



# HICHROM

Chromatography Columns and Supplies

## LC COLUMN SELECTION Column Selection By USP Specifications

Catalogue 9

### Hichrom Limited

1 The Markham Centre, Station Road  
Theale, Reading, Berks, RG7 4PE, UK

Tel: +44 (0)118 930 3660 Fax: +44 (0)118 932 3484

Email: [sales@hichrom.co.uk](mailto:sales@hichrom.co.uk) [www.hichrom.co.uk](http://www.hichrom.co.uk)

## HPLC COLUMN SELECTION BY USP SPECIFICATIONS

The following list of USP (United States Pharmacopoeia) column specifications (USP 35) includes a selection of recommended columns within each category. In most cases there are several columns available within a given category, but in a few indicated instances a packing very closely fitting the specification has been included. Please contact us for further advice and assistance on selecting a suitable column by USP specification. Please also contact us for advice on column selection by EP (European Pharmacopoeia) specification. The USP monographs allow chromatographers flexibility to make method adjustments within specified limits in order to meet system suitability requirements. Please see page 61 for further details.



L1	Octadecylsilane chemically bonded to porous or non-porous silica or ceramic microparticles, 1.5 to 10µm in diameter, or a monolithic rod <i>Widely available</i>
L2	Octadecylsilane chemically bonded to silica gel of a controlled surface porosity that has been bonded to a solid spherical core, 30 to 50µm in diameter <i>Pellicular ODS</i>
L3	Porous silica particles, 1.5 to 10µm in diameter, or a monolithic silica rod <i>Widely available</i>
L4	Silica gel of controlled surface porosity bonded to a solid spherical core, 30 to 50µm in diameter <i>Pellicular silica</i>
L5	Alumina of controlled surface porosity bonded to a solid spherical core, 30 to 50µm in diameter <i>Please enquire</i>
L6	Strong cation-exchange packing – sulphonated fluorocarbon polymer coated on a solid spherical core, 30 to 50µm in diameter <i>Please enquire</i>
L7	Octylsilane chemically bonded to totally or superficially porous silica particles, 1.5 to 10µm in diameter, or a monolithic silica rod <i>Widely available</i>
L8	An essentially monomolecular layer of aminopropylsilane chemically bonded to totally porous silica gel support, 1.5 to 10µm in diameter <i>Widely available</i>
L9	Irregular or spherical, totally porous silica gel having a chemically bonded, strongly acidic cation-exchange coating, 3 to 10µm in diameter <i>Partisil SCX NUCLEOSIL SA</i>
L10	Nitrile groups chemically bonded to porous silica particles, 1.5 to 10µm in diameter <i>Widely available</i>
L11	Phenyl groups chemically bonded to porous silica particles, 1.5 to 10µm in diameter <i>Widely available</i>
L12	A strong anion-exchange packing made by chemically bonding a quaternary amine to a solid silica spherical core, 30 to 50µm in diameter <i>Please enquire</i>
L13	Trimethylsilane chemically bonded to porous silica particles, 3 to 10µm in diameter <i>YMC TMS Hypersil SAS Develosil TMS-UG</i>
L14	Silica gel having a chemically bonded, strongly basic quaternary ammonium anion-exchange coating, 5 to 10µm in diameter <i>NUCLEOSIL SB Exsil SAX Partisil SAX</i>
L15	Hexylsilane chemically bonded to totally porous silica particles, 3 to 10µm in diameter <i>Spherisorb C6 Chromegabond C6</i>
L16	Dimethylsilane chemically bonded to porous silica particles, 5 to 10µm in diameter <i>NUCLEOSIL C2 Chromegabond C2</i>
L17	Strong cation-exchange resin consisting of sulphonated cross-linked styrene-divinylbenzene copolymer in the hydrogen form, 6 to 12µm in diameter <i>Hamilton HC-75 H<sup>+</sup> PL Hi-Plex H NUCLEOGEL Sugar 810H</i>
L18	Amino and cyano groups chemically bonded to porous silica particles, 3 to 10µm in diameter <i>Partisil PAC Partisphere PAC</i>
L19	Strong cation-exchange resin consisting of sulphonated cross-linked styrene-divinylbenzene copolymer in the calcium form, about 9µm in diameter <i>Hamilton HC-75 Ca<sup>2+</sup> NUCLEOGEL Sugar 810 Ca PL Hi-Plex Ca</i>
L20	Dihydroxypropane groups chemically bonded to porous silica or hybrid particles, 1.5 to 10µm in diameter <i>Kromasil Diol YMC Diol NUCLEOSIL Diol</i>
L21	A rigid, spherical styrene-divinylbenzene copolymer, 3 to 30µm in diameter <i>Hamilton PRP-1 PLRP-S Shodex RSpak RP18</i>
L22	A cation-exchange resin made of porous polystyrene gel with sulphonic acid groups, about 10µm in size <i>Hamilton PRP-X200 Shodex SUGAR SH1011</i>
L23	An anion-exchange resin made of porous polymethacrylate or polyacrylate gel with quaternary ammonium groups, 7 to 12µm in size <i>TSKgel BioAssist Q COSMOGEL QA Shodex IEC QA-825</i>

## HPLC Column Selection by USP Specifications (continued)

L24	A semi-rigid hydrophilic gel consisting of vinyl polymers with numerous hydroxyl groups in the matrix surface, 32 to 63µm in diameter <i>TOYOPEARL HW-type</i>
L25	Packing having the capacity to separate compounds with a molecular weight range from 100-5000 (as determined by polyethylene oxide), applied to neutral, anionic, and cationic water-soluble polymers. A polymethacrylate resin base, cross-linked with polyhydroxylated ether (surface contained some residual carboxyl functional groups) was found suitable <i>TSKgel G2500PW<sub>XL</sub> Shodex OHpak SB-802HQ</i>
L26	Butylsilane chemically bonded to totally porous silica particles, 1.5 to 10µm in diameter <i>Widely available</i>
L27	Porous silica particles, 30 to 50µm in diameter <i>YMC Silica LiChroprep Silica Develosil Silica NUCLEODUR Silica</i>
L28	A multifunctional support, which consists of a high purity, 100Å, spherical silica substrate that has been bonded with anionic exchanger, amine functionality in addition to a conventional reversed-phase C8 functionality <i>Alltech Mixed-Mode C8/Anion</i>
L29	Gamma alumina, reversed-phase, low carbon percentage by weight, alumina-based polybutadiene spherical particles, 5µm in diameter with a pore volume of 80Å units <i>GammaBond RP1</i>
L30	Ethylsilane chemically bonded to totally porous silica particles, 3 to 10µm in diameter <i>As for L16<sup>1</sup></i>
L31	A hydroxide-selective, strong anion-exchange resin-quaternary amine bonded on latex particles attached to a core of 8.5µm macroporous particles having a pore size of 2000Å units and consisting of ethylvinylbenzene cross-linked with 55% divinylbenzene <i>IonPac AS11-HC</i>
L32	A chiral ligand-exchange resin packing - L-proline copper complex covalently bonded to irregularly shaped silica particles, 5 to 10µm in diameter <i>NUCLEOSIL Chiral-1 CHIRALCEL WH</i>
L33	Packing having the capacity to separate dextrans by molecular size over a range of 4,000 to 500,000 Da. It is spherical, silica-based, and processed to provide pH stability <i>TSKgel G4000SW<sub>XL</sub> Shodex PROTEIN KW-800 series</i>
L34	Strong cation-exchange resin consisting of sulphonated cross-linked styrene-divinylbenzene copolymer in the lead form, about 7 to 9µm in diameter <i>Hamilton HC-75 Pb<sup>2+</sup> Shodex SUGAR SP0810 PL Hi-Plex Pb</i>
L35	A zirconium-stabilised spherical silica packing with a hydrophilic (diol-type) molecular monolayer bonded phase having a pore size of 150Å <i>ZORBAX GF-250</i>
L36	A 3,5-dinitrobenzoyl derivative of L-phenylglycine covalently bonded to 5µm aminopropyl silica <i>Hichrom CHIRA-chrom-1</i>
L37	Packing having the capacity to separate proteins by molecular size over a range of 2,000 to 40,000 Da. It is a polymethacrylate gel <i>TSKgel G3000PW<sub>XL</sub> Shodex OHpak SB-803HQ</i>
L38	A methacrylate-based size-exclusion packing for water-soluble samples <i>TSKgel G1000-G6000PW<sub>XL</sub> Shodex OHpak SB-800HQ Series</i>
L39	A hydrophilic polyhydroxymethacrylate gel of totally porous spherical resin <i>TSKgel G1000-G6000PW<sub>XL</sub> Shodex OHpak SB-800HQ Series</i>
L40	Cellulose tris-3,5-dimethylphenylcarbamate coated porous silica particles, 5µm to 20µm in diameter <i>CHIRALCEL OD-H Kromasil CelluCoat RegisCell NUCLEOCEL DELTA</i>
L41	Immobilised α <sub>1</sub> -acid glycoprotein on spherical silica particles, 5µm in diameter <i>CHIRALPAK AGP</i>
L42	Octylsilane and octadecylsilane groups chemically bonded to porous silica particles, 5µm in diameter <i>Hichrom RPB</i>
L43	Pentafluorophenyl groups chemically bonded to silica particles by a propyl spacer, 1.5 to 10µm in diameter <i>HALO PFP Hypersil GOLD PFP Partisphere TAC-1</i>
L44	A multifunctional support, which consists of a high purity, 60Å, spherical silica substrate that has been bonded with a cationic exchanger, sulphonic acid functionality in addition to a conventional reversed phase C <sub>8</sub> functionality <i>Chromegabond RP-SCX</i>
L45	Beta cyclodextrin, R,S-hydroxypropyl ether derivative, bonded to porous silica particles, 5 to 10µm in diameter <i>ChiraDex NUCLEODEX β-OH Ultron ES-CD</i>
L46	Polystyrene/divinylbenzene substrate agglomerated with quaternary amine functionalised latex beads, about 9µm to 11µm in diameter <i>CarboPac PA1</i>
L47	High capacity anion-exchange microporous substrate, fully functionalised with a trimethylamine group, 8µm in diameter <i>CarboPac MA1</i>

<sup>1</sup> Column represents the closest match to USP specifications

## HPLC Column Selection by USP Specifications (continued)

L48	Sulphonated, cross-linked polystyrene with an outer layer of sub-micron, porous, anion-exchange microbeads, 5 to 15µm in diameter <i>IonPac AS5</i>
L49	A reversed-phase packing made by coating a thin layer of polybutadiene on to spherical porous zirconia particles, 3 to 10µm in diameter <i>ZirChrom PBD</i>
L50	Multi-function resin with reversed-phase retention and strong anion-exchange functionalities. The resin consists of ethylvinylbenzene, 55% cross-linked with divinylbenzene copolymer, 3 to 15µm in diameter, and a surface area of not less than 350 m <sup>2</sup> /g. Substrate is coated with quaternary ammonium functionalised latex particles consisting of styrene cross-linked with divinylbenzene <i>OmniPac PAX-500</i>
L51	Amylose tris-3,5-dimethylphenylcarbamate-coated, porous, spherical, silica particles, 5 to 10µm in diameter <i>CHIRALPAK AD Kromasil AmyCoat RegisPack</i>
L52	A strong cation-exchange resin made of porous silica with sulphopropyl groups, 5 to 10µm in diameter <i>BioBasic SCX TSKgel SP-2SW</i>
L53	Weak cation-exchange resin consisting of ethylvinylbenzene, 55% cross-linked with divinylbenzene copolymer, 3 to 15µm diameter. Substrate is surface grafted with carboxylic acid and/or phosphoric acid functionalised monomers. Capacity not less than 500 µEq/column <i>IonPac CS14</i>
L54	A size exclusion medium made of covalent bonding of dextran to highly cross-linked porous agarose beads, about 13µm in diameter <i>Please enquire</i>
L55	A strong cation-exchange resin made of porous silica coated with polybutadiene-maleic acid copolymer, about 5µm in diameter <i>Universal Cation</i>
L56	Propyl silane chemically bonded to totally porous silica particles, 3 to 10µm in diameter <i>Zorbax SB-C3</i>
L57	A chiral-recognition protein, ovomucoid, chemically bonded to silica particles, about 5µm in diameter, with a pore size of 120Å <i>Ultron ES-OVM</i>
L58	Strong cation-exchange resin consisting of sulphonated cross-linked styrene-divinylbenzene copolymer in the sodium form, about 6 to 30µm in diameter <i>PL Hi-Plex Na Shodex SUGAR KS series</i>
L59	Packing for the size exclusion separations of proteins (separation by molecular weight) over the range of 5 to 7000 kDa. It is spherical (1.5 to 10µm), silica or hybrid packing with a hydrophilic coating <i>TSKgel G3000SW<sub>XL</sub> Shodex PROTEIN KW-803</i>
L60	Spherical, porous silica gel, 10µm or less in diameter, the surface of which has been covalently modified with alkyl amide groups and endcapped <i>HALO RP-Amide Discovery RP-Amide</i>
L61	A hydroxide-selective, strong anion-exchange resin consisting of a highly cross-linked core of 13µm microporous particles having a pore size less than 10Å units and consisting of ethylvinylbenzene cross-linked with 55% divinylbenzene with a latex coating composed of 85nm diameter microbeads bonded with alkanol quaternary ammonium ions (6%) <i>IonPac AS11</i>
L62	C30 silane bonded phase on a fully porous spherical silica, 3 to 15µm in diameter. <i>YMC Carotenoid Develosil C30 ProntoSIL C30</i>
L63	Glycopeptide teicoplanin linked through multiple covalent bonds to a 100Å units spherical silica <i>CHIROBIOTIC T</i>
L64	Strongly basic anion-exchange resin consisting of 8% crosslinked styrene-divinylbenzene copolymer with a quaternary ammonium group in the chloride form, 45 to 180µm in diameter <i>AG 1-X8</i>
L65	Strongly acidic cation-exchange resin consisting of 8% sulphonated crosslinked styrene-divinylbenzene copolymer with a sulphonic acid group in the hydrogen form, 63 to 250µm in diameter <i>AG 50W-X2</i>
L66	A crown ether coated on a 5µm particle size silica gel substrate. The active site is (S)-18-crown-6-ether <i>CROWNPAK CR(+)</i>
L67	Porous vinyl alcohol copolymer with a C18 alkyl group attached to the hydroxyl group of the polymer, 2 to 10µm in diameter <i>Asahipak ODP-50 apHera C18</i>
L68	Spherical, porous silica, 10µm or less in diameter, the surface of which has been covalently modified with alkyl amide groups and not endcapped <i>Suplex pKb-100</i>
L69	Ethylvinylbenzene/divinylbenzene substrate agglomerated with quaternary amine functionalised 130nm latex beads, about 6.5µm in diameter <i>CarboPac PA20</i>

## HPLC Column Selection by USP Specifications (continued)

L70	Cellulose tris(phenyl carbamate) coated on 5µm silica <i>CHIRALCEL OC-H</i>
L71	A rigid, spherical polymethacrylate, 4 to 6µm in diameter <i>Shodex RSpak DE</i>
L72	(S)-phenylglycine and 3,5-dinitroaniline urea linkage covalently bonded to silica <i>Sumichiral OA-3300 S</i>
L73	A rigid, spherical polydivinylbenzene particle, 5 to 10µm in diameter <i>Jordi-Gel DVB</i>
L74	A strong anion-exchange resin consisting of a highly cross-linked core of 7µm macroporous particles having a 100Å average pore size and consisting of ethylvinylbenzene cross-linked with 55% divinylbenzene and an anion-exchange layer grafted to the surface, which is functionalised with alkyl quaternary ammonium ions <i>IonPac AS14A</i>
L75	A chiral-recognition protein, bovine serum albumin (BSA), chemically bonded to silica particles, about 7µm in diameter, with a pore size of 300Å <i>RESOLVOSIL BSA</i>
L76	Silica based weak cation-exchange material, 5µm in diameter. Substrate is surface polymerised polybutadiene-maleic acid to provide carboxylic acid functionalities. Capacity not less than 29 µEq/column <i>IonPac SCS-1</i>
L77	Weak cation-exchange resin consisting of ethylvinylbenzene, 55% cross-linked with divinylbenzene copolymer, 6 to 9µm diameter. Substrate is surface grafted with carboxylic acid functionalised groups. Capacity not less than 500 µEq/column (4mm x 25cm) <i>IonPac CS17</i>
L78	A silane ligand that consists of both reversed-phase (an alkyl chain longer than C8) and anion-exchange (primary, secondary, tertiary or quaternary amino) functional groups chemically bonded to porous, non-porous or ceramic microparticles, 1.0 to 50µm in diameter or a monolithic rod <i>Acclaim Mixed-Mode WAX-1</i>
L79	A chiral-recognition protein, human serum albumin (HSA), chemically bonded to silica particles, about 5µm in diameter <i>CHIRALPAK HSA</i>
L80	Cellulose tris(4-methylbenzoate)-coated, porous spherical silica particles, 5µm in diameter <i>CHIRALCEL OJ-H</i>

## USP and EP Allowable Adjustments

Allowable adjustments that can be made to a USP or EP (European Pharmacopoeia) method, without the method requiring revalidation, are summarised in the table below. Please contact us for further advice and assistance.

Parameter	USP <sup>1</sup> Allowable Adjustment	EP <sup>2</sup> Allowable Adjustment
Column Length	±70%	±70%
Column i.d.	±25%	±25%
Particle Size	-50%	-50%
Column Temperature	±10°C	±10°C
Flow Rate	±50%	±50%
Eluent pH	±0.2 units	±0.2 units
Concentration of Buffer Salts	±10%	±10%
Solvent A:B Ratio	Minor ±30% relative, but ≤±10% absolute	Minor ±30% relative or ±2% absolute, ≤ ±10% absolute for other
Injection Volume	Any reduction	Any reduction
Change of UV Detector Wavelength	0, but ±3nm between detectors	No change

<sup>1</sup> United States Pharmacopoeia 34 (2011) Section 621

<sup>2</sup> European Pharmacopoeia 6.0 (2010) Section 2.2.4.6