



## Stainless Steel Capillary Columns and Tubing

### Ultra Alloy® Capillary Columns, Stainless Steel or Fused Silica?

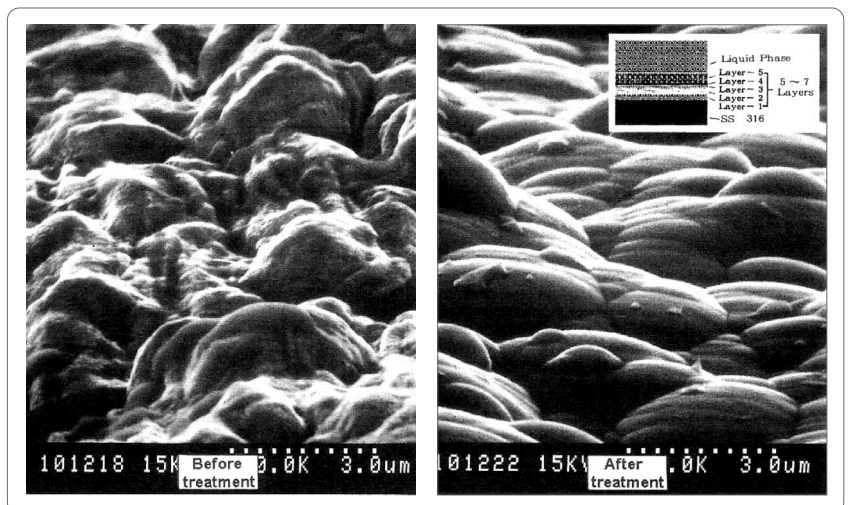
Ultra ALLOY® metal capillary columns are characterized by their inertness, high temperature stability and mechanical durability.

A high heat and contamination resistant column with a proprietary deactivation treatment on the inner surface of the stainless steel tube. It is more heat resistant than fused silica columns and can be used at 450 °C. In addition to low bleed and long life, there are many other benefits such as (1) prevention of column deterioration due to oil in the sample, (2) solvent-free cleaning, (3) low ghost peaks, (4) saving analysis time, and (5) high performance sustainability.

Employing a slanted-multi-layer structure on a Stainless Steel (SS) column surface, Ultra ALLOY® capillary columns have been paid much attention, and are replacing conventional columns based on fused silica (FS), which has been considered as the ultimate material. The following ten Q&A's feature the high performance.

**Q1: Capillary columns have evolved from Goly (SS) column, then to glass, and to FS. Why SS column now? What is the difference between FS and SS besides the materials? Please describe it using a methylsilicone column as an example among many others.**

Your concern is very natural. Although we have developed the columns, there are some areas that we cannot explain. Iron atoms in SS are known to adsorb hydrocarbons and polar components. However, if the surface can be completely covered by an inert layer, SS will be an ideal material for capillary columns. Because SS is a metal, it has high flexural, abrasion, impact, and thermal resistances. Use of SS and our advanced proprietary column pretreatment technology have made it possible to develop the Ultra ALLOY columns and we are the center of world attention.



**Figure 1.** SEM images of stainless steel column surface before and after multi-layer pretreatment.



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**Q2: How was the metal surface pretreated?**

We have succeeded in forming a multi-layer structure (5-7 layers each less than 0.001 micron) on the surface of SS column as shown in the SEM pictures in the front cover page (patent applied for). These layers are chemically bonded to each other, and the chemical structure of the top layer can be modified depending on the kind of liquid phase. We wanted to limit the number of layers to 3, but we found at least 5 layers were required in order to outperform the FS column performance. Our top grade columns have 7 layers to provide highest inertness.

**Q3: What about the absorption of primary amines which are known to be the problems with ODS columns used in HPLC? Is the analysis difficult with FS columns due to tailing problems?**

That's a hard question. Only Hewlett Packard, known to supply high performance products, has done the tests on this. We have challenged them with Ultra ALLOY® 1. Figure 1 shows the performance comparison with Brand (J). When 5mg of a sample was used in heating program mode, ours clearly outperforms. The pyrolysis of Nylon-12.6 is known to give peaks due to various amines, shown in Figure 5. These peaks are extremely difficult to separate with FS columns.

**Q4: The internal surface of a SS capillary column has less than 10µm (peak to valley) roughness. The thickness of liquid phase at the peak is small, while that at the valley is large. Does this affect peak separation?**

Yes, it does. As the liquid phase becomes very thin, the top layer of the slanted 5 layer structure emerges, causing problems. We found 3 layer surface pretreatment of the SS column to be inadequate due to the effects from the metal surface; therefore, 5 layer pretreatment was necessary to solve the problem. The coating efficiency is about 90% and is comparable to FS columns. The SEM picture shown in the front cover page clearly shows the improved surface structure.

**Q5: I hear that Ultra ALLOY® columns have high thermal stability: however, I rarely heat up to 250°C. I do not think such high temperature stability is necessary, because I thoroughly pretreat samples before analysis. Does it still have any advantages?**

Yes, it does. Advantages of high thermal stability of a column are: (1) low bleeding and high durability; (2) protection against column degradation by nonvolatiles from samples; (3) cleaning of columns without use of solvents and guarding against ghost peaks - allowing great time saving; and (4) high data reproducibility over extended period of time.

Samples normally contain a minute amount of nonvolatile species as impurities. Such species deposit over the column inlet or the entire column, they can act as the liquid phase and cause peak broadening and adsorption. Triglycerides and mineral oil are the common high boiling impurities, and they can be eluted off the column by baking at high temperatures (380-400°C). Cumbersome solvent cleaning steps (removing column, cleaning, drying, mounting column, and baking) are not required, if columns

are baked at the end of a day. Another advantage is that it is effective in reducing ghost peaks due to high boiling species remained in the column, leading to great saving of analysis time. The high degree of durability means that the analysis is reliable and the data are reproducible over an extended period of time. Figure 2 shows a comparison of column degradation by blending 5% rapeseed oil in a sample. The internal surface area of our SS columns is 10-20 times greater than that of FS columns; thus, oil components are difficult to diffuse. As a result, SS columns have high resistance against contamination.

**Q6: Is the lot-to-lot reproducibility good?**

Yes, it is. Ultra ALLOY columns are quality checked by retention indices, partition ratios, coating efficiency, and the use of polar species for inertness. Table 1. shows the reproducibility of the columns.

**Q7: How small can a column be coiled? We would like to condense a sample using a liquid nitrogen trap. FS Megabore columns cannot be coiled so small in diameter.**

You have come up with a good application. If SS columns are coiled slowly, the diameter can be as small as 1 cm. Columns with 0.25 mm inner diameter can be clogged by moisture and solvent condensation, when concentrating sample at liquid nitrogen temperature, but ones with 0.5 mm inner diameter should work without problems. (See Figure 7 for an example)

**Q8: What polar columns do you have?**

There are a variety of polar columns available as tabulated in the last page. See application examples. Liquid phases used in packed columns are available in Ultra ALLOY® columns. Please ask for details. PyGC, triglyceride and PEG20M (with KOH) columns are also available for specific applications.

**Q9: What precautions do you recommend for GC/MS applications? With a quadruple type MS, the column outlet can be inserted to the ion source, but with a magnetic type, a jet separator should be used, or alternatively, a length (50 cm) of a FS column (P/N:PY1-2210) should be connected at the column outlet.****Q10: I have seen SS columns internally coated with fused silica in the U.S. If bent, do you think the FS breaks and metal surface is exposed?**

FS coating was considered in our lab at the early stage of development, but we found FS on the internal surface would break easily when columns were bent as you speculated Figure 6 shows that a commercial FS coated columns becomes very active when the internal FS coating breaks and comes off from the metal surface, exposing the metal surface. Because of the reasons above, Frontier Lab does not employ the FS coating method, although the manufacturing cost is less. Currently our inert tubing is extensively used as an interface in various purge & trap TG/MS and GC/MS.

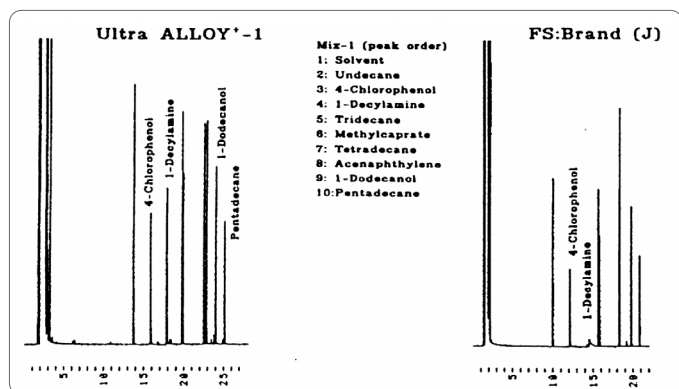
**Table 1.** Lot-to-lot Reproducibility (n=30 for each year) Column: UA-1(HT), 100% dimethylpolysiloxane, 30 m (0.25Ø), 0.15 µm at 130 °C.

	1993		1994		1995	
	RI	CV (%)	RI	CV (%)	RI	CV (%)
Methylcaprate	1305.4	0.018	1305.5	0.017	1305.6	0.015
Acenaphthalene	1418.7	0.021	1419.1	0.022	1419.7	0.022
1-dodecanol	1456.1	0.009	1456.1	0.008	1456.0	0.006
Column Efficiency (%)	82.3	2.010	83.4	1.970	87.2	1.720

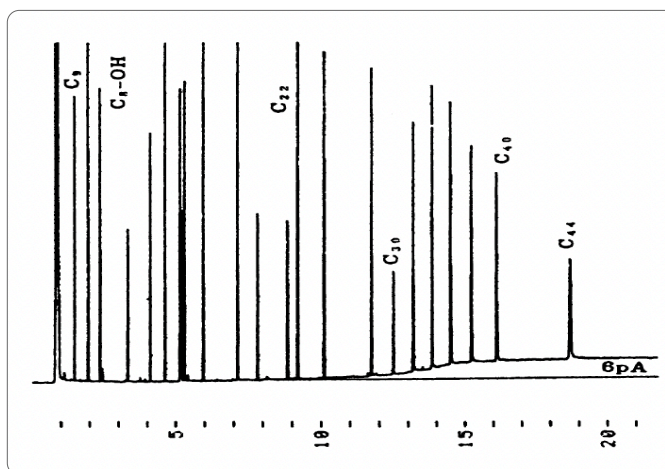
RI: Retention Index

## Basic Performance

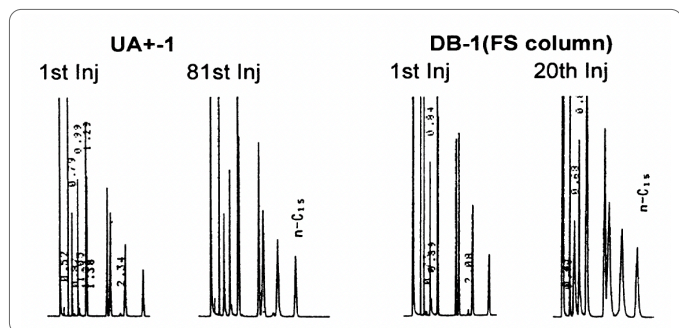
Applications featuring high inertness, high contamination resistance, high thermal resistance, low bleeding, and high durability



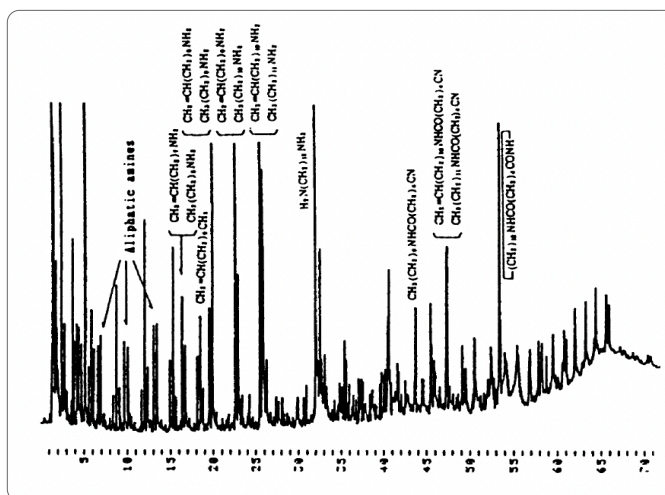
**Figure 1.** Activity Comparison of Ultra ALLOY®-1 and Fused Silica (FS) Columns. 30m (0.25Ø) 0.25 µm, programmed from 40°C to 220°C at 5°C/min



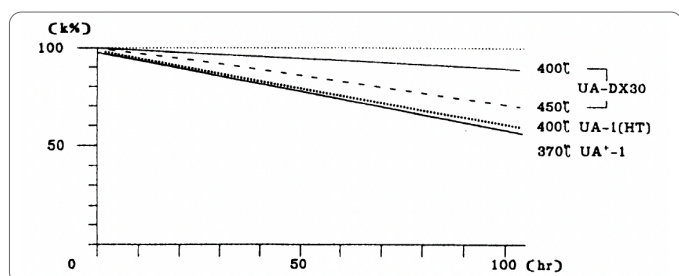
**Figure 4.** Low Bleeding (UA-5: 6pA at 350°C). 15m (0.25 mmØ) 0.25 µm at 70 to 350°C at 20°C/min, Split at 300°C



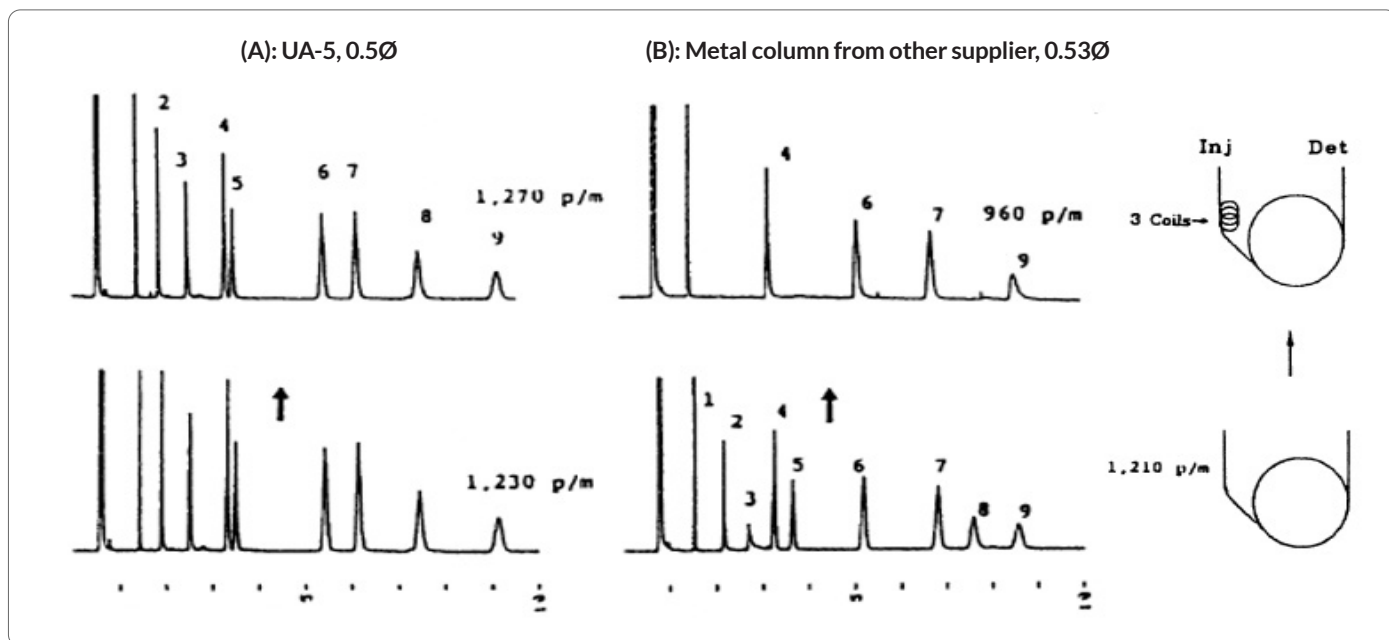
**Figure 2.** High Contamination Resistance (consecutive injection of a sample containing 5% rapeseed oil). UA-1 (10m (0.25Ø) 0.25 µm at 120°C, Split at 250°C)



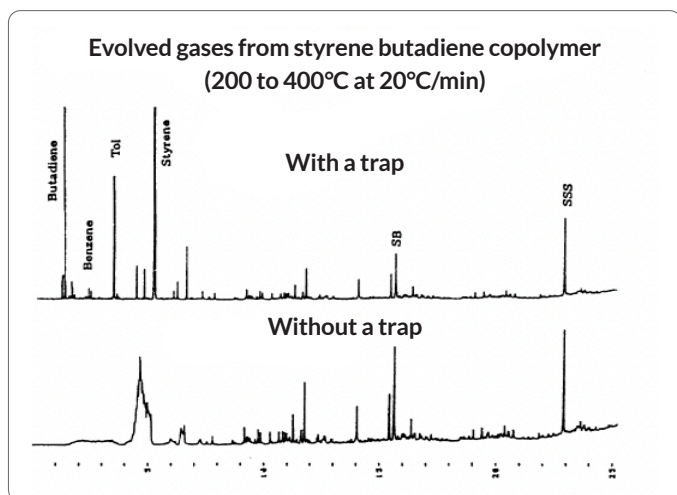
**Figure 5.** Inertness (PyGC of Nylon 12-6): UA-PY2. (Various primary amines from pyrolysis are eluted off). Pyrolysis at 550°C, 30m (0.25Ø) 0.5µm, 40-360°C at 5°C/min, Split at 300°C.



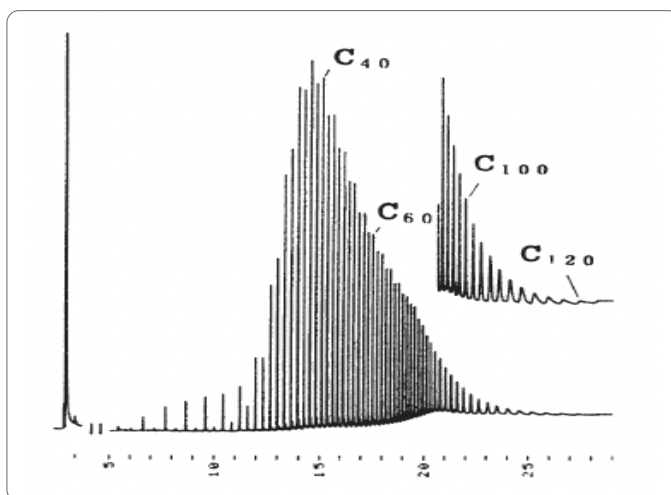
**Figure 3.** Thermal Stability change in capacity ratio (k) upon continuous exposure to high temperatures. Column: UA-DX30, UA-1(H/T), 15m (0.25Ø) 0.15 µm (Because the stationary phases are physically bonded to the rough column internal surface as shown in the SEM picture in the front cover page, our products offer high maximum temperatures and durability.)



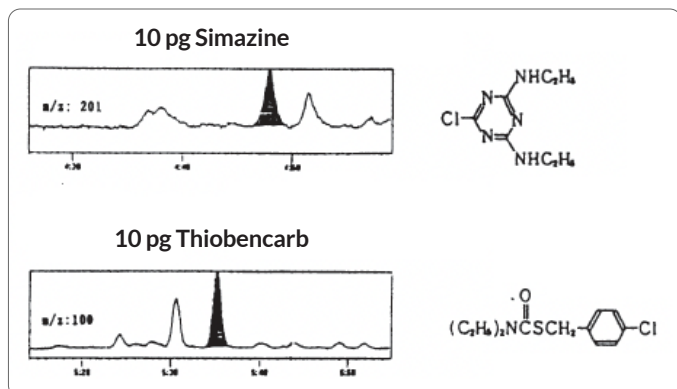
**Figure 6. Comparison with USA Products: UA-5.** Column activity with a coiled column at the inlet (3 turns / 3cm in diameter) with Column (B), polar species are adsorbed when the internal silica coating came off. 15m, 0.5  $\mu$ m at 120°C. Sample is the same as in Figure 1.



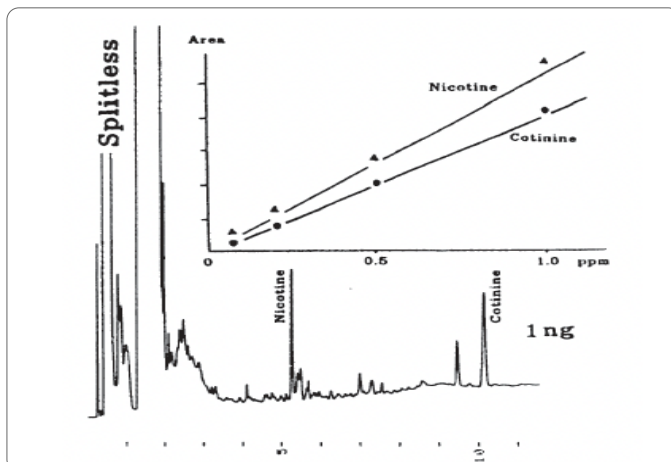
**Figure 7. Use of Gas Trap: UA-1.** A length of a column at the edge was coiled (2 cm in diameter) and was immersed in liquid N<sub>2</sub>. Evolved gases from pyrolysis were trapped for 10 min. 30m (0.25Ø) 0.5  $\mu$ m, 30 to 250°C at 10°C/min



**Figure 9. Wax: UA-DX-30.** 15m (0.5Ø) 0.15 $\mu$ m, 50°C to 440°C at 20°C/min, On-column



**Figure 8. A trace amount of agricultural chemicals: UA-1(S)** 15m (0.25Ø) 0.25  $\mu$ m, 60 to 320°C at 15°C/min



**Figure 10. A trace amount of nictines: UA-WAX (KOH.** (Effective for basic species). 5m (0.25Ø) 0.25  $\mu$ m, 50 to 220°C at 20°C/min



## 0.25 mm Inner Diameter Column

0.25 mm Inner Diameter Column										
				15 m		30 m		60 m		Max Temp. (°C)
	Name	Composition	(µm)	Product Number	AFP Part No.	Product Number	AFP Part No.	Product Number	AFP Part No.	
<b>Premier Grade</b>	UA-1(MS/HT)	Dimethyl polysiloxane (PDMS)	0.10	UA1(MS/HT)-15M-0.1F	CH-100056		CH-100056			450
			0.25	UA1(MS/HT)-15M-0.25F	CH-100057	UA1(MS/HT)-60M-0.25F	CH-100057	UA1(MS/HT)-60M-0.25F	CH-100063	(420°C: 0.5 µm)
			0.50	UA1(MS/HT)-15M-0.5F	CH-100058		CH-100058			
	UA-DX30	Carborane-siloxane	0.15	UADX30-15M-0.15F	CH-100062	UADX30-60M-0.15F	CH-100062	UADX30-60M-0.15F	CH-100064	360
<b>Regular Grade</b>	UA+-1	PDMS	0.10	UA1-15M-0.1F	CH-100076		CH-100076			380
			0.25	UA1-15M-0.25F	CH-100077	UA1-60M-0.25F	CH-100077	UA1-60M-0.25F	CH-100087	360
			0.50	UA1-15M-0.5F	CH-100078	UA1-60M-0.5F	CH-100078	UA1-60M-0.5F	CH-100088	350
			1.00	UA1-15M-1.0F	CH-100079	UA1-60M-1.0F	CH-100079	UA1-60M-1.0F	CH-100089	380
	UA+-5	5% Diphenyl PDMS	0.10	UA5-15M-0.1F	CH-100080		CH-100080			260
			0.25	UA5-15M-0.25F	CH-100081	UA5-60M-0.25F	CH-100081	UA5-60M-0.25F	CH-100090	420
			0.50	UA5-15M-0.5F	CH-100082	UA5-60M-0.5F	CH-100082	UA5-60M-0.5F	CH-100091	380
	UA+-35	35% Diphenyl PDMS	0.10	UA5-15M-1.0F	CH-100083	UA5-60M-1.0F	CH-100083	UA5-60M-1.0F	CH-100092	380
			0.25		CH-100084		CH-100084			370
	<b>Application Specific</b>	UA-PBDE	PDMS	0.05	UAPBDE-15M-0.05F	CH-100110		CH-100110		
UA-PHTHA		PDMS	0.05	UAPHTHA-15M-0.05F	CH-100111		CH-100111			390
UA+-1(S)		PDMS	0.25	UA1(S)-15M-0.25F	CH-100112		CH-100112			370
			0.40	UA1(S)-15M-0.4F	CH-100113	UA1(S)-60M-0.4F	CH-100113	UA1(S)-60M-0.4F	CH-100130	260
UA+-1701		14% Cyanopropylphenyl-polysiloxane	0.25	UA1701-15M-0.25F	CH-100114	UA1701-60M-0.25F	CH-100114	UA1701-60M-0.25F	CH-100131	380
			0.50	UA1701-15M-0.5F	CH-100115	UA1701-60M-0.5F	CH-100115	UA1701-60M-0.5F	CH-100132	390
			1.00	UA1701-15M-1.0F	CH-100116	UA1701-60M-1.0F	CH-100116	UA1701-60M-1.0F	CH-100133	380
UA+-50		50% Diphenyldimethyl-polysiloxane	0.10	UA50-15M-0.1F	CH-100117	UA50-60M-0.1F	CH-100117	UA50-60M-0.1F	CH-100134	270
			0.25	UA50-15M-0.25F	CH-100118	UA50-60M-0.25F	CH-100118	UA50-60M-0.25F	CH-100135	150
			0.50	UA50-15M-0.5F	CH-100119	UA50-60M-0.5F	CH-100119	UA50-60M-0.5F	CH-100136	380
			1.00	UA50-15M-1.0F	CH-100120	UA50-60M-1.0F	CH-100120	UA50-60M-1.0F	CH-100137	280
UA-FFAP		PEG20M (nitro-TPA ester)	0.25	UAFFAP-15M-0.25F	CH-100121	UAFFAP-60M-0.25F	CH-100121	UAFFAP-60M-0.25F	CH-100138	260
UA-5(P)		5% Diphenyl PDMS	0.25		CH-100122		CH-100122			
UA-PY1		Polydimethylsiloxane	0.25		CH-100123		CH-100123			
UA-PY2		Polydimethylsiloxane	0.50		CH-100124		CH-100124			
UA-624		Cyanopropylphenyl-polysiloxane	1.00		CH-100125	UA624-60M-1.0F	CH-100125	UA624-60M-1.0F	CH-100139	
UA-DIDP		Di-isodecylphthalate	0.40		CH-100126	UADIDP-60M-0.4F	CH-100126	UADIDP-60M-0.4F	CH-100140	
UA-TRG		65% Diphenyldimethyl-polysiloxane	0.10	UATR-15M-0.1F	CH-100127		CH-100127			
UA-Sil10C		100% Cyanopropyl (Silar 10C)	0.20	UASIL-15M-0.2F	CH-100128	UASIL-60M-0.2F	CH-100128	UASIL-60M-0.2F	CH-100141	
UA-WAX(KOH)		PEG 20M (KOH treatment)	0.25	UAWAXK-15M-0.25F	CH-100129	UAWAXK-60M-0.25F	CH-100129	UAWAXK-60M-0.25F	CH-100142	

## 0.32 mm Inner Diameter Column

0.32 mm Inner Diameter Column										
				15 m		30 m		60 m		Max Temp. (°C)
	Description	Composition	(µm)	Product Number	AFP Part No.	Product Number	AFP Part No.	Product Number	AFP Part No.	
<b>Regular Grade</b>	UA+-1	Polydimethylsiloxane	0.10			UA1-30MW-0.1F	CH-100143			380

## 0.53 mm Inner Diameter Column

0.53 mm Inner Diameter Column											
				15 m			30 m		60 m		Max Temp. (°C)
	Name	Composition	(µm)	Product Number	AFP Part No.	Product Number	AFP Part No.	Product Number	AFP Part No.		
<b>Premier Grade</b>	UA+-1(HT)	PDMS	0.10	UA1(HT)-15W-0.1F	CH-100144	UA1(HT)-30W-0.1F	CH-100148			420	
			0.25	UA1(HT)-15W-0.15F	CH-100145	UA1(HT)-30W-0.15F	CH-100149	UA1(MS/HT)-60M-0.25F	CH-100063		
			0.50	UA1(HT)-15W-0.25F	CH-100146	UA1(HT)-30W-0.25F	CH-100150				
	UA-DX30	Carborane-siloxane	0.15	UADX30-15W-0.15F	CH-100147	UADX30-30W-0.15F	CH-100151	UADX30-60M-0.15F	CH-100064	450	
<b>Regular Grade</b>	UA+-1	PDMS	0.10	UA1-15W-0.25F	CH-100152	UA1-30W-0.25F	CH-100156	UA1-60W-0.25F	CH-100160	380	
			0.25	UA1-15W-0.5F	CH-100153	UA1-30W-0.5F	CH-100157	UA1-60W-0.5F	CH-100161		
			0.50	UA1-15W-1.5F	CH-100154	UA1-30W-1.5F	CH-100158	UA1-60W-1.5F	CH-100162	330	
			1.00	UA1-15W-5.0F	CH-100155	UA1-30W-5.0F	CH-100159	UA1-60W-5.0F	CH-100163		
	UA+-5	5% Diphenyl PDMS	0.10	UA5-15W-0.25F	CH-100164	UA5-30W-0.25F	CH-100168	UA5-60W-0.25F	CH-100172	380	
			0.25	UA5-15W-0.5F	CH-100165	UA5-30W-0.5F	CH-100169	UA5-60W-0.5F	CH-100173		
			0.50	UA5-15W-1.5F	CH-100166	UA5-30W-1.5F	CH-100170	UA5-60W-1.5F	CH-100174	330	
			1.00	UA5-15W-5.0F	CH-100167	UA5-30W-5.0F	CH-100171	UA5-60W-5.0F	CH-100175		
	UA-WAX	PEG20M	1.00	UAWAX-15W-1.0F	CH-100176	UAWAX-30W-1.0F	CH-100177	UAWAX-60W-1.0F	CH-100178	240	
	<b>Application Specific</b>	UA-SIM-DIS(HT)	PDMS	0.10	UASIM(HT)-5W-0.1F (The length is 5m)	CH-100179	UASIM(HT)-10W-0.1F	CH-100180			450
				UAPHTHA-15M-0.05F	CH-100181	UAPHTHA-30M-0.05F (The length is 10m)	CH-100182				
UA-624		6% Cyanopropyl-phenylpolysiloxane	3.00			UA624-30W-3.0F	CH-100183	UA624-60W-3.0F	CH-100184	270	
UA-624Dx		6% Cyanopropyl-phenylpolysiloxane	3.00			UA624Dx-45W-3.0F (The length is 45m)	CH-100185			270	
UA+-1(S)		Polydimethylsiloxane		UA1(S)-15W-0.25F	CH-100186	UA1(S)-30W-0.25F	CH-100187			370	
UA+-1701		14% Cyanopropyl-phenylpolysiloxane	0.25	UA1701-15W-0.25F	CH-100188	UA1701-30W-0.25F	CH-100189	UA1701-60W-0.25F	CH-100190	320	
			0.50	UA1701-15W-0.5F	CH-100191	UA1701-30W-0.5F	CH-100192	UA1701-60W-0.5F	CH-100193		
			1.00	UA1701-15W-1.0F	CH-100194	UA1701-30W-1.0F	CH-100195	UA1701-60W-1.0F	CH-100196	300	
UA+-50		50% Diphenyl-dimethylpolysiloxane	0.10					UA50-60W-0.1F	CH-100197	390	
			0.25	UA50-15W-0.25F	CH-100198	UA50-30W-0.25F	CH-100199	UA50-60W-0.25F	CH-100200		
			0.50	UA50-15W-0.5F	CH-100201	UA50-30W-0.5F	CH-100202	UA50-60W-0.5F	CH-100203	370	
			1.00	UA50-15W-1.0F	CH-100204	UA50-30W-1.0F	CH-100205	UA50-60W-1.0F	CH-100206		
UA+-65		65% Diphenyldimethyl-polysiloxane	0.10	UA65-15W-0.1F	CH-100207	UA65-30W-0.1F	CH-100208	UA65-60W-0.1F	CH-100209	380	
UA-WAX		PEG20M (Polyethyl-ene glycol 20M)	0.50	UAWAX-15W-0.5F	CH-100210	UAWAX-30W-0.5F	CH-100211	UAWAX-60W-0.5F	CH-100212	240	
UA-FFAP		PEG20M (Nitro-TPA ester)	0.50	UAFFAP-15W-0.5F	CH-100213	UAFFAP-30W-0.5F	CH-100214	UAFFAP-60W-0.5F	CH-100215	240	
	1.00		UAFFAP-15W-1.0F	CH-100216	UAFFAP-30W-1.0F	CH-100217	UAFFAP-60W-1.0F	CH-100218	240		
UA-WAX(KOH)	PEG 20M (KOH treatment ) Cyanopropylphenyl-polysiloxane	0.50	UAWAXK-15W-0.5F	CH-100219	UAWAXK-30W-0.5F	CH-100220	UAWAXK-60W-0.5F	CH-100221	240		
		1.00	UAWAXK-15W-1.0F	CH-100222	UAWAXK-30W-1.0F	CH-100223	UAWAXK-60W-1.0F	CH-100224	240		

## UA Guard Column Phthalates

Name	Product Number	AFP Part No.	Specifications
UA Guard Column Set Ph	UAGU-K01	CH-100225	Designed specifically for phthalates analysis Compatible column: UAPBDE-15M-0.05F Stationary phase: Dimethylpolysiloxane Material: Deactivated stainless steel Size: Length 1.5 m, i.d. 0.25 mm, o.d. 0.47 mm, df. 0.1 µm Max use temperature: 380 °C Contents: UA connector (1 ea), UA guard column Ph (1 ea) VF metal ferrule D (3 ea), Wrench (6/8 mm, 2 ea)
UA Guard Column Ph	UAGU-M15	CH-100226	Contents: UA Guard Column Ph (2 ea)
UA Connector	UAGU-K02	CC-100336	Contents: UA Connector (1 ea)
VF Metal Ferrule D	MS402167	CC-100337	Contents: VF Metal Ferrule D (20 ea)

## Smart Pre-Column

Name	Product Number	AFP Part No.	Specifications
Smart Pre-Column	UASMC-M20	CH-100239	Smart Pre-column (ferrule on one end) 2 ea

## EGA Capillary Tube

ID x OD (mm)	Polarity	2.5 m		Specifications
		Product Number	AFP Part No.	
0.15 x 0.47	None	UADTM-2.5N	CT-100109	EGA Capillary Tube for Pyrolyzer and $\mu$ -Reactor [Material] SUS 316 [Film Thickness] less than 0.01 $\mu$ m [Deactivation] Polydimethylsiloxane [Min-Max Temp] -196 °C to 450 °C

## Capillary Deactivated Tube

ID x OD (mm)	Polarity	5 m		10 m		Specifications
		Product Number	AFP Part No.	Product Number	AFP Part No.	
0.15 x 0.47	None	UADTM-5N	CT-100110	UADTM-10N	CT-100119	[Material]:SUS 316 [Film Thickness]:less than 0.01 $\mu$ m [Deactivation]:Polydimethylsiloxane [Min-Max Temp]: -196°C to 450°C
0.25 x 0.47	None	UADTM-5M	CT-100111	UADTM-10M	CT-100120	
0.25 x 1.58 (1/16")	None	UADTM-5M16	CT-100112	UADTM-10M16	CT-100121	
0.32 x 0.75	None	UADTM-5MW	CT-100113	UADTM-10MW	CT-100122	
0.53 x 0.75	None	UADTM-5W	CT-100114	UADTM-10W	CT-100123	
0.53 x 1.58 (1/16")	None	UADTM-5W16	CT-100115	UADTM-10W16	CT-100124	
0.80 x 1.15	None	UADTM-5G	CT-100116	UADTM-10G	CT-100125	
0.80 x 1.58 (1/16")	None	UADTM-5G16	CT-100117	UADTM-10G16	CT-100126	
1.20 x 1.58 (1/16")	None	UADTM-5E16	CT-100118	UADTM-10E16	CT-100127	

## Untreated Metal Capillary Tube

ID x OD (mm)	Polarity	5 m		10 m		30 m		Specifications
		Product Number	AFP Part No.	Product Number	AFP Part No.	Product Number	AFP Part No.	
0.05 x 0.315	None			UA-TUBE-10SN	CT-100137			[Material]: SUS 316 [Inner Face]: untreated
0.15 x 0.47	None	UA-TUBE-5N	CT-100128	UA-TUBE-10N	CT-100138			
0.25 x 0.47	None	UA-TUBE-5M	CT-100129	UA-TUBE-10M	CT-100139	UA-TUBE-30M	CT-100140	
0.25 x 1.58 (1/16")	None	UA-TUBE-5M16	CT-100130	UA-TUBE-10M16	CT-100141			
0.32 x 0.75	None	UA-TUBE-5MW	CT-100131	UA-TUBE-10MW	CT-100142			
0.53 x 0.75	None	UA-TUBE-5W	CT-100132	UA-TUBE-10W	CT-100143			
0.53 x 1.58 (1/16")	None	UA-TUBE-5W16	CT-100133	UA-TUBE-10W16	CT-100144			
0.80 x 1.15	None	UA-TUBE-5G	CT-100134					
0.80 x 1.58 (1/16")	None	UA-TUBE-5G16	CT-100135					
1.20 x 1.58 (1/16")	None	UA-TUBE-5E16	CT-100136					