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PROCESS LASER GAS ANALYSIS SYSTEM

Focused Photonics Inc.



LGA series PROCESS LASER GAS ANALYSIS SYSTEM

Utilizing proprietary technologies of Tunable Diode Laser Absorption Spectroscopy (TDLAS), FPI delivers the LGA system to satisfy in-situ measurements with high accuracy, fast response, strong reliability and virtually maintenance free.

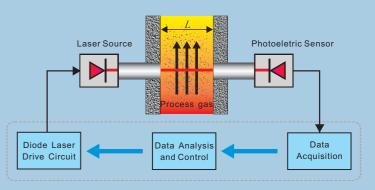
The LGA system is applicable to almost all industrial process, especially well proven in harsh conditions in combination of high temperature, pressure, dust, corrosives and contaminants.

Leveraging an installed base of over 8,000 units, the LGA system has been extensively used for combustion and safety control, process optimization, energy recovery, scientific research as well as environment monitoring. To date, these units have been employed in metallurgy, refinery, petrochemical, natural gas, power plant, waste incineration, cement and other situations where gas measurement is needed.

Gas	Detection Limit	Measurement Range
O ₂	0.01%Vol	0-1%Vol, 0-100%Vol.
СО	0.6 ppm	(0-60)ppm, (0-100)%Vol.
CO_2	1.5 ppm	(0-150)ppm,(0-100)%Vol.
H_2O	0.3 ppm	(0-30)ppm, (0-100)%Vol.
H_2S	2 ppm	(0-200) ppm, (0-30)%Vol.
HF	0.02 ppm	(0-2)ppm, (0-10,000) ppmVol.
HCI	0.01 ppm	(0-7) ppm,(0-8000)ppmVol.
HCN	0.3 ppm	(0-30)ppm, (0-10,000)ppmVol.
NH_3	0.4 ppm	(0-40) ppm, (0-100)%Vol.
$CH_{\!\scriptscriptstyle 4}$	10 ppm	(0-200)ppm, (0-100)%Vol.
C_2H_2	0.1 ppm	(0-10) ppm, (0-100)%Vol.
C_2H_4	0.6 ppm	(0-60)ppm, (0-100)%Vol.

Notes: Listed are detection limits specified for 1m optical path at 20°C, 1 bar abs. Dual Gas CO+CO2, HCL+H2O are available for particular applications. Other gases and detailed measurement ranges may be available or customizable on request.







CONFIGURATION

The transmitter portion of the LGA system consists mainly of diode laser, laser driver and HMI modules, realizing diode laser driving, spectrum data processing and human-machine interface. The receiver unit of the analyzer is composed of a photoelectric sensor, signal processing and purge control modules, is capable of signal processing and anti-explosion control.

MEASURING PRINCIPLE

The laser beam from the transmitter unit passes across the stack or duct work and is absorbed by the measured gas. The attenuated light is then detected by the photoelectric sensor in the receiver unit, and the resulting signal is sent back to the transmitter unit and analyzed to yield gas concentration.

Measuring Principle Diagram

TECHNOLOGY COMPARISON

ITEM	LGA LASER SYSTEM	CONVENTIONAL ONLINE ANALYSIS	
Adaptability	Applicable to high temperature, pressure, moisture, dust density and corrosion	Applicable to constant temperature, pressure and dust free	
Measurement	In-situ, continuous/real-time measurement; sample gas evacuation free	With sample conditioning system, discontinuous measurement	
Response Time	Fast, only limited by electronics response, less than 1sec	Slow, limited by gas sampling, transport, and instrument electronics response 20+sec	
Accuracy	Average concentration along the optical path; no cross interference from other gas species, dust, and gas parameter fluctuations	Gas concentration at the tip of the sampling probe only, affected by gas influence and absorption, and leaked during gas sampling and transport; cross interference from other gas species, dust, and gas parameter fluctuations; gas information lost due to dissolution, absorption, and leakage	
Reliability	No moving parts, highly reliable	Many moving parts, low reliability	
Calibration& Maintenance	Calibration:<2times/year Maintenance:<2times/year	Calibration:2-3times/month Maintenance: frequent	
Operation Costs	No spare parts, only cost of electricity	Lots of spare parts, around20% of the equipment cost per year	



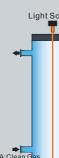
TECHNICAL PRINCIPLE

No Cross Interference

The laser spectrum features excellent monochromaticity with spectral width down to 0.001nm, which is much narrower than spectral width of other light sources. By utilizing the 'Singleline' spectroscopy, a well-targeted laser spectrum can be sorted out to cover only the measuring gas without overlapping spectrum of all background gases.

No Effects from Dust, Moisture and Window Contamination

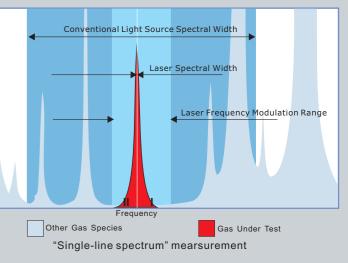
TDLAS gas analyzers use a laser spectral scanning technique. The unit periodically scans the gas under test with a modulation frequency range larger than the gas absorption spectral line-width such that, within one scan period, there are two distinctive areas. Area I is uneffected by the gas absorption and gives Td, whereas Area II is effected and gives Tgd.



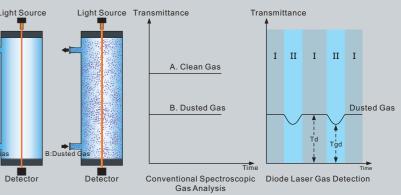
The transmittance of the gas under test is then calculated accurately by A:Clean Ga Tg=Tgd/Td. The interference from dust and optical window contamination is, therefore, automatically screened out.

Automatic Temperature & Pressure Compensation

When gas temperature and pressure under measurement changes, the width and height of the absorption waveform change, which effects the accuracy of the measurement. By having 4-20mA process temperature and pressure input, the LGA system automatically compensates for them with a proprietary algorithm to ensure measurement accuracy.







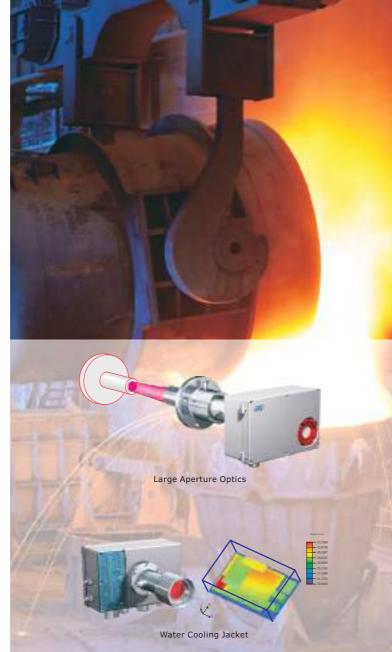


LGA-4100 In-situ

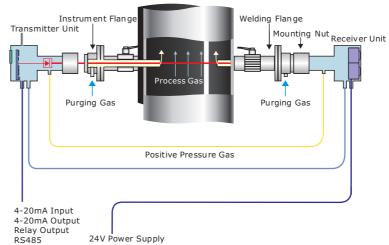


Features and Benefits

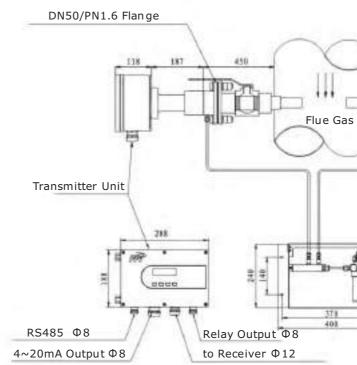
- In-situ, no gas sampling
- No cross interference
- Fast response less than one second
- Diverse optical length (0.5~20m)
- Reliable in all harsh conditions: high temperature & pressure, dust density, moisture and corrosion
- Online calibration, no zero drift
- Thousands of tailor-made solutions for various applications
- International ATEX certified



LGA Composition



LGA Dimension



Application Areas

Refinery & Petrochemical

- FCC Catalyst Regeneration
- SCR NH3 Injection
- Desulfurization Efficiency
- Explosive Process Gas
- Reactant Ratio Optimization
- Product Purity
- HCL, HF Emission
- Flue Gas Measurement Outlet of Process Heaters, Fractionators, Thermal Crackers, Utility Boilers and Incinerators
- Sulfur Recovery

Metallurgy

- Combustion Control for Reheating Furnace, Heat treatment Furnace, Forging Furnace
- Converter Gas Recycle
- Blast Furnace Gas
- Coke Oven Gas
- Flue Gas of Sintering, Pelletizing
- Coal Injection Safety Control
- Electric Tar Precipitator (ETP) Safety Control
- CDQ Circulating Gas
- Gas Tank Safety Control
- Calorific Value Analysis
- Sulfur Recovery

Thermal Power

- SCR NH3 Injection
- Desulfurization Efficiency
- Coal Injection Safety Control
- HCL, HF Emission

Technical Data

Specifications

Repeatability: $\leq \pm 1\%$ F.S. Linearity: $\leq \pm 1\%$ F.S. Span drift: $\leq \pm$ 1%F.S./6 months Response time: \leq 1s(T90) Warm-up time: ≤ 15min Optical path length: 0.5-20m Process gas temperature: max. 1500°C Process gas pressure: 0.8 to 4 bar abs.

Input & Outputs

Analog outputs: 2 outputs 4-20mA, max. load 750Ω, electrically isolated Relay outputs: 3 outputs 24V DC/1A Analog inputs: 2 inputs 4-20mA, for gas temperature & pressure compensation Communications: RS485(or Bluetooth, RS232 or GPRS)

Operating conditions

Power supply: 24V DC(21-36V DC), or 90-240V AC Power consumption: max. 20W Operating temperature: -30°C to +60°C Storage temperature: -40°C to +80°C Purge gas: 0.3 to 0.8MPa nitrogen gas or instrument air Protection class: IP65

Approvals

Laser class: class 1 conformant with IEC60825-1 CE certified: conformant with 2004/108/EC ATEX(IECEx) certified: Ex d op is pxIIC T5 Gb

DN50 Ball Valve au Receiver Unit Purging Unit na InletΦ8 24V Power Supply Φ8 to Transmitter



LGA-4500 Bypass





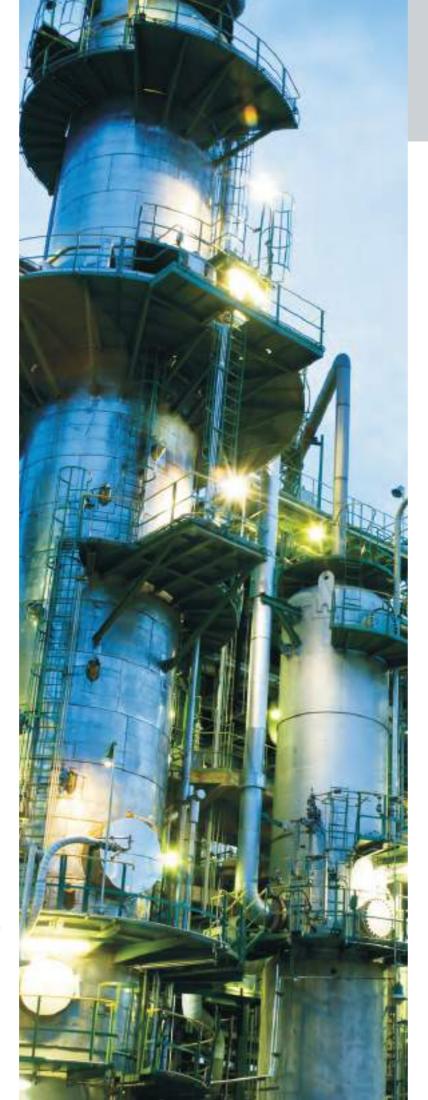
Corrosion resistant/high temperature proof gas cell

Features and Benefits

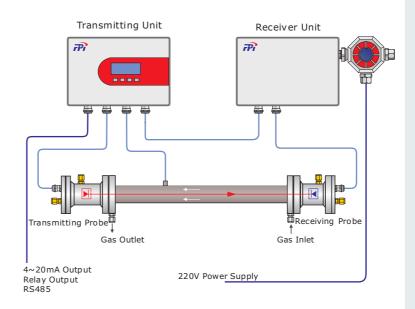
- Fast response
- High accuracy, ppm level resolution
- No cross interference
- Reliable in all harsh conditions: high temperature & pressure, dust density, moisture and corrosion
- Online calibration, no zero drift
- International ATEX certified

Application Areas

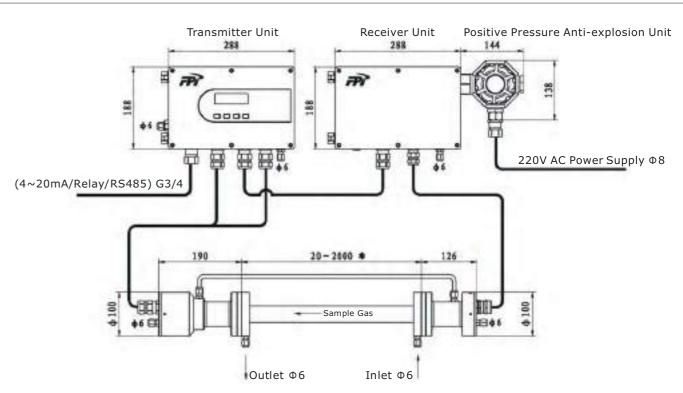
- Trace H₂O in VCM Production
- Coal Injection Safety Control
- SCR NH₃ Injection in Coal-fueled Plants
- All other applications where in-situ doesn't fit due to high pressure or dust density, limitation of stack diameter or position.



LGA Composition



LGA Dimension



Technical Data

Specifications

Repeatability: $\leq \pm 1\%$ F.S. Linearity: $\leq \pm 1\%$ F.S. Span drift: $\leq \pm 1\%$ F.S./6 months Instrument response time: $\leq 1s^*$ Warm-up time: ≤ 15 min Gas cell temperature: -30°C to +250°C Gas cell pressure: 0.5 to 3 bar abs. *Gas flow>11/min, system response time: 790 $\leq 20s$.

Input & Outputs

Analog outputs: 2 outputs 4-20mA, max. load 750Ω, electrically isolated

Relay outputs: 3 outputs 24V DC/1A Communications: RS485(or Bluetooth, RS232 or GPRS)

Operating Conditions

Power supply: 200-240V AC/48-63Hz Power consumption: ≤30W (no heat tracing) Operating temperature: -30°C to +60°C Storage temperature: -40°C to +80°C Purge gas: 0.3MPa nitrogen gas or instrument air Protection class: IP65

Approvals

Laser class: class 1 conformant with IEC60825-1 CE certified: conformant with 2004/108/EC ATEX(IECEx) certified: Ex d op is pxIIC T5 Gb



LGA-4500IC Trace Level



Features and Benefits

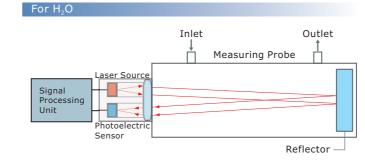
- Drift free, Maintenance free
- Accurate, real-time measurement
- No tape, No carrier gas, No light source or probe replacement
- No interference from glycol, methanol or amine
- Reliable in harsh conditions
- ATEX certified

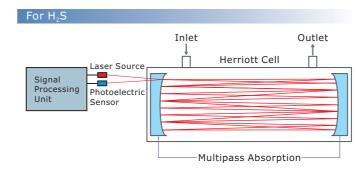
Application Areas

- \blacksquare H₂O, H₂S in natural gas
- Trace level H_2O , H_2S in chemicals

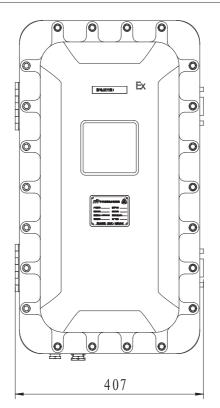
Gas	Detection Limit	Measurement Range
$\rm H_{2}O$ in natural gas	2ppm	0-100ppm
$\rm H_{2}S$ in natural gas	2ppm	0-50ppm,0-200ppm

LGA Composition





LGA Dimension



Technical Data

Specifications (H₂O)

 $\label{eq:response} \begin{array}{l} \mbox{Repeatability:} \leqslant \pm 1\% \mbox{F.S.} \\ \mbox{Linearity:} \leqslant \pm 1\% \mbox{F.S.} \\ \mbox{Span drift:} \leqslant \pm 1\% \mbox{F.S.}/6 \mbox{ months} \\ \mbox{Instrument response time:} \leqslant 1 \mbox{s}^* \\ \mbox{Warm-up time:} \leqslant 15 \mbox{min} \\ \mbox{Suggested gas flow:} 1-5 \mbox{L/min} \\ \mbox{*Gas flow} > 1 \mbox{L/min, system response time (long OPL 112 \mbox{cm}):} \mbox{T90} \leqslant 11 \mbox{s}, \\ \mbox{system response time (long OPL 112 \mbox{cm}):} \mbox{T90} \leqslant 21 \mbox{s}. \end{array}$

Specifications (H2S)

Repeatability: $\leq \pm 1\%$ F.S. Linearity: $\leq \pm 1\%$ F.S. Span drift: $\leq \pm 2\%$ F.S./6 months Instrument response time: $\leq 3s^*$ Warm-up time: ≤ 60 min Sample gas: dust/moisture/oil free (filtration ≤ 0.5 um) Suggested gas flow: 1-5L/min * Gas flow > 1L/min, system response time: T90 $\leq 30s$.

Input & Outputs

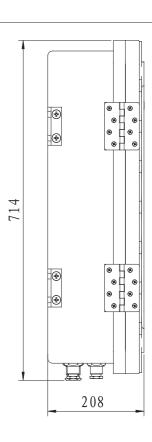
Analog outputs: 2 outputs 4-20mA, max. load 500Ω, electrically isolated Relay outputs: 3 outputs 24V DC/1A Communications: RS485(or RS232/Modbus)

Operating Conditions

Power supply:100-240V AC(H₂O), 200-240V AC(H₂S)/48-63Hz Power consumption: $\leq 12W(H_2O)$; $\leq 450W(H_2S)$ Operating temperature: -20°C to +50°C Protection class: IP65

Approvals

Laser class: class 1 conformant with IEC60825-1 CE certified: conformant with 2004/108/EC



LGA-C300 Calorific Value

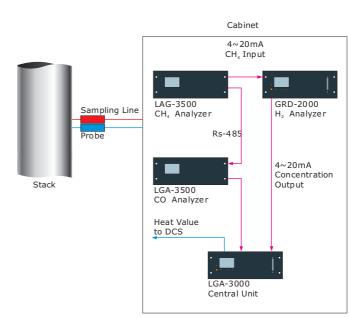


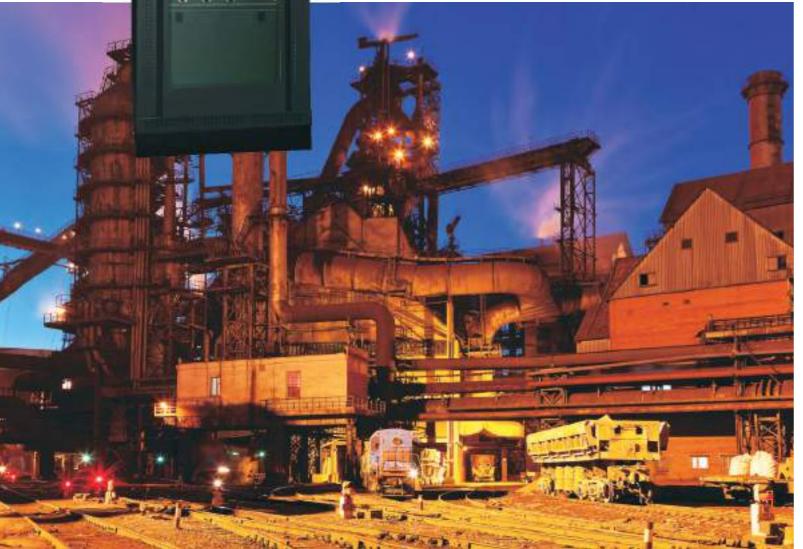
Features and Benefits

- Integrated and compact
- Simultaneous and continuous multiple fuel compositions (CO, CH₄, H₂) analysis
- Low cost ownership and operation
- Reliable in harsh conditions

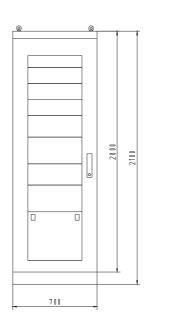
Application Areas

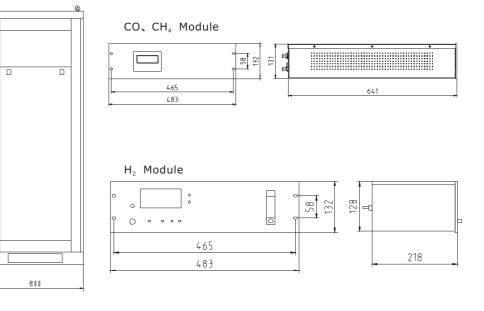
Calorific value analysis in iron&steel





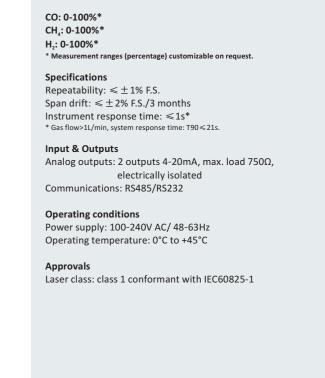
LGA Dimension





LGA Composition

Technical Data



Iron & Steel

Process Measuring Position Gas Measured Typical Range Measuring Purpose Sintering, Pelletizing 0, 0-21% Combustion Optimizing, Energy Saving CO, 0-15% Combustion Optimizing, Energy Saving Safety Control Sintering Flue Gas 0, 0-21% Combustion Optimizing, Energy Saving Fuel Colorific Value Safety Control Pelletizing Flue Gas 0, 0-15% Combustion Optimizing, Energy Saving Fuel Colorific Value Safety Control Pelletizing Flue Gas 0, 0-15% Combustion Philiphic Store Safety Control Safety Control Color 0-15% Safety Control Combustion Philiphic Store Saving Fuel Colorific Value Safety Control Outlet of Coal Mill 0, 0-21% Combustion Efficiency Control Combustion Efficiency Control Outlet of Coal Mill 0, 0-21% Combustion Efficiency Control Funce Coal Safety Control Outlet of Bag Filter Coil 0-30% Co-30% Constant Combustion Efficiency Control, Funce Ceas Funce Ceas Flue Gas after Bag Filter Coil 0-30% Co-30% Constant Combustion Efficiency Control, Funce Ceas Funce Ceas Flue Gas after Bag Filter Coil 0-30% Co-30% Constant Condenser Operation Monitoring Coil 0-30% Concos Forces Opti	LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4500 LGA-4500 LGA-4500 LGA-4500 LGA-4100 LGA-4100
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Iron Making Intel of Coal Mill O, Outlet of Coal Mill O, O, Outlet of Bag Filter O, O, O, O, O, O, O, O, O, O, O, O, O, O	LGA-4100 LGA-4500 LGA-4500 LGA-4100 LGA-4100 LGA-4500 LGA-4500
Irinet of Coal Mill Co 0-5000ppm Making Outlet of Coal Mill O, 0-21% Outlet of Bag Filter Co 0-5000ppm Safety Control Coal Bunk O, 0-21% Safety Control Coal Bunk O, 0-21% Combustion Efficiency Control. Flue Gas after Bag Filter O, 0-3% Combustion Efficiency Control. Flue Gas after Bag Filter CO, 0-30%/0-50% Combustion Efficiency Control. Flue Gas after Bag Filter CO, 0-30%/0-50% Combustion Efficiency Control. Hot Blast Stove Flue Gas O, 0-21% Combustion Efficiency Control. Flue Gas after Bag Filter CO 0-30%/0-50% Combustion Efficiency Control. Flue Gas after Bag Filter CO 0-30%/0-50% Process Optimizing. Energy Saving. CO (O-2000/0-5000)ppm Safety Control Safety Control Hot Blast Stove Flue Gas O, 0-21% Gas Recycle Control Intel or Outlet of Induced Draft Fan O, 0-5%/0-1% Condenser Operation Monitoring Hot Blast	LGA-4100 LGA-4500 LGA-4500 LGA-4100 LGA-4100 LGA-4500 LGA-4500
Making Making Outlet of Coal Mill O, Coal Bunk O, Coal Bunk O, Coal Bunk O, Coal Bunk Safety Control Value of Bag Filter CO 0-5000ppm Safety Control Coal Bunk CO (0-5000/0-2000)ppm Coal Bunk Coal Bunk CO (0-5000/0-2000)ppm Coal Bunk Flue Gas after Bag Filter CO 0-30%/0-50% Combustion Efficiency Control. Flue Gas after Bag Filter CO 0-30%/0-50% Combustion Efficiency Control. Hot Blast Stove Flue Gas O, 0-21% Coal Bunk Hot Blast Stove Flue Gas O, 0-21% Process Optimizing. Energy Saving. Safety Control Co 0-10% Safety Control Inlet or Outlet of Induced Draft Fon Inlet or Outlet of Induced Draft Fon Inlet or Outlet of Induced Draft Fon Inlet or Outlet of Induced Draft Fon Hat & Outlet of Gas Tank CO 0-10% Gas Bark Safety Control Gas Bark Safety Control Inlet A Outlet of Gas Tank O, 0-5% Hiet & Outlet of Gas Tank O, 0-5% Safety Control Safety Control Inlet A Outlet of Gas Tank O, 0-5% Condenser Operation Monitoring Flue Gas Before Electrostatic O, 0-5% Safety Control Inlet A Outlet of Gas Tank O, 0-5% </td <td>LGA-4500 LGA-4500 LGA-4100 LGA-4100 LGA-4500 LGA-4500</td>	LGA-4500 LGA-4500 LGA-4100 LGA-4100 LGA-4500 LGA-4500
Making Outlet of Codi Mill Co 0-5000ppm Safety Control Outlet of Bag Filter Co 0-3000ppm Co Safety Control Coal Bunk Co 0-21% Co Co Coal Bunk Co 0-21% Co Co Flue Gas after Bag Filter Co 0-30%/0-50% Combustion Efficiency Control, Furnace Leakage Monitoring Flue Gas after Bag Filter CO 0-30%/0-50% Furnace Leakage Monitoring Co 0-21% Process Optimizing, Energy Saving, Safety Control Furnace Leakage Monitoring Intel or Outlet of Induced Draft Fan Co 0-21% Process Optimizing, Energy Saving, Safety Control Intel or Outlet of Induced Draft Fan Co 0-5%/0-21% Gas Recycle Control Intel or Outlet of Induced Draft Fan Co 0-10% Safety Control Intel a Outlet of Induced Draft Fan Co 0-10% Condenser Operation Monitoring Intel a Outlet of Gas Tank O2 0-10% Safety Control Intel a Outlet of Induced Draft Fan Co 0-10% Safety Control <td< td=""><td>LGA-4500 LGA-4100 LGA-4100 LGA-4500 LGA-4500</td></td<>	LGA-4500 LGA-4100 LGA-4100 LGA-4500 LGA-4500
Outlet of Bag Filter Org O-21% Safety Control Coal Bunk Org 0-21% Co Co Coal Bunk Co 0-21% Co Co Blast Furnace Gas Org 0-3% Combustion Efficiency Control. Flue Gas after Bag Filter Org 0-30%/0-50% Combustion Efficiency Control. Flue Gas after Bag Filter Org 0-30%/0-50% Combustion Efficiency Control. Hot Blast Stove Flue Gas Org 0-21% Combustion Efficiency Control. Hot Blast Stove Flue Gas Org 0-21% Combustion Efficiency Control. Hot Blast Stove Flue Gas Org 0-21% Process Optimizing. Energy Saving. Co 0-10% Converter Gas Recycle Control Safety Control Inlet or Outlet of Induced Draft Fan Org 0-5% Contenser Operation Monitoring Inlet or Outlet of Induced Draft Fon Ha Org Org Co Inlet or Outlet of Gas Tank Org Org Org Control Inlet a Outlet of Gas Tank Org Org Org </td <td>LGA-4100 LGA-4100 LGA-4500 LGA-4500</td>	LGA-4100 LGA-4100 LGA-4500 LGA-4500
Steel Co 0-5000ppm 0-, 0-21% 0-21% Flue Gas after Bag Filter Co 0-3% Co Combustion Efficiency Control. Flue Gas after Bag Filter Co 0-30% Co Combustion Efficiency Control. Flue Gas after Bag Filter Co 0-30%/0-50% H ₂ Combustion Efficiency Control. Hot Blast Stove Flue Gas 0-0-03% H ₂ Combustion Efficiency Control. Furnace Leakage Monitoring Hot Blast Stove Flue Gas 0-0-03% Co 0-21% (0-2000/0-5000)ppm Process Optimizing, Energy Saving, Safety Control Inlet or Outlet of Induced Draft Fan Inlet or Outlet of Induced Draft Fan Inlet or Outlet of Induced Draft Fan H ₁ 0-10% Co Condenser Operation Monitoring Inlet & Outlet of Gas Tank Co 0-10% Co Condenser Operation Monitoring Inlet & Outlet of Gas Tank Co 0-10% Co Condenser Operation Monitoring Fue Gas Before Electrostatic Precipitator(ESP) Co 0-5% Condenser Operation Monitoring Fue Gas Before Electrostatic Precipitator(ESP) Co 0-5% Condenser Operation Monitoring Fue Gas Before Electrostatic Coke Oven Exhaust Gas O, 0-5% Condenser Operation Optimizing, Energy Saving Coke Oven Exhaust Gas	LGA-4100 LGA-4500 LGA-4500 LGA-4100
Coal Bunk O, (0-5000/0-2000)ppm Blast Furnace Gas O, (0-5000/0-2000)ppm O, (0-5000/0-5000) Flue Gas after Bag Filter O, (CO, O-30%/0-50%) Combustion Efficiency Control, Furnace Leakage Monitoring Hot Blast Stove Flue Gas O, O, O, O-30%/0-50% Furnace Leakage Monitoring Hot Blast Stove Flue Gas O, O, O, O, O-21% Process Optimizing, Energy Saving, Safety Control Hot Blast Stove Flue Gas O, O, O, O, O, O, O, O, O, O, O, O, O, O	LGA-4500 LGA-4500 LGA-4100
Steel CO (0-5000/0-2000)ppm Making CO (0-5000/0-2000)ppm Flue Gas after Bag Filter CO 0-3% Combustion Efficiency Control, Furnace Leakage Monitoring Hot Blast Stove Flue Gas CO 0-30%/0-50% Combustion Efficiency Control, Furnace Leakage Monitoring Hot Blast Stove Flue Gas O2 0-21% Process Optimizing, Energy Saving, Safety Control Inlet or Outlet of Induced Draft Fan CO 0-100% Gas Recycle Inlet or Outlet of Induced Draft Fan O2 0-21% Gas Recycle Control Inlet or Outlet of Induced Draft Fan O2 0-100% Gas Recycle Control Inlet or Outlet of Induced Draft Fan O2 0-100% Gas Recycle Control Inlet or Outlet of Induced Draft Fan O2 0-100% Gas Recycle Control Inlet a Outlet of Gas Tank O2 0-100% Gas Recycle Control Inlet a Outlet of Gas Tank O2 0-100% Safety Control Fue Gas Before Electrostatic O2 0-5% Combustion Optimizing, Energy Saving Coke Oven Exhaust Gas O2 0-5%/0-1%	LGA-4500 LGA-4100
Blast Furnace Gas O ₂ 0-3% Combustion Efficiency Control, Furnace Leakage Monitoring Flue Gas after Bag Filter CO 0-30%/0-50% Combustion Efficiency Control, Furnace Leakage Monitoring Hot Blast Stove Flue Gas O ₂ 0-21% Process Optimizing, Energy Saving, Safety Control Inlet or Outlet of Induced Draft Fan Inlet or Outlet of Gas Tank CO 0-100% Gas Recycle Control Inlet ar Outlet of Gas Tank CO 0-100% Condenser Operation Monitoring Contenser Operation Monitoring Inlet & Outlet of Gas Tank CO 0-100% Condenser Operation Monitoring Inlet & Outlet of Gas Tank CO 0-100% Safety Control Inlet & Outlet of Gas Tank CO 0-100% Safety Control Flue Gas Before Electrostatic Precipitator(ESP) CO 0-100% Safety Control Flue Gas Before Electrostatic Precipitator(ESP) O ₂ 0-5%/0-1% Safety Control EIP Outlet O ₂ 0-10%/0-5%/0-1% Combustion Optimizing, Energy Saving Coke Oven Exhaust Gas O ₂	LGA-4100
Flue Gas after Bag Filter O: CH, CO 0-3% 0-30%/0-50% CO, CO Combustion Efficiency Control. Fundace Leakage Monitoring Hot Blast Stove Flue Gas O: CO 0-30%/0-50% CO, 0-30%/0-50% H, CO Process Optimizing, Energy Saving. Safety Control Steel Inlet or Outlet of Induced Draft Fan Inlet or Outlet of Gas Tank CO 0-100% 0-100% Gas Recycle Control Inlet & Outlet of Gas Tank CO 0-100% Condenser Operation Monitoring Inlet & Outlet of Gas Tank CO 0-100% Condenser Operation Monitoring Inlet & Outlet of Gas Tank CO 0-100% Condenser Operation Monitoring Inlet & Outlet of Gas Tank CO 0-100% Safety Control Inlet & Outlet of Gas Tank CO 0-5% Combustion Optimizing, Energy Saving Flue Gas Before Electrostatic Precipitator(ESP) O: 0-5% Combustion Optimizing, Energy Saving Coke Oven Exhaust Gas O: 0-5%/0-1% Safety Control Combustion Optimizing, Energy Saving CDQ O: 0-00%/0-5%/0-1% Safety Cont	
Flue Gas after Bag Filter CH, CO 0-5% CO, O-30%/0-50% CO, O-30%/0-50% Combustion Efficiency Control, Funce Leakage Monitoring Hot Blast Stove Flue Gas Hot Blast Stove Flue Gas 0,2 0-21% CO Process Optimizing, Energy Saving, Safety Control Hot Blast Stove Flue Gas Intel or Outlet of Induced Draft Fan Intel & Outlet of Gas Tank CO 0-100% O Gas Recycle Control Intel & Outlet of Gas Tank CO 0-100% O Gas Recycle Control Intel & Outlet of Gas Tank CO 0-100% O Safety Control Intel & Outlet of Gas Tank CO 0-100% O Safety Control Intel & Outlet of Gas Tank CO 0-100% O Condenser Operation Monitoring Intel & Outlet of Gas Tank CO 0-100% O Condenser Operation Intel & Outlet of Gas Tank CO 0-100% O Condenser Operation	
Flue Gas after Bag Filter CO 0~30%/0~50% CO, 0~30%/0~50% Funce Leakage Monitoring Flue Gas after Bag Filter CO 0~30%/0~50% CO, 0~10% Hot Blast Stove Flue Gas 0, 0~21% CO Process Optimizing, Energy Saving, Safety Control Hot Blast Stove Flue Gas 0, 0~21% CO Process Optimizing, Energy Saving, Safety Control Inlet or Outlet of Induced Draft Fan Inlet or Outlet of Induced Draft Fan Inlet or Outlet of Induced Draft Fan Inlet or Outlet of Gas Tank CO 0~10% CO Gas Recycle Inlet a Outlet of Gas Tank Inlet or Outlet of Gas Tank CO 0~10% CO Condenser Operation Monitoring Inlet & Outlet of Gas Tank Inlet & Outlet of Gas Tank O, 0~5% CO Safety Control Inlet & Outlet of Gas Tank Inlet & Outlet of Gas Tank O, 0~5% CO Safety Control Flue Gas Before Electrostatic Precipitator(ESP) O, 0~5% Safety Control ELEV Clifter O, 0~5%/0~1% Combustion Optimizing, Energy Saving Combustion Optimizing, Energy Saving Colde Oven Exhaust Gas O, 0~5%/0~1% Combustion Cptimizing, Energy Saving Combustion Optimizing, Energy Saving CDQ O, 0, 0~5%/0~1% Combustion Optimizing, Energy Saving Combustion Optimizing, Energy Saving CDQ CDQ 0, 0~5%/0~1% Combustion Optimizing, Energy Saving <td< td=""><td></td></td<>	
Steel CO2 0~30%/0~50% Protect Educage Molinioning Hot Blast Stove Flue Gas O2 0~21% Process Optimizing, Energy Saving, Safety Control CO 0~200/0~5000)ppm Process Optimizing, Energy Saving, Safety Control Inlet or Outlet of Induced Draft Fan CO 0~100% Gas Recycle Control Inlet or Outlet of Induced Draft Fan O2 0~5% Condenser Operation Monitoring Inlet or Outlet of Induced Draft Fan O2 0~100% Condenser Operation Monitoring Inlet or Outlet of Induced Draft Fan O2 0~100% Condenser Operation Monitoring Inlet or Outlet of Induced Draft Fan O2 0~100% Condenser Operation Monitoring Inlet or Outlet of Induced Draft Fan O2 0~100% Condenser Operation Monitoring Inlet or Outlet of Gas Tank O2 0~100% Condenser Operation Monitoring Inlet & Outlet of Gas Tank O2 0~100% Safety Control Inlet & Outlet of Gas Tank O2 0~5% Condenser Operation Monitoring Inlet & Outlet of Gas Tank O2 0~5% Control Inlet & Outlet of Gas Tank O2 0~5% Control Inlet & Outlet of Gas Tank O2 0~5% Control Ele Coutlet O2 0~5% Con	LGA-4100
H $_2$ 0-10%Hot Blast Stove Flue GasO2O-21% (0-2000/0-5000)ppm /0-5%Process Optimizing. Energy Saving. Safety ControlConverter Gas RecycleInlet or Outlet of Induced Draft Fan Inlet or Outlet of Induced Draft Fan Inlet or Outlet of Induced Draft Fan Inlet or Outlet of Induced Draft Fan HOOOOOnerster Gas Recycle ControlInlet or Outlet of Induced Draft Fan Inlet or Outlet of Induced Draft Fan Inlet or Outlet of Induced Draft Fan Inlet or Outlet of Gas Tank COOO	LGA-4100
Hot Blast Stove Flue Gas O2 0-21% CO Process Optimizing, Energy Saving, Safety Control Steel Inlet or Outlet of Induced Draft Fan Inlet are Outlet of Gas Tank CO 0~100% O-5%/0~21% Gas Recycle Control Inlet are Outlet of Induced Draft Fan Inlet or Outlet of Gas Tank O2 0~5%/0~21% Condenser Operation Monitoring Inlet & Outlet of Gas Tank O2 0~10% Condenser Operation Monitoring Inlet & Outlet of Gas Tank O2 0~5% Flue Gas Before Electrostatic Precipitator(ESP) Safety Control Flue Gas Before Electrostatic Precipitator(ESP) O2 0~5% Safety Control ETP Outlet Coke Oven Exhaust Gas O2 0~5%/0~1% Safety Control Inlet of Desulfurization H ₂ S 0~2000ppm Desulfurization Efficiency Control Outlet of Desulfurization H ₂ S 0~2000ppm Desulfurization Efficiency Control CDQ CO2 0~5% Conduction Efficiency Control Desulfurization Efficiency Control CDQ CO2 0~2000ppm Desulfuri	GRD-2000
Hot Bidst Stove Flue Gas CO (0-2000/0-5000)ppm /0-5% Process Optimizing, Energy Saving, Safety Control Steel Inlet or Outlet of Induced Draft Fan Inlet & Outlet of Sa Tank CO 0~10% Gas Recycle Control Inlet & Outlet of Sa Tank CO 0~10% Condenser Operation Monitoring Inlet & Outlet of Gas Tank CO 0~10% Condenser Operation Monitoring Inlet & Outlet of Gas Tank CO 0~10% Safety Control Flue Gas Before Electrostatic Precipitator(ESP) CO 0~10% Safety Control Flue Gas Before Electrostatic Precipitator(ESP) O2 0~5% Combustion Optimizing, Energy Saving Coke Oven Exhaust Gas O2 0~5%/0~1% Safety Control ETP Outlet O2 0~5%/0~1% Combustion Optimizing, Energy Saving Coke Oven Exhaust Gas O2 0~10%/0~5%/0~1% Combustion Optimizing, Energy Saving Coke Oven Exhaust Gas O2 0~10%/0~5%/0~1% Combustion Optimizing, Energy Saving Coke Oven Exhaust Gas O2 0~10%/0~5%/0~1% Combustion Optimizing, Energy Saving Coke Oven Exhaust Gas O2 0~10%/0~5%/0~1% Desulfurization Efficiency Control Utilet of Desulfurization H ₂ S 0~20%	
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Steel CO j0-5% Steel Inlet or Outlet of Induced Draft Fan Inlet & Outlet of Induced Draft Fan Inlet & Outlet of Induced Draft Fan Inlet & Outlet of Gas Tank CO 0~100% Gas Recycle Control Inlet & Outlet of Gas Tank CO 0~10% Condenser Operation Monitoring Inlet & Outlet of Gas Tank CO 0~10% Condenser Operation Monitoring Flue Gas Before Electrostatic Precipitator(ESP) CO 0~10% Safety Control Flue Gas Before Electrostatic Precipitator(ESP) O2 0~5% Safety Control EIP Outlet O2 0~5%/0~1% Safety Control Inlet of Desulfurization H ₂ S 0~200ppm Ocake Oven Gas Inlet of Desulfurization H ₂ S 0~200ppm Desulfurization Efficiency Control CDQ CO 0~5% Conducting Gas CDQ CO 0~20%/0~3% Process Optimizing, Safety Control	1 C A (100
Steel Inlet or Outlet of Induced Draft Fan CO 0~100% Gas Recycle Control Inlet or Outlet of Induced Draft Fan O2 0~5%/0~21% Condenser Operation Monitoring Inlet or Outlet of Induced Draft Fan H2 0~100% Condenser Operation Monitoring Inlet & Outlet of Gas Tank CO 0~100% Condenser Operation Monitoring Inlet & Outlet of Gas Tank CO 0~100% Inlet & Outlet of Gas Tank Inlet & Outlet of Gas Tank O2 0~5% Orton% Flue Gas Before Electrostatic Precipitator(ESP) CO 0~100% Safety Control Flue Gas Before Electrostatic Precipitator(ESP) O2 0~5% Combustion Optimizing, Energy Saving Coke Oven Exhaust Gas O2 0~10%/0~1% Safety Control Combustion Optimizing, Energy Saving Outlet of Desulfurization H3 0~2000ppm Desulfurization Optimizing, Energy Saving CDQ CO 0~2 0~5% Desulfurization Efficiency Control Outlet of Desulfurization H3 0~2000ppm Desulfurization Efficiency Control CDQ CO2 0~5% <	LGA-4100
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Gas Tank Safety Control Making Inlet & Outlet of Gas Tank CO 0~100% Inlet & Outlet of Gas Tank O2 0~5% Safety Control Flue Gas Before Electrostatic Precipitator(ESP) CO 0~100% Safety Control Flue Gas Before Electrostatic Precipitator(ESP) O2 0~5% Control Flue Gas Before Electrostatic Precipitator(ESP) O2 0~5% Control EIP Outlet Coke Oven Exhaust Gas O2 0~5%/0~1% Safety Control Coke Oven Exhaust Gas O2 0~10%/0~5%/0~1% Combustion Optimizing, Energy Saving Outlet of Desulfurization H_5 0~2000ppm Desulfurization Efficiency Control Outlet of Desulfurization H_5 0~500mg/Nm³ Desulfurization Efficiency Control CDQ CO 0~20% 0~5% Process Optimizing, Safety Control CDQ CO 0~20%/0~30% Process Optimizing, Safety Control	LGA-4100
Making Inlet & Outlet of Gas Tank CO 0~100% Inlet & Outlet of Gas Tank O2 0~5% Flue Gas Before Electrostatic Safety Control Flue Gas Before Electrostatic CO 0~100% Safety Control Flue Gas Before Electrostatic O2 0~5% Safety Control Flue Gas Before Electrostatic O2 0~5% Safety Control Flue Gas Before Electrostatic O2 0~5% Control Flue Gas Before Electrostatic O2 0~5% Control Flue Gas Before Electrostatic O2 0~5% Control Coke Oven Exhaust Gas O2 0~10%/0~5%/0~1% Safety Control Coke Oven Exhaust Gas O2 0~10%/0~5%/0~1% Combustion Optimizing, Energy Saving Outlet of Desulfurization H_5 0~2000ppm Desulfurization Efficiency Control Outlet of Desulfurization H_5 0~500mg/Nm³ Desulfurization Efficiency Control CDQ CO 0~20% 0~5% Process Optimizing, Safety Control CDQ CO 0~20%/0~30% Process Optimizing, Safety Control	GRD-2000
Making Inlet & Outlet of Gas Tank O2 0~5% Flue Gas Before Electrostatic Precipitator(ESP) CO 0~100% Safety Control Flue Gas Before Electrostatic Precipitator(ESP) O2 0~5% Safety Control Electric Tar Precipitator (ETP) Safety Control Coke Oven Exhaust Gas O2 0~5%/0~1% Safety Control Coke Oven Exhaust Gas O2 0~10%/0~5%/0~1% Combustion Optimizing, Energy Saving Outlet of Desulfurization H2S 0~2000ppm Desulfurization Efficiency Control Outlet of Desulfurization H2S 0~50mg/Nm³ Desulfurization Efficiency Control CDQ CO 0~20% 0~5% Process Optimizing, Safety Control CDQ CO 0~20% Process Optimizing, Safety Control Desulfurization Efficiency Control	
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Precipitator(ESP) CO 0~100% Safety Control Flue Gas Before Electrostatic Precipitator(ESP) O2 0~5% Control EECtric Tar Precipitator (ETP) Safety Control Safety Control Safety Control Coke Oven Exhaust Gas O2 0~5%/0~1% Safety Control Coke Oven Exhaust Gas O2 0~10%/0~5%/0~1% Combustion Optimizing, Energy Saving Outlet of Desulfurization H2S 0~2000ppm Desulfurization Efficiency Control Outlet of Desulfurization H2S 0~5% Desulfurization Efficiency Control CDQ CO 0-20% 0~5% Desulfurization Efficiency Control CDQ CO 0-20% 0~5% Process Optimizing, Safety Control CDQ CO 0-20% Process Optimizing, Safety Control	LGA-4100
Flue Gas Before Electrostatic Precipitator(ESP) O₂ 0~5% Electric Tar Precipitator (ETP) Safety Control ETP Outlet Coke Oven Exhaust Gas O₂ 0~5%/0~1% Safety Control Coke Oven Exhaust Gas O₂ 0~10%/0~5%/0~1% Combustion Optimizing, Energy Saving Coke Oven Gas Inlet of Desulfurization H₂S 0~2000ppm Outlet of Desulfurization H₂S 0~500mg/Nm³ Desulfurization Efficiency Control CDQ Circulating Gas CDQ CO 0~5% CDQ CO 0~20% CDQ CO 0~30% Process Optimizing, Safety Control	LGA-4100
Electric Tar Precipitator (ETP) Safety Control ETP Outlet O2 0~5%/0~1% Safety Control Coke Oven Exhaust Gas O2 0~10%/0~5%/0~1% Combustion Optimizing, Energy Saving Coke Oven Gas Inlet of Desulfurization H2S 0~2000ppm Outlet of Desulfurization H2S 0~500mg/Nm³ Desulfurization Efficiency Control CDQ O2 0~5% O CDQ CO 0~20% Process Optimizing, Safety Control CDQ CO2 0~30% Process Optimizing, Safety Control	LGA-4100
ETP Outlet O2 0~5%/0~1% Safety Control Coke Oven Exhaust Gas O2 0~10%/0~5%/0~1% Combustion Optimizing. Energy Saving Coke Oven Gas Inlet of Desulfurization H2S 0~2000ppm Outlet of Desulfurization H2S 0~500mg/Nm3 CDQ O2 0~5% CDQ CO 0~20% CDQ CO 0~20% CDQ CO2 0~5% CDQ CO2 0~20% CDQ CO2 0~30% Process Optimizing, Safety Control	20/11/00
Coke Oven Exhaust Gas O2 0~10%/0~5%/0~1% Combustion Optimizing, Energy Saving Coke Oven Gas Inlet of Desulfurization H2S 0~2000ppm Desulfurization Efficiency Control Outlet of Desulfurization H2S 0~500mg/Nm³ Desulfurization Efficiency Control CDQ Circulating Gas CDQ O2 0~50% CDQ CO2 0~20% CDQ CO2 0~30% Process Optimizing, Safety Control Control	LGA-4100
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CDQ O2 0~5% CDQ CO 0~20% CDQ Co2 0~30% CDQ CO/CO2 0~20%/0~30%	LGA-4500IC
CDQ O2 0~5% CDQ CO 0~20% CDQ Co2 0~30% CDQ CO/CO2 0~20%/0~30%	
CDQ CO 0~20% CDQ Co2 0~30% CDQ CO/CO2 0~20%/0~30%	LGA-4100
CDQ Co2 0~30% Process Optimizing, Safety Control CDQ CO/CO2 0~20%/0~30% Process Optimizing, Safety Control	LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4500IC LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4100 LGA-4100
CDQ CO/CO ₂ 0~20%/0~30%	
Coking CDQ H, 0~10%/0~20%	GRD-2000
Claus Sulfur Recovery	
Acid Gas H ₂ S 0-100% H ₂ S:Air Proportioning, Reaction Optimizir	LGA-4100 LGA-4100 LGA-4500IC LGA-4500IC LGA-4100 LGA-4100 LGA-4100 GRD-2000 GRD-2000 CMA-2000 CMA-2000 CMA-2000 LGA-4100 LGA-4100
Outlet of Catalytic Reactor H ₂ S/SO ₂ 0-1%/0-2% H2S:SO2 Ratio, Reaction Optimizing	OMA-2000
Claus Exhaust Gas Cleaning	
Outlet of Sulfur Condenser H ₂ 0~5% Oxidization Control	GRD-2000
Outlet of Tail Gas Scrubber H ₂ S 0~1% Scrubbing Efficiency Monitoring	
Outlet of Incinerator O2 0~5% Combustion Optimizing, Energy Saving	
Chimney SO ₂ (0~2000/0~1000)ppm Emission Monitoring	CEMS-2000
Hot Reheating Furnace	
Rolling in-situ on Furnace O2 0~21% Burning Loss Control	LGA-4100
	LGA-4100
Calorific Value Analysis	
	LGA-4100
	1.64.6200
Calquifia	LGA-C300
	0~60% LGA-4100 0~20% LGA-C300 0~60% LGA-C300 0~40% Fuel Gas Proportioning, Cost Accounting 0~60% LGA-C300
Value	
	LGA-4100 LGA-C300 Fuel Gas Proportioning, Cost Accounting
H ₂ 0~40% CO 0~50%	LGA-C300
Blast Furnace Gas CO 0~50% H ₂ 0~10%	LGA-C300
O ₂ 0~10%	
Others Industrial boilers/calciners 0~5%/0~1% Process Optimizing, Safety Control	
CO /(0~5000/0~2000)ppm	

Oil&Gas

Industry	Application	Measuring Position	Objects to measure	Instruments
	FCC	Outlet of Regenerator	CO,CO ₂ , O ₂	LGA-4100
	Hydrogen Production	Process gases	CO, CO_2, C_2H_4	LGA-4500
Oil		Feedstock gas	H ₂ S	OMA-3120/LGA-4500
		Outlet of Claus Reactor	H ₂ S/SO ₂	OMA-3510
Refining	Sulfurrecovery	Outlet of Condenser	H ₂	TAI-2020
-		Exhaust gas incineration	SO ₂	OMA-3110
		Emission gas	SO ₂ , H ₂ S, O ₂ , particulate, velocity	CEMS-2000,LGA-4100
	Ethylene Cracking	Outlet of cracking furnace	CO, Co_2, C_2H_2	LGA-4100/4500, PGC
	PTA	Process gases	O ₂ , CO, Co ₂ , H ₂ O, CH ₃ COOH	LGA-4100/4500, SUPNIR
	EO/EG	Process gases	O ₂ , CO ₂ , CH ₄ , C ₂ H ₆ , C ₂ H ₄ , EO, Ar, N ₂	MGA, LGA-4500
Petrochemical	PE	Process gases	$CO, CO_2, C_2H_4, C_2H_6, O_2$, trace H_2O	LGA-4500, TAI-2000/8800
i ettoenenneur	PP	Process gases	$CO, CO_2, C_3H_4, C_3H_8, H_2, C_4H_8, C_4H_9CL,$ Trace H_2O, O_2	LGA-4500, TAI-2000/8800/3020T
	PS	Process gases	O ₂ , CO/CO ₂ , Trace H ₂ O in Benzene	LGA-4500
Chemical		Feedstock C2H4	H ₂ O, O ₂ in C ₂ H ₄	LGA-4500
	PVC (VCM)	Feedstock Cl2	O ₂ , trace H ₂ O in Cl ₂	LGA-4500
		EDC gas	Cl ₂ , Trace H ₂ O in EDC	OMA-3010, LGA-4500
		Recycle gas	O_2 , CO , CO_2 , C_2H_4	LGA4500/4100
		HCL stripping	O ₂ in HCL	LGA-4500
	Methanol Ammonia Synthesis	Process gases	O ₂ , CO, CO ₂ , NH ₃	LGA-4500/4100
	Urea Synthesis	Trocess guses	NH _a , Co ₂	LGA-4500
	Hydrogen Peroxide	Oxidation	O ₂	LGA-4100
	Sulfuric Acid	Feedstock gas	SO ₂	OMA-3110
	SCR of	0	NH ₃ slip	LGA-4500/4100
DeNOx		on stack	NOx, SO ₂ , O ₂ , CO, CO ₂	CEMS-2000
	Extraction	Rawgas	High H ₂ S, CO ₂	LGA-4500PA (portable)
		Acid gas removing	High H ₂ S	LGA-4500
	Sulfur recovery exhaust an	Sulfur recovery exhaust gas	H ₂ S/SO ₂	OMA-3510
Natural Gas	Purification	Exhaust gas treatment	SO ₂	OMA-3110
Nuturul Ous		Purified gas	Trace H ₂ S, H ₂ O	LGA-4500IC
	Transportation	Pipelines and stations	Trace H ₂ S, H ₂ O	LGA-4500IC
	Compression	CNG	Trace H ₂ S, H ₂ O	LGA-4500IC

Other Applications

Industry	Measuring Position	Gas Measured	Measuring Purpose	Instruments
	Incinerator	0 _{2'} CO	Incinerator Combustion Control	LGA-4100
	Outlet of Acid Scrubber	HCL, HF	Input Control of Calcium Hydroxide	LGA-4100
Waste	Outlet of Bag House Filter	HCL, HF	Filter Efficiency Control	LGA-4100
Incineration	Outlet of SCR Reactor	NH ₃	NH ₃ Injection Control and NH ₃ Slip Detection	LGA-4100
	Charaly Indian	HCL+H ₂ O	Dry HCL Exhaust	LGA-4100
	Stack Inlet	SO ₂ , NOx, O ₂ , CO, Co ₂ , Dust, TPF	Emission Monitoring	CEMS-2000B
	Inlet of SCR Reactor	NOX, O ₂	Flue are Menitering	CEMS-2000B
Thermal Power	Outlet of SCR Reactor	NOx, O ₂ , Dust, TPF, Humidity	Flue gas Monitoring	CEMS-2000B
	Outlet of SCR Reactor	NH ₃	NH ₃ Injection Control and NH ₃ Slip Detection	LGA-4100
	Inlet of Desulfurization Reactor	SO ₂ , O ₂ , Velocity, Humidity	Desulfurization Efficiency Control	CEMS-2000B
	Outlet of Desulfurization Reactor	SO ₂ , NOx, O ₂ , Dust, TPF, Humidity	Desulturization Efficiency Control	CEMS-2000B
	Chimney	SO ₂ , NOx, O ₂ , Dust, TPF, Humidity	Emission Monitoring	CEMS-2000B
	Inlet of Coal Mill	O ₂ , CO		LGA-4100
	Outlet of Coal Mill	0 _{2′} CO	Safety Control	LGA-4500
	Outlet of Bag Filter	O ₂ , CO	salely Connor	LGA-4100
	CoalBunk	O ₂ , CO		LGA-4500
Cement	Kiln Outlet	O ₂ , CO, CO ₂	Combustion Optimizing	LGA-4100
	Outlet of Preheater Tower	O ₂ , CO, CO ₂	Process Optimizing	LGA-4100
	Inlet of Coal Mill	O _{2'} CO		LGA-4100
	Outlet of Coal Mill	0 ₂ , CO		LGA-4500
	Outlet of Bag Filter	0 ₂ , CO	Safety Control	LGA-4100
	Coal Bunk	0 ₂ , CO		LGA-4500