Analytical HPLC

LC-4000 Series

JASCO

Performance
Innovation
Reliability

The LC-4000 Series HPLC is the latest in a long history of innovative HPLC systems developed by JASCO reaching all the way back to the start of the commercial HPLC in the early 1970s.

The concept of the integrated LC-4000 series HPLC provides key separation platforms at 30 MPa, 70 MPa and 130 MPa which correspond to conventional HPLC, the increasingly popular Rapid Analysis (RHPLC) and sub 2 µm UHPLC, respectively. Each platform is supplied with a dedicated pump and autosampler matched to the operating pressure and all three platforms share common detectors optimized for high-speed 100 Hz acquisition and narrow peak shapes common to both RHPLC and UHPLC.

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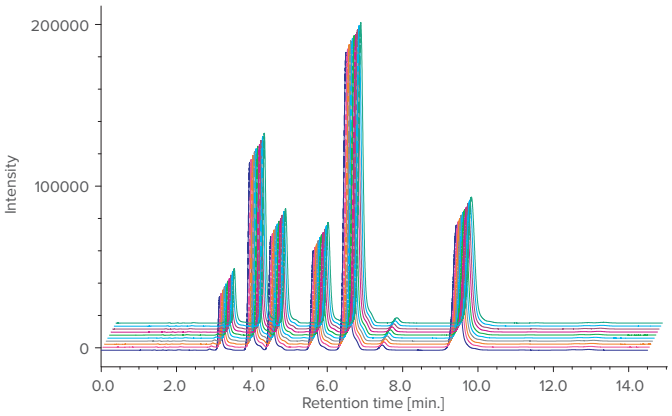
LC-4000 Advances

Flow Innovation

For over two decades JASCO analytical HPLC pumps have employed an asymmetric twin-piston delivery system SSQD (Slow Suction, Quick Delivery) providing significantly better flow and pressure profiles than conventional twin-piston reciprocating designs. The SSQD was redeveloped for the LC-4000 series to offer the highest stability in solvent delivery using ExReFT (Extremely Reliable Flow Technology).



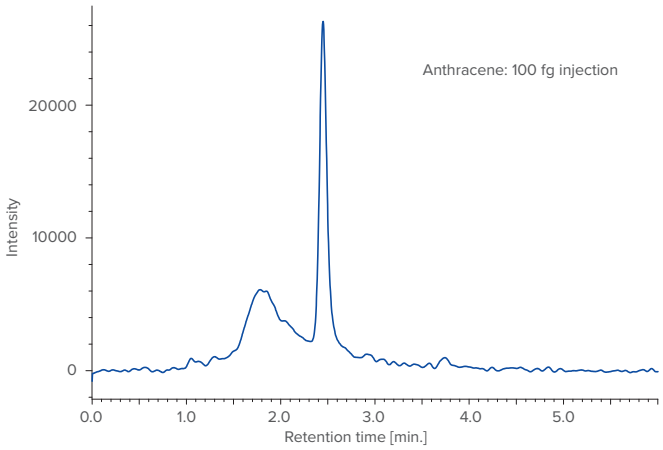
Flow rate accuracy of PU-4180 (1.0 mL/min., n = 10)

Peak retention time reproducibility of PU-4180 (n = 10)

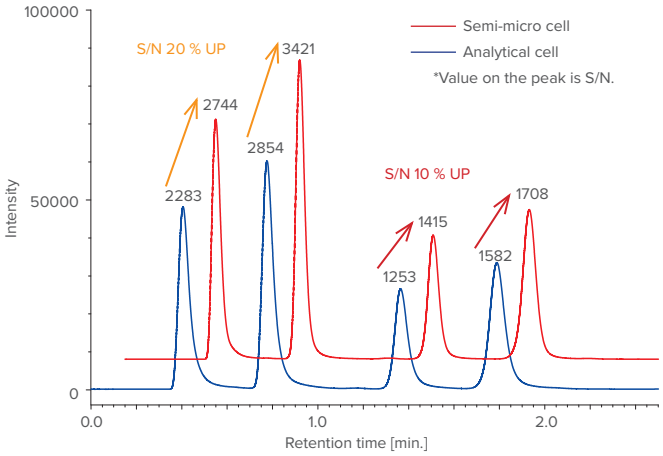
Retention Time	Naphthalene	Fluorene	Anthracene	Pyrene	Chrysene	Benzo[a]pyrene
% RSD	0.025	0.018	0.017	0.022	0.016	0.020

Pioneering Optical Design

As a pioneer in optical spectroscopy dating back over 65 years, JASCO has been at the forefront of optical detection. Adapting designs from the most powerful spectrometers, JASCO has developed a range of HPLC detectors with unrivaled performance like the class leading FP-4020 fluorescence detector with S/N of over 2300:1 and the world's only circular dichroism detector for chiral chromatography. Dual simultaneous wavelength detection is offered as standard on the UV and FP detectors adding flexibility and versatility. In addition, JASCO offers RI (refractive index), PDA, OR (optical rotation), and MS detectors.



High sensitivity detection of FP-4020



Redesigned flow cells for excellent peak shape.

Compact and Easy to Use

Despite the extra power delivered by the LC-4000 series HPLC, the standard footprint is only 300 mm wide requiring very little bench space. For those users that require front panel control, the LC-4000 series returns the popular keypad and display.

For easy user maintenance, all LC-4000 modules feature front access for replacing consumables such as check valves and seals in the pumps, sample needle and syringe parts in the autosamplers and lamps for the detectors.

Configurations

HPLC

Designed for routine HPLC research and academic settings.
For use with 5 µm columns.

Flow rate: 0.500 to 10.0 mL/min.
(Semi-micro option 0.050 to 4.0 mL/min.)
Pressure: Analytical (0.500 to 10.0 mL/min.): 35 MPa
Semi-micro (0.050 to 4.0 mL/min.): 40 MPa
Inert system: 25 MPa

Options:

- Isocratic
- High Pressure Gradient
- Low Pressure Gradient
- Autosampler up to 100 µL injections standard
  Optional 1 mL injection and temperature control
- Column Oven for various column lengths
- UV, PDA, FP, RI, CD, OR, MS

RHPLC

Designed for those requiring more sample throughput. For use with 2.5 µm coreshell, 3 µm and 5 µm columns.

Flow rate: 0.500 to 6.0 mL/min.
(Semi-micro option 0.050 to 3.0 mL/min.)
Pressure: 70 MPa

Options:

- Isocratic
- High Pressure Gradient
- Low Pressure Gradient
- Autosampler up to 20 µL injections standard
  Optional 1 mL injection and temperature control
- Column Oven for various column lengths
- Detection: UV, PDA, FP, RI, CD, OR, MS

UHPLC

Designed for those requiring the highest sample throughput. For use with sub-2 µm columns.

Flow rate: 0.050 to 2.0 mL/min.
Pressure: 0.050 to 2.0 mL/min.: 100 MPa
0.050 to 1.5 mL/min.: 130 MPa

Options:

- Isocratic
- High Pressure Gradient
- Autosampler up to 5 µL injections standard
  Optional 1 mL injection and temperature control
- Column Oven for various column lengths
- Detection: UV, PDA, FP, RI, CD, OR, MS

Detectors

UV-4070/4075
UV-Visible Detector
Both detectors offer simultaneous dual wavelength acquisition and spectra scanning.

Wavelength ranges:
UV-4070: 190 to 900 nm
UV-4075: 190 to 600 nm

MD-4010/4015/4017
UV-Visible PDA Detectors
When 2 wavelengths are not enough a PDA can provide the additional needed as well as spectral information and identification possibilities.

Wavelength ranges:
MD-4010: 190 to 900 nm
MD-4015: 200 to 600 nm
MD-4017: 200 to 400 nm

CD-4095
Circular Dichroism Detector
The world's only circular dichroism detector that provides the utmost sensitivity.

Wavelength range:
220 to 460 nm

CMS
Mass Spectrometer
When mass identification is needed the CMS offers ESI, APCI or ASAP with positive and negative switching.

CMS-S up to 1200 m/z
CMS-L up to 2000 m/z

FP-4020/4025
Fluorescence Detector
For the ultimate in sensitivity the FP-4020 provides S/N of 2300:1. The FP-4025 offers excellent sensitivity with S/N of 1400:1 and both offer simultaneous detection of 2 wavelength pairs.

Wavelength range:
200 to 700 nm

OR-4090
Optical Rotation Detector
The optical rotation detector provides chiral detection for optically active isomers and chiral compounds that have no absorption.

Light source: Hg/Xe lamp

RI-4030/4035
Refractive Index Detector
The refractive index detector is a universal detector for those compounds that cannot be seen on the UV or FP.

RI-4030 up to 120 mL/min.
RI-4035 for RHPLC/UHPLC

Related Instruments

LCMS

Prep LCMS

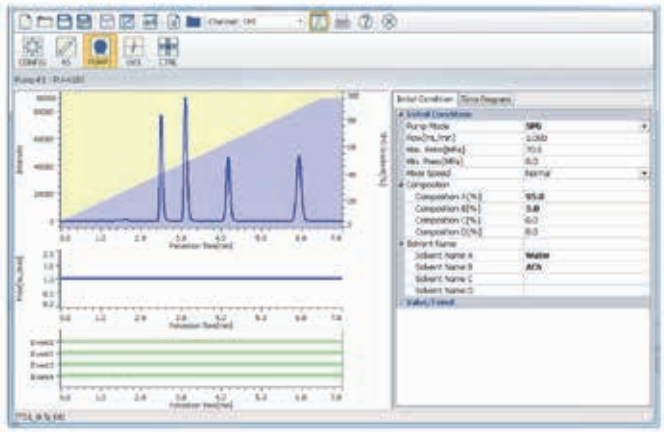
ChromNAV Software

ChromNAV 2.0 (and ChromNAV-CFR 2.0) are JASCO's next generation CDS developed from the powerful and easy-to-use ChromNAV 1.0 with a host of existing new features. With a customizable graphical-user-interface (GUI), the user can set-up the system to display only the functions necessary for their application. This latest intuitive GUI allows the user to quickly learn the operation and explore the extensive functionality of data processing.

ChromNAV 2.0 is a universal CDS which can be used with any type of separation – HPLC, RHPLC, UHPLC, Prep LC, Analytical SFC and Prep SFC. ChromNAV can also satisfy the demands of dedicated analyses or mutli-purpose systems.

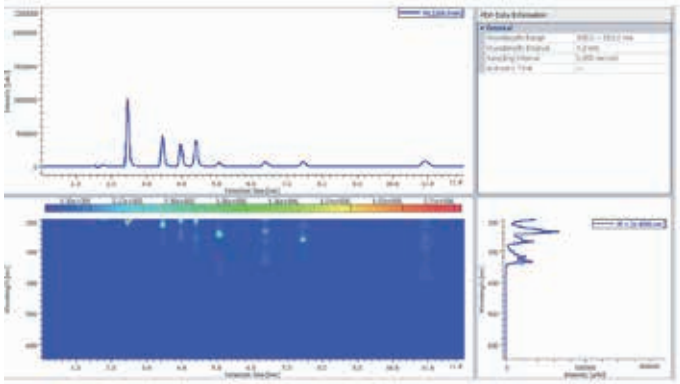
Control Method

The pump flow rate and gradient profile display is flexible and can be overlaid with a chromatogram for adjusting gradient conditions.



PDA Analysis

PDA data processing is included as standard. Data is displayed in a 2D contour plot and 3D with simultaneous overlay of spectra and chromatograms. Chromatograms can be extracted at single or multiple wavelengths for quantitation.



ChromNAV 2.0 offers powerful system control and data acquisition. During acquisition, the run-time can be extended to capture later eluting peaks. Previously acquired chromatograms can be overlaid for visual comparison with data currently being acquired.

Samples can be changed or added to the sequence while it is acquiring. Also the sequence can be setup to stop the pump, turn off the lamps, turn off the oven temperature and even turn off the power on the system at the end of the sequence.

Standard Features

- Peak integration and peak identification
- Peak grouping
- Linear and non-linear quantitation
- 3D chromatogram analysis
- Spectral analysis for UV-visible, Fluorescence and PDA detectors
- Customizable report generator
- User formula calculations
- Automatic raw data export

All data is protected and saved; which can then be analyzed and re-analyzed, reported and saved with both raw data and with any data processing from the user's analysis.

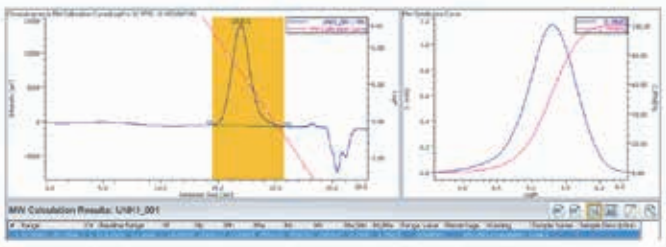
A comprehensive audit trail records the acquisition method along with the history of the instrument performance in each data file. This provides the user with a snap-shot of the condition of the system during the run and can indicate warnings about requirements for impending maintenance.

Optional Applications

- ChromNAV CFR for CFR Part 11 compliance and electronic registration of data
- ChromNAV GPC/SEC for molecular weight dispersion calculations and determinations
- ChromNAV Herparin for molecular weight dispersion of low molecular weight heparin
- ChromNAV FUMI for Function of Mutual Information (FUMI) for theoretical precision analysis
- ChromNAV FC for fraction collection (included as standard with a Prep LC)
- ChromNAV CMS for control of the CMS Mass Spectrometer (included as standard with CMS)
- ChromNAV Method Scouting for solvent and column screening in SFC and HPLC

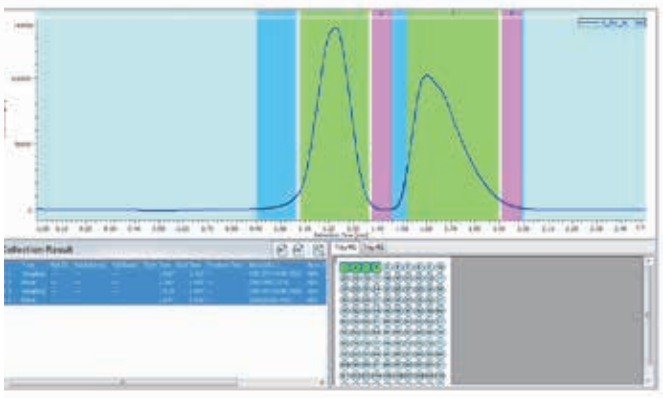
ChromNAV GPC/SEC

Molecular weight distribution program (Option) for GPC and SEC analysis.



ChromNAV FC

Fraction collection control for the CHF-122SC fraction collector triggered from time, threshold and/or slope.



Specifications

Pumps

Isocratic

System	HPLC	RHPLC	UHPLC
Flow Range	0.500 to 10.0 mL/min. (Semi-micro: 0.050 to 4.0 mL/min.)	0.500 to 6.0 mL/min. (Semi-micro: 0.050 to 3.0 mL/min.)	0.050 to 2.0 mL/min.
Maximum Pressure	35 MPa (Semi-micro: 40 MPa) (Inert type: 25 MPa)	70 MPa	130 MPa (up to 1.5 mL/min.) 100 MPa (up to 2.0 mL/min.)
Flow Rate Accuracy	±1 % of setting value or ±2 µL/min., whichever is larger		
Flow Rate Precision *Measured by Chromatogram*	0.05 % RSD or ±0.04 min. SD, whichever is larger		
Dimensions, Weight	300 (W) × 470 (D) × 150 (H) mm, 13.8 kg		300 (W) × 470 (D) × 150 (H) mm, 15.3 kg
Power Requirement	AC 100 to 240 V, 50/60 Hz, 115 VA		AC 100 to 240 V, 50/60 Hz, 95 VA

Low Pressure Gradient

System	HPLC	RHPLC
Mixing Accuracy	±0.8 % (5 to 95 %, 0.5 to 5.0 mL/min.)	
Semi-micro type	± 0.6 % (5 to 95 %, 0.2 to 1.0 mL/min.) ± 1.2 % (5 to 95 %, up to 4.0 mL/min.)	
Mixing Precision *Measured by Chromatogram*	0.25 % RSD or ±0.02 min. SD, whichever is larger	
Semi-micro type	0.15 % RSD or ±0.01 min. SD, whichever is larger	
Dimensions, Weight	300 (W) × 470 (D) × 150 (H) mm, 16.0 kg	
Power Requirement	AC 100 to 240 V, 50/60 Hz, 115 VA	

Binary High Pressure Gradient

System	HPLC	RHPLC	UHPLC
Mixing Accuracy	±0.4 % (5 to 95 %, 0.2 to 4.0 mL/min.)		±0.4 % (5 to 95 %, 0.2 to 2.0 mL/min.)
Mixing Precision *Measured by Chromatogram*	0.15 % RSD or ±0.01 min. SD, whichever is larger		
Dimensions, Weight	300 (W) × 470 (D) × 150 (H) mm, 21.9 kg		300 (W) × 470 (D) × 150 (H) mm, 24.1 kg
Power Requirement	AC 100 to 240 V, 50/60 Hz, 130 VA		AC 100 to 240 V, 50/60 Hz, 110 VA

Autosamplers

Model	AS-4050 (HPLC)	AS-4150 (HPLC/RHPLC)	AS-4250 (UHPLC)
Sample Injection Method	Full or partial fill loop injection		
Number of Samples	60 (2 mL vials)	180 (2 mL vials)	
Injection Volume	0.1 to 100.0 µL Large volume option (1 to 1000 µL)		
Injection Accuracy	±0.1 % or less		
Injection Precision	0.3 % RSD or less	0.25 % RSD or less	
Carry Over	0.01 % or less	0.01 % or less 0.005 % or less with multiple solvent flushing	
Maximum Pressure	30 MPa	70 MPa	130 MPa
Sample Cooling/ Heating	Option: (room temp. - 21) °C or 4 °C (whichever is higher) to 40 °C		
Pre-Column Derivatization	Standard (up to 2 reagents, dilution)		
Dimensions, Weight	300 (W) × 470 (D) × 300 (H) mm, 21 kg	300 (W) × 470 (D) × 385.5 (H) mm, 25 kg	
Power Requirement	AC 100 to 240 V, 50/60 Hz, 60 VA	AC 100 to 240 V, 50/60 Hz, 75 VA	

Column Ovens

Model	CO-4061	CO-4062	CO-4060	CO-4065
Temperature Range	(Room temp. - 15) °C or 4 °C (whichever is larger) to 100 °C		(Room temp. - 15) °C or 4 °C (whichever is larger) to 80 °C	(Room temp. - 15) °C or 4 °C (whichever is larger) to 90 °C
Column Compartment Dimensions	270 (W) × 30 (D) × 60 (H) mm, Option 380 (W) mm	260 (W) × 25 (D) × 105 (H) mm	110 (W) × 105 (D) × 410 (H) mm	260 (W) × 120 (D) × 410 (H) mm
Safety Features	Heating/cooling power shut off when unusually high temperatures or solvent leaks are detected			
Optional Column Switching Valve	-	Available (up to 6 positions)	-	Available (up to 10 positions)
Dimensions, Weight	300 (W) × 470 (D) × 150 (H) mm, 10 kg		150 (W) × 470 (D) × 465 (H) mm, 16 kg	300 (W) × 470 (D) × 465 (H) mm, 25 kg
Power Requirement	AC 100 to 240 V, 50/60 Hz, 160 VA	AC 100 to 240 V, 50/60 Hz, 200 VA	AC 100 to 240 V, 50/60 Hz, 350 VA	AC 100 to 240 V, 50/60 Hz, 660 VA

Reaction Oven

Model	RO-4068
Temperature Range	(Room temp. + 10) °C to 200 °C
Reaction Coil Holder Compartment Dimensions	43 (W) × 354 (D) × 76 (H) mm
Safety Features	Heating/cooling power shut off when unusually high temperatures or solvent leaks are detected
Dimensions, Weight	300 (W) × 470 (D) × 150 (H) mm, 12 kg
Power Requirement	AC 100 to 240 V, 50/60 Hz, 450 VA

Specifications

Detectors

UV-Vis and Circular Dichroism

Model	UV-4070	UV-4075	CD-4095
Light Source	D_2 lamp + WI lamp	D_2 lamp	Hg-Xe lamp
Wavelength Range	190 to 900 nm	190 to 600 nm	220 to 460 nm
Noise Level	$\pm 0.2 \times 10^{-5}$ AU (specified condition)		0.04 mdeg (at specified conditions)
Drift *At constant room temperature*	1×10^{-4} AU/h (specified condition)		0.1 mdeg/h (at specified conditions)
Data Output	100 Hz		
Flow Cell	Temperature controlled, tapered, path length 10 mm		Tapered cell, path length 25 mm
Spectrum Measurement	200 to 900 nm	200 to 600 nm	220 to 460 nm
Dimensions, Weight	300 (W) × 470 (D) × 150 (H) mm, 14 kg		300 (W) × 470 (D) × 225 (H) mm, 21 kg
Power Requirement	AC 100 to 240 V, 50/60 Hz, 175 VA	AC 100 to 240 V, 50/60 Hz, 125 VA	AC 100 to 240 V, 50/60 Hz, 210 VA

Photo Diode Array

Model	MD-4010	MD-4015	MD-4017
Light Source	D_2 lamp + WI lamp	D_2 lamp	D_2 lamp
Wavelength Range	190 to 900 nm	200 to 600 nm	200 to 400 nm
PDA Elements	1024 channels	512 channels	512 channels
Slit Width	1, 4, 8 nm	4 nm	4 nm
Noise Level	$\pm 3.0 \times 10^{-6}$ AU (specified condition)		$\pm 7.0 \times 10^{-6}$ AU (specified condition)
Drift	$\pm 0.5 \times 10^{-3}$ AU/h (specified condition)		$\pm 1.0 \times 10^{-3}$ AU/h (specified condition)
Linearity	2.0 AU or more (specified condition)		
Data Acquisition Rate	100 spectra/sec.		20 spectra/sec.
Flow Cell	Path length 10 mm		
PC Communication	USB		
Dimensions, Weight	300 (W) × 470 (D) × 150 (H) mm, 14.5 kg	300 (W) × 470 (D) × 150 (H) mm, 13.5 kg	
Power Requirement	AC 100 to 240 V, 50/60 Hz, 180 VA	AC 100 to 240 V, 50/60 Hz, 150 VA	AC 100 to 240 V, 50/60 Hz, 120 VA

Fluorescence

Model	FP-4020	FP-4025
Light Source	Xenon short arc lamp	
Wavelength Range	200 to 700 nm Option up to 900 nm	
Spectral Bandwidth	Excitation side: 20 nm, Emission side: 20 or 40 nm	
Sensitivity	Raman peak of water S/N > 2300	Raman peak of water S/N > 1400
Data Output	100 Hz	
Flow Cell	Front loading cassette cell	
Temperature Control	OFF, (room temp. - 10) °C to 40 °C	-
Spectrum Measurement	Excitation and emission spectrum measurement	
Two-Wavelength Monitoring	Two sets of Ex/Em wavelength setting. Maximum wavelength difference 200 mm or shorter.	
Dimensions, Weight	300 (W) × 470 (D) × 225 (H) mm, 24 kg	
Power Requirement	AC 100 to 240 V, 50/60 Hz, 270 VA	AC 100 to 240 V, 50/60 Hz, 230 VA

Refractive Index

Model	RI-4030	RI-4035
Measurement System	Deflection type	
Refractive Index Range	1.00 to 1.75	
Linearity	5.0×10^{-5} RIU (HIGH) 5.0×10^{-4} RIU (STD) 5.0×10^{-3} RIU (LOW)(H_2O)	5.0×10^{-5} RIU (HIGH) 5.0×10^{-4} RIU (STD)(H_2O)
Noise Level	0.20×10^{-8} RIU or less (specified condition)	0.50×10^{-8} RIU or less (specified condition)
Cell Capacity	10 µL	2.7 µL
Maximum Flow Range	10 mL/min. (Low flow tubing) 120 mL/min. (High flow tubing)	1.2 mL/min. (specified condition)
Maximum Pressure	0.1 MPa (Low flow tubing) 0.3 MPa (High flow tubing)	0.1 MPa
Temperature Control	(Room temp. + 10) °C to (room temp. + 25) °C	
Dimensions, Weight	300 (W) × 470 (D) × 150 (H) mm, 15 kg	
Power Requirement	AC 100 to 240 V, 50/60 Hz, 80 VA	

ChromNAV 2.0 and ChromNAV-CFR 2.0

Language	English or Japanese
Windows OS	Windows 7 Professional 32/64 bit Windows 8.1 Professional 32/64 bit Windows 10 Pro 32/64 bit
Controllable Hardware	LC-4000, XLC-3000, LC-2000, some LC-1500 and some LC-900. Control up to 4 systems.

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CERTIFIED

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