USP listing

USP specification of MN HPLC phases

Code	Specification	MN HPLC Phases	Page
USP L1	octadecyl silane chemically bonded to porous silica particles 1.5 to 10 µm diameter, or monolithic silica gel	NUCLEODUR® C_{18} ec	181
		NUCLEODUR® C_{18} Gravity	158
		NUCLEODUR® C_{18} Gravity-SB	162
		NUCLEODUR® C_{18} HTec	178
		NUCLEODUR® C_{18} Isis	164
		NUCLEODUR® C_{18} Pyramid	166
		NUCLEODUR® PolarTec	168
		NUCLEODUR® Sphinx RP	176
		NUCLEOSHELL® RP 18	200
		NUCLEOSHELL® RP 18plus	202
		NUCLEOSIL® C_{18}	220
		NUCLEOSIL® C_{18} AB	220
		NUCLEOSIL® C_{18} HD	220
		NUCLEOSIL® Nautilus	221
		NUCLEOSIL® C_{18} MPN	250
		NUCLEOSIL® C_{18} PPN	251
USP L3	porous silica particles, 1.5 to 10 µm diameter, or monolithic silica gel	NUCLEODUR® SiOH	190
		NUCLEOSIL® SiOH	230
USP L7	octyl silane chemically bonded to totally porous silica particles, 1.8 to 10 µm diameter	NUCLEODUR® C_8 ec	181
		NUCLEODUR® C_8 Gravity	158
		NUCLEOSIL® C_8	224
		NUCLEOSIL® C_8 HD	224
USP L8	an essentially monomolecular layer of aminopropyl silane chemically bonded to totally porous silica gel support, 1.5 to 10 µm diameter	NUCLEODUR® NH_2 / NH_2-RP	188
		NUCLEOSIL® Carbohydrate	254
		NUCLEOSIL® NH_2 / NH_2-RP	227
USP L9	irregular or spherical, totally porous silica gel having a chemically bonded, strongly acidic cation-exchange coating, 3 to 10 µm diameter	NUCLEOSIL® SA	229
USP L10	nitrile groups chemically bonded to porous silica particles, 1.5 to 10 µm diameter	NUCLEODUR® CN / CN-RP	186
		NUCLEOSIL® CN / CN-RP	228
USP L11	phenyl groups chemically bonded to porous silica particles, 1.5 to 10 µm diameter	NUCLEODUR® Phenyl-Hexyl	170
		NUCLEODUR® π^2	172
		NUCLEOSHELL® Phenyl-Hexyl	207
		NUCLEODUR® Sphinx RP	176
		NUCLEOSIL® C_6H_5	226
USP L14	silica gel having a chemically bonded, strongly basic quaternary ammonium anion-exchange coating, 5 to 10 µm diameter	NUCLEOSIL® SB	229
USP L16	dimethylsilane chemically bonded to porous silica particles, 5 to 10 µm diameter	NUCLEOSIL® C_2	225
USP L17	strong cation-exchange resin consisting of sulfonated cross-linked PS/DVB copolymer in the H form, 6 to 12 µm diameter	NUCLEOGEL® ION 300 OA	256
		NUCLEOGEL® SUGAR 810 H	255
USP L19	strong cation-exchange resin consisting of sulfonated cross-linked PS/DVB copolymer in the Ca form, 5 to 15 µm particle size	NUCLEOGEL® SUGAR 810 Ca	255
		NUCLEOGEL® SUGAR Ca	256
USP L20	dihydroxypropane groups chemically bonded to porous silica particles, 5 to 10 µm diameter	NUCLEOSIL® OH (Diol)	226
USP L21	a rigid, spherical styrene-divinylbenzene copolymer, 5 to 10 µm diameter	NUCLEOGEL® RP	252
USP L22	a cation-exchange resin made of porous polystyrene gel with sulfonic acid groups, about 10 µm in size	NUCLEOGEL® SCX	247
USP L23	an anion-exchange resin made of porous polymethacrylate or polyacrylate gel with quaternary ammonium groups, about 10 µm in size	NUCLEOGEL® SAX	247
USP L26	butyl silane chemically bonded to totally porous silica particles, 5 to 10 µm diameter	NUCLEODUR® C_4 ec	248
		NUCLEOSIL® C_4	225
		NUCLEOSIL® C_4 MPN	250
USP L32	a chiral ligand-exchange resin packing · L-proline copper complex covalently bonded to irregular shaped silica particles, 5 to 10 µm diameter	NUCLEOSIL® CHIRAL-1	242
USP L34	strong cation-exchange resin consisting of sulfonated cross-linked PS-DVB copolymer in the Pb form, 5 to 7 µm particle size	NUCLEOGEL® SUGAR Pb	256
USP L36	a 3,5-dinitrobenzoyl derivative of L-phenylglycine covalently bonded to 5 µm aminopropyl silica	NUCLEOSIL® CHIRAL-3	243
USP L40	cellulose tris-(3,5-dimethylphenylcarbamate) coated porous silica particles, 5 to 20 µm diameter	NUCLEOCEL *DELTA*	240

USP listing

USP specification of MN HPLC phases

Code	Specification	MN HPLC Phases	Page
USP L43	pentafluorophenyl groups chemically bonded to silica particles by a propyl spacer, 1.5 to 10 µm diameter	NUCLEODUR® PFP	174
		NUCLEOSHELL® PFP	212
USP L45	beta-cyclodextrin bonded to porous silica particles, R,S-hydroxypropyl ether derivative, 3 to 10 µm diameter	NUCLEODEX β-OH, β-PM	238
USP L58	strong cation-exchange resin consisting of sulfonated cross-linked PS/DVB copolymer in the Na form, 6 to 30 µm diameter	NUCLEOGEL® SUGAR Na	256
USP L60	spherical porous silica gel, particle size of 10 µm diameter or smaller, the surface of which has been covalently modified with alkyl amide groups and endcapped	NUCLEODUR® PolarTec	168
		NUCLEOSIL® C_{18} Nautilus	220
USP L75	A chiral-recognition protein, bovine serum albumin (BSA), chemically bonded to silica particles, about 7 µm in diameter, with a pore size of 300 Angstrom	RESOLVOSIL BSA-7	241
USP L118	Aqueous polymerized C_{18} groups on silica particles, 1.2 to 5 µm in diameter	NUCLEODUR® C_{18} PAH	234
		NUCLEOSIL® C_{18} PAH	236

MACHEREY-NAGEL
Column Protection System

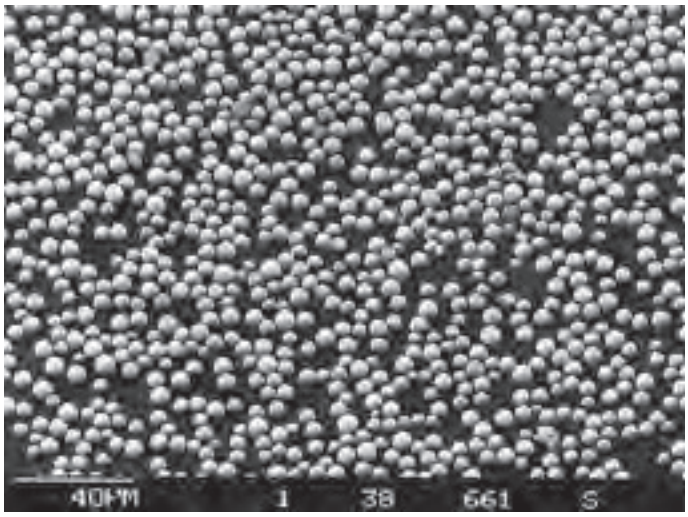
The guard column system for HPLC / UHPLC from MN

- Ideal protection for your analytical main column: significant increase in column lifetime
- Minimized void volume: suitable also for ultra fast HPLC (UHPLC)
- Special ferrules: pressure stability up to 1300 bar (18850 psi)
- Cartridges filled with NUCLEODUR®, NUCLEOSIL® and NUCLEOSHELL® HPLC adsorbents.
- Universal screw-on guard column holder system
- Suitable for all analytical HPLC columns with 1/16“ fittings

Further information on page 258.

NUCLEOSIL® standard silica for HPLC

NUCLEOSIL®



Key feature

- NUCLEOSIL® is a family of totally porous spherical silicas. They feature a very pure and uniform SiO_2 structure and have gained wide acceptance as routine chromatographic packings for very different fields of modern chromatography.
- One of the first spherical silicas used in HPLC
- Developed in the early seventies, it became a world-renowned HPLC packing
- Absolutely reliable choice for routine analyses
- Largest variety of modified HPLC silicas available
- pH stability 2 – 8 (for NUCLEOSIL® 100-5 C_{18} AB 1-9)
- Due to its particle sizes NUCLEOSIL® finds application in analytical as well as in preparative columns.

Benefits of NUCLEOSIL® silica

- High efficiency due to narrow particle size distribution
- High separation performance due to optimized binding techniques
- High chemical and mechanical stability
- High load capacity and recovery rates
- High reproducibility from lot to lot

Physical properties

NUCLEOSIL® is manufactured with different pore diameters (50, 100, 120, 300, 500, 1000 and 4000 Å) and particle sizes from 3 µm (only NUCLEOSIL® 50, 100 and 120) to 10 µm with very narrow fractionation. All narrow-pore NUCLEOSIL® packings are stable up to 500 bar (7,250 psi), the wide-pore NUCLEOSIL® silicas are stable up to 300 or 400 bar (4,200 or 5,600 psi).

Physical properties of unmodified NUCLEOSIL® materials

Phase	Pore size	Pore volume	Surface (BET)	Density	Pressure stability*
NUCLEOSIL® 50	50 Å	0.8 mL/g	420 m^2/g	0.45 g/mL	500 bar
NUCLEOSIL® 100	100 Å	1 mL/g	350 m^2/g	0.36 g/mL	500 bar
NUCLEOSIL® 120	120 Å	0.65 mL/g	200 m^2/g	0.55 g/mL	500 bar
NUCLEOSIL® 300	300 Å	0.8 mL/g	100 m^2/g	0.45 g/mL	400 bar
NUCLEOSIL® 500	500 Å	0.8 mL/g	35 m^2/g	0.45 g/mL	400 bar
NUCLEOSIL® 1000	1000 Å	0.8 mL/g	25 m^2/g	0.45 g/mL	300 bar
NUCLEOSIL® 4000	4000 Å	0.7 mL/g	10 m^2/g	0.48 g/mL	300 bar

* Maximum packing pressure of NUCLEOSIL® bulk packings

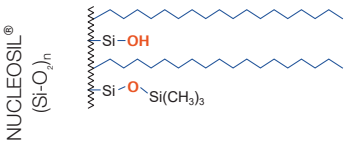
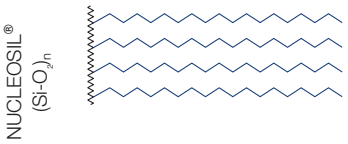
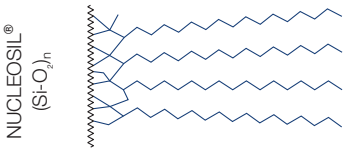
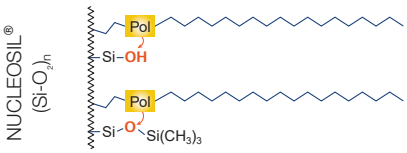
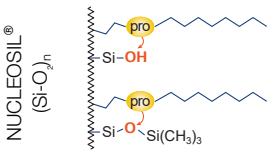
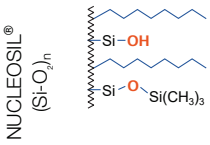
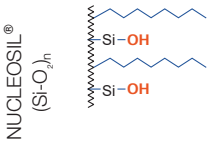
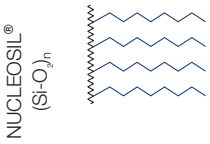
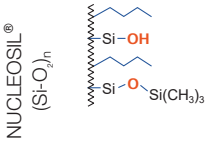
NUCLEOSIL® modifications

- NUCLEOSIL® packings are available as unmodified silica or with numerous chemically bonded phases: RP phases like C_{18} AB, C_{18} HD, C_{18} Nautilus, C_{18}, C_{18} ec, Protect I, C_8 HD, C_8 ec, C_8, C_4, C_2 and C_6H_5 separate mainly by hydrophobic interactions (van der Waals forces). The less polar the sample molecules, the more they are retained – the more polar the sample, the weaker are the hydrophobic interactions and consequently the retention times are shorter.
- Phases with chemically bonded polar groups such as CN, NH_2, $N(CH_3)_2$, OH show selective separation properties. Due to the availability of different functional groups it is possible to vary the chemical characteristics of the surface and consequently the adsorption characteristics of the stationary phase.
- Silica-based ion exchangers (NUCLEOSIL® SA and SB) are stable from pH 2 to 8 and do not swell. Compared to resin-based ion exchangers they offer the advantage of constant permeability, even when the ionic strength and/or pH of the eluent are changed. The separation can be influenced by
  – the type of buffer
  – the ionic strength and
  – the pH value.

A tabular overview of NUCLEOSIL® phases can be found on page 218.

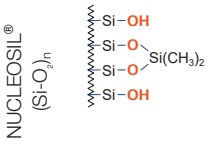
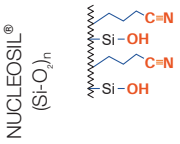
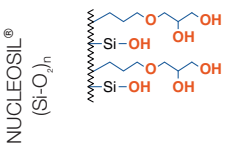
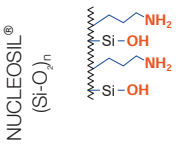
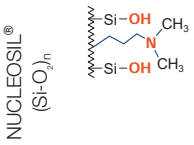
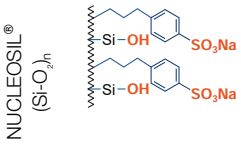
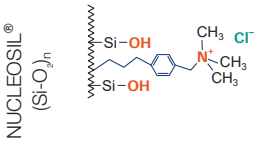
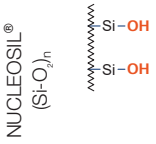
NUCLEOSIL® phase overview

Overview of NUCLEOSIL® HPLC phases

Phase	Specification	Page	Stability	Interactions	Structure
NUCLEOSIL® RP-Phasen					
C_{18}	octadecyl phase, medium density modification, endcapping 15 % C · USP L1	220	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	220	pH 2 – 9	hydrophobic (van der Waals) interactions	
C_{18} AB	octadecyl phase, special crosslinked modification, endcapping 25 % C · USP L1	220	pH 1 – 9	steric and hydrophobic interactions	
C_{18} Nautilus	octadecyl phase, embedded polar group, endcapping 16 % C · USP L60	220	pH 2 – 8 up to 100 % H_2O	hydrophobic and polar interactions	
Protect I	special RP phase, protective polar group, monomeric modification, endcapping 11 % C	222	pH 2 – 8 up to 100 % H_2O	hydrophobic and polar interactions	
C_8 ec	octyl phase, medium density modification, endcapping 9 % C · USP L7	224	pH 2 – 8	hydrophobic (van der Waals) interactions slight residual silanol interactions	
C_8	octyl phase, no endcapping 8.5 % C · USP L7	224	pH 2 – 8	hydrophobic (van der Waals) interactions noticeable residual silanol interactions	
C_8 HD	octyl phase, high density modification, endcapping 13 % C · USP L7	224	pH 2 – 8	hydrophobic (van der Waals) interactions	
C_4	butyl phase, medium density modification, endcapping ~ 2 % C · USP L26	225	pH 2 – 8	hydrophobic (van der Waals) interactions residual silanol interactions	

NUCLEOSIL® phase overview

Overview of NUCLEOSIL® HPLC phases

Phase	Specification	Page	Stability	Interactions	Structure
C_2	dimethyl phase 3.5 % C · USP L16	225	pH 2 – 8	hydrophobic (van der Waals) interactions noticeable residual silanol interactions	
C_6H_5	phenyl phase, no endcapping 8 % C · USP L11	226	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	228	pH 2 – 8	π–π, polar and hydrophobic interactions	
OH (Diol)	diol · USP L20	226	pH 2 – 8	polar interactions (hydrogen bonds)	
NH_2 / NH_2-RP	amino · USP L8	227	pH 2 – 8	polar and hydrophobic interactions, weak ion exchange interactions	
$N(CH_3)_2$	dimethylamino	225	pH 2 – 8	polar and hydrophobic interactions, weak ion exchange interactions	
SA	sulfonic acid, strongly acid cation exchanger (SCX) USP L9	229	pH 2 – 8	strong ion exchange interactions	
SB	quaternary ammonium, strongly basic anion exchanger (SAX) USP L14	229	pH 2 – 8	strong ion exchange interactions	
SiOH	unmodified spherical silica USP L3	230	pH 2 – 8	polar	

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

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.

NUCLEOSIL® columns

NUCLEOSIL® octadecyl phases (C_{18}) wide pore octadecyl phases · USP L1

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

Technical data

- Many biologically interesting molecules can not be separated using conventional narrow pore silicas with pore sizes of about 100 Å. This is why MACHEREY-NAGEL offers a complete line of wide pore packings with pore sizes of 300, 500, 1000 and 4000 Å.
- These materials can also be used for size exclusion chromatography (SEC).

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

Eluent in column acetonitrile – water

ID		Length → 250 mm	EC guard columns*
NUCLEOSIL® 300-5 C_{18}; particle size 5 µm, pore size 300 Å, endcapped, 6.5 % C			
Analytical EC columns			
	4 mm	720065.40	721085.30
	4.6 mm	720065.46	721085.30
NUCLEOSIL® 500-7 C_{18}; particle size 7 µm, pore size 500 Å, endcapped, 2 % C			
Analytical EC columns			
	4.6 mm	720074.46	
NUCLEOSIL® 1000-7 C_{18}; particle size 7 µm, pore size 1000 Å, endcapped, ~ 1 % C			
Analytical EC columns			
	4.6 mm	720077.46	
EC columns in packs of 1, guard columns in packs of 3.			

VarioPrep preparative HPLC columns with NUCLEOSIL® packing material on request.

NUCLEOSIL® 100 Protect I special RP phase with protective polar group

Technical data

- RP phase with pronounced hydrophilic properties
- Monomeric coating
- Endcapped
- Carbon content 11 %

Eluent in column acetonitrile – water

ID		Length → 125 mm	150 mm	250 mm	EC guard columns*
NUCLEOSIL® 100-5 Protect I; particle size 5 µm, pore size 100 Å					
Analytical EC columns					
	4 mm	720175.40		720170.40	721157.30
	4.6 mm	720175.46	720174.46	720170.46	721157.30

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.

NUCLEOSIL® octyl phases (C_8) NUCLEOSIL® standard octyl phases · USP L7

$-(CH_2)_7-CH_3$

Technical data

- Nonpolar phases for RP and ion-pairing chromatography
- Endcapped and non-endcapped modifications available; pH stability at 20 °C: 2 – 8
- Carbon content depending on pore size (see table)

Recommended application

- Separation of moderately to highly polar (water-soluble) compounds: steroids, nucleosides, cyclodextrins, pharmacological plant constituents
- Corresponding NUCLEODUR® phases see C_8 ec page 183

Eluent in column acetonitrile – water

ID	Length → 125 mm	150 mm	250 mm	EC guard columns*
NUCLEOSIL® 100-5 C_8 ec; particle size 5 µm, pore size 100 Å, endcapped, 9 % C				
Analytical EC columns				
4.6 mm			720165.46	721096.30
NUCLEOSIL® 100-5 C_8; particle size 5 µm, pore size 100 Å, not endcapped, 8.5 % C				
Analytical EC columns				
4 mm	720001.40		720013.40	721194.30
4.6 mm	720001.46	720990.46	720013.46	721194.30
NUCLEOSIL® 100-7 C_8; particle size 7 µm, pore size 100 Å, not endcapped, 8.5 % C				
Analytical EC columns				
4.6 mm			720017.46	
NUCLEOSIL® 100-10 C_8; particle size 10 µm, pore size 100 Å, not endcapped, 8.5 % C				
Analytical EC columns				
4 mm			720022.40	
4.6 mm			720022.46	
NUCLEOSIL® 120-3 C_8; particle size 3 µm, pore size 120 Å, not endcapped, 6.5 % C				
Analytical EC columns				
4 mm	720071.40			721093.30
4.6 mm	720071.46	720214.46		721093.30
NUCLEOSIL® 120-5 C_8; particle size 5 µm, pore size 120 Å, not endcapped, 6.5 % C				
Analytical EC columns				
4 mm	720050.40		720052.40	721095.30
4.6 mm	720050.46	720735.46	720052.46	721095.30
NUCLEOSIL® 300-5 C_8; particle size 5 µm, pore size 300 Å, not endcapped, ~ 3 % C				
Analytical EC columns				
4.6 mm			720062.46	721061.30
Custom-packed columns with different column dimensions are available on request.				

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.

NUCLEOSIL® columns

NUCLEOSIL® octyl phases (C_8) NUCLEOSIL® C_8 HD · USP L7

$-(CH_2)_7-CH_3$

Technical data

- Nonpolar high density phases; monomeric modification; endcapped; carbon content 13 %
- Corresponding NUCLEODUR® phases see C_8 Gravity page 158

Recommended application

- Separation of moderate to strong polar (water soluble) analytes like steroids, cyclodextrines, pharmalogical plant ingredients

Eluent in column acetonitrile – water

ID	Length → 125 mm	150 mm	250 mm	EC guard columns*
NUCLEOSIL® 100-5 C_8 HD; particle size 5 µm, pore size 100 Å				
Analytical EC columns				
4 mm			720196.40	721071.30
4.6 mm		720194.46	720196.46	721071.30
Custom-packed columns with different column dimensions are available on request.				

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.

Beside analytical HPLC columns we also produce VarioPrep columns (see page 260) for preparative applications.

NUCLEOSIL® butyl phases (C_4) · USP L26

$-(CH_2)_3-CH_3$

Technical data

- Endcapped phases for RP and ion-pairing chromatography
- pH stability at 20 °C: 2 – 8; carbon content ~ 2 %
- Retention times are shorter than on C_8 and C_{18} phases

Recommended application

- For separation of macromolecules and hydrophobic substances
- For butyl phases for biochemical separations please refer to page 244

Eluent in column acetonitrile – water

ID	Length → 250 mm	EC guard columns*
NUCLEOSIL® 120-5 C_4; particle size 5 µm, pore size 120 Å		
Analytical EC columns		
4.6 mm	720096.46	721083.30
NUCLEOSIL® 300-5 C_4; particle size 5 µm, pore size 300 Å		
Analytical EC columns		
4 mm	720059.40	721916.30
4.6 mm	720059.46	721916.30

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

NUCLEOSIL® dimethyl phase (C_2) · USP L16

$-(CH_3)_2$

Technical data

- Non-endcapped phase for RP and ion-pairing chromatography
- pH stability at 20 °C: 2 – 8; carbon content 3.5 %
- Retention times are much shorter than for the other RP phases

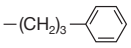
Eluent in column acetonitrile – water

ID	Length → 250 mm	EC guard columns*
NUCLEOSIL® 100-7 C_2; particle size 7 µm, pore size 100 Å		
Analytical EC columns		
4.6 mm	720089.46	721030.30

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

NUCLEOSIL® columns

NUCLEOSIL® phenyl phases (C_6H_5) · USP L11



Technical data

- Relatively nonpolar, non-endcapped phases for RP and ion pairing chromatography
- Polarity similar to C_8, but with different selectivity for PAHs, polar aromatics, fatty acids etc.
- pH stability at 20 °C: 2 – 8; carbon content 8 %

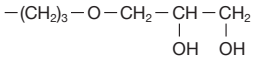
Recommended application

- Separation of moderately polar compounds

Eluent in column acetonitrile – water

ID		Length → 250 mm	EC guard columns*
NUCLEOSIL® 100-5 C_6H_5; particle size 5 µm, pore size 100 Å, not endcapped			
Analytical EC columns			
	4.6 mm	720956.46	721137.30
NUCLEOSIL® 100-7 C_6H_5; particle size 7 µm, pore size 100 Å, not endcapped			
Analytical EC columns			
	4 mm	720019.40	
	4.6 mm	720019.46	

NUCLEOSIL® diol phases · USP L20



Technical data

- Dihydroxypropyl modified silica for RP and NP chromatography
- Less polar than unmodified silica, very easily wettable with water
- pH stability at 20 °C: 2 – 8; carbon content 5 %

Eluent in column is *n*-heptane. When using an eluent which is not miscible with *n*-heptane (e.g., water), it is necessary to rinse the column with THF first.

ID		Length → 250 mm	EC guard columns*
NUCLEOSIL® 100-5 OH (Diol); particle size 5 µm, pore size 100 Å			
Analytical EC columns			
	4.6 mm	720143.46	721142.30

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.

NUCLEOSIL® amino phases · USP L8

$-(CH_2)_3-NH_2$

Technical data

- Aminopropyl modified polar silica phase; pH stability at 20 °C: 2 – 8; carbon content 3.5 %
- Corresponding NUCLEODUR® phases see page 188

Recommended application

Multi-mode chromatography

- NP chromatography with hexane, dichloromethane or 2-propanol as mobile phase for polar compounds such as substituted anilines, esters, chlorinated pesticides
- RP chromatography of polar compounds like carbohydrates in aqueous-organic eluent systems
- Anion exchange chromatography of anions and organic acids using common buffers (e. g., acetate or phosphate) in conjunction with organic modifiers (e. g., acetonitrile)

Eluent in column is *n*-heptane (except for NH_2 RP). When using an eluent which is not miscible with *n*-heptane (e.g., water), it is necessary to rinse the column with THF first.

ID	Length → 250 mm	EC guard columns*
NUCLEOSIL® 100-5 NH_2; particle size 5 µm, pore size 100 Å; eluent in column *n*-heptane		
Analytical EC columns		
4.6 mm	720095.46	721020.30
NUCLEOSIL® 100-5 NH_2-RP; particle size 5 µm, pore size 100 Å; eluent in column acetonitrile – water (80:20)		
Analytical EC columns		
4.6 mm	720095.46RP	721155.30
NUCLEOSIL® 100-10 NH_2; particle size 10 µm, pore size 100 Å; eluent in column *n*-heptane		
Analytical EC columns		
4.6 mm	720025.46	

NUCLEOSIL® dimethylamino phase

$-(CH_2)_3-N(CH_3)_2$

Technical data

- Weakly basic anion exchanger, pH stability at 20 °C: 2 – 8; carbon content 4 %

Recommended application

- Separation of many anions; can also be used in a similar way as the NH_2 phase

Eluent in column is *n*-heptane. When using an eluent which is not miscible with *n*-heptane (e.g., water), it is necessary to rinse the column with THF first.

ID	Length → 250 mm	EC guard columns*
NUCLEOSIL® 100-5 $N(CH_3)_2$; particle size 5 µm, pore size 100 Å		
Analytical EC columns		
4.6 mm	720994.46	721158.30

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.

NUCLEOSIL® columns

NUCLEOSIL® cyano phases · USP L10

$-(CH_2)_3-CN$

Technical data

- Polar to midpolar cyano (nitrile) modified silica
- pH stability at 20 °C: 2 – 8; carbon content 5 % for 100 Å pores, ~ 3 % for 120 Å pores
- Corresponding NUCLEODUR® phases see page 186

Recommended application

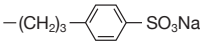
Reversed phase and normal phase chromatography

- Normal phase:
  with low-polarity solvents for many compounds, which can also be separated on unmodified silica, however, due to the rapid equilibration much more suitable for gradient separations
- Reversed phase:
  with different selectivity than C_{18}, C_8 or phenyl modified packings

Eluent in column (except for NUCLEOSIL® 100-5 CN-RP) is *n*-heptane. When using an eluent which is not miscible with *n*-heptane (e.g., water), it is necessary to rinse the column with THF first.

ID		Length →250 mm	EC guard columns*
NUCLEOSIL® 100-5 CN; particle size 5 µm, pore size 100 Å; eluent in column *n*-heptane			
Analytical EC columns			
	4 mm	720090.40	721078.30
	4.6 mm	720090.46	721078.30
NUCLEOSIL® 100-5 CN-RP; particle size 5 µm, pore size 100 Å; eluent in column acetonitrile – water			
Analytical EC columns			
	4 mm	720205.40	721039.30
	4.6 mm	720205.46	721039.30
NUCLEOSIL® 100-10 CN; particle size 10 µm, pore size 100 Å; eluent in column *n*-heptane			
Analytical EC columns			
	4 mm	720024.40	
	4.6 mm	720024.46	
NUCLEOSIL® 120-7 CN; particle size 7 µm, pore size 120 Å; eluent in column *n*-heptane			
Analytical EC columns			
	4 mm	720057.40	
	4.6 mm	720057.46	

NUCLEOSIL® SA phases · USP L9



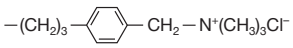
Technical data

- Strongly acidic cation exchanger (SCX) with benzenesulfonic acid modification
- Capacity ~ 1 meq/g; pH stability at 20 °C: 2 – 8; carbon content 6.5 %

Eluent in column 0.15 mol/L $(NH_4)_2HPO_4$, pH 5

ID	Length → 125 mm	150 mm	250 mm	EC guard columns*
NUCLEOSIL® 100-5 SA; particle size 5 µm, pore size 100 Å				
Analytical EC columns				
4 mm			720097.40	721024.30
4.6 mm	720709.46	720182.46	720097.46	721024.30
NUCLEOSIL® 100-10 SA; particle size 10 µm, pore size 100 Å				
Analytical EC columns				
4.6 mm			720028.46	

NUCLEOSIL® SB phases · USP L14



Technical data

- Strongly basic anion exchanger (SAX) with quaternary ammonium modification
- Capacity ~ 1 meq/g; pH stability at 20 °C: 2 – 8; carbon content 10 %

Eluent in column 0.15 mol/L $(NH_4)_2HPO_4$, pH 5

ID	Length → 125 mm	150 mm	250 mm	EC guard columns*
NUCLEOSIL® 100-5 SB; particle size 5 µm, pore size 100 Å				
Analytical EC columns				
4 mm			720996.40	721025.30
4.6 mm	720989.46	720183.46	720996.46	721025.30
NUCLEOSIL® 100-10 SB; particle size 10 µm, pore size 100 Å				
Analytical EC columns				
4.6 mm			720029.46	

NUCLEOSIL® columns

NUCLEOSIL® SiOH unmodified silica · USP L3

Technical data

- Spherical silica, pH stability 2 – 8
- For physical properties of unmodified NUCLEOSIL® materials please see page 217.
- Maximum working pressure for the EC columns listed below is 400 bar.

Eluent in column is *n*-heptane. When using an eluent which is not miscible with *n*-heptane (e.g., water), it is necessary to rinse the column with THF first.

ID	Length → 250 mm	EC guard columns*
NUCLEOSIL® 50-5; particle size 5 µm, pore size 50 Å		
Analytical EC columns		
4.6 mm	720093.46	721167.30
NUCLEOSIL® 100-5; particle size 5 µm, pore size 100 Å		
Analytical EC columns		
4.6 mm	720099.46	721518.30

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.