# NSX-5000V: List of relevant standard testing method



Element	Method	Number	Scope
	ASTM	D5453	Light hydrocarbons, Fuels, Oils
	ASTM	D6667	LPG, Gaseous hydrocarbons
~ • •	ASTM	D7183	Aromatic hydrocarbons
Sulfur by UVFL	ASTM	D7551	Gaseous hydrocarbons, LPG & NG
<i>»j c i i L</i>	DIN/EN/ISO	20846	Petroleum products
	JIS	K2541-6	Crude oil and petroleum products
	UOP	987 Part-A	Very volatile liquid hydrocarbons
	ASTM	D4629	Trace contents, Liquid petroleum hydrocarbons
	ASTM	D6069	Aromatic hydrocarbons
	ASTM	D7184	Ultra-traces, Aromatic hydrocarbons
Nitrogen by CLD	JIS	K2609	Crude oil and petroleum products
	UOP	936	LPG
	UOP	971	Light aromatic hydrocarbons
	UOP	981	Very volatile liquid hydrocarbons
	ASTM	D5808	Aromatic hydrocarbons
	ASTM	D4929	Crude oil
Chlorine	ASTM	D7457	Aromatic hydrocarbons
by coulometry	IP/EPA	9076	New and used petroleum products
· ·	UOP	779	Petroleum products
	UOP	910	LPG and gases
	ASTM	D3120	Light petroleum hydrocarbons
Sulfur	ASTM	D3246	LPG
by	DIN/EN/ISO	16591	Petroleum products
coulometry	JIS	K2541-2	Crude oil and petroleum products
	JIS	K2240	LPG

Note: Follow instructions in manuals to correctly install, connect and operate the instruments. Contents of catalogues are subject to change without prior notice when improvements are made in performance. The actual color of the goods may appear different from color printed. All screen images are simulated. \*Company and product names contained herein are the trademarks or registared trademarks of the company concerned.

Safety Precautions • Read through the user's manual first before installing, piping, wiring and operating this monitor, then always follow to the manual to correctly operate the monitor.

# Nittoseiko Analytech Co., Ltd.

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CAT No.31010122021E



# Trace elemental analyzer **NSX-5000V**<sub>SERIES</sub> Vertical furnace system

Nittoseiko Analytech Co., Ltd.

# **NSX-5000V**

NSX-5000V series will contribute to the reduction of environmental impact through advanced technologies.

It enables automatic, safe and highly sensitive measurement of trace nitrogen, sulfur and chlorine in liquid or gas samples. Can be used in a wide range of applications such as quality control of petroleum/ chemical/ recycled products or automotive fuels and environmental analysis.

# Features

# Automatic syringe dilution (ASC-550L)

Automatic dilution can be performed accurately regardless of the proficiency of the operation by simply setting stock solution and solvent in the vials. Advance preparation for calibration curves is no need and waste solution can be reduced, resulting in reducing environmental load and low running costs.



# User-friendly software

Simple and Advanced modes are available for a wide range of users such as in lab and product quality control.



Advanced mode

For unknown sample measurement or advanced operations.

Detailed setting for condition examination is possible.

For steady sample measurement such as product inspections. Easy and simple operation, no need to re-enter parameters.

# Automatic operation

Automated operation is available from "Furnace ON" to "Gas OFF". Also continuous run with various temperature settings are able to conduct.

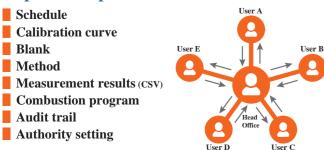
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# Import/Export function

Various setting such as "schedule", "methods" and "the others" can back up and restore.

This is useful function when using multiple systems need to be operated at the same condition.

**Imported/Exported items** 



Audit trail

All operations are recorded in preparation to an audit, and it can be viewed in Advanced mode.

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# User management

Three levels of login function enable to protect method and data from unintended change or deletion.

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# Features

# Wide range, Easy of use

High/Low, simplified selection of sensitivity for each detector.

		High sensitivity	Low sensitivity	
ND-500		$0.03{\sim}250\mu\text{g/mL}$	$1\sim$ 10,000 µg/mL	
SD-500		$0.02{\sim}100\mu\text{g/mL}$	$1\sim10,000\mu g/mL$	
MCD-500	chlorine	$0.05{\sim}200\mu\text{g/mL}$	$1\sim$ 5,000 µg/mL	
IVICD-300	Sulfur	0.1 ~ 1,000 µg/mL		

\*\* For TCL-5000V chlorination, a high-density electrolyte solution is used for quantitation of  $10\mu L$  or more in a single measurement.

# Liquid sample temperature control system STC-500L (Option)

By cooling a "vial (containing a highly volatile liquid)" and a "microsyringe" to low temperature, it is possible to suction stably and inject the sample as a liquid state.

# Easy Daily maintenance

Unique open/close type furnace provides easy operation and easy visual check of the condition of pyrolysis tube.

# LINK to LIMS

Software makes data handling easier. It can output the result data to specified folder automatically.

# **System configuration**





# Reanalysis function \* Available only for TN-5000V, TS-5000V

After measurement, the "start time of measurement" and "end time" for chart date can be corrected if necessary to optimize.



# Low running cost

Less gas consumption than before. It is also available to shutoff the gas at the end of measurement automatically.

# NSX-5000V MEASUREMENT PRINCIPLE

# UV fluorescence sulfur detector SD-500

# Sulfur Measurement

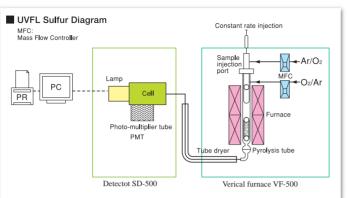
Sample is injected into a heated (800 to 1100 °C) pyrolysis tube by argon carrier gas. After sulfur compounds in the sample are pyrolyzed, they are oxidized by O2 gas.

# $R-S + O_2 \rightarrow SO_2 + SO_3 + combustion product$

The produced SO<sub>2</sub> gas is excited by irradiating the ultraviolet ray v1 (190 to 230 nm). Then, SO2\* emits the energy (fluorescent ray) and returns to the ground state.

# $SO_2 + hv1 \rightarrow SO_2^* \rightarrow SO_2 + hv2$

This fluorescent ultraviolet ray v2 (300 to 400 nm) is received by the photomultiplier tube and area value is obtained. The sulfur concentration is obtained by a calibration curve preliminarily drawn using standard solution.



Liquid cooling option for auto sampler

Low B.P. sample

Result (n=5) ppm

RSD (%)

By preventing sample vaporization during syringe handling, cooling option is very effective for high volatile sample.

Sample Tempe

OFF (22°C)

3.59

21.1%

SD-500 Detector

ure Contro

ON (15°C)

7.54

1.0%

# **UVFL** Sulfur applications

	Injection (µl)	Analysis (ppm)	RSD (%)
Diesel	40	9,95	0.43
Kerosene	40	1.41	2.95
Gasoline	40	3.79	0.38
BDF	40	1.01	7.07
BTX	40	0.60	0,50
Desulfured light naphtha	40	0.61	6.77
Propane	10ml	2.77	0.76
Butane	25ml	0.18	2,97

#### Simultaneous applications for Nitrogen and Sulfur

	N (ppm)	RSD (%)	S (ppm)	RSD (%)
Heavy oil	0.32%	0.84	0.48%	1.47
Lub oil	2,11	2,61	7.72	1.42
Diesel	2.91	0.41	9.79	0.27
Gasoline	6.92	0.19	3.79	0.38
Naphtha	4.6	1.78	26.4	0.42

\* The above values are measured by the previous model NSX-2100V series. NSX-5000V series have as same level of capability as NSX-2100V series.

# Specification for Trace Sulfur Analyzer NSX-5000V/SD

	Sulfur measurement	Nitrogen measurement (optional)			
Sample	Liqui	id/Gas			
Analytical method	Oxidative combustion and UV fluorescence detection	Oxidative combustion and chemiluminescence detection			
Furnace	Max. 1,100 °C, Openable ele	ectric furnace, 2-section type			
Measuring range	2 to 20,000 ng (up to 10,000 μg/mL) LOQ: 0.02 μg/mL*	Non-aq. 3 to 20,000 ng (up to 10,000 µg/mL) Aq. 1 to 10,000 ng (up to 5,000 µg/mL) LOQ: Non-aq. 0.03 µg/mL*, Aq. 0.01 µg/mL *			
Sample volume	Liquid: Max 200 µL				
Measurement time	less that	un 5 min			
Vacuum pump		Diaphragm type dry vacuum pump			
Gas used	Argon: Purity 99.98 % or more, $0.3 \pm 0.1$ MPa	, Oxygen: Purity 99.7 % or more, $0.3 \pm 0.1$ MPa			
Power supply	VF-500:AC100 / 115 V (50 / 60 Hz), 1100 VA, AC230 / 240 V (50 / 60 Hz), 1800 VA SD/ND-500:AC100-240 V 300 VA				
Mass and weight	VF-500:500(W) ×430(D)×500(H) mm, approx. 35 kg SD-500:220(W) ×375(D)×500(H) mm, approx. 21 kg ND-500: 220(W) x 375(D) x 500(H) mm, approx. 22 kg Vacuum pump:160 (W) × 320 (D) × 220 (H) mm, approx. 7.5 kg				

\* It depends on the sample volume, the matrix, the purity of reagents and the condition of the unit.

# **Chemiluminescence nitrogen detector ND-500**

# Nitrogen measurement

Sample is injected into a high-temperature (900 to 1000 °C) pyrolysis tube by argon carrier gas. After nitrogen compounds in the sample are pyrolyzed, it is combusted, oxidized, and converted to nitric oxide (NO). After removing moisture from the combustion gas by a dehumidifier (tube dryer), the following oxidation reaction occurs by the reaction of NO with ozone.

# $NO + O_3 \rightarrow NO_2 + O_2 + hv$

By this reaction, 590 to 2,500 nm of emitting light is generated. The optical intensity of this light is proportional to the NO concentration at a wide wavelength range. After emitted light is detected by a photomultiplier tube and signal processing is performed, an area value is obtained. Using the calibration curve, the total nitrogen concentration in the sample is calculated. Some of samples generate interference substances such as SOx and CO2 in the process of oxidative combustion. However, the interference can be decreased to an irrelevant level by the contribution of reduced pressure method.

#### ■ Nitrogen, standard sample

	Recovery (%)	RSD (%)		Analysis (ppm)	RSD (%)
10.0 ppm Quinoline	98.5	0.9	Naphtha	0.8	4.2
0,32% Heavy oil	99.1	0.7	Kerosene	3,2	2,2
0.11% Heavy oil	104.0	0.1	Diesel	4.1	1.7
0.0064% Heavy oil	100.6	0.1	Gasoline	2.5	1.7

#### ■ Nitrogen aqueous applications

	Analysis (ppm)	RSD (%)
River Water	3.1	1.70
Factory Disposal	2.6	2.10
Seawater*	0.2	4.80
Sewage Plant (Treated Sewage)	2.2	1.80

\* Sea water option

\* The above values are measured by the previous model NSX-2100V series. NSX-5000V series have as same level of capability as NSX-2100V series.

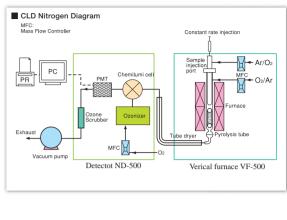
# Specification for Trace Nitrogen Analyzer NSX-5000V/ND

	Nitrogen measurement (non-aqueous system)	Nitrogen measurement (aqueous system)				
Sample	Liqu	id/Gas				
Analytical method	Oxidative combustion and chemiluminescence detection					
Furnace	Max. 1,100 °C, Openable ele	ectric furnace, 2-section type				
Measuring range	3 to 20,000 ng (up to 10,000 μg/mL) LOQ: 0.03 μg/mL* Liquid: Max. 200 μL	1 to 10,000 ng (up to 5,000 μg/mL) LOQ: 0.01 μg/mL * Liquid: Max. 100 μL				
Sample volume	Liquid: Max 200 µL	Liquid: Max 100 µL				
Measurement time	less than 4 min					
Vacuum pump	Diaphragm type of	lry vacuum pump				
Gas used	Argon: Purity 99.98% or higher, $0.3 \pm 0.1$ MPa	, Oxygen: Purity 99.7% or more, $0.3 \pm 0.1$ MPa				
Power supply	VF-500: 100/115 VAC, 50/60 Hz: 1,100 VA, 230/240 VAC, 50/60 Hz: 1,800 VA ND-500: 100/115/230/240 VAC, 50/60 Hz: 300 VA					
Mass and weight	VF-500:500(W) ×430(D)×500(H) mm, approx. 35 kg ND-500:220(W) ×375(D)×500(H) mm, approx. 22 kg Vacuum pump:160 (W) × 320 (D) × 220 (H) mm, approx. 7.5kg					

\* It depends on the sample volume, the matrix, the purity of reagents and the condition of the unit.







# ■ Nitrogen, application sample

# ■ ND-500 detector with vacuum pump



# MEASUREMENT PRINCIPLE

# Micro coulometry detector MCD-500

# Chlorine analysis

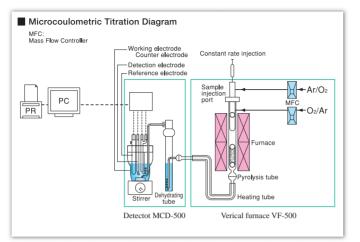
Samples are combusted in an argon/oxygen atmosphere. The resulting hydrogen chloride is led into a titration cell where it is automatically titrated by silver ions generated by electrolysis. The amount of chlorine is calculated from the quantity of electricity required for the titration.

# $HCL + Ag^+ \rightarrow H^+ + AgCl$ (titration) Ag $\rightarrow$ Ag<sup>+</sup>+ e<sup>-</sup>(electrolysis)

# Sulfur analysis

Samples are combusted in an argon/oxygen atmosphere. The resulting sulfur dioxide is led into a titration cell where it is automatically titration by triiodide ions generated by electrolysis. The amount of sulfur is calculated from the quantity of electricity required for the titration.

 $SO_2 + I_3^- + H_2O \rightarrow SO_3 + 3I^- + 2H^+$ (titration)  $3I^- \rightarrow I3^- + 2e^-$  (electrolysis)





50

50

50

50

50

50

50

# • Sample applications

#### ■ Chlorine

	Injection (µI)	Analysis (ppm)	RSD (%)
Naphtha	200	0.08	9.8
Gasoline	200	0.53	5.3
Kerosene	200	0.09	5.0
Lub oil	90	1.35	3.2
Diesel 1	200	0.18	7.6
Diesel 2	200	0.05	13.5
Xylene	90	2.47	3.1

% The above values are measured by the previous model NSX-2100V series. NSX-5000V series have as same level of capability as NSX-2100V series.

# Specification for Trace Chlorine/Nitrogen Analyzer NSX-5000V/MCD

	Chlorine measurement	Sulfur measurement
Sample	Liquid/Gas	
Analytical method	Oxidative combustion and chemiluminescence detection	
Furnace	Max. 1,100 °C, Openable electric furnace, 2-section type	
Sensing electrode	Silver electrode	Platinum electrode
Measuring range	10 to 500,000 ng (up to 5,000 μg/mL) LOQ: 0.05 μg/mL*	20 to 50,000 ng (up to 1,000 μg/mL) LOQ: 0.1 μg/mL*
Sample volume	Liquid: Max 200 µL	
Measurement time	less than 10 min	
Gas used	Argon: Purity 99.98 % or more, 0.3 $\pm$ 0.1 MPa , Oxygen: Purity 99.7 % or more, 0.3 $\pm$ 0.1 MPa	
Power supply	VF-500: 100/115 VAC, 50/60 Hz: 1,100 VA, 230/240 VAC, 50/60 Hz: 1,800 VA MCD-500: 100/115/230/240 VAC, 50/60 Hz: 300 VA	
Mass and weight	VF-500:500(W) ×430(D)×5 MCD-500:220(W) ×375(D)	500(H) mm, approx. 35 kg )×500(H) mm, approx. 14 kg

Sulfur

High Octane

Gasoline

Kerosene

Diesel

Lub oil 1

Lub oil 2

Lub oil 3





Sample	<ol> <li>Gas (Use a gastight syringe.) Nitrogen, sulfur, and chlorine in gas</li> <li>Volatile liquid (Use a gastight microsyringe.) Nitrogen, sulfur, and chlorine in volatile liquid</li> <li>Liquefied petroleum gas (Use an LPG cylinder.) Nitrogen, sulfur, and chlorine in liquefied petroleum gas (LPG)</li> <li>Liquefied natural gas (LNG) is not acceptable.</li> </ol>
Injection	Gas: Syringe port (max. 10 mL/ min) Volatile liquid: Syringe port (max. 10 µL) LPG: 30 µL sampling loop
Carrier gas	Argon
Heater temperature	From room temperature to 105 °C (Recommended value: 85 °C)
Sample gas pressure	6.5 MPa or less
Power	100/115/230/240 VAC (50/60 Hz) 108 VA
Dimensions	$220 \text{ mm} (W) \times 370 \text{ mm} (D) \times 490 \text{ mm}$
Mass	18 kg

Liquid Sample Changer ASC-550L

Option





Sample	Liquid (non-aqueous, aqueous)	
Injection	Gastight microsyringes: 25, 50, 100, 250 µL	
Rinse vial	28 mL vials with septum	
Number of samples	50 or 105 bottles	
Vial size / Sample tray	6 mL / 50 bottles 4 mL / 50 bottles 2 mL / 50 bottles 2 mL / 105 bottles	
Power	100/115/230/240 VAC (50/60 Hz) 180 VA	
Dimensions	460(W) ×320(D)×470(H) mm Approx.	
mass	16 kg	

Rinse vials Cooling temperature Power Dimension and mass

Sample

STC

vial rack

I

# **Gas Injector GI-510**

RSD (%)

2.3

1.7

1.3

3.9

2.1

1.2

2.3

ysis (p

7.3

5.5

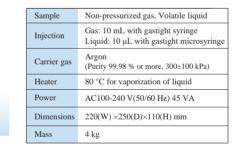
13.7

1.3

126

37

13



\* It depends on the sample volume, the matrix, the purity of reagents and the condition of the unit.

# **Sample Temperature Controller STC-500L**



iquid
mL vial / 24 bottles mL vial / 24 bottles mL vial / 24 bottles
pcs. 28 mL
TC vial rack: 5 °C to room temperature TC syringe holder: 0 °C to room temperature
00/115/230/240 VAC (50/60 Hz) 00 VA
Temperature controller: 20 (W) $\times$ 375 (D) $\times$ 100 (H) mm, kg
TC vial tray: 2.7 kg

STC syringe holder: 0.45 kg

# **Constant Rate Injector** for Vertical Furnace **CRI-500V**



Sample	Liquid(non-aqueous)
Syringe	Gastight microsyringe 25, 50, 100 and 250 µL
Injection	Minimum injection volume 10 µL Maximum injection volume 200 µL (with 250 µL gas-tight microsyringe)
Injection rate	0.4~1.6 µL/sec
Power	100/115/230/240 VAC (50/60 Hz) 30 VA
Dimensions and mass	150 (W) $\times$ 248 (D) $\times$ 240 (H) mm 5.6 kg

# **Gas Injector GI-520**



Sample	Non-pressurized gas, Volatile liquid
Injection	1-10 μL liquid 2-25 mL gas (max. 999 mL)
Carrier gas	Argon (purity 99.9 8 % or more, 300±100 kPa)
Heat	80 °C for vaporization of liquid
Power	AC100-240 V(50/60Hz) 70 VA
Dimensions	180(W) ×360(D)×500(H) mm
Mass	13 kg

# Trap & Release Unit for Sulfur **TRU-500(SD-500)**



Sample	Liquid, Gas
System	SO2 Gas Adsorption and Desorption
Measuring range	5 ppb to 1 ppm
Temperature	100∼1,050 °C
Power	100/115/230/240 VAC (50/60 Hz) 1500 VA
Dimensions	180 (W) $\times$ 540 (D) $\times$ 500 (H) mm
Mass	16 kg