SHIMADZU
Excellence in Science

Ultra High Performance Liquid Chromatograph

Nexera series

Specifications

System Configuration

UV-VIS Detector
SPD-40/40V
Photodiode Array (PDA) Detector
SPD-M40

Baseline stability and linearity have been improved, and stability remains even under fluctuating temperatures. The PDA detector is equipped with a UV cut-off filter to improve the quantitation accuracy of photodegradable compounds. The cell and lamp are traceable via individual IDs.

Solvent Delivery Pump
LC-40 series

In addition to the four parallel double plunger models based on the maximum pressure limit, the XR and X3 models have a dual pump that reduces gradient delay volume and enables an ultra-fast high-pressure gradient. Other pumping environments (low-pressure gradient, mobile phase blending) can also be provided.

Autosampler
SIL-40 series

The autosampler boasts ultra-low carryover, less than 0.0003% (under specified conditions). Its ultra-fast injection cycle and auto pretreatment functions also contribute to more efficient analysis. The optional dual-injection system consists of two separate injection ports and flow lines, enabling different analyses to be carried out simultaneously.

Plate Changer

The installation area has been greatly reduced to 170 mm. It is possible to load up to 7 racks of 1.5 mL vials or 14 microtiter plates. Up to 3 plate changers can be connected, allowing up to 44 MTPs with up to 16896 samples to be loaded at once (using 384-well MTPs).

Mobile Phase Monitor
MPM-40 (Optional)

The monitoring device can be placed in the reservoir tray. The volume of liquid remaining in each mobile phase bottle is measured in real time and can be checked from a PC or mobile device. Before a batch analysis is started, the amount of mobile phase required is calculated and a warning is displayed if the amount remaining is insufficient.

System Controller
SCL-40, CBM-40/40lite

The SCL-40 system controller features a touch panel and allows the user to control the instrument and carry out analysis preparation directly without the need for a PC. A graphical UI makes the controller easy to use.

Degassing Unit
DGU-403/405

3-channel and 5-channel types available. Since the degassing unit is built into the LC-40B X3 pump, a separate unit is not required.

Column Oven
CTO-40 series

The circulation oven has a slim 130 mm model (maximum temperature: 85°C) and a standard 260 mm model (maximum temperature: 100°C). Both are able to accommodate a 300 mm column and have connection ports for CMD or mixer ID recognition. Active preheater tubing is available as an option.

Specifications

System Controller


SCL- 40

	SCL-40	CBM-40	CBM-40lite
Monitor	Touch panel LabSolutions™ Web monitor	LabSolutions Web monitor	LabSolutions Web monitor
Connectable unit	Solvent delivery unit: max. 4, Autosampler: 1, Column oven: max. 4, Detector: max 2, etc.		
Number of connectable units	8 (Using option: 12)		4 (Excluding built-in solvent delivery unit)
Event input/output	Input: 1, output: 2		
Analog board	Up to two channels (option)	Up to one channel (option)	—
Communication	Ethernet		
Reservoir tray	Built-in	—	
Dimensions [mm], weight	W 260 × D 500 × H 140, 6 kg	W 260 × D 500 × H 72, 5 kg	—
Operating temperature range	4 to 35°C		
Power supply	AC 100–240 V, 50 VA, 50/60 Hz		Supplied from solvent delivery unit

Solvent Delivery Pump


LC-40B XR

	LC-40D	LC-40D XR LC-40B XR	LC-40D XS	LC-40D X3 LC-40B X3
Pumping method	Parallel-type double plunger (approx. 10 µL/1 stroke)			
Allowable maximum pressure	44 MPa	70 MPa	105 MPa	130 MPa
Flow rate settings range	0.0001 – 5.0000 mL/min (1.0 – 44 MPa) 5.0001 – 10.0000 mL/min (1.0 – 22 MPa)	0.0001 – 3.0000 mL/min (1.0 – 70 MPa) 3.0001 – 5.0000 mL/min (1.0 – 44 MPa) 5.0001 – 10.0000 mL/min (1.0 – 22 MPa)	0.0001 – 3.0000 mL/min (1.0 – 105 MPa) 3.0001 – 5.0000 mL/min (1.0 – 80 MPa) 5.0001 – 10.0000 mL/min (1.0 – 22 MPa)	0.0001 – 3.0000 mL/min (1.0 – 130 MPa) 3.0001 – 5.0000 mL/min (1.0 – 80 MPa) 5.0001 – 10.0000 mL/min (1.0 – 22 MPa)
Flow rate accuracy	≤ ± 1% or ± 2 µL/min, whichever greater (under specified conditions)		≤ ± 1% (under specified conditions)	
Flow rate precision	≤ 0.06% RSD or 0.02 minSD, whichever greater			
Gradient mode	High-pressure gradient (2 or 3 solvents) Quaternary low-pressure gradient	High-pressure gradient (2 solvents (LC-40B XR standard) or 3 solvents) Quaternary low-pressure gradient (Only available for LC-40D XR)	High-pressure gradient (2 or 3 solvents) Quaternary low-pressure gradient	High-pressure gradient (2 solvents (LC-40B X3 standard) or 3 solvents) Quaternary low-pressure gradient (Only available for LC-40D X3)
Gradient range of set concentrations	0 to 100% (0.1% step)			
Gradient concentration accuracy	± 0.5% (under specified conditions)			
Wetted materials	SUS316L, Hastelloy® C, PEEK, PTFE, Sapphire, Ruby	SUS316L, Hastelloy C, PEEK, PE, Sapphire, Ruby		
Available pH range	1 to 14			
Automatic rinsing kit	Option	Standard equipment		
Degassing unit	1 unit connectable	LC-40D XR: 1 unit connectable LC-40B XR: 2 units connectable	1 unit connectable	LC-40D X3: 1 unit connectable LC-40B X3: pre-installed (5 port built-in), 1 unit connectable
Dimensions [mm]	W 260 × D 500 × H 140			LC-40D X3: W 260 × D 500 × H 140 LC-40B X3: W 260 × D 500 × H 210
Weight	10 kg	LC-40D XR: 10 kg LC-40B XR: 13 kg	12 kg	LC-40D X3: 12 kg LC-40B X3: 21 kg
Operating temperature range	4 to 35°C			
Power supply	AC 100–240 V, 50/60 Hz			
	150 VA	LC-40D XR: 150 VA LC-40B XR: 180 VA	150 VA	LC-40D X3: 150 VA LC-40B X3: 180 VA

Degassing Unit


DGU-403

	DGU-403	DGU-405
Number of degassed solvents	3	5
Degassed flow line capacity	400 µL/1 line	
Dimensions [mm], weight	W 260 × D 500 × H 72, 4 kg	
Operating temperature range	4 to 35°C	
Power supply	Supplied from solvent delivery unit	

Autosampler

SIL-40C XR

		SIL-40 SIL-40C	SIL-40 XR SIL-40C XR	SIL-40C XS	SIL-40C X3
Injection method		Total-volume Injection (standard), loop injection (optional)			
Allowable maximum pressure		44 MPa	80 MPa	105 MPa	130 MPa
Injection volume		0.1 to 100 µL	0.1 to 50 µL		
		0.1 to 2000 µL (optional)			
Injection volume accuracy		≤ ± 1% (5 µL injection, n = 20)			
Linearity		≥ 0.9999			
Injection cycle time		≤ 6.7 seconds (under specified conditions)			
Samples for processing		288 (microtiter plate, 96 well × 3 plates), 1152 (microtiter plate, 384 well × 3 plates), 252 (1 mL sample vial, 84 × 3 plates), 162 (1.5 mL sample vial, 54 × 3 plates), 84 (4 mL sample vial, 28 × 3 plates), 36 (10 mL sample vial, 12 × 3 plates), 72 (1.5 mL micro tube, 24 × 3 plates)			
Injection volume reproducibility		RSD ≤ 1.0% (0.5 to 0.9 µL), RSD ≤ 0.5% (1.0 to 1.9 µL), RSD ≤ 0.25% (2.0 to 4.9 µL), RSD ≤ 0.15% (More than 5.0 µL), RSD < 0.5% (typically, 0.5 µL), RSD < 0.25% (typically, 1.0 µL)			
Carryover		≤ 0.0025% (without rinse) ≤ 0.0005% (with rinse, typically) (under specified conditions)	≤ 0.0015% (without rinse) ≤ 0.0003% (with rinse, typically) (under specified conditions)		
Dip rinsing outside the needle and injection port rinsing		Standard equipment			
Pumping rinse outside the needle		Option	Standard equipment		
Internal rinsing (3 dil)		Option			Standard equipment
Sample cooler		SIL-40: None SIL-40C: Standard equipment (Air-circulation temperature control type)	SIL-40 XR: None SIL-40C XR: Standard equipment (Air-circulation temperature control type)	Standard equipment (Air-circulation temperature control type)	
Sample cooler temperature setting range		4 to 45°C (Room temperature needs to be less than 30°C and humidity needs to be less than 70% to set 4°C)			
Sample cooler temperature accuracy		± 2°C (sensor position ± 0.5°C)			
Wetted material		SUS316L, DLC, PEEK, GFP, PTFE, FEP, ETFE, sapphire, ceramics, PPS, FFKM			
Available pH range		1 to 14			
Dimensions [mm], weight		W 260 × D 500 × H 280 (SIL-40C/40C XR/40C XS/40C X3: Protrusion adds 140 mm to the depth)			
		SIL-40: 17 kg SIL-40C: 24 kg	SIL-40 XR: 17 kg SIL-40C XR: 24 kg	24 kg	
Operating temperature range		4 to 35°C			
Power supply	Cooler model	AC 100–240 V, 400 VA, 50/60 Hz			
	Non cooler model	AC 100–240 V,150 VA, 50/60 Hz		—	

Plate Changer

		PLATE CHANGER
Samples for processing (includes two plates of autosampler)	1 PLATE CHANGER	1536 (microtiter plate, 96 well × 16 plates), 864 (deep-well plate, 96 well × 9 plates) 6144 (microtiter plate, 384 well × 16 plates), 3456 (deep-well plate, 384 well × 9 plates) 756 (1 mL sample vial, 84 × 9 plates), 486 (1.5 mL sample vial, 54 × 9 plates) 252 (4 mL sample vial, 28 × 9 plates), 108 (10 mL sample vial, 12 × 9 plates)
	3 PLATE CHANGERS	4224 (microtiter plate, 96 well × 44 plates), 2208 (deep-well plate, 96 well × 23 plates) 16896 (microtiter plate, 384 well × 44 plates), 8832 (deep-well plate, 384 well × 23 plates) 1932 (1 mL sample vial, 84 × 23 plates), 1242 (1.5 mL sample vial, 54 × 23 plates) 644 (4 mL sample vial, 28 × 23 plates), 276 (10 mL sample vial, 12 × 23 plates)
Sample cooler temperature setting range		Air-circulation temperature control type, 4 to 45°C (Room temperature needs to be less than 30°C and humidity needs to be less than 70% to set 4°C)
Dimensions [mm], weight		W 170 × D 500 × H 560 (Protrusion adds 140 mm to the depth), 26 kg
Operating temperature range		4 to 35°C
Power supply		AC 100–240 V, 400 VA, 50/60 Hz

Column Oven

CTO-40C

CTO-40S

	CTO-40C	CTO-40S
Temperature control type	Forced air circulation	
Cooling Method	Electronic cooling	
Temperature control range	Room temperature – 10°C to 100°C	Room temperature – 10°C to 85°C
Temperature accuracy	± 0.5°C	± 0.8°C
Temperature precision	± 0.05°C	± 0.1°C
Containable column size and number	Up to 250 mm L. column × 6 or 300 mm L. column × 3	Up to 100 mm L. column × 6 or 300 mm L. column × 3
Dimensions [mm], weight	W 260 × D 500 × H 415, 21 kg	W 130 × D 500 × H 553, 15 kg
Operating temperature range	4 to 35°C	
Power supply	AC 100–120 V / 220–240 V (Automatic switching), 400 VA, 50/60 Hz	AC 100–240 V, 300 VA, 50/60 Hz

UV-VIS Detector

SPD-40V

	SPD-40	SPD-40V
Light source	Deuterium (D_2) lamp	Deuterium (D_2) lamp, tungsten lamp
Wavelength range	190 to 700 nm	190 to 1000 nm
Bandwidth	8 nm	
Wavelength accuracy	≤ ± 1 nm	
Wavelength reproducibility	≤ ± 0.1 nm	
Drift	≤ 0.1×10^{-3} of AU/h (under specified conditions)	
Noise	1 Wavelength mode: ≤ 4.0×10^{-6} AU, 2 Wavelength mode: ≤ 10.0×10^{-6} AU (under specified conditions)	
Linearity	2.5 AU (under specified conditions)	
Standard flow cell	Optical path length: 10 mm, Cell volume: 12 µL, Pressure: 12 MPa Material of wetted parts: SUS316L, PFA, quartz, PEEK	
Cell temperature control range	19 to 50°C, 1°C Step	
Optional flow cell	UHPLC cell (optical path length: 10 mm, cell volume: 8 µL, equipped with temperature control function) Semi-micro cell (optical path length: 5 mm, cell volume: 2.5 µL, equipped with temperature control function) Conventional cell (optical path length: 10 mm, cell volume: 12 µL, equipped with temperature control function) Inert cell (optical path length: 10 mm, cell volume: 12 µL, equipped with temperature control function) Preparative cell (optical path length: 0.1/0.2/0.5 mm, cell volume: 0.8/1.6/4.0 µL) Micro flow cell (optical path length: 3 mm, cell volume: 0.21 µL) Maximum pressure cell (optical path length: 10 mm, cell volume: 12 µL)	
Available pH range	1 to 13 (Cell quartz might be damaged by a mobile phase of pH >10.)	
Dimensions [mm], weight	W 260 × D 500 × H 140, 11 kg	
Operating temperature range	4 to 35°C	
Power supply	AC 100–240 V, 150 VA, 50/60 Hz	

Photodiode Array Detector

SPD-M40

	SPD-M40
Light source	Deuterium (D_2) lamp, Tungsten lamp
Number of diode elements	1024
Wavelength range	190 to 800 nm
Wavelength accuracy	≤ ± 1 nm
Wavelength reproducibility	≤ ± 0.1 nm
Slit width	1.2 nm, 8 nm
Spectral resolution	≤ ± 1.4 nm
Drift	≤ 0.4×10^{-3} of AU/h (under specified conditions)
Noise	≤ 4.5×10^{-6} AU (under specified conditions)
Linearity	2.5 AU (under specified conditions)
Standard flow cell	Optical path length: 10 mm, Cell volume: 12 µL, Pressure: 12 MPa Material of wetted parts: SUS316L, PFA, quartz, PEEK
Cell temperature control range	19 to 50°C, 1°C Step
Optional flow cell	UHPLC cell (optical path length: 10 mm, cell volume: 8 µL, equipped with temperature control function) Semi-micro cell (optical path length: 5 mm, cell volume: 2.5 µL, equipped with temperature control function) Conventional cell (optical path length: 10 mm, cell volume: 12 µL, equipped with temperature control function) Inert cell (optical path length: 10 mm, cell volume: 12 µL, equipped with temperature control function) Preparative cell (optical path length: 0.1/0.2/0.5 mm, cell volume: 0.8/1.6/4.0 µL, equipped) Micro flow cell (optical path length: 3 mm, cell volume: 0.21 µL) Maximum pressure cell (optical path length: 10 mm, cell volume: 12 µL)
Available pH range	1 to 13 (Cell quartz might be damaged by a mobile phase pH >10.)
Dimensions [mm], weight	W 260 × D 500 × H 140, 10 kg
Operating temperature range	4 to 35°C
Power supply	AC 100–240 V, 180 VA, 50/60 Hz

Capillary cell type Photodiode Array Detector

	SPD-M30A
Light source	Deuterium (D_2) lamp
Number of diode elements	1024
Wavelength range	190 to 700 nm
Wavelength accuracy	≤ ± 1 nm
Wavelength reproducibility	≤ ± 0.1 nm
Slit width	1 nm, 8 nm
Spectral resolution	≤ 1.4 nm
Drift	≤ 0.5×10^{-3} AU/h (under specified conditions)
Noise	≤ 4.0×10^{-6} AU (under specified conditions)
Linearity	2.0 AU (under specified conditions)
Cell	Standard cell: Optical path length: 10 mm, Capacity: 1 µL, Pressure: 8 MPa Optional high-sensitivity cell: Optical path length: 85 mm, Capacity: 9 µL, Pressure: 8 MPa
Dimensions [mm], weight	W 260 × D 500 × H 140, 12 kg
Operating temperature range	4 to 35°C
Power supply	AC 100–240 V, 150 VA, 50/60 Hz

Spectrofluorometric Detector

	RF-20A	RF-20Axs
Light source	Xenon lamp	Xenon lamp Low-pressure mercury lamp (to check wavelength accuracy)
Wavelength range	200 to 650 nm	200 to 750 nm
Spectral bandwidth	20 nm	
Wavelength accuracy	± 2 nm	
Wavelength precision	± 0.2 nm	
S/N	Water Raman peak S/N ≥1200 Low background S/N ≥ 9000	Water Raman peak S/N ≥ 2000 Low background S/N ≥ 12000
Range of cell temperature control	—	Room temperature – 10°C to 40°C, 1°C step
Cell	Standard conventional cell: volume 12 µL, maximum pressure 2 MPa Optional semi-micro cell: volume 3 µL, maximum pressure 2 MPa	
Function	Simultaneous measurement of four wavelengths, Wavelength scanning	
Dimensions [mm], weight	W 260 × D 500 × H 210, 16 kg	W 260 × D 500 × H 210, 18 kg
Operating temperature range	4 to 35°C	
Power supply	AC 100–240 V, 400 VA, 50/60 Hz	

Differential Refractive Index Detector

	RID-20A
Measurement range	1 to 1.75 RIU
Noise	≤ 2.5×10^{-9} RIU
Drift	≤ 1×10^{-7} RIU/h
Range	A mode: 0.01×10^{-6} to 500×10^{-6} RIU P, L-mode: 1×10^{-6} to 5000×10^{-6} RIU
Response	0.05 to 10 sec, 10 steps
Polarity – Change	Available
Zero adjustment	Auto zero, Optical zero, Fine zero
Maximum flow rate	20 mL/min (150 mL/min in option)
Range of cell temperature control	30 to 60°C
Cell	Volume 9 µL, Maximum pressure 2 MPa
Dimensions [mm], weight	W 260 × D 420 × H 140, 12 kg
Operating temperature range	4 to 35°C
Power supply	AC 100–240 V, 150 VA, 50/60 Hz

Conductivity Detector

	CDD-10Avp
Cell volume	0.25 µL
Cell constant	25 $\mu S \cdot cm^{-1}$
Material of wetted parts	PEEK, SUS316
Maximum use pressure	2.9 MPa (30 kgf/cm^2)
Response	0.05 to 10 s, 10 steps
Zero adjustment	Auto-zero function, Baseline-shifting function
Dimensions [mm], weight	W 260 × D 420 × H 140, 6 kg
Operating temperature range	4 to 35°C
Power supply	AC 100–240 V, 250 VA, 50/60 Hz

Evaporative Light-Scattering Detector

	ELSD-LT II
Nebulizing method	Siphon Splitting
Light source	LED
Detection	Photomultiplier
Scope of set temperature	Room temperature + 5°C to 80°C
Gas nebulizer	Nitrogen or air*
Gas flow rate, gas pressure	Up to 3.0 mL/min, up to 450 kPa
Standard mobile phase flow rate	0.2 to 2.5 mL/min
Analog output	0 to 1 V
Dimensions [mm], weight	W 260 × D 550 × H 450, 20 kg
Operating temperature range	5 to 40°C
Operation humidity range	≤ 80% (Room temperature + 5°C to 31°C), ≤ 50% (Room temperature + 31°C to 40 °C)
Power supply	AC 100 V, 210 VA, 50/60 Hz

*Requires a gas supply source, such as an air compressor, nitrogen generator and gas piping.

[Note] • Please use a regulator with filter (option) in order to remove small foreign matters in the gas.
• Please make sure that nitrogen or air doesn't contain oil, dust, or moisture when you use nitrogen generator and/or air compressor.
• Please use the instrument in a room with exhaust facilities.

Optional accessories

Solvent Delivery Unit

Part Name		P/N	Description
Low-pressure gradient unit		228-65016-58	Low-pressure gradient unit for LC-40D/40D XR/40D XS/40D X3
Reservoir selection valve		228-65017-58	Two-solvent switching unit to be incorporated in solvent delivery unit
FCV-11AL		228-65611-58	The mobile phase switching valve of 3 flow lines that connects to solvent delivery unit (external)
FCV-11ALS		228-65610-58	The mobile phase switching valve of 1 flow line that connects to solvent delivery unit (external)
Automatic rinsing kit		228-56201-41	Automatic rinsing kit for plunger seal cleaning
Mixer	MR 20 µL	228-72652-41	High-efficiency mixer for high-pressure gradient system (volume 20 µL)
	MR 40 µL	228-72652-42	High-efficiency mixer for high-pressure gradient system (volume 40 µL)
	MR 100 µL	228-72652-43	High-efficiency mixer for high-pressure gradient system (volume 100 µL)
	MR 180 µL	228-72652-44	High-efficiency mixer for high-pressure gradient system (volume 180 µL)
	MR 40 µL LPGE	228-65020-41	High-efficiency mixer for low-pressure gradient system (volume 40 µL)
	MR 300 µL LPGE	228-72653-42	High-efficiency mixer for low-pressure gradient system (volume 300 µL)

Autosampler

Part Name		P/N	Description
Sample loop	50 µL	228-63132-44	Sample loop for 50 µL injection (standard configuration of SIL-40 XR/40C XR/40C XS/40C X3)
	100 µL	228-63132-45	Sample loop for 100 µL injection (standard configuration of SIL-40/40C)
	500 µL	228-45405-45	Sample loop to increase the injection volume up to 500 µL (Connect sample loop 100 µL (228-63132-45))
	2000 µL	228-45405-46	Sample loop to increase the injection volume up to 2 mL (Connect sample loop 100 µL (228-63132-45))
Dual-injection kit		228-72568-41, -42	Tubing kits for dual injection (228-72568-41 is for CTO-40S and 228-72568-42 is for CTO-40C)
Sample loop for loop injection	5 µL	228-71759-42	Sample loop for loop injection mode (volume 5 µL)
	20 µL	228-71759-43	Sample loop for loop injection mode (volume 20 µL)
	50 µL	228-71759-44	Sample loop for loop injection mode (volume 50 µL)
Sample plate	1.5 mL	228-71762-46	Plate for 1.5 mL sample vial (54)
	1 mL	228-71762-42	Plate for 1 mL sample vial (84)
	4 mL	228-71762-43	Plate for 4 mL sample vial (28)
	10 mL	228-71762-44	Plate for 10 mL sample vial (12)
Identification labels	For 96-well microplates	228-71840-41	Identification label affixed to the 96-well microtiter plate (100 set)
	For 96-well deep-well plates	228-71840-42	Identification label affixed to the 96-well deep-well plate (100 set)
	For 384-well microplates	228-71840-43	Identification label affixed to the 384-well microtiter plate (100 set)
	For 384-well deep-well plates	228-71840-44	Identification label affixed to the 384-well deep-well plate (100 set)

Column Oven

Part Name		P/N	Description
Active pre-heater		228-72084-41	Pre-heater device for thermostatting mobile phase before the column inlet
FCV kits	For CTO-40S	228-72438-41	This is a kit for attaching a flow line switching valve to CTO-40S
	For CTO-40C	228-72589-41	This is a kit for attaching a flow line switching valve to CTO-40C
Two FCV tubing kits	ID 0.3	228-72437-41	Tubing kit to connect the flow line switching valve and columns
	ID 0.1	228-72437-42	
Six FCV tubing kits	ID 0.3	228-72437-43	
	ID 0.1	228-72437-44	
Nexlock™ SS (with fitting)	ID 0.1 mm × 600 mm	228-62544-11	Finger-tight high-pressure fitting
	ID 0.3 mm × 600 mm	228-62544-22	

UV Detector / PDA Detector

Part Name	P/N	Description
UHPLC cell	228-64724-41 (PDA), -42 (UV)	Flow cell for high-speed analysis (volume 8 µL)
Semi-micro cell	228-64725-41 (PDA), -42 (UV)	Flow cell for semi-micro analysis (volume 2.5 µL)
Conventional cell	228-68250-41 (PDA), -42 (UV)	Flow cell with the same cell volume (12 µL) as standard cell of SPD-20A and SPD-M20A
Inert cell	228-64728-41 (PDA), -42 (UV)	Inert-type flow cell with metal-less wetted parts
Preparative cell	228-64727-41 (PDA), -42 (UV)	Preparative flow cell with variable optical path length
Micro flow cell	228-64737-41 (PDA), -42 (UV)	Flow cell for micro analysis (volume 0.21 µL)
Maximum pressure cell	228-64726-41 (PDA), -42 (UV)	High-pressure resisting flow cell for Nexera™ UC
Solvent recycle valve	228-56808-42 (UV)	Valve to recycle mobile phase by attaching to SPD-40/40V

Others

Part Name	P/N	Description
Mobile phase monitor (controller)	228-65525-58	MPM-40 controller to monitor remaining mobile phase in real-time Up to six bottle holders can be connected (228-65526-58, set of two)
Power outlet unit 6P	228-65523-42 (socket type B) 228-65523-43 (socket type D) 228-65523-46 (socket type I) 228-65523-58 (socket type F)	Power tap to turn off the main power of the instrument completely at one time. Switches can be installed in front of the reservoir tray. It provides six outlets.
Power outlet unit 2PS	228-65524-46 (for China) 228-65524-58 (for other than China)	Outlet to supply power to main units that need to be connected to service outlets, such as SIL-10A and FRC-10A. It provides two outlets.
Tubing kit A, ID 0.3 for high-pressure GE	228-70254-41	Tubing kits for high-pressure gradient system. Column inlet tubing ID 0.3 mm
Tubing kit B, ID 0.1 for high-pressure GE	228-70254-42	Tubing kits for high-pressure gradient system. Column inlet tubing ID 0.1 mm
Tubing kit C, ID 0.3 for low-pressure GE	228-70254-43	Tubing kits for low-pressure gradient system. Column inlet tubing ID 0.3 mm
Tubing kit D, ID 0.1 for low-pressure GE	228-70254-44	Tubing kits for low-pressure gradient system. Column inlet tubing ID 0.1 mm
Cable kit A	228-70247-41	Optical link cable kit, 600 mm × 1 pc, 800 mm × 1 pc
Cable kit B	228-70247-42	Optical link cable kit, 600 mm × 2 pcs, 800 mm × 1 pc
Cable kit C	228-70247-43	Optical link cable kit, 600 mm × 3 pcs, 800 mm × 1 pc
Cable kit D	228-70247-44	Optical link cable kit, 600 mm × 4 pcs, 800 mm × 1 pc
Reservoir tray	228-65508-58	Reservoir tray for up to 8 bottles (1L)
AD board	228-55519-41	Board for analog–digital conversion. It takes in detector signals as analog signals.
Optical cable connector expansion board	228-70481-41	The board to expand the number of optical cable connector channels to 12ch from 8ch (standard) by attaching to SCL-40/CBM-40

Valve

Part Name	P/N	Description
FCV-DR	228-65602-58	Drive unit and control board for incorporating valve into CTOs (1 FCV valve is required separately)
FCV-0206	228-65603-58	2-position 6-port valve (Maximum pressure: 44 MPa)
FCV-0607	228-65604-58	6-position 7-port valve (Maximum pressure: 44 MPa)
FCV-0206H	228-65607-58	2-position 6-port valve (Maximum pressure: 80 MPa)
FCV-0607H	228-65608-58	6-position 7-port valve (Maximum pressure: 80 MPa)
FCV-0206H3	228-65624-58	2-position 6-port valve (Maximum pressure: 130 MPa)
FCV-0607H3	228-65625-58	6-position 7-port valve (Maximum pressure: 130 MPa)

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CHROMATOGRAPHY

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Within chromatography, we have been pioneers in the field since the 1960s, having successively expanded our product portfolio to include high quality solutions for HPLC, GC, TLC, SPE and flash, as well as syringe filters and vials and caps.

Based in Düren / Germany we have subsidiaries in three different countries, namely the United States, France and Switzerland. World-wide, more than 500 employees work for MACHEREY-NAGEL, while we are active in more than 150 countries.

The company's success is based on our passion for quality, customer focused service and the warm-hearted business approach of an entirely family owned enterprise.

Our chromatography mission

"Providing excellent chromatography solutions you can trust"

We know that the analytical work of our customers – your work – is of fundamental value, as it delivers answers and results to help shaping a better planet. We also believe that such answers and results can only be generated with products and tools that inspire trust and within which you have the utmost confidence.

Our comprehensive portfolio includes technically advanced HPLC and GC columns, high purity SPE phases as well as premium autosampler vials and caps. MACHEREY-NAGEL – your one-stop solution provider for premium sample preparation and reliable analytics.

Chromatography product families

HPLC columns
NUCLEODUR®
NUCLEOSHELL®

GC columns
OPTIMA®
Reagents

SPE phases
CHROMABOND®
Accessories

TLC plates
ALUGRAM®
POLYGRAM®

Syringe filters
CHROMAFIL®

Vials and
closures

Customers around the globe trust in MN products – discover how you can trust in MN as well to optimize your analysis.

NUCLEOSIL®
manufacturer-packed columns from MACHEREY-NAGEL
Highest quality in HPLC for over 40 years

You probably know that

- NUCLEOSIL® was one of the first spherical silicas for HPLC
- NUCLEOSIL® comes in numerous different modifications, particle sizes and pore sizes
- NUCLEOSIL® is renowned around the globe due to its versatile applicability

Dr. Helmut Riering, Senior Scientist
Separation Science and Analytics

Do you also know that

- NUCLEOSIL® was originally developed by MACHEREY-NAGEL in 1974?
- NUCLEOSIL® is still manufactured exclusively by MACHEREY-NAGEL in Germany?
- NUCLEOSIL® is still one of the most used HPLC silicas in quality control around the globe?

Achim Kippels, Sorbent Synthesis
and Scale-up Production

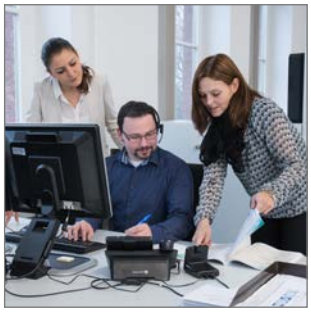
Buy NUCLEOSIL® directly from MACHEREY-NAGEL, the silica specialists who invented it.

Thus, you will receive

- A finely tuned portfolio of NUCLEOSIL® phases for all your individual applications
- Expert know-how and highly trained staff for unrivaled customer support
- Decades of experience in manufacturing and packing columns for safe and reliable results
- A wide variety of NUCLEOSIL® – and other – applications
  in our free-of-charge application database (***www.mn-net.com/apps***)

Dr. Simon Forster, Stephan Frech
R&D Surface Chemistries

"For more than forty years it's our main goal to ensure highest quality standards for our NUCLEOSIL® and NUCLEODUR® columns. Reproducibility, column life-time and excellent performance are our ambition."



Julia Schweigert, Heike Heyne
Andreas Bohne
Customer Service / Order Processing

Monika Kosiahn, Maria Thelen
Sieglinde Harth
Column Production / Quality Control

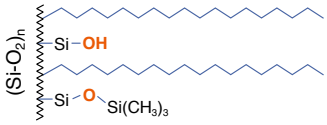
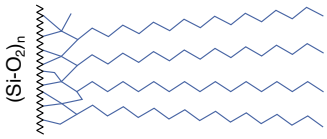
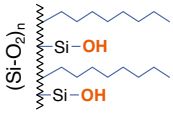
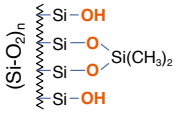
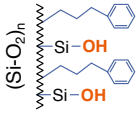
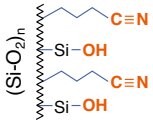
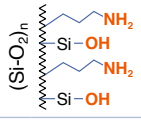
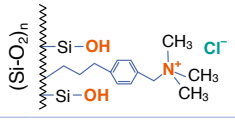
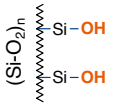
Dr. Hans Rainer Wollseifen
Torsten Kretschmer
Application Development

NUCLEOSIL®

Selection of most popular phases

We want our customers to achieve the best possible results, hence we offer a wide variety of chemistries to the standard NUCLEOSIL® silica. The following table gives an overview of the most well known and heavily used NUCLEOSIL® phases.

For additional modifications, please visit ***www.mn-net.com/NUCLEOSIL***.

Phase	Modification	Stability	Structure	Separation principle
NUCLEOSIL® RP phases				
C_{18}	Octadecyl phase, medium density modification, endcapping 15 % C · USP L1	pH 2–8		hydrophobic (van der Waals) interactions slight residual silanol interactions
C_{18} HD	Octadecyl phase, high density monomeric modification, endcapping 20 % C · USP L1	pH 2–9		hydrophobic (van der Waals) interactions
C_{18} AB	Octadecyl phase, special crosslinked modification, endcapping 25 % C · USP L1	pH 1–9		steric interactions and hydrophobic interactions
C_8	Octyl phase, no endcapping 8.5 % C · USP L7	pH 2–8		hydrophobic (van der Waals) interactions noticeable residual silanol interactions
C_2	Dimethyl phase 3.5 % C· USP L16	pH 2–8		hydrophobic (van der Waals) interactions noticeable residual silanol interactions
C_6H_5	Phenyl phase, no endcapping 8 % C · USP L11	pH 2–8		π–π interactions and hydrophobic interactions noticeable residual silanol interactions
Polar NUCLEOSIL® phases and NUCLEOSIL® ion exchangers				
CN / CN-RP	Cyano (nitrile) phase USP L10	pH 2–8		π–π interactions, polar interactions and hydrophobic interactions
NH_2 / NH_2-RP	Amino USP L8	pH 2–8		polar and hydrophobic interactions, weak ion exchange interactions
SA	Sulfonic acid, strongly acid cation exchanger (SCX) · USP L9	pH 2–8		strong ion exchange interactions
SB	Quaternary ammonium, strongly basic anion exchanger (SAX) · USP L14	pH 2–8		strong ion exchange interactions
SiOH	Unmodified spherical silica USP L3	pH 2–8		polar interactions

Selected NUCLEOSIL® columns

When quality counts, trust the original.

In order to facilitate your purchase, we have compiled a selection of our most common NUCLEOSIL® columns.
If you require different variations, please do not hesitate to contact us at info@mn-net.com.

Columns with selected RP phases

HPLC phase	ID	Length [mm] 100	125	150	250	EC guard columns*
NUCLEOSIL® 100-3 C_{18}, particle size 3 µm, pore size 100 Å	4 mm		720150.40		720133.40	721022.30
	4.6 mm	720841.46	720150.46	720949.46	720133.46	721022.30
NUCLEOSIL® 100-5 C_{18}, particle size 5 µm, pore size 100 Å	2 mm			720120.20		721074.20
	3 mm		720002.30		720014.30	721074.30
	4 mm	720141.40	720002.40	720120.40	720014.40	721074.30
	4.6 mm	720141.46	720002.46	720120.46	720014.46	721074.30
NUCLEOSIL® 100-7 C_{18}, particle size 7 µm, pore size 100 Å	4 mm				720018.40	721005.30
	4.6 mm		720951.46	720110.46		721005.30
NUCLEOSIL® 100-10 C_{18}, particle size 10 µm, pore size 100 Å	4 mm				720023.40	721181.30
	4.6 mm				720023.46	721181.30
NUCLEOSIL® 120-3 C_{18}, particle size 3 µm, pore size 120 Å	4.6 mm	720149.46	720040.46			721075.30
NUCLEOSIL® 120-5 C_{18}, particle size 5 µm, pore size 120 Å	4 mm				720041.40	721070.30
	4.6 mm				720041.46	721070.30
NUCLEOSIL® 100-5 C_{18} HD, particle size 5 µm, pore size 100 Å	4 mm				720280.40	721072.30
	4.6 mm				720280.46	721072.30
NUCLEOSIL® 100-5 C_{18} AB, particle size 5 µm, pore size 100 Å	3 mm				720936.30	721073.30
	4.6 mm				720936.46	721073.30
NUCLEOSIL® 100-5 C_8, particle size 5 µm, pore size 100 Å	4 mm		720001.40		720013.40	721194.30
	4.6 mm			720990.46	720013.46	721194.30
NUCLEOSIL® 100-7 C_2, particle size 7 µm, pore size 100 Å	4.6 mm				720089.46	721030.30
NUCLEOSIL 100-5 C_6H_5, particle size 5 µm, pore size 100 Å	4.6 mm				720956.46	721137.30

Columns with selected polar phases

HPLC phase	ID	Length 250 mm	EC guard columns*
NUCLEOSIL® 100-5 CN, particle size 5 µm, pore size 100 Å	4 mm	720090.40	721078.30
	4.6 mm	720090.46	721078.30
NUCLEOSIL® 100-10 CN, particle size 10 µm, pore size 100 Å	4 mm	720024.40	721942.30
	4.6 mm	720024.46	721942.30
NUCLEOSIL® 100-5 CN-RP, particle size 5 µm, pore size 100 Å	4.6 mm	720205.46	721039.30
NUCLEOSIL® 100-5 NH_2, particle size 5 µm, pore size 100 Å	4.6 mm	720095.46	721020.30
NUCLEOSIL® 100-5 SA, particle size 5 µm, pore size 100 Å	4.6 mm	720097.46	721024.30
NUCLEOSIL® 100-10 SA, particle size 10 µm, pore size 100 Å	4.6 mm	720028.46	721163.30
NUCLEOSIL® 100-5, particle size 5 µm, pore size 100 Å	4.6 mm	720099.46	721518.30

* Column Protection System required (REF 718966, see next page)

Other NUCLEOSIL® phases and other column dimensions are available on request.

A global network of subsidiaries and distributors in 150 countries ensures the availability of original manufacturer-packed NUCLEOSIL® columns all over the world.

Column hardware
Technical information

High vertical range of manufacture does not stop at sorbent technology. All stainless steel column hardware components are generated in our in-house CNC controlled production processes.

EC standard columns for analytical HPLC

- Analytical column system manufactured from stainless steel
- Hardware guarantees pressure stability up to 1,200 bar (17,400 psi):
  Thus EC columns are suitable for UHPLC applications and can be run on all HPLC systems.

Ideal protection for your main column:
Column Protection System
significant increase in column lifetime

Especially designed to meet our customers' requirements, we have developed a universal guard column holder for analytical columns – our **Column Protection System**

Column Protection System

- Innovative and universal screw-on guard column holder system
- Suitable for all analytical HPLC columns with 1/16" connections
- Minimized void volume: suitable also for ultra fast HPLC
- Pressure stability up to 1,034 bar (15,000 psi)

MN products for chromatography
Expertise beyond HPLC

In addition, we have established a broad range of other high quality chromatography products and services. All products are made in Germany and include SPE, TLC, GC, syringe filters as well as vials and caps.

Experienced customer service

Service at MN is all about customers. For us, great service starts way before the sales process and continues even after the product has been supplied and used.

Please contact us per telephone (+49 24 21 969-0) or e-mail at info@mn-net.com.

Our website also offers a wide variety of services and valuable information, such as

- A vast online application database with more than 3000 applications from all fields of chromatography: ***www.mn-net.com/apps***
- An informative and helpful troubleshooting section ***www.mn-net.com/chroma***
- Find our entire network of local distributors
- Multiple finder tools, e.g., for syringe filters, vials and caps
- Download sections for certificates, flyers, manuals, catalogs, MSDS and much more

NUCLEOSIL® · the original

Find what you are looking for!

local distributor

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www.mn-net.com

MACHEREY-NAGEL

MACHEREY-NAGEL GmbH & Co. KG · Neumann-Neander-Str. 6–8 · 52355 Düren · Germany

Germany and international:
Tel.: +49 24 21 969-0
Fax: +49 24 21 969-199
E-mail: info@mn-net.com

Switzerland:
MACHEREY-NAGEL AG
Tel.: +41 62 388 55 00
Fax: +41 62 388 55 05
E-mail: sales-ch@mn-net.com

France:
MACHEREY-NAGEL EURL
Tel.: +33 388 68 22 68
Fax: +33 388 51 76 88
E-mail: sales-fr@mn-net.com

USA:
MACHEREY-NAGEL Inc.
Tel.: +1 484 821 0984
Fax: +1 484 821 1272
E-mail: sales-us@mn-net.com

MN Since 1911

NUCLEOGEL® SUGAR 810 separation of sugars · USP L17 (H^+ form) · USP L19 (Ca^{2+} form)

Technical data

- Sulfonated polystyrene - divinylbenzene resins in different ionic forms; due to a different selectivity pattern compared to NUCLEOGEL® SUGAR columns, the range of application is considerably enlarged
- Separation mechanism: ion exclusion, ion exchange, size exclusion, ligand exchange, NP and RP chromatography

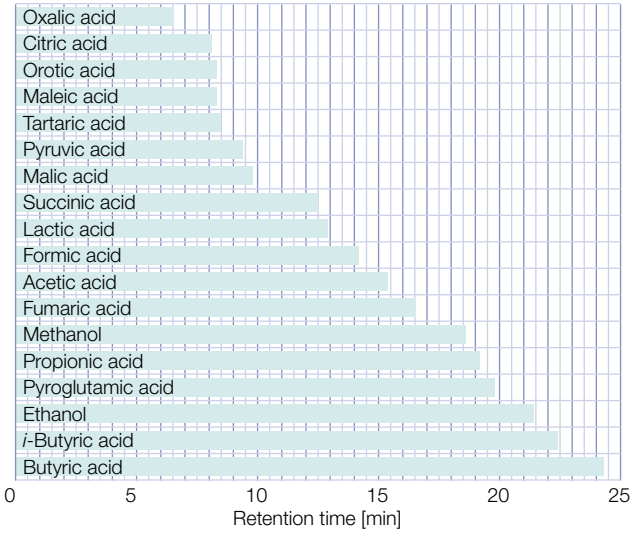
Recommended application

- H+ form:
  Separation of sugars, sugar alcohols and organic acids; eluent in column 5 mmol/L H_2SO_4
- Ca^{2+} form:
  Separation of mono-, di- and oligosaccharides; eluent in column water

Organic acids and alcohols

MN Appl. No. 113870

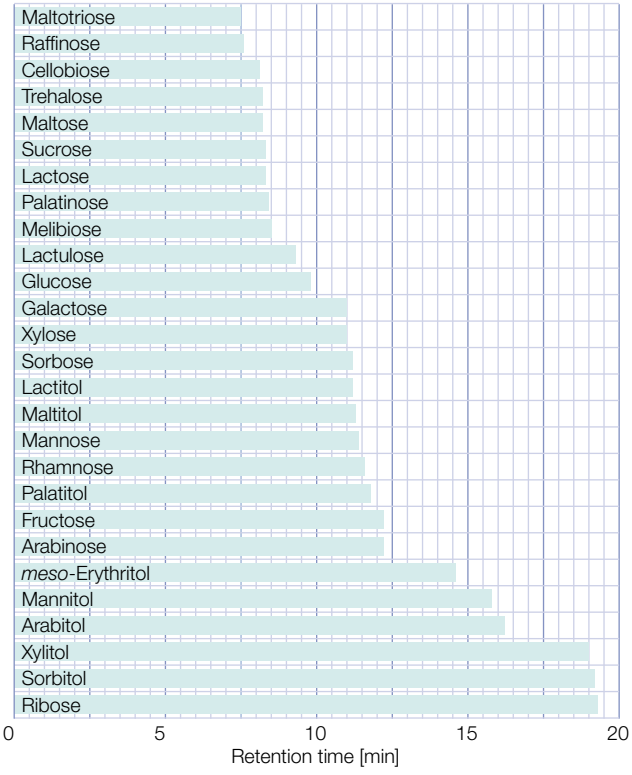
Column:	300 x 7.8 mm NUCLEOGEL® SUGAR 810 H
Eluent:	5 mmol/L H_2SO_4
Flow rate:	0.6 mL/min
Temperature:	35 °C
Detection:	RI
Injection:	5 µL



Sugars and sugar alcohols

MN Appl. No. 114160

Column:	300 x 7.8 mm NUCLEOGEL® SUGAR 810 Ca
Eluent:	water
Flow rate:	0.6 mL/min
Temperature:	85 °C
Detection:	RI



ID	Length → 300 mm	Guard columns*
NUCLEOGEL® SUGAR 810 H; eluent in column 5 mmol/L H_2SO_4		
Analytical Valco type columns		
7.8 mm	719574	719575
NUCLEOGEL® SUGAR 810 Ca; eluent in column water		
Analytical Valco type columns		
7.8 mm	719570	719571

* NUCLEOGEL® SUGAR 810 guard columns measure 30 × 4 mm and require the CC column holder 30 mm (REF 721823)
Columns in packs of 1, guard columns in packs of 2.

Eluent in column acetonitrile – water

ID	Length → 100 mm	125 mm	150 mm	250 mm	EC guard columns*
NUCLEOSIL® 100-7 C_{18}; particle size 7 µm, pore size 100 Å, endcapped, 15 % C					
Analytical EC columns					
4 mm				720018.40	
4.6 mm		720951.46	720110.46	720018.46	
NUCLEOSIL® 100-10 C_{18}; particle size 10 µm, pore size 100 Å, endcapped, 15 % C					
Analytical EC columns					
4 mm				720023.40	
4.6 mm		720701.46	720140.46	720023.46	
NUCLEOSIL® 120-3 C_{18}; particle size 3 µm, pore size 120 Å, endcapped, 11 % C					
Analytical EC columns					
4 mm	720149.40	720040.40		720055.40	721075.30
4.6 mm	720149.46	720040.46	720740.46	720055.46	721075.30
NUCLEOSIL® 120-5 C_{18}; particle size 5 µm, pore size 120 Å, endcapped, 11 % C					
Analytical EC columns					
4 mm		720051.40		720041.40	721070.30
4.6 mm		720051.46	720730.46	720041.46	721070.30
NUCLEOSIL® 120-7 C_{18}; particle size 7 µm, pore size 120 Å, endcapped, 11 % C					
Analytical EC columns					
4 mm				720042.40	
NUCLEOSIL® 120-10 C_{18}; particle size 10 µm, pore size 120 Å, endcapped, 11 % C					
Analytical EC columns					
4 mm				720043.40	
4.6 mm				720043.46	
NUCLEOSIL® 100-3 C_{18} HD; particle size 3 µm, pore size 100 Å, 20 % C					
Analytical EC columns					
4 mm		720191.40			721196.30
4.6 mm		720191.46	720193.46		721196.30
NUCLEOSIL® 100-5 C_{18} HD; particle size 5 µm, pore size 100 Å, 20 % C					
Analytical EC columns					
4 mm		720296.40		720280.40	721072.30
4.6 mm		720296.46	720294.46	720280.46	721072.30
NUCLEOSIL® 100-5 C_{18} AB; particle size 5 µm, pore size 100 Å, 25 % C					
Analytical EC columns					
4 mm		720935.40		720936.40	721073.30
4.6 mm		720935.46	720305.46	720936.46	721073.30
NUCLEOSIL® 100-3 C_{18} Nautilus; particle size 3 µm, pore size 100 Å, 16 % C					
Analytical EC columns					
4 mm		720472.40			721649.30
4.6 mm		720472.46	720471.46		721649.30
NUCLEOSIL® 100-5 C_{18} Nautilus; particle size 5 µm, pore size 100 Å, 16 % C					
Analytical EC columns					
4 mm		720430.40		720431.40	721133.30
4.6 mm		720430.46	720432.46	720431.46	721133.30

Guard column system

Guard columns for EC columns with ID		2 mm	3 mm	4 mm	4.6 mm	Guard column holder
* Column Protection System (pack of)	EC	4/2 (3)	4/3 (3)	4/3 (3)	4/3 (3)	718966

EC columns in packs of 1, guard columns in packs of 3. For details of our column systems see page 258.

Eluent in column acetonitrile – water

ID	Length → 30 mm	50 mm	75 mm	100 mm	125 mm	150 mm	250 mm
NUCLEODUR® C_{18} Gravity, 5 µm; octadecyl phase, particle size 5 µm, 18 % C							
Analytical EC columns							
2 mm		760102.20		760104.20	760100.20	760103.20	760101.20
3 mm		760102.30		760104.30	760100.30	760103.30	760101.30
4 mm		760102.40		760104.40	760100.40	760103.40	760101.40
4.6 mm		760102.46	760106.46	760104.46	760100.46	760103.46	760101.46
EC guard columns*		4 × 2 mm: 761903.20		4 × 3 mm: 761903.30			
Preparative VarioPrep columns							
10 mm		762103.100			762109.100		762113.100
21 mm		762103.210			762109.210		762113.210
32 mm							762113.320
40 mm						762100.400	762113.400
VP guard columns ***		10 × 8 mm: 762160.80		10 × 16 mm: 762160.160		15 × 32 mm: 762163.320	
NUCLEODUR® C_{18} Gravity, 10 µm; octadecyl phase, particle size 10 µm, 18 % C							
Preparative VarioPrep columns							
21 mm							762250.210
40 mm							762250.400
VP guard columns **				10 × 16 mm: 762160.160		15 × 32 mm: 762163.320	

Eluent in column acetonitrile – water

ID	Length → 30 mm	50 mm	75 mm	100 mm	125 mm	150 mm	250 mm
NUCLEODUR® C_8 Gravity, 1.8 µm; octyl phase, particle size 1.8 µm, 11 % C · UHPLC							
Analytical EC columns							
2 mm	760756.20	760755.20	760760.20	760757.20		760759.20	
3 mm	760756.30	760755.30		760757.30			
4 mm	760756.40	760755.40		760757.40			
4.6 mm	760756.46	760755.46		760757.46			
EC guard columns*		4 × 2 mm: 761905.20		4 × 3 mm: 761905.30			
NUCLEODUR® C_8 Gravity, 5 µm; octyl phase, particle size 5 µm, 11 % C							
Analytical EC columns							
2 mm		760750.20		760754.20	760751.20	760752.20	760753.20
3 mm		760750.30		760754.30	760751.30	760752.30	760753.30
4 mm		760750.40		760754.40	760751.40	760752.40	760753.40
4.6 mm		760750.46	760749.46	760754.46	760751.46	760752.46	760753.46
EC guard columns*		4 × 2 mm: 761907.20		4 × 3 mm: 761907.30			
Preparative VarioPrep columns							
10 mm		762081.100			762071.100		762070.100
21 mm		762081.210			762071.210	762082.210	762070.210
VP guard columns **		10 × 8 mm: 762097.80		10 × 16 mm: 762097.160			
EC and VarioPrep columns in packs of 1, guard columns see below.							

Guard column systems

Guard columns for EC columns with ID		2 mm	3 mm	4 mm	4.6 mm	Guard column holder
* Column Protection System (pack of)	EC	4/2 (3)	4/3 (3)	4/3 (3)	4/3 (3)	718966
Guard columns for VarioPrep columns with ID		**8, 10 mm**	**16, 21 mm**	**32, 40 mm**	**≥ 50 mm**	
** VP guard columns (pack of)	VP	10/8 (2)	10/16 (2)	15/32 (1)	15/50 (1)	
VP guard column holder		718251	718256	718253	718255	

For details of our column systems see page 258.

MN column systems

EC standard columns for analytical HPLC / UHPLC

- Analytical column system manufactured from stainless steel M8 outer threads on both ends combination of sealing element and very fine-meshed stainless steel screen, PTFE ring and fitting adaptor column heads SW 12, with inner threads M8 × 0.75 and UNF 10 – 32 (= 1/16″ connection)
- EC column hardware guarantees pressure stability of 1200 bar - hereby EC columns are suitable for UHPLC applications (ultra fast HPLC) and all modern HPLC systems.
- As screw-on guard column system we recommend the Column Protection System used with EC guard column cartridges with 4 mm length.
- EC guard columns supplied with NUCLEODUR®, NUCLEOSIL® spherical silicas and NUCLEOSHELL® spherical core shell silica particles

Available standard dimensions of EC columns

ID	Length → 20 mm	30 mm	50 mm	75 mm	100 mm	125 mm	150 mm	200 mm	250 mm	300 mm
2 mm	+	+	+	+	+	+	+	+	+	+
3 mm	+	+	+	+	+	+	+	+	+	+
4 mm	+	+	+	+	+	+	+	+	+	+
4.6 mm	+	+	+	+	+	+	+	+	+	+
Please ask for availability of certain phases.										

Note: NUCLEODUR® and NUCLEOSHELL® column head must not be removed!

Guard columns for EC columns

EC column with ID	EC guard column*
2 mm	4/2
3 mm	4/3
3 mm	4/3
3 mm	4/3
Packs of 3 cartridges	
* Information about the Column Protection System on page 259.	

For preparative applications MN offers the so-called VarioPrep® hardware system, which is described from page 260 on.

Valco type columns

- Analytical column system manufactured from stainless steel
- Available inner diameters: 4.6 mm ID (1/4“ OD) and 7.7 mm (3/8“ OD)
- Mainly used for NUCLEOGEN® and NUCLEOGEL® (see page 231)

Description	Pack of	REF
Accessories for Valco type columns		
Guard column holder B for VA columns 5 × 3 mm	1	719539
Guard column holder C for VA guard columns 21 × 4 mm	1	719538

NUCLEOSIL® columns

NUCLEOSIL® octadecyl phases (C_{18})

NUCLEOSIL® standard octadecyl phases · USP L1

$-(CH_2)_{17}-CH_3$

Technical data
- Nonpolar phases
- pH stability at 20 °C: 2 – 8
- carbon content depending on pore size (see table)

- Corresponding NUCLEODUR® phases see C_{18} ec page 181

NUCLEOSIL® C_{18} HD · USP L1

$-(CH_2)_{17}-CH_3$

Technical data
- Nonpolar hydrophobic high density phases; monomeric modification
- pH stability 2 – 9

- Carbon content 20 %
- Corresponding NUCLEODUR® phases see C_{18} Gravity page 158

NUCLEOSIL® C_{18} AB · USP L1

$-(CH_2)_{17}-CH_3$

Technical data
- Crosslinked hydrophobic phase; polymeric modification; inert towards acidic and basic substances with high affinity for silica
- pH stability 1 – 9

- Carbon content 25 %; distinct steric selectivity
- Corresponding NUCLEODUR® phases see C_{18} Isis page 164

NUCLEOSIL® C_{18} Nautilus · USP L60

$-(CH_2)_{17}-CH_3$

Technical data
- Stable in 100 % aqueous eluents
- Carbon content 16 %
- Interesting polar selectivity features; very good base deactivation

- Corresponding NUCLEODUR® phases see PolarTec page 168

All NUCLEOSIL® octadecyl phases are endcapped.
Custom-packed columns with different column dimensions are available on request.

Eluent in column acetonitrile – water

ID	Length → 100 mm	125 mm	150 mm	250 mm	EC guard columns*
NUCLEOSIL® 50-5 C_{18} ec; particle size 5 µm, pore size 50 Å, endcapped, 14.5 % C					
Analytical EC columns					
4.6 mm				720098.46	721473.30
NUCLEOSIL® 100-3 C_{18}; particle size 3 µm, pore size 100 Å, endcapped, 15 % C					
Analytical EC columns					
4 mm		720150.40		720133.40	721022.30
4.6 mm	720841.46	720150.46	720949.46	720133.46	721022.30
NUCLEOSIL® 100-5 C_{18}; particle size 5 µm, pore size 100 Å, endcapped, 15 % C					
Analytical EC columns					
2 mm		720002.20		720014.20	721074.20
3 mm		720002.30		720014.30	721074.30
4 mm	720141.40	720002.40	720120.40	720014.40	721074.30
4.6 mm	720141.46	720002.46	720120.46	720014.46	721074.30

HPLC columns for sugar analyses

NUCLEOGEL® ION 300 OA / SUGAR

separation of sugars · USP L17 (H^+ form) · USP L19 (Ca^{2+} form) · USP L34 (Pb^{2+} form) · USP L58 (Na^+ form)

Technical data

- Sulfonated spherical PS/DVB resins in different ionic forms; mean particle size 10 µm, pore size 100 Å
- Separation mechanism includes steric exclusion, ligand exchange and partition effects, ligand exchange being the predominant force, since the hydrated metal ions form strong interactions with the hydroxyl groups of the sample molecules. The intensity of these interactions decreases in the sequence Pb > Ca > Na
- Recommended operating temperatures: 60 – 95 °C; maximum pressure 70 bar

Recommended application

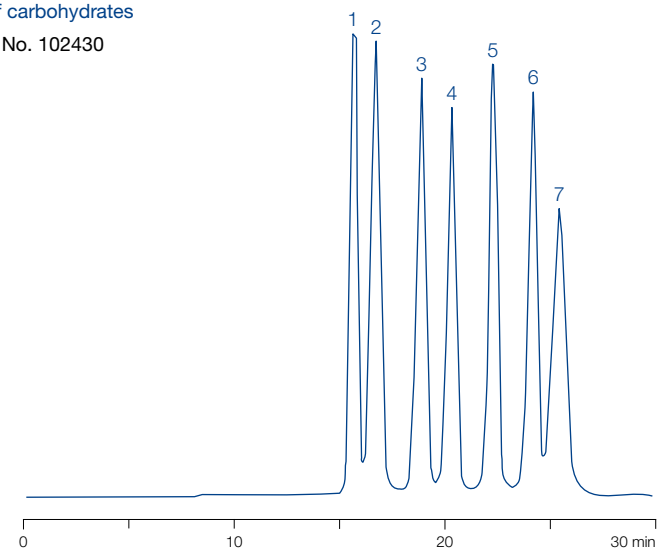
- NUCLEOGEL® ION 300 OA: H^+ form for separation of sugars, alcohols and organic acids
- NUCLEOGEL® SUGAR: Ca^{2+} form: separation of mono- and oligosaccharides, sugar alcohols
- Pb^{2+} form: separation of mono- and disaccharides from food and biological samples
- Na^+ form: separation of oligosaccharides from starch hydrolysates and food

Separation of carbohydrates

MN Appl. No. 102430

Column: 300 x 7.8 mm NUCLEOGEL® SUGAR Pb
Eluent: deionized water
Flow rate: 0.4 mL/min
Temperature: 80 °C
Detection: RI

Peaks:
1. Sucrose
2. Maltose
3. Glucose
4. Xylose
5. Galactose
6. Arabinose
7. Mannose



ID	Length → 300 mm	Guard columns*
NUCLEOGEL® ION 300 OA; eluent in column 5 mmol/L H_2SO_4 5 mmol/L H2SO4		
Analytical Valco type columns		
7.8 mm	719501	719537
NUCLEOGEL® SUGAR Ca; eluent in column water + 0.02 % azide		
Analytical Valco type columns		
6.5 mm	719531	719535
NUCLEOGEL® SUGAR Pb; eluent in column water + 0.02 % azide		
Analytical Valco type columns		
7.8 mm	719530	719534
NUCLEOGEL® SUGAR Na; eluent in column water + 0.02 % azide		
Analytical Valco type columns		
7.8 mm	719532	719536

* Valco Type guard columns measure 21 × 4 mm and require the guard column holder C, REF 719538, see page 258.
Columns in packs of 1, guard columns in packs of 2.

NUCLEODUR® columns

Chemical stability

The utmost purity of the base silica and the exceptional silane bonding chemistry minimize the risk of dissolution, or hydrolysis at pH extremes.

The chromatograms show the retention behavior at pH values of 1.5 and 10.0 for NUCLEODUR® 100-5 C_{18} ec.

NUCLEODUR® octyl phases

In addition to NUCLEODUR® C_{18} phases MACHEREY-NAGEL offers octyl modified NUCLEODUR® C_8 Gravity and NUCLEODUR® C_8 ec columns to expand the RP tool box. Based on the same spherical high purity silica the C_8 phases exhibit the same chemical and mechanical stability as the C_{18} counterparts. Indeed NUCLEODUR® C_8 Gravity can also be run at pH extremes (pH 1 – 11) by choosing appropriate elution parameters. Due to the shorter chain and less hydrophobic properties of the stationary phase the retention of non-polar compounds is decreased, and in consequence a reduction in time of analysis can be achieved. Moreover a stronger polar selectivity, particularly with the separation of ionizable analytes is frequently observed (as distinct from the C_{18} phases). NUCLEODUR® C_8 ec and NUCLEODUR® C_8 Gravity are most suitable for the development of new methods but also for robust routine analyses.

There are no general guidelines which could make the choice between C_8 and C_{18} phases easier but it will always be beneficial to add both phases to the existing pool of RP columns in the laboratory. Comparative studies reveal some different selectivity patterns of NUCLEODUR® C_8 ec and C_{18} ec. The separation of phenols at right shows baseline separation for 2-ethoxyphenol and dimethoxybenzene (veratrol) and in addition a reversal of the elution order of phenol and 4-methoxyphenol can be shown on the octyl phase.

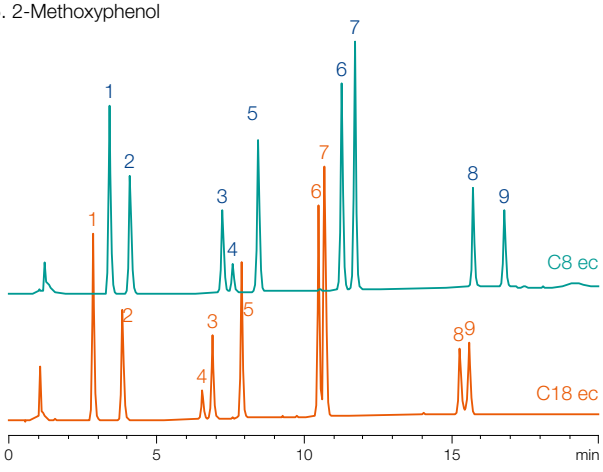
Separation of phenols

MN Appl. Nos. 120890 / 120891

Columns:	250 x 4 mm NUCLEODUR® 100-5 C_8 ec / C_{18} ec
Eluent:	A) water, B) methanol
	C_8: 20 % B (2 min) → 60 % B in 12 min
	C_{18}: 25 % B (2 min) → 65 % B in 12 min
Flow rate:	1.0 mL/min
Temperature:	25 °C
Detection:	UV, 275 nm
Injection:	10 µL

Peaks:

1. Resorcinol
2. Pyrocatechol
3. 4-Methoxyphenol
4. Phenol
5. 2-Methoxyphenol
6. 2-Ethoxyphenol
7. Veratrol
8. Biphenyl-2-ol
9. Phenetole



NUCLEODUR® phases for biochromatography

A description and applications for C_{18} and C_4 modified 300 Å NUCLEODUR® widepore materials for the separation of biopolymers, like peptids and proteins can be found in chapter “HPLC column for biochemical separations” (see page 244).

C_{18} or C_8 · the best of both worlds

- Octyl phases (C_8) show superior polar selectivity.
- Octadecyl phases (C_{18}) show superior hydrophobic selectivity.
- Hydrophobic compounds show shorter retention times on C_8 phases.

Eluent in column acetonitrile – water

	ID	Length → 50 mm	75 mm	100 mm	125 mm	150 mm	250 mm
NUCLEODUR® 100-3 C_{18} ec; octadecyl phase, particle size 3 µm, 17.5 % C							
Analytical EC columns							
	2 mm	760050.20		760054.20	760051.20	760053.20	760052.20
	3 mm	760050.30		760054.30	760051.30	760053.30	760052.30
	4 mm	760050.40		760054.40	760051.40	760053.40	760052.40
	4.6 mm	760050.46	760046.46	760054.46	760051.46	760053.46	760052.46
EC guard columns*			4 × 2 mm: 761931.20		4 × 3 mm: 761931.30		

NUCLEODUR® columns

Chemical stability

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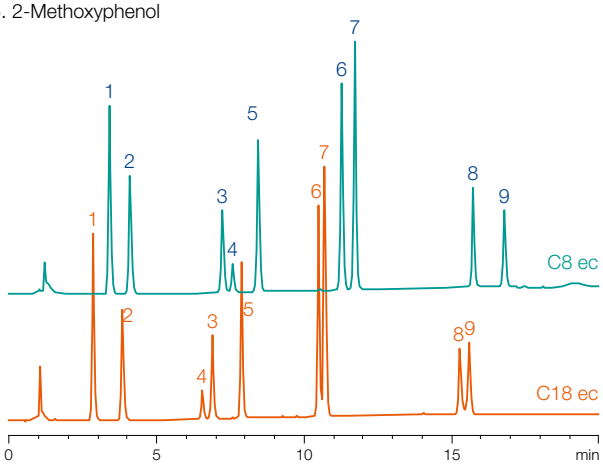
	C_{18}: 25 % B (2 min) → 65 % B in 12 min
Flow rate:	1.0 mL/min
Temperature:	25 °C
Detection:	UV, 275 nm
Injection:	10 µL

Peaks:

1. Resorcinol
2. Pyrocatechol
3. 4-Methoxyphenol
4. Phenol
5. 2-Methoxyphenol
6. 2-Ethoxyphenol
7. Veratrol
8. Biphenyl-2-ol
9. Phenetole



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NUCLEODUR® 100-3 C_{18} ec; octadecyl phase, particle size 3 µm, 17.5 % C							
Analytical EC columns							
	2 mm	760050.20		760054.20	760051.20	760053.20	760052.20
	3 mm	760050.30		760054.30	760051.30	760053.30	760052.30
	4 mm	760050.40		760054.40	760051.40	760053.40	760052.40
	4.6 mm	760050.46	760046.46	760054.46	760051.46	760053.46	760052.46
EC guard columns*			4 × 2 mm: 761931.20		4 × 3 mm: 761931.30		