

Atomic Emission Detector – AED III

Specifications



Atomic Emission Detector – AED III

Specifications and Check Out Conditions

Checkout Specifications

Element(s)	Wavelength (nm)	Minimum Detectable Level (pg/sec)	Selectivity Over Carbon	Measurement Compound
Carbon	193	0,1	-	t-Butyl disulfide
Sulfur	181	0,2	10000	t-Butyl disulfide
Nitrogen	174	3	2500	Nitrobenzene
Hydrogen	486	0,4	-	t-Butyl disulfide
Chlorine	479	3	3000	1,2,4-Trichlorobenzene
Phosphorus	178	0,2	5000	Triethyl phosphate
Oxygen	171 ¹	15	5000	Nitrobenzene

¹ Uses molecular band instead of atomic emission line

Check Out Conditions

GC Injection Port	Split/Splitless, optionally JAS UNIS 2100 PTV in S/SL mode or JAS UNIS 3100 HT-PTV in S/SL mode	
GC Injector Temperature	280°C	
GC Column	Part no. 19091Z-012, HP-1, 25 m x 320 µm x 0.17 µm	
GC Inlet Conditions	Nominal pressure = 20 psi, nominal split flow = 100 mL/min.	
GC Temperature Program	60°C to 180°C at 30°C/min.	
Injected Volume	0,2µL	
Checkout Sample	Part no. JAS 2350-50552	P, S dilution 1:10
AED Reagent Gas(es)	O ₂ , H ₂ auxiliary gas (10% CH ₄ / 90% N ₂)	
AED Spectrometer Purge	0.5 L/min	
AED Transfer Line Temperature	250°C	
AED Cavity Temperature	280°C	
AED Data Rate	5 Hz	
Ambient Temperature	25°C (Recommended ambient temperature 15°C to 35°C)	

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Experimental Conditions

Instrument performance for minimum detectable level and selectivity for the above elements is verified at installation using a checkout sample containing the above compounds. Detection of the above elements can be done in a sequence using four separate injections.

Comparison of the typical Minimum Detection Levels (MDL) AED Plus and AED III

Element	Typical MDL (pg/s) AED Plus	Typical MDL (pg/s) AED III
Antimony	5	0.5
Argon		
Arsenic	3	0.3
Boron	20	1.9
Bromine	75	3.8
Carbon (12)	10	1
Carbon (13)	10	1
Carbon		see right →
Chlorine	40	2.5
Deuterium	2.5	0.3
Fluorine	80	6.4
Germanium	10	1.1
Hydrogen	2.5	0.22
Iodine	9	1
Iron	0.05	0.004
Krypton		
Lead	2	0.2
Manganese	2	0.21
Mercury	0.5	0.04
Nickel	0.8	0.09
Nitrogen	7	0.32
Nitrogen (14)	10	0.95
Nitrogen (15)	3.5	0.3
Oxygen	80	15
Phosphorus	0.5	0.06
Selenium	4	0.37
Silicon	1.6	0.12
Sulfur	1.7	0.04
Tellurium	10	0.97
Tin	1	0.09
Vanadium	4	0.38
Xenon		

Carbon [nm]	Typical MDL (pg/s) AED Plus	Typical MDL (pg/s) AED III
175	50	2.4
193	0.5	0.04
248	7	0.65
264	7	0.65
496	11	1.2

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Element Groupings

The JAS Atomic Emission Detector software allows for the following element groupings (set of up to 8 elements/emission lines that can be detected simultaneously) for the JAS AED III. Each grouping represents a specific combination of wavelength range detected and the reagent gas(es) used. Other elements and element groupings may be possible.

Contact Joint Analytical Systems GmbH to inquire regarding any updated capabilities.

Frame/ Group	Element(s) or Isotope	Wavelength (nm)	Reagent Gas(es)	
1/1	Carbon	193	O ₂ and H ₂	
	Iodine	183		
	Sulfur	181		
	Carbon	179 ¹		
	Nitrogen	174		
	Iodine	206		
	Carbon-12	177 ¹		
	Carbon-13	177 ¹		
1/2	Oxygen	171 ¹	H ₂ and 10% CH ₄ / 90% N ₂	
1/3	Selenium	196	H ₂	He High Flow ²
	Carbon	193 ³		
	Arsenic	189		
	Phosphorus	186		
	Sulfur	181 ³		
	Phosphorus	178 ³		
1/4	Boron	250	O ₂	He High Flow ²
1/5	Mercury	254	O ₂ and H ₂	He High Flow ²
	Silicon	252		
	Carbon	248		
2/1	Germanium	265	O ₂ and H ₂	He High Flow ²

Table continues on next page →

Atomic Emission Detector – AED III

Element Groupings

Frame/ Group	Element(s) or Isotope	Wavelength (nm)	Reagent Gas(es)	
	Lead	261		
	Manganese	259		
	Mercury	254		
	Silicon	252		
	Carbon	248		
	Tin	271		
	Tin	303		
	Iron	302		
	Nickel	301		
	Tin	301		
	Vanadium	292		
	Tin	326		
3/1	Lead	406	O ₂ and H ₂	He High Flow ²
3/2	Nitrogen-14	421 ¹	O ₂ , H ₂ and Methane	
	Nitrogen-15	420 ¹		
3/3	Nitrogen	388 ¹	O ₂ , H ₂ and Methane	He High Flow ²
4/1	Carbon	496	O ₂	
	Hydrogen	486		
	Chlorine	479		
	Bromine	478		
5/1	Hydrogen	656	O ₂	
	Deuterium	656		
5/2	Fluorine	690	H ₂	

1 Uses molecular band instead of atomic emission line.

2 "He High Flow" – For certain element groupings, additional helium carrier makeup gas flow is added.

3 Performance for elements offered in multiple groups may vary depending on the reagent gas(es) used.

Atomic Emission Detector – AED III

System Characteristics

GC-AED Interface

A heated, insulated, and thermostatted tube contains fused silica tubing to carry effluent from the gas chromatograph (GC) to the microwave cavity.

Maximum temperature for transferline and cavity: 450°C

Microwave Generator

- Frequency: 2,450 MHz
- Power level: 70 watts
- Power tube: TO300-M23
- Tuning: Not required
- Stray emission: <5 mW/cm² at 5 cm
- Coupling to cavity: 75 '36 mm

Microwave Plasma

- Cavity: Reentrant design
- Discharge tube: Water-cooled, 0.1 mm thick walls
- Ignition: Automatic
- Exhaust: From discharge tube into a purged chamber to prevent air diffusion

Spectrometer

Type: 0.25 µm Flat Field

Wavelengths: 160 to 720 nm

All wavelength regions are calibrated automatically for position and focus at initial turn-on and whenever excessive drift is detected. The current wavelength setting is fine-tuned at the start of each run.

Signal Processing

Raw data consists of 2048 simultaneous outputs from a CCD Chip. This data can be read at a rate of up to 100 times per second (100 Hz), although **JAS AED III** performance specifications are only valid at the data rate of 5 Hz. The JAS AED software can display, in real time, this spectral data collected by the CCD as well as the element chromatograms generated from this data. For the elements selected, chromatographic data is saved for evaluation.

The spectral data may also be saved and examined later at a particular chromatographic peak retention time.

The **JAS AED** software provides data acquisition, control, and data evaluation for a single GC-AED system. Data acquisition, control, and data evaluation of additional instruments using add-on software are not supported.

Atomic Emission Detector – AED III

System Characteristics

Environmental Conditions

Condition	Operating Range
Temperature	10 °C to 40 °C (recommended ambient temperature is 15 °C to 30 °C)
Relative humidity	50 % at 40 °C 80 % at 31 °C
Storage Extremes	-40°C to 65°C. Cooling water must be drained from the AED III if below 0°C.
Radiated Emissions	CE-mark with emissions level A.

Instrument Weight and Dimensions

The **JAS AED III** weighs about 37 kg and measures 40,5 cm high x 51 cm wide x 63,5 cm deep.

At least 5 cm must be allowed for the transfer line between the GC and AED.

Space considerations for a complete AED system must take into account the injector/automatic liquid sampler, GC, data system, printer, and clearances for maintenance. Allow 340 cm width x 87 cm depth x 100 cm height. Total system weight is about 160 kg. At least 25 cm must be allowed behind the GC to dissipate oven exhaust air and provide access for maintenance.

Power

100 VAC (6A) - 240 VAC (2.5A) (50 - 60 Hz)

One outlet is required. One or more 10 amp circuits are required for the computer and peripherals. Consult the GC and ALS documentation for their power requirements.

Cooling Water Requirements

Approximately 600 mL of distilled water is required for a closed, self-contained cooling water system. It requires periodic refilling.

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System Characteristics

GC-AED System Requirements

JAS GC-AED III System:

- Configuration on request (e.g. JAS-24919)

The Agilent GC is required to have:

- Split/Splitless inlet, alternatively JAS UNIS 2100 PTV or JAS UNIS 3100 HT-PTV
- GC-AED interface

PC hardware requirements (minimum) required by your data system to operate the JAS AED software:

- CPU ≥ 3 GH Quadcore (i7 4th Gen. / i5 6th Gen.)
- RAM ≥16 Gigabyte
- Hard Drive ≥128 Gigabyte SSD + ≥ 2 Terrabyte SATA
- Optical Drive DVD-ROM
- USB 3.0 Dedicated USB 3.0 controller card
- Operating system Windows 7 Professional SP1(x64)
Windows 8.1
Windows 10
- Language of operating system Englisch
Chinese
Japanese
Russian

Software:

- JAS AED III Instrument Control Software (Ver. 1.37.204.201 or higher)
- Agilent OpenLAB CDS ChemStation Edition (C.01.07 SR2 or higher)

Other Agilent GC options may also be ordered, including (but not limited to):

- A second inlet
- Up to two standard Agilent GC detectors

NOTE: Any customer-supplied GC must be clean, leak-free and in good working conditions. JAS can only guarantee the AED specifications when a complete GC-AED system is supplied. Otherwise, JAS can only guarantee the specifications run at JAS. Please talk to your JAS representative regarding required adjustments at the GC.

CAUTION: Any change on your operating system settings or system/software updates might lead to a non-working JAS AED III system. In case of doubt, consult JAS.

Although not required, a fully automated system typically includes:

- Automatic liquid sampler
- Headspace sampler
- CTC sampler
- Valve sampling system
- Pyrolysis system
- Printer

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Gas Requirements

Name	Purity	Description
Helium	6.0 or 99.9999%	For GC carrier and AED plasma. This purity can be achieved using 99.999% gas with a Helium purifier (included). The flow rate required is about 100 mL/min. Some elements require a higher flow rate of about 240 mL/min.
Nitrogen	5.0 or 99.999%	Spectrometer purge gas (must be dry). The user is advised to provide a hydrocarbon and a moisture trap. The purge gas flow requirements are nominally 100 mL/min.
Hydrogen	5.0 or 99.997%	AED reagent gas
Oxygen	5.0 or 99.997%	AED reagent gas
10% CH ₄ /90% N ₂ Mixture	4.7 or 99.997%	AED reagent gas-typically used for oxygen analysis. Purity requirement is on original gases for reagent gas mixture.
Methane	4.7 or 99.997%	AED reagent gas-typically used for nitrogen (388 nm) and nitrogen-15 analysis

Note: The JAS AED III can only be plumbed for three reagent gases. Each reagent gas flow is typically 20 mL/min. The user must decide whether to plumb for 10% CH₄ / 90% N₂ (to detect oxygen 171 nm) or methane (to detect nitrogen 388 nm and nitrogen-15).



About Joint Analytical Systems

Since 1995 JAS has been a Premier Solution Partner and Value Added Reseller of Agilent Technologies. We are an innovative-driven organization that offers customized solutions for GC, GCxGC, μ GC, GC-AED, GC-MS, GC-QQQ, LC, LC-MS, LC-QQQ and Q-TOF LC-MS applications.

JAS serves key industries such as

- Chemical
- Petrochemical/HPI
- Environmental
- Food & Flavor
- Forensic

JAS Products for GC

- Atomic Emission Detector
- UNIS Inlet Systems
- CryoTrap
- EzPrep - Preparative Fraction Collector
- Olfactometer
- Customized Valving Systems
- GICU - Gas Injection Control Unit

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