2.15	2.04	2.00	2014-03-17	18:03:08	10:00:30		~	Mad(%)	
	120140317110	100.8	2.10	2.11	2.22	2014-03-17	18:00:00	18.00.02			St, ad(%)	10.00
Shortcut	120140317111	100.3	2.10	2.10	2.20	2014-03-17	10.05.00	10.11.20			St, d(%)	
	120140317112	100.3	2.15	2.13	2.15	2014-03-17	18.14.24	18.15.47			Tester	
button	120140317114	100.3	1.82	2.10	2.13	2014-03-17	18.16.25	18.17.46				2014-04-11
	120140317115	100.1	1.82	2.10	2.14	2014-03-17	18:18:25	18:19:49			lest date	15.10.25
	120140317116	99.6	1.82	2.08	2.12	2014-03-17	18:20:27	18:21:49			End time	12:18:32
	120140317117	99.6		2.00	2.14	2014-03-17	18:22:27	18:23:50			Begin time	15:16:36
	120140317118	99.8	-		8, 13	2014-03-17	18:24:29	18:25:51			Renarks	
	120140317119	100.2		Data sheet	2 13	2014-03-17	18:26:29	18:27:52			-	任硷
	120140317120	100.1			2.13	2014-03-17	18:28:32	18:29:53			Type	WARDC
	120140317121	99.2	1.82	2 10	2 14	2014-03-17	18:30:32	18:31:54			Test method	默认力法
	120140317122	99.5	1.82	2.09	2 13	2014-03-17	18:32:32	18:33:55			Device No.	D002
	120140317123	100.3	1.82	2.10	2.14	2014-03-17	18:34:34	18:35:56			Tenn	
	120140317124	99.1	2 64	1 42	1 46	2014-03-17	18:36:34	18:37:57			Tomp .	
	120140317125	99.2	2.64	1.47	1.51	2014-03-17	18:38:34	18:40:13			Humidity	1
	120140317126	99.8	2.64	1.46	1.50	2014-03-17	18:40:51	18:42:21				
	120140317127	99.2	2.64	1.47	1.51	2014-03-17	18:43:01	18:44:38				
	120140317128	100.1	2,64	1.47	1.51	2014-03-17	18:45:17	18:46:51				
	120140317129	100.1	2.64	1.47	1.51	2014-03-17	18:47:29	18:49:01				
	120140317130	99.6	2.64	1.44	1.48	2014-03-17	18:49:39	18:51:03				
	120140317131	99.4	2.64	1.46	1,50	2014-03-17	18:51:41	18:53:19				
	120140317132	100.5	2.64	1.45	1.49	2014-03-17	18:53:58	18:55:42				
	120140317133	100.4	2.64	1.47	1.51	2014-03-17	18:56:20	18:57:52				
	120140317134	100.1	3.22	1.88	1.94	2014-03-17	18:58:30	18:59:53				
	120140317135	99.9	3.22	1.90	1.96	2014-03-17	19:00:32	19:01:54				
	120140317136	100.3	3.22	1.92	1.98	2014-03-17	19:02:32	19:03:55				
	120140317137	100.2	3.22	1.89	1.95	2014-03-17	19:04:34	19:05:59				
	120140317138	100.4	3.22	1.89	1.95	2014-03-17	19:06:37	19:08:00				
	120140317139	99.8	3.22	1.91	1.97	2014-03-17	19:08:39	19:10:01				
	120140317140	100.3	3.22	1.90	1.96	2014-03-17	19:10:39	19:12:02				
	120140317141	99.5	3.22	1.90	1.96	2014-03-17	19:12:41	19:14:05				
	120140317142	100.1	3.22	1.89	1.95	2014-03-17	19:14:43	19:16:07				
	120140317143	99.4	3.22	1.91	1.97	2014-03-17	19:16:45	19:18:08				
	120140317144	100.5	2.71	4.20	4.32	2014-03-17	19:18:46	19:20:09				
	120140317145	99.6	2.71	4.15	4.27	2014-03-17	19:20:48	19:22:10				
tatus bar	120140317146	100.9	0.71	4 16	90 h	2014-03-17	10.00.40	10.04.19				Reca
tatus Dai	<u> </u>									<u> </u>		

Fig. 5-1

Right click mouse to pop up Fig.5-2.

Export selected records: select different files to export after selecting records.

Column setting: Function and operation are the same as main program.

Other function are the same as that with same menu.

	Drift correction by using selected records	
	Recalculate the selected records	
	Export the selected records	Export the selected records to EXCEL file
	Searching today's records	Export the selected records to RTF file
	Searching parallel sample	Export the selected records to PDF file
	Searching this year's records	Export the selected records to CSV file
1	Searching the records with the same date of the selected one	Export the selected records to Image file
	Columms Setting	
	Display all columns	
	Hide selected column	
	Automatically adjust column width	
41		

Fig.5-2

# 5.2 Functions of Each Menu Bar

# 5.2.1 System Menu

As Fig.5-1-1



Fig. 5-1-1

1. Setting: Click this bar, popup the window as Fig.5-1-2

Setting
Basic setting Device card No. Data backup Password management Report form configuration
Print type
Report
Report forms Vhether the parallel sample is out-of-range or not
C Report forms
Report sheet of configurabl
Calculation condition of the parallel sample
Total sulfur content(%)≤1.50,range less than 0.05 % passed
1.50 <total %="" 0.10="" content(%)≤4.00,range="" less="" passed<="" sulfur="" td="" than=""></total>
Total sulfur content(%)>4.00,range less than 0.20 % passed
Print parameter
Parameter name Parameter value
Add
Delete
Save Back

Fig.5-1-2

**1-1.Basic setting:** Click "Basic Setting" on the Setting window popup the window as Fig. 5-1-2.

- Print type
  - Report: Select the item, then print the selected records in the report form
  - Report forms: Select this item, then print the selected records in the report forms.
- In dropdown box of report and report forms, different format of report and report forms can be selected. Report and report forms can also be set in "Report form configuration". After saving, you can print after selecting.
- Whether the parallel sample is out-of-range or not: After selecting it, report and report forms can check if parallel sample is out of range according to "Calculation condition of the parallel sample". Otherwise, only average value will be displayed in the report or report form.
- Display blank sample: Select blank sample, then display the blank sample record on the data sheet.
- Calculation condition of the parallel sample: Set up total sulfur content parallel sample in different sections is the condition to judge whether or not it is out-of-range.
- Save: After modify related parameters, click the button, then the parameters can be saved, otherwise, the parameters can not be saved.
- Back: Click the button, quit the window, then return to the main interface of the data base.

**1-2.Device card No.:** Click "Device Card No." on the Setup window, popup the window as Fig. 5-1-3.

The function of this window is to set up ID No. corresponding to the device.

Setting								
Basic setting	Device o	card No.	Data backu	p   Password	. management	Report	form	configuration
		Card	No. of No.1 No. of No.2	device device				
		Card	No. of No.3	device				
					:	Save		Back

Fig. 5-1-3

1-3.Data backup: Click "Data Backup" on the Setup window, popup the window

as	Fig.	5-1	-4
----	------	-----	----

Setting								_	
Basic setti	ng Device	card No.	Data back	up Passwo	ord managemer	nt   Repor	t form	configura	tion
Backu									
	₽ D	ata automa	atic backup	)					
	Book	un timo: /		10	dowa		Bookur		
	Dack	up time. (	NICE EVELY	10	uays	_	Dackup	<u></u>	
Resto	:e								
2014	812085618	. bak				_			
							Delete		
							Restor	e	
						Save	1	Back	
					_				_ //

Fig. 5-1-4

- Backup
  - Data automatic backup: Select this item, the procedure will automatically backup the data base based on the set backup time.
  - Backup now: Click the button, the data base this time or this year can be backup.
- Restore

 Delete: Select the records on the left textbox, then click the button, the backup data base can be deleted.

Restore: Select the records on the left textbox, then click the button, the backup data base can be restored.

Note:

#### $\diamond$ When use the function, it shall be careful.

#### 1-4.Report form configuration (Only for configurable report): Click "Report

Form Configuration" on the Setup window, popup the window as Fig. 5-1-5.

- Column name: name corresponding to the main window column.
- > Print or not: whether the column is printed on the report form or not.
- > Print name: display the column name on the report form.
- Print sequence: The print sequence of each column on the report form shall be based on the ascending sequence.
- > Print width: The unit is mm for each column width on the report form.

Note :

#### ♦ The selected record lines can not exceed the printed range of A4 paper.

1	Sett	ing							
	Bas	sic setting	Device car	d No. Data ba	ackup   Password	l management	Report	form	configuration
		Colname	IsPrint	PrintName	PrintWidth				
		AutoNmb	✓	AutoNmb	25				
		Name	✓	Sample No.	30				
		Weight	✓	Weight(mg)	20				
		Mad	✓	Mad(%)	15				
		Stad	<ul><li>✓</li></ul>	St, ad(%)	20				
		StadAvg	<ul><li>✓</li></ul>	Average(%)	20				
		Std	✓	St,d(%)	20				
		StdAvg	✓	Average(%)	20				
		TestDate	✓	Test date	20				
		TestTime	✓	End time	15				
		Tester	✓	Tester	15				
		TestMethod	<ul><li>✓</li></ul>	Test method	20				
		Bake	✓	Bake	25				
		CodeId	<ul><li>✓</li></ul>	Device No.	15				
:									
	_								
	No	ote: unit of	column wid	lth is mm.					
						:	Save		Back



2.Generate correction formula: Select the records that shall take part in the

generating correction formula on the data display column, then click the item, popup the correction window as Fig. 5-1-6.

🖳 Generate co	rrection formul	La-[ZH22]							<u>_    ×</u>
Detection	Low-Sulfur	•		06.	1	1	1		
Test method	Default metho			···•]					
Calibration	Quadratic equ	 							
Calibration	llagagracic edg	" <u> </u>		te te					
Currently	used corrector	formula		<sup>5</sup> 0.4		•			
Y=0+1X				ų -					
				e. s					
				Jan					
Newly gene	rated correcto	r formula		go. 2 -					
V=-0.0211	752188+0_004402	275373¥^1+		ά ι •					
7.34102334	1E-06X^2	210010X 1		₩0.1	0				
					6				
				0					
Generated c	alibration	Apply newly g	enerated	ō :	25 50 7	75 100 1	25 150 1	75 200	225
				<b>••</b> • 141	<u></u>	A 501.			
Automatic No.	Sample number	Used for corre	Sample weight	Mad(%)	Standard sulfu	St, ad(%)	St, d(%)	Tester	R/14/201
120140814001	01+	~	100.0	1.30	0.0821	10.00	10.03	cyf11111	8/14/201
120140814009	031	~	100.0	3.40	0.0348	10.00	10.35	cvf11111	8/14/201
120140814010	26b	~	100.0	5.36	0.0246	10.00	10.57	cyf11111	8/14/201
120140814011	11r	✓	100.0	1.56	0.6133	10.00	10.16	cyf11111	8/14/201
120140814012	10i	~	100.0	1.23	0.4247	10.00	10.12	cyf11111	8/14/201
120140814013	09i		100.0	0.08	0.3807	10.00	10.01	cyf11111	8/14/201
120140814014	12g	~	100.0	0.33	0.2113	10.00	10.03	cyf11111	8/14/201
120140814015	04h	✓	100.0	1.02	0.1010	10.00	10.10	cyf11111	8/14/201
•									•
Related coeffici	ent (R) : 0. 9901	relativity:Highly	significant corr	elation Surpl	is deviation(S):C	1. 0330			

Fig. 5-1-6

Select the correction effective records on the data sheet of the main interface window of the data base, and then click "Generate correction formula" on the shortcut button column or click "System"  $\rightarrow$  "Generate correction formula" on the menu, popup the window as above displayed Figure.

- Detection cell: Select the generated correction formula of high sulfur or low sulfur detection cell.
- Test method: Select correction method, generally, it shall coincide the selected record.
- Correction curve: Select the correction line type, generally, quadratic one is selected, with line type as related coefficient (R) >0.9990.
- Currently used correction formula: currently used correction curve formula as the current method.
- Newly generated correction formula: display the newly generated correction curve formula.
- Generate correction curve: click the button, the procedure will automatically

generate correction curve.

- Apply newly generated correction curve: click the button, the procedure will automatically use newly generated correction curve.
- Records on the data sheet used in the correction column: Records listed or selected can take part in the correction and vise versa.

Note:

- ☆ The sample number of the selected generated correction records shall be found on the standard substance bank; otherwise, the records that not satisfy the requirement will be automatically waived when the generate correction curve interface is open in the system.
- ♦ After the correction curve modified, it shall recalculate the records of the method; otherwise, the records will not be renewed.

**3. Edit correction formula:** click this item, popup the window as Fig.5-1-7; check and modify the correction formula and linear of some method.



Fig. 5-1-7

- 4. Print: print the selected records in the data sheet.
- 5. Print preview: preview the selected records in the data sheet.
- 6. Report forms editor: Users can modify or add report and report forms according

to their requirements. Operating interface is shown as Fig.5-1-8. (For use details, please refer to instruction files in software installation package.)

In interface shown as following diagram, user-defined report and report forms can be set. Click "Save" after finishing setting to cover existing file or rename the new file.

Report forms editor	
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Image: Second	ortHeader1:ReportHeader ailGrid Columns ColumnContent ColumnCitelo
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Automatically Sample number TestMethod Sample weight(mg) Mad(%) St,ad(%)	
- Count(#AutoNo Avg(#Stad#)	<u>م</u>
ColumnContent ☐ ColumnContent ☐ : #AutoNo#:::::::::::::::::::::::::::::::::::	oGrid True
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E ReportFooter:ReportFooter1       ShowGri         Test company: #Test company#       Storage         TextEnc       TextEnc	id True Format Text code UTF-8
PageFooter Title	Your Report I
= [#C [#C ] Appear	rance
Normal View Pare View Proview View Display View	H+Rapart (mm, subslaps an)

Fig.5-1-8

# 5.2.2 Edit Menu

```
As Fig. 5-2-1
```



Fig. 5-2-1

**1. Modify:** Click it and input passwords to open single-record browse window to modify parameters and click "Re-calculation" to update the parameters.

2. Delete the selected records: delete the selected records in the data display

column.

3. Delete all records: delete all displayed records in the data display column.

**4. Drift correction by using selected records:** to generate drift correction coefficient based on the selected records in the data display column, and recalculate currently selected records based on the new drift correction coefficient.

**5. Recalculate the selected records:** the system will recalculate the selected records in the data display column.

#### 5.2.3 Searching Menu

As Fig. 5-3-1

Sea	arching View Data base Help							
60	User-defined searching							
	Searching parallel sample							
	Searching today's records							
	Searching all records							
	Searching the records with the same date of the selected one							

Fig. 5-3-1

**1. Searching parallel sample:** click this item, display the records in the data display column with the similar sample No. and test date as the selected records.

**2. Searching today's records:** display the records in the data display column with the same test date as the computer system date.

**3. Searching all records:** display all records of the data base in the data display column.

**4.** Searching the records with the same date of the selected one: display the records in the data display column with the same test date as the selected records.

**5. User-defined searching:** click this item, popup the displayed window as Fig. 5-3-2.

User-defined searching $\times$	Auto No.	Sample No.	Test method	Sample weight(mg)	Had(%)	St, ad(%)	St,d(%)	Unireoc	erd view window	×
	120140415001	空日样	200mg1350	200.0		0.05147			100140415000	
	120140415002	空日样	200mg1350	200.0		0.05154		Auto No.	120140415030	_
Automatic numbering	120140415003	空日样	200mg1350	200.0		0.0517		Sample No.	11g	
ke 💌	120140415004	空日样	200mg1350	200.0		0.05164		Sample	199.1	
	120140415005	空日样	200mg1350	200.0		0.05169		Hed (%)	1.65	_
	120140415006	04h	200mg1350	199.3	5.07	0.97	1.02	nau(m)	1 54	-
Sample number	120140415007	04h	200mg1350	199.3	5.07	0.98	1.03	St, ad(%)	1.34	_
ke v	120140415008	04h	200mg1350	199.8	5.07	0.99	1.04	St, d(%)	1.57	_
	120140415009	101	200mg1350	199.6	2.71	3.78	3.89	Tester		
	120140415010	101	200mg1350	200.7	2.71	3.76	3.86	Test date	2014-04-15	
Test method	120140415011	13f	200mg1350	199.9	2.78	2.99	3.08	iest uate	14.46.19	Made
1 (				199.9	2.78	2.98	3.07	End time	11.40.10	woult
	User_def	hen		200.4	1.57	0.23	0.23	Begin time	14:44:43	window
	User-uer	meu		200.2	1.57	0.26	0.26	Sarea	86.1603	windo
Test date	Searchin	o wind	low	200.2	1.82	2.08	2.12	Ponorka		>
14/8/12 To 2014/ 512	bearennin	5		200.5	1.82	2.06	2.10	Remains	/年2次	
				199.9	2.15	2.23	2.28	Туре	16.00	_
	120140415018	12g	200mg1350	199.3	2.15	2.21	2.26	Peak value of	6078	
Result scope	120140415019	12g	200mg1350	199.9	2.15	2.21	2.26	Area of	86.1603	
7 100	120140415020	12g	200mg1350	199.6	2.15	2.22	2.27	Toot nothed	200ng1350	_
10 100	120140415021	12g	200mg1350	199.9	2.15	2.23	2.28	rest method	D001	-
	120140415022	12g	200mg1350	200.0	2.15	2.23	2.28	Device No.	0001	_
	120140415023	12g	200mg1350	199.8	2.15	2.22	2.27	Temp		_
	120140415024	12g	200mg1350	199.2	2.15	2.23	2.28	Humidity		
	120140415025	11g	200mg1350	200.2	1.65	1.57	1.60			
	120140415026	11g	200mg1350	199.2	1.65	1.55	1.58			
	120140415027	11g	200mg1350	200.1	1.65	1.55	1.58			
	120140415028	11g	200mg1350	200.5	1.65	1.52	1.55			
	120140415029	11g	200mg1350	200.4	1.65	1.55	1.58			
	120140415030	11g	200mg1350	199.1	1.65	1.54	1.57			
	120140415031	11g	200mg1350	200.2	1.65	1.52	1.55			
	120140415032	11g	200mg1350	199.6	1.65	1.54	1.57			
	220140422001		200mg1350	200.0		0.34				
	220140422002	900-4¥	200mg1350	200.0		0.36				
	120140504001	ビロ件	款认力法 BNI 古注	100.0		0.05133				
	120140504002	エロ件	試い力法	100.0		0.05259				
	120140504003	エロ件	試い力法	100.0		0.05245				
	120140504004	ビロ样	就认为法	100.0		0.05321				
	120140504005	ビ日祥	就认为法	100.0		0.05471				
	120140504006	ビ日祥	默认方法	100.0		0.05192				
	120140508001	空日祥	默认力法	100.0		0.05142				
Searching	120140508002	12日秤	默认为法	100.0		0.05385	•		Recal	aul a

Fig. 5-3-2

There are 5 methods for data query: Automatic numbering, sample numbering, test method, test date and result scope.

Query based on one or more conditions: the first is to select query method and then select the query condition; input related condition in condition box and then click "Searching" button, all records that satisfy the condition will display in the data column, such as the query steps of automatic numbering:

- Setting up searching method: click "Automatic numbering" check box, making it in selected state.
- Setting up searching condition: click "v" button and select one item (such as "Like"), and then input the date in the right box (such as 201004).
- Searching: click this button, the system will automatically display all test records that contain 201004 automatic numbering in the data display column.

# 5.2.4 View Menu

As fig. 5-4-1



Fig. 5-4-1

**1. Display unirecord:** click this item, display unirecord browse window on the right side of the data display column.

**2. Hide selected column:** click this item, hide the selected line in the data display column.

**3. Display all columns:** click this item, display all configured display columns in the data display column.

**4.** Automatically adjust column width: click this item; automatically adjust alignment displayed width in the data display column based on the contents in every line.

## 5.2.5 Data Base Menu

As Fig. 5-5-1, to select the year, display all records of the year selected in data display column.

Da	ta base	Help	
✓ 2014¥ear		n	
Fig. 5-5-1			

5.2.6 Help Menu

As Fig. 5-6-1

He	lp
	About(A)

Fig. 5-6-1

1. Help: Click it to get online help file of data management.

**2. About:** click this item, you can obtain the version information about data management program of SDS350 infrared sulfur analyzer.

#### 5.2.7 Exit Data Management

As Fig. 5-8-1, click "×" on the top right corner of the Data Management window, popup the prompt window as the following Figure, and then click (Y) and exit the Data Management window; return to the main program interface of SDS350 infrared sulfur analyzer; click (N), it is to waive the exit.



Fig. 5-7-1

## **Chapter 6 Operation Instructions**

This chapter introduces how to finish a complete test process, including preparatory work, system detection, blank analysis, standard sample analysis and user sample analysis.

#### **6.1 Preparatory Work**

- Instrument online: Start the computer, open the Windows desktop, double click the shortcut icon of "SDS350 Infrared Sulfur Analyzer" to be online.
- After the program prompts online, confirm whether it is necessary to replace the desiccant and clean the filters in accordance with the intraday test quantity and the information prompted by the program.

#### Note:

- After finishing every 600 samples, dehydrite and silica wool in No.1 drying tube must be replaced.
- ☆ The dehydrite should have a granularity of ¢ 3~4mm, domestic manufactured dehydrite, powdery dehydrite and other desiccants are strictly prohibited.
- Ordinary cotton, cotton for medical purpose or absorbent cotton shall not be adopted to replace silica wool. Silica wool should be compacted.
- Don't shut down the power switch of the instrument during its normal online working and test process to avoid abnormal running of the instrument caused by mis-operation.
- On't adjust gas circuit flow valve during the normal test process of the instrument, and don't move filter and Bastogne filter, otherwise, it may influence the gas circuit flow and the test result.

#### **6.2 System Detection**

#### 1. Detection of gas source:

Click "Manual Detection" icon in the toolbar of the main interface or click "Detection"  $\rightarrow$  "Gas circuit cleaning" icon in the menu bar, then do the following checks:

Check whether the switch of the oxygen cylinder is on.

- Check the indicated pressure of the high pressure gauge of the reducing valve on the oxygen cylinder. If the pressure is below 1MPa, the oxygen cylinder should be replaced.
- Adjust the indicated pressure of the low pressure gauge of the reducing valve on the oxygen cylinder to 0.2MPa.
- $\blacktriangleright$  Check flow of O<sub>2</sub>, SO<sub>2</sub> flow meter and adjust flow to 3.5L/min and 2.5L/min.
- Click "Stop cleaning", exit "Manual Detection", return to the main interface of the program.

#### 2. Detection of system gas tightness

For system gas tightness check operation method, please refer to instrument debugging part. System gas tightness test is not done during normal tests. If test results are abnormal obviously or doubt that there is leakage in gas circuit, then gas tightness check should be carried out.

#### 6.3 Create test method

If new test method needs to be added for the first time to use instrument or after software upgrading, test method should be created first to do sample analysis. If test method is existed and new method does not need to be added, this step can be ignored.

- A. Click "Test method" dialog in "Setting" menu.
- B. Click "Add" to create a new test method, then click "Save" to save the new method, shown as Fig.6-3-1.

etting[1#]						
High temperature furnac	e setting					
Test User information	n Serial port s	etting Standard :	substance	Test meth	nod	
Name of method	nt temperature:	test integration	time compa	ratively a	s cleaning	tirf
Default method	1350		80	50		5
Newly added method2	1350		80	50		20
•						•
	Add	D	elete			
Modify special param	ieters		Sav	re 🛛	Back	

Fig.6-3-1

Note:

- For the first time to use software, there is default method (Test parameters are recommended parameters.) If you do not have other special requirements, you can use this method directly. Test parameters of "Default method" can be modified, click "save" to get the required test method.
- Without guiding from Sundy technicians, please do not modified default parameters of test method at will.
- ♦ Select created test method, click "Delete" to delete the method. This operation is irrecoverable, please use it with care.

#### 6.4 Heating

Turn on heating power and air switch on instrument IO plate, click "<sup>1</sup> button in quick icon bar of main program to start instrument heating and temperature control.

Note:

- Select "Test method" in program interface before heating, then instrument will heat and control temperature according to "constant temperature point" of the selected method.
- If you do not select "Test method" in main interface before heating, system will heat and control temperature according to "constant temperature point" of the method used last time.
- ♦ If it is the first time to use the software, system will heat and control temperature according to "constant temperature point" of the default method.

#### 6.5 Sample weighing

Put clean crucible on balance tray. Do zero clearing after balance is stable, weigh about 100mg sample, wait balance reading to be stable, record the balance weight, even the sample and place them in sample box in order.

#### Note:

- $\diamond$  Crucible processing method:
  - a) Before the first time to use crucibles, bake them in Muffle furnace with slow ash method.

- b) For the used crucibles, clean residual ash and wipe them with brush. Then back them at the temperature of 950°C for 30min and cool them in the air before using again.
- Sample weight requirement: single coal sample weight can be 100mg, 200mg or 300mg. In order to save test cost, 100mg is recommended. But if the coal sample is with poor representation or hard to combust completely, sample weight is recommended to be higher to do test.

#### 6.6 Sample placing

Place samples on the sample placing platform in order as introduction of Fig.6-6-1 (Sample tray vertical view).



Note:

- ♦ Sample placing regulation: There are 1-5 rows on the sample tray, place samples from No.1 row according to arrow indicating direction.
- All samples should be placed on sample placing tray shown as Fig.6-6-1 according to arrow indicating direction in order. Other positions are forbidden to place any samples at will.
- Crucibles should be placed in sample placing slot of the trays, otherwise, it may cause mechanical error.

#### 6.7 Blank Analysis

Input "Blank sample" into the "Sample number" of the data sheet bar of the main interface, input "100" into the sample weight bar, select method in the method

bar, click "Start test" icon in the toolbar of the main interface or click "Test"  $\rightarrow$  "Start" icon in the menu bar, the program will automatically do blank analysis.(Shown as Fig.6-7-1)

t data[1#]								
Auto No.	Sample No.	Test method	mple weight(mg	Mad(%)	St, ad(%)	St, d(%)	Test date	Beg
	Blank Sample	Default method	100.0					
	Blank Sample	Default method	100.0					
	Blank Sample	Default method	100.0					
	Blank Sample	Default method	100.0					
	Blank Sample	Default method	100.0					
	Blank Sample	Default method	100.0					

Fig.6-7-1

Note:

- ♦ Generally, blank sample and sample test can be done after instrument stable heating for 2h.
- ♦ When making blank analysis, no sample will be put in the crucible, but the crucible should be placed on the sample placing tray.
- ♦ The blank analysis is used for automatically balancing the system baseline and ensuring the system stability. So blank analysis should be done every day, and should be executed before standard sample analysis and test sample analysis. Make blank analysis till the instrument reaching balance (parallel sample error≤0.3%) and the instrument will generate blank values and update them to later tests. Blank analysis should be done at least 3~5 times.
- After finishing blank analysis, before standard sample analysis or test sample analysis, it is necessary to do 1 or 2 waste samples transition.
- ♦ In this stage, the tester should observe whether the aspitation flow is 2.5L/min, whether the gas supply test flow is 3.5L/min. If there is difference on the above flow, please adjust them timely.

#### 6.8 Standard Sample Analysis

In the "sample number" of the data sheet bar of the main interface, select adopted standard coal number or input corresponding standard coal number, input standard sample weight into the sample weight bar, input moisture value into the moisture bar, select adopted method in the method bar, the program will automatically do standard sample analysis.

Note:

- ♦ The standard sample analysis is used for instrument correction and check.
- The adopted standard samples must be defined in the standard substance bank. For building the standard substance bank, please refer to Chapter 4.
- ♦ Generally, it is necessary to analyze 2~3 standard samples, and the accuracy of sulfur element value in the standard sample analysis should be in the repeatability allowable range.
- $\diamond$  It is suggested to analyzing the samples continuously.

#### **6.5 Standard Sample Correction**

Standard sample is corrected by adjusting the instrument mathematical model according to the given standard sample. Standard sample correction consists of rating curve correction and drift correction. Rating curve correction is used in generating a certain methodological linear of the instrument, drift correction is used in compensation standard sample correction, for the purpose of correcting the system's slight change influence to the test result.

1. Rating curve correction (If there is valid correction curve for the selected test method, then this step can be ignore.)

Operation method:

- ➤ Define standard sample in the standard substance bank. Click "Setup"→ "Setup"→ "Standard substance" page, input St, d% and name of standard sample into the table of this page, click "Save".
- Analyze the standard sample in accordance with the requirements in 6.1~6.8.

➤ After analysis, input standard sample analysis result into the data bank, select standard sample analysis record for rating curve, click into the data bank, popup dialog box as Fig.6-9-1, select relevant parameters such as curve linear in this window for setting up, click "Generate correction curve" →



"Apply newly generated correction formula", finally finish generating rating curve of a certain method.

Fig.6-9-1

Exit the data base, back to the main interface, select standard sample analysis record in the data table bar of the main interface, click the right mouse button to select "Recalculate the selected records", and adopt new correction formula to recalculate the analysis result of the standard sample analysis record.

#### Note:

- During the analysis, the sample number of the standard sample, which is for correction of rating curve, must be consistent with the number in the standard substance, such standard sample must be the standard sample defined in the standard substance, and its Mad% value must be input.
- ♦ Tester can select multi-sample standardization or single-sample

standardization. We suggest selecting multi-sample standardization and selecting standard samples with high, medium and low sulfur contents for standardizing curve correction samples.

- ♦ We suggest to select quadratic curve linear, and its correlation coefficient (R) should be bigger than 0.9990, the best linear.
- ♦ Each standard sample must go through test of 2~3 sub-samples, and the precision must be in the range of national standard.
- ♦ If you need to modify the calibrated curve, click "Edit correction curve" to pop up dialog shown as Fig.6-9-2. Only need to check or not check "For correction" in sample record sheet of data bar, then re-click "Generate correction curve", "Apply correction curve" to finish modifying curve.





#### 2. Drift correction:

In the data sheet bar of the main interface, select standard coal analysis record, click "Drift correction by using selected records" in the menu bar of the main interface, the program will automatically generate drift coefficient, later test records will be corrected automatically.

#### Note:

#### $\diamond$ Drift correction shall be conducted at the very start of every day, or

conducted when using standard sample to check the accuracy of the instrument and it is unqualified

- ♦ For the standard sample used for drift correction, the precision of sulfur element value must be in the range of national standard of coulometry.
- ♦ Generally, the standard sample used for drift correction should be close to routine analysis samples in property and sulfur element value for drift correction.
- ♦ The drift correction standard sample must be the standard sample defined in the standard substance bank.
- ♦ After standard coal drift correction, 1-2 kinds of standard coals can be used to check if the correction coefficient is suitable. But the standard sample used for reexamination must be different from drift standard sample.

#### 6.10 Analysis of User Sample

Input number of user sample into the "Sample number" bar of the data sheet bar of the main interface, input weight of such sample into the sample weight bar, select adopted method in the method bar, the program will automatically make an analysis of the user sample.

#### Note:

♦ If there are quite a few user samples, we suggest to add standard sample analysis after finishing user sample analysis, for the purpose of ensuring the accuracy of the user sample analysis.

#### 6.11 Recalculation

Select relevant record in the data sheet bar of the main interface, click "recalculate selected records", the system will use new parameters to recalculate the analysis result.

#### Note:

Recalculate the selected records: when modifying correction curve, drift coefficient, Mad%, sample weight and sample number, after selecting the records, "Recalculate the selected records" must be clicked for the recalculation of record result and storage in data base, otherwise, the record cannot be updated and stored into data base.

♦ After modifying the sample weight or sample number or Mad% of a certain record, when click "Recalculate the selected records" or "Recalculate", the system will prompt "Whether replace the correction formula, drift coefficient with latest parameters or not?", it indicates that the correction formula and intraday drift coefficient of the test method of this record have been changed. If you want to calculate by latest parameters, please click "Yes', otherwise, click "No".

#### 6.12 Insert, delete rows

In continuous tests, you can right click the mouse and select "Insert sample" or "Delete sample" to insert emergency sample or delete any samples, at the same time, you can insert samples in corresponding position of sample placing tray or take away deleted sample.

#### Note:

- ♦ Samples can be added at any time during tests. Additive sample order should be the same as that of interface.
- ☆ If you need to delete samples to be tested during tests, you only need to take the samples from sample tray and delete the corresponding record from main interface.
- If you need to insert samples during tests, you only need to insert samples in the corresponding position of sample tray and insert blank row and input sample record in main interface.
- ♦ While delete and insert samples, samples on the sample placing tray will be taken and placed, so, care should be taken during operation. Also, make sure the sample order is the same as records in the main interface.

#### 6.13 Data export

After finishing tests, test results can be exported. Select records to be exported, then right click mouse to select "Export the selected records" to show the menu as Fig.6-13-1. User can select export data to different format.

Drift correction by using selected records Recalculate the selected records	
Export the selected records	Export the selected records to EXCEL file
Searching today's records Searching parallel sample Searching this year's records Searching the records with the same date of the selected one	Export the selected records to RTF file Export the selected records to FDF file Export the selected records to CSV file Export the selected records to Image file
Columms Setting Display all columns Hide selected column Automatically adjust column width	

Fig.6-13-1

# 6.14 Printing

After finishing user sample analysis and recalculation, open the data base, print

the record required. For printing, please refer to Chapter 5.

# 6.15 Dropping Temperature and Logging Out

Click in the menu bar of the main interface.

When the instrument temperature drops to 1000°C below, log out of the program, turn off the power supply of the instrument and the computer.

#### Note:

# ✤ To shut down the power supply of the instrument will influence the service life of the instrument.

#### **Chapter 7 Instrument Maintenance**

Equipment maintenance is of very importance, which directly concerns the accuracy, precision, fault rate and service life of the equipment. Please carefully read this chapter to finish normal maintenance work of equipment in order to ensure normal maintenance of SDS350 infrared sulfur analyzer.

1. The following matters shall be noticed when using crucible:

Before its use, the test crucible for daily use shall be put into muffle furnace for burning under the temperature of 950°C after the residue in it has been disposed and cleaned.

- a) Treatment of new crucible: the new test crucible shall be burned in the muffle furnace by slow ash method before use.
- b) Treatment of test crucible: clear off the residue in the crucible and burn it in muffle furnace under the temperature of 920°C for 20min, after cooling down, the crucible shall be stored in drying tower and ready for use.
- c) Clearing method of residue in crucible: after the cooling of the crucible, use tweezer to scrape the residue in crucible gently (Note: the tweezer shall not scrape the residue by leaning closely against the wall of the crucible, and the scraping strength shall not be big, so as to avoid the damage to the crucible), then use a small and clean brush to brush down the residue in the crucible.
- 2. The following matters shall be noticed when changing silicon-carbon tube:
  - a) Before the installation of silicon-carbon tube, use ohms range of multi-meter (200ohms range) to measure the cold-state resistance of the silicon-carbon tube, if the resistivity is less than 4ohms or is infinite, it means there is a short circuit or an open circuit, and the silicon-carbon tube of this type shall not be used.
  - b) Take, place and install the silicon-carbon tube gently, operation behavior should be normalized so as to avoid damage of the tube caused by improper operation.
  - c) After the installation, the ohms range of multimeter shall be used for short-circuit inspection of two terminals of the silicon-carbon tube. The

silicon-carbon tube shall not achieve conduction with the instrument enclosure or furnace shell; otherwise, the power-on test cannot be conducted.

- d) Before the use of the installed silicon-carbon tube, the anti-aging treatment shall be carried out first. Anti-aging treatment: add method to test method page of system setup, such as method 1, then set the constant temperature point of "Method 1" at 200°C, exit test method page, and select "Method 1" in test data sheet bar on the main interface, click "Start heating up", wait for the temperature of the combustion furnace rising to 200°C and maintaining this temperature for 30min, click "Stop heating up", and set the constant temperature point of "Method 1" at 1000°C, click "Start heating up", after maintaining 1000°C for 30min, set the constant temperature at 1350°C according to the foregoing steps, after maintaining 1350°C for 1h, the anti-aging treatment is finished.
- e) While the installed new silicon-carbon tube is being heated for the first time, the tester shall observe whether there is fire striking voice or cracking voice or not, if there is, stop heating up at once and carry out failure checking, if there is not, continue the heating.
- Combustion furnace mouth, sample placing platform, sample pushing platform maintenance:
  - a) After large quantity of tests, there is some ash remained in crucible cooling position of combustion furnace mouth. It is suggested to do regular cleaning, as to much ash will affect the stability of crucible sending or sending out furnace mouth.
  - b) Sample placing platform and sample pushing platform should be cleaned regularly, as crucible will fall ash after long time using, stability of crucible pushing will be affected and motor will also be affected if there is too much ash on the platforms. What's more, if there is too much dust around, there will be lots of ash on the platforms and ash may stick to the crucible, which will affect test results.
  - c) Generally, it is suggested to use portable vacuum cleaner or soft brush to

clean combustion furnace mouth (at ambient temperature), sample placing platform and sample pushing platform. But when soft brush is used, please pay special attention not to sweep dust into instrument or components or guiders around to avoid new mechanical problems.

- 4. Maintain drying tube, gas tube and connector.
  - a) After replacing drying tube, it is suggested to use alcohol to clean it and dry it before use to avoid remainders in the drying tube pollute new reagent.
  - b) Every time after replacing drying tube, its upper and lower metal joints should be cleaned, as there will be some green materials sticking on the joints after large quantity of tests and the green materials will gather into a rounded mass to affect gas circuit. Cleaning steps: clear solid adhesive material firstly, wash the joints with alcohol, finally install drying tube after drying them.
  - c) Maintenance of gas tube mainly includes fluorine rubber tube between combustion furnace and sensor and PU tube of sensor outlet end. There will be lots to dust and adhesive material existing on fluorine rubber tube between combustion furnace and sensor after large quantity of tests. It is suggested to replace the tube or clean it to avoid affecting gas circuit. PU tube of sensor outlet end may turn yellow and crap or be stick with yellow mucoid material after long time use, which will affect front gas tube and SO2 generated will leak after the tube burst.
  - d) Mental joint between combustion furnace mouth and fluorine rubber tube should be maintained regularly, as there will be lots of dust accumulating here, which will affect gas circuit, even test results after long term accumulation.
- 5. Instrument Maintenance
  - Computer and printer equipped with the instrument shall be maintained as required in relating operating manual. In computer virus shall be periodically checked and killed to prevent virus invasion from affecting normal operation of instrument.

- 2) Instrument shall be operated in dry environment to avoid invasion of dust or corrosive gas. If instrument is not operated for long time, please use special dustproof cover to protect the instrument and periodically power on the instrument. The time for increasing temperature by powering on instrument shall be not less than 90 minutes and the time for flushing gas circuit shall be 30 minutes.
- Instrument shall be maintained by special person. Each part of instrument must not be dismantled at will to avoid fault due to malfunction.
- Instrument shall be used for a special purpose to avoid affecting the normal operation of system.
- 5) Carefully carry instrument to avoid damaging the wearing part in instrument or displacing key part.
- 6) When instrument surface is dirty, after the instrument is powered off, use wet towel coated with a little detergent (soap, water or alcohol) to slightly wipe housing, then use clean towel to remove detergent.

#### The following matters shall be noticed during wiping:

- a) Before wiping, power supply must be cut off to avoid electric shock and damaging instrument.
- b) During wiping, water should be prevented from penetrating into instrument to result in fault.

# **Chapter 8 Common Troubles and Solutions**

This chapter describes the common trouble and maintenance knowledge of the instrument. If user cannot solve it by itself, please contact Sundy Company.

Trouble	Cause and solution
	1. Network card driver is not installed in computer.
	2. Net cable or interface is damaged.
1. System displays that	3. If it is connected in local area network, IP address may
machine is not online.	conflict.
	4. Program was damaged by virus.
	5. Communication is abnormal. Please fix it by professional.
	1. Heating power supply is not powered on or badly
2 "Illocting newson symply not	connected.
2. Heating power suppry not	2. Air break switch on instrument IO plate is not opened.
powered on is prompted.	2. Instrument fuse is broken. Please replace it.
	3. Control card has trouble. Please fix it by professional.
	1. Various temperature points are out of constant temperature
	range.
	2. Sample quality or test method is not entered into data sheet
	of main program.
3. Test status cannot be entered.	3. System has abnormal prompt.
	4. Some functions turned on are locked with "start test" into
	each other.
	1. Weighing is not accurate or operation is not correct.
	2. Preheating time of instrument constant temperature is not
	enough.
	3. Blank analysis is not made until instrument is stable.
	4.Test result accuracy is not good due to drift correction is
	not made timely.
	5. Test result precision is bad due to leakage or blockage of
	gas circuit.
4. Test results are not ideal.	6. Pressure and purity of oxygen are not correct.
	7. Balance is not preheated for 30min.
	8. Sample combustion is incomplete.
	9. Infrared pool or gas circuit is contaminated.
	10. Drying agent and filter are not timely replaced and
	cleaned.
	11. Coal sample is difficult to burn, 300g of sample is
	recommended to do test.
5. Aspitation flow cannot be	1. Drying agent is gathered into a rounded mass, which
regulated to 2.5L /min or to	makes gas resistance is great.
top all along.	2. Gas circuit is blocked. Please clean the joint and tube

	between combustion furnace gas outlet and drying tube.					
	3. Bastogne filter is blocked. Please replace it.					
	4. There is leakage in gas circuit.					
	1. Pate pushing position photoelectric switch is damaged or					
	installed improperly and position unsuccessfully.					
6. "Push plate initialization failure" is prompted or push	2. Pushing plate movement over time due to damaged motor,					
	fail to initialize.					
plate has no action.	3. Position photoelectric switch position fails due to infrared					
	interference					
7. When instrument is powered on, buzzer continuously rings and machine cannot be normally connected.	RS485 communication cable between analysis box and instrument master has connection error or disconnection or damage.					
	1. Check whether signal cable of printer is well connected or					
	damaged.					
9 Deinting sound he was to an	2. Printer program has problem. Reset printer.					
8. Printing cannot be made or	3. Measurement & control software has problem. Replace the					
printing error occurs.	software.					
	4. Printer has problem. Hold warranty to contact local					
	maintenance agent.					
	1. Check and change computer CONFIG.SYS setup. Test					
	software should be re-installed.					
0. Commutan is halted	2. Computer has virus. The virus should be killed.					
9. Computer is nation.	3. Test software is damaged.					
	4. Computer has trouble. Hold warranty to contact local					
	computer maintenance agent.					



# **Chapter 9 Instrument Diagram**

9.3 Inner structure (Key elements)



Fig.9-3.1





# Appendix 1:

# List of Spare Parts of SDS350

No	Code	Name
1	3.02.01.4536	Sample introducing rod
2	3.02.01.4681	Crucible
3	3.02.01.4679	Metal filter
4	3.01.03.0075	Flow meter SO <sub>2</sub> 3L
5	3.01.03.0076	Flow meter O <sub>2</sub> 6L
6	3.02.01.4678	Drying tube
7	3.02.03.0190	Outer combustion tube
8	3.02.03.0189	Inner combustion tube
9	4.02.0078	Silicon-cabide tube
10	3.02.01.4534	Combustion supportive tube
11	3.01.02.0049	Bastogne filter
12	3.01.01.0030	Air filter
13	3.01.05.0578	Cylinder CJPB6-15
14	3.01.02.0070	Quick coupling PC06-01
15	3.01.02.0071	Quick coupling PG10-06
16	3.02.02.0025	O Ring Ø5.3ר34.7
17	3.01.02.0231	O Ring Ø5.3ר48.7
18	3.02.02.0030	O Ring Ø2.65ר9.5
19	3.01.02.0341	O Ring Ø1.8ר9.5
20	3.01.02.0342	O Ring Ø3.55ר28
21	3.02.02.0027	O Ring Ø1.8ר6
22	3.01.02.0207	O Ring Ø2.65ר11.2
23	3.01.02.0202	PU Tube Ø6.5ר10
24	3.01.07.0397	PU Tube Ø4ר6
25	3.01.02.0153	PU Tube Ø5ר8
26	3.01.02.0151	Silicone tube Ø6ר9
27		Fluorine rubber tube Ø8ר12
28	3.02.01.0867	Guiding collar
29	3.03.00.0042	Thermocouple

No	Code	Name
30	3.01.05.0244	Three-cord cable (Heating cable)
31	3.01.07.0015	Controlling power cable
32	4.02.0035	Matching plug
33	3.01.01.0138	Signal cable for balance (external) (Optional)
34	3.01.07.1470	Net cable (5m)
35	3.01.05.0207	on-off switch
36	3.01.05.0211	Gas pump
37	3.01.05.0085	Two way solenoid valve (220V)
38	3.01.05.0181	Two way solenoid value $(12V)$
39	3.01.05.0084	Three way solenoid valve
40	3.01.05.0562	DC Motor 1/120
41	3.01.05.0485	DC Motor 1/300
42	3.01.05.0103	AC Motor
43	3.01.05.0090	Regulator 152X-40(O <sub>2</sub> )
44	3.01.05.0036	Fan (110×110)
45	3.01.05.0565	Fan (120×120)
46	3.01.04.1167	Pressure adjusting mode
47	3.01.05.0011	Relay
48	3.01.05.0014	Wave filter
49	3.01.05.0082	Air break switch
50	3.01.05.0367	ON-OFF switch
51	3.01.05.0082	Protection tube (3A)
52	3.01.04.1193	Photoelectric switch BS5-T2M
53	3.01.04.1163	Photoelectric switch (OPB815WZ)
54	3.01.04.1194	Photo-electric sensing switch
55	3.01.05.0045	Sensitive switch
56	4.01.0484	Power Card
57	3.01.04.1164	Pressure sensor (Pressure difference)
58	3.01.04.1165	Pressure sensor (Absolute Pressure)

No	Code	Name	ľ	No	Code	
9	4.01.0481	DC driving card	6	58	4.01.0485	
0	4.01.0385	AC driving card	6	59	4.01.0486	
51	4.01.0483	ADDA card	7	70	4.01.0320	
52	4.01.0382	Main board card	7	71	4.01.0482	
53	3.02.01.4681	Crucible	7	72	3.01.06.0016	
64	4.02.0028	Program download cable	7	73	3.02.01.4678	
65	3.01.03.0008	Silica wool	7	74	3.01.03.0031	
66	3.01.07.0073	Vacuum Grease	7	75	3.01.08.0003	
67	3.01.08.0002	Brush	7	76	4.02.0077	
			_			
			_			

1		
No	Code	Name
68	4.01.0485	Transfer card 1
69	4.01.0486	Transfer card 2
70	4.01.0320	Cement resistor card
71	4.01.0482	Bottom board card
72	3.01.06.0016	Magnesium perchlorate
73	3.02.01.4678	Drying tube
74	3.01.03.0031	Loose wool F-1600
75	3.01.08.0003	Sample ladle
76	4.02.0077	Auxiliary hook

Maintenance Item	Maintenance Period	Position	Operating method
Silicon-carbon tube	Half a year	In high temperature furnace	Replace it
Outer combustion tube	Half a year	In high temperature furnace	Replace it
Inner combustion tube	Half a year	In high temperature furnace	Replace it
O ring Ø5.3ר34.7 O ring Ø5.3ר48.7	Half a year	In the end cover of sample sending mouth	Replace it
Gas pipe	3 years	Inside the instrument	Replace it
Dehydrite	600 samples (Drying tube I) Or 1/4 invalid in Drying tube II	In drying tube	Replace it
O ring Ø3.55ר28	1 year	In drying tube	Clean it and smear it with Vacuum grease
O ring Ø2.65ר11.2	1 year	In drying tube	Clean it and smear it with Vacuum grease
Bastogne filter	1 year	On right of instrument	Replace it
O ring Ø1.8ר6	1 year	On right of instrument	Replace it
O ring Ø2.65ר9.5	1 year	On right of instrument	Replace it
O ring Ø2.65ר11.2	1 year	On right of instrument	Replace it
Crucible	100 samples		Replace it

# **Periodic Maintenance Schedule**

Note: Based on working 8 hours each day.
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