

# Sapphire Orifice Assemblies

**.0012" to .0252" DIA.**

## Description

The restrictors incorporate a precision synthetic sapphire orifice which is fitted within a main body. The sapphire orifice is a stable, accurate flow restrictor. Standard sizes range from .0012" to .0252" orifice diameter in 32 increments.

## Applications

- Precision Flow Control - Gases or Liquids
- Accurate Timing in Pneumatic or Hydraulic Circuits
- Pressure Dividing Circuits and Pneumatic Resistance Bridges
- Impedance Matching

## Kits

See page 31 for kit selection.

## General Specifications

**Maximum Operating Pressure** – 100 psig

**Flow Direction** – Preferred direction shown below.

Not recommended for reverse flow.

**Flow** – See flow chart for air on page 22.

**Orifice Diameters** – .0012" to .0252"

**Orifice Diameter Accuracy** –  $\pm .0003$ "

**C<sub>v</sub> Range** – .00003 to .013 See page 22.

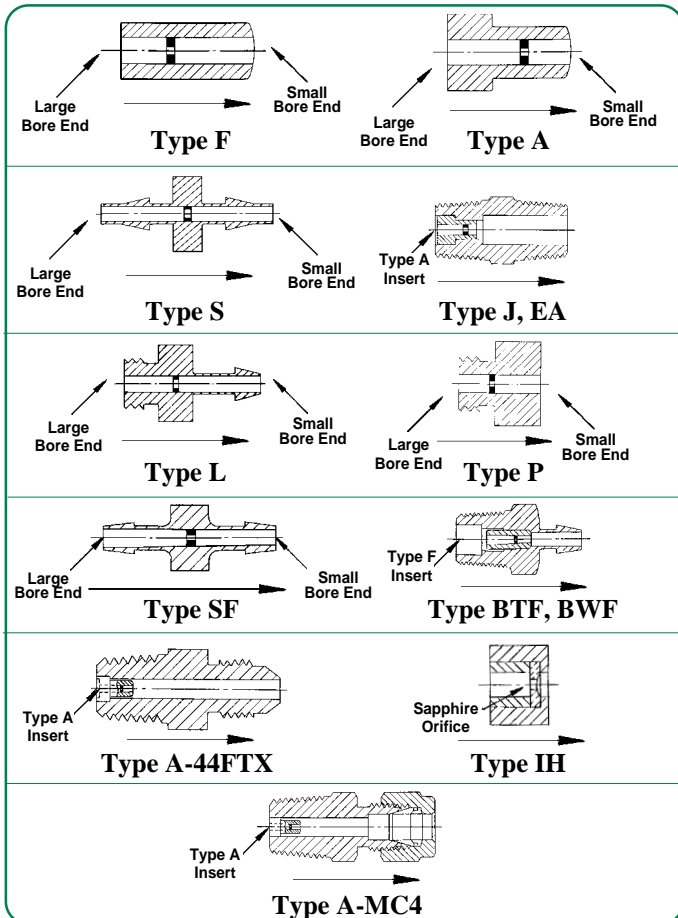
**Fluid Media** – Air, Water, Gases and Liquids compatible with materials of construction.

**Dimensions** – See drawings on page 4, 5.

## Sapphire Sizes Available

Size Number	Orifice Diameter	
	mm	In.
3	.03	.0012
4	.04	.0016
5	.05	.0020
6	.06	.0024
7	.07	.0028
8	.08	.0031
9	.09	.0035
10	.10	.0039
11	.11	.0043
12	.12	.0047
13	.13	.0051
14	.14	.0055
15	.15	.0059
16	.16	.0063
17	.17	.0067
18	.18	.0071
20	.20	.0079
22	.22	.0087
24	.24	.0094
26	.26	.0102
28	.28	.0110
30	.30	.0118
32	.32	.0126
34	.34	.0134
36	.36	.0142
40	.40	.0157
44	.44	.0173
48	.48	.0189
52	.52	.0205
54	.54	.0213
58	.58	.0228
64	.64	.0252

## Construction



The restrictors should be installed with flow in the direction shown above. The flow data provided in this catalog is measured for the flow direction shown above.

## Part Numbers

The complete part number for an orifice assembly includes Type, Size Number, Body Material and Options.

### EXAMPLES

Type	Size Number (Orifice Dia.)	Body Material	Options	Part Number
A	3 (.0012")	Nylon	—	A-3-NY
S	5 (.0020")	Brass	—	S-5-BR
S	5 (.0020")	Brass	EN	S-5-BR-EN
J	10 (.0039")	Brass	—	J-10-BR
J	10 (.0039")	SS	—	J-10-SS

## Options

- Electroless nickel plating is available on Type S and Type L. Add suffix EN.
- Plating is for external appearance only.
- See page 37 for screened orifices.

(More on pages 4, 5.)

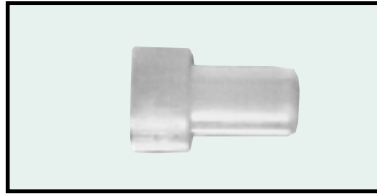
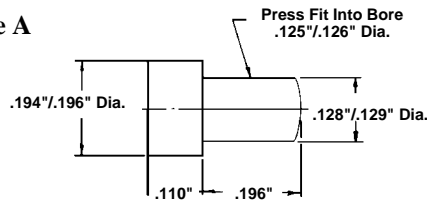
# Sapphire Orifice Assemblies

**.0012" to .0252" DIA.**

## Dimensions

## Specifications

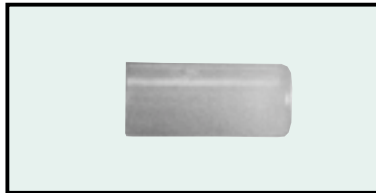
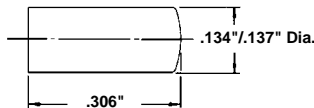
### Type A



### PLASTIC INSERT

**Body** – Nylon  
**Orifice** – Synthetic Sapphire  
**Press fits into bore** – .125\"/>

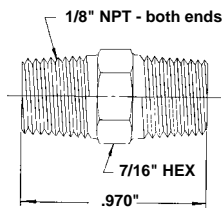
### Type F



### PLASTIC INSERT

**Body** – Nylon  
**Orifice** – Synthetic Sapphire  
**Press fits into bore** – .132\"/>

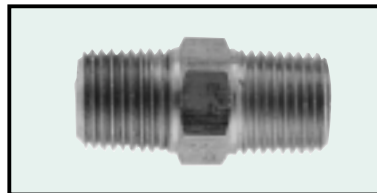
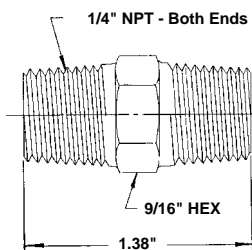
### Type J



### HEX NIPPLE

**Body** – Brass or 303 SS  
**Insert** – Nylon  
**Orifice** – Synthetic Sapphire  
**Threads** – 1/8" NPT  
**Standard Orifice Sizes** – .0012" to .0252" Dia.

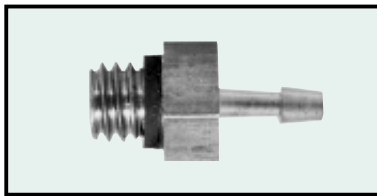
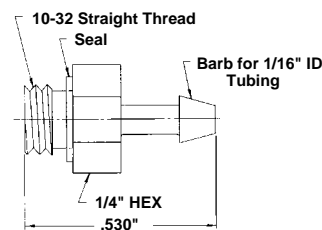
### Type EA



### HEX NIPPLE

**Body** – Brass or 303 SS  
**Insert** – Nylon  
**Orifice** – Synthetic Sapphire  
**Threads** – 1/4" NPT  
**Standard Orifice Sizes** – .0012" to .0252" Dia.

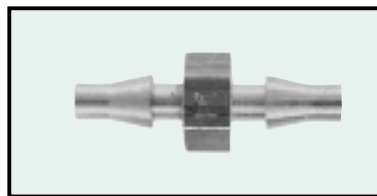
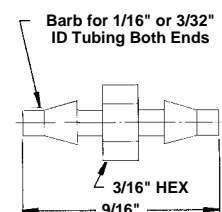
### Type L



### ADAPTER

**Body** – Brass      **Seal** – Viton  
**Orifice** – Synthetic Sapphire  
**Thread** – 10-32 UNF  
**Barb** – For 1/16" ID Tubing  
**Option** – Electroless nickel plating on brass  
**Standard Orifice Sizes** – .0012" to .0252" Dia.

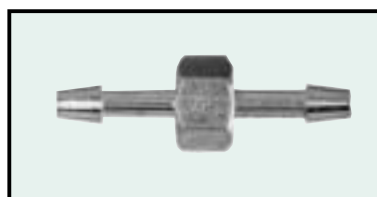
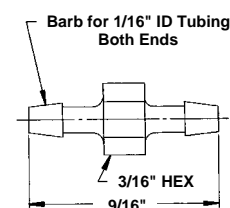
### Type S



### DUAL BARB

**Body** – Brass  
**Orifice** – Synthetic Sapphire  
**Barb** – For 1/16" or 3/32" ID Tubing  
**Option** – Electroless nickel plating on brass  
**Standard Orifice Sizes** – .0012" to .0252" Dia.

### Type SF



### DUAL BARB

**Body** – Brass  
**Orifice** – Synthetic Sapphire  
**Barb** – For 1/16" ID Tubing  
**Standard Orifice Sizes** – .0012" to .0252" Dia.

(More on page 5.)

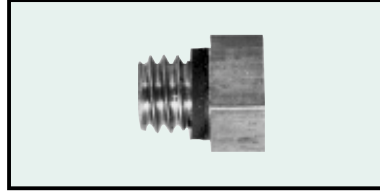
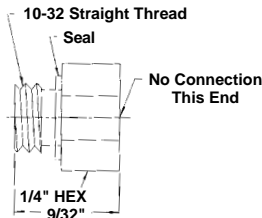
# Sapphire Orifice Assemblies

**.0012" to .0252" Dia.**

## Dimensions

## Specifications

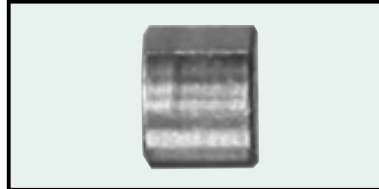
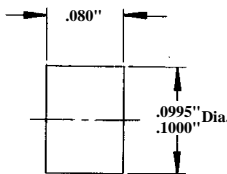
**Type P**



### BLEED PLUG

**Body** – Brass      **Seal** – Viton  
**Orifice** – Synthetic Sapphire  
**Maximum Operating Pressure** – 100 psig  
**Thread** – 10-32 UNF  
**Standard Orifice Sizes** – .0012" to .0252" Dia.

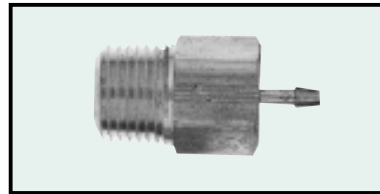
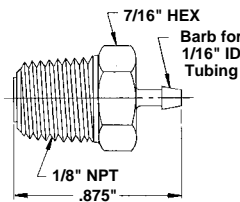
**Type IH**



### INSERT

**Materials**  
**Body** – Brass or 303 SS  
**Orifice** – Synthetic Sapphire  
**Maximum Operating Pressure** – 100 psig  
**Press Fit** – presses into .0980"/.0990" Dia.  
**Orifice Sizes** – .0012" to .0252" Dia.

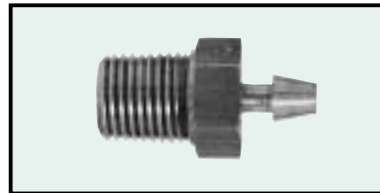
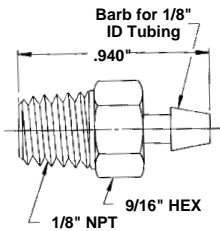
**Type BTF**



### ADAPTER

**Materials**  
**Body** – Brass or 303 SS  
**Orifice** – Sapphire/Nylon Sleeve  
**Maximum Operating Pressure** – 100 psig  
**Connections** – 1/8" NPT x 1/16" Barb  
**Orifice Sizes** – .0012" to .0252" Dia.

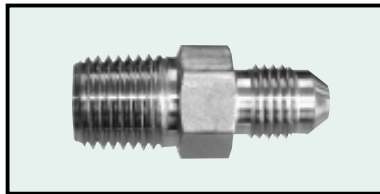
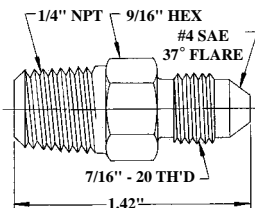
**Type BWF**



### ADAPTER

**Materials**  
**Body** – Brass or 303 SS  
**Orifice** – Sapphire/Nylon Sleeve  
**Maximum Operating Pressure** – 100 psig  
**Connections** – 1/8" NPT x 1/8" Barb  
**Orifice Sizes** – .0012" to .0252" Dia.

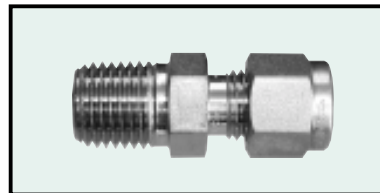
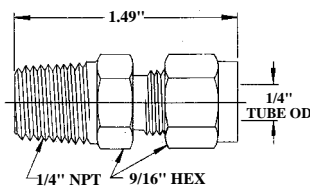
**Type A-44FTX**



### 37° FLARED TUBE CONNECTOR

**Body** – Brass or 304 SS  
**Orifice** – Sapphire/Nylon Sleeve  
**Maximum Operating Pressure** – 200 psig  
**Maximum Pressure Differential** – 100 psi  
**Orifice Sizes** – .0012" to .0252" Dia.

**Type A-MC4**



### TUBE ADAPTER

**Body** – 316 SS  
**Orifice** – Sapphire/Nylon Sleeve  
**Maximum Operating Pressure** – 100 psig  
**Orifice Sizes** – .0012" to .0252" Dia.  
 For 1/4" OD Metal Tubing  
 Made from Swagelok Male Connector

# Sapphire Orifice Air Flow – SLPM

Orifice Diameter Inches	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	22	24	26	28	30	32	34	36	40	44	48	52	54	58	64	
0.0012	0.0016	0.0020	0.0024	0.0028	0.0031	0.0035	0.0039	0.0043	0.0047	0.0051	0.0055	0.0059	0.0063	0.0067	0.0071	0.0079	0.0087	0.0094	0.0102	0.0110	0.0118	0.0126	0.0134	0.0142	0.0157	0.0173	0.0189	0.0205	0.0213	0.0228	0.0252		
0.00030	0.00053	0.00080	0.00112	0.0017	0.0022	0.0028	0.0035	0.0044	0.0050	0.0061	0.0071	0.0084	0.0094	0.0111	0.0122	0.0139	0.0161	0.0194	0.0229	0.0275	0.0300	0.0340	0.0393	0.0446	0.0499	0.0677	0.0822	0.0965	1.10	1.12	1.18	1.69	
5	0.009	0.013	0.027	0.036	0.047	0.059	0.076	0.093	0.108	0.136	0.159	0.192	0.223	0.256	0.300	0.340	0.350	0.430	0.584	0.623	0.695	0.800	0.933	1.06	1.20	1.51	1.81	2.16	2.50	2.57	3.26	4.06	
10	0.010	0.016	0.036	0.049	0.065	0.082	0.107	0.132	0.164	0.193	0.228	0.264	0.308	0.357	0.382	0.430	0.480	0.590	0.830	0.868	0.968	1.09	1.27	1.45	1.63	2.01	2.43	2.90	3.32	3.45	4.43	5.58	
15	0.014	0.021	0.046	0.062	0.082	0.104	0.134	0.166	0.205	0.240	0.285	0.329	0.386	0.443	0.482	0.535	0.613	0.755	1.05	1.11	1.24	1.42	1.62	1.85	2.09	2.56	3.08	3.69	4.26	4.43	5.55	7.08	
20	0.016	0.025	0.055	0.074	0.099	0.125	0.159	0.197	0.243	0.284	0.337	0.390	0.457	0.525	0.569	0.635	0.730	0.910	1.25	1.32	1.48	1.70	1.95	2.20	2.48	3.04	3.64	4.36	5.06	5.31	6.55	8.33	
25	0.019	0.030	0.063	0.087	0.115	0.144	0.184	0.229	0.280	0.327	0.389	0.450	0.526	0.605	0.654	0.733	0.843	1.05	1.44	1.52	1.70	1.96	2.24	2.52	2.84	3.50	4.19	5.03	5.81	6.11	7.53	9.55	
30	0.022	0.034	0.072	0.098	0.132	0.164	0.208	0.260	0.317	0.370	0.440	0.511	0.595	0.685	0.710	0.838	0.958	1.19	1.63	1.69	1.91	2.19	2.52	2.84	3.19	3.96	4.75	5.69	6.57	6.90	8.48	10.7	
40	0.027	0.043	0.089	0.122	0.163	0.203	0.257	0.321	0.390	0.466	0.543	0.632	0.724	0.845	0.880	1.04	1.18	1.47	2.02	2.11	2.35	2.67	3.07	3.46	3.90	4.89	5.86	7.02	8.10	8.50	10.4	13.1	
50	0.032	0.052	0.106	0.147	0.195	0.241	0.306	0.383	0.463	0.542	0.652	0.753	0.872	1.00	1.05	1.24	1.41	1.75	2.39	2.50	2.78	3.16	3.63	4.09	4.59	5.83	6.96	8.35	9.63	10.1	12.3	15.5	
60	0.037	0.061	0.123	0.171	0.227	0.280	0.356	0.445	0.536	0.630	0.751	0.875	1.01	1.16	1.23	1.45	1.64	2.03	2.77	2.89	3.28	3.62	4.12	4.72	5.31	5.99	7.71	9.23	11.0	12.7	13.3	16.0	20.2
70	0.042	0.070	0.141	0.195	0.259	0.318	0.403	0.507	0.609	0.717	0.855	0.996	1.15	1.32	1.40	1.68	1.87	2.31	3.14	3.28	3.62	4.12	4.72	5.31	5.99	7.71	9.23	11.0	12.7	13.3	16.0	20.2	
80	0.047	0.080	0.158	0.200	0.292	0.357	0.453	0.569	0.683	0.804	0.959	1.12	1.28	1.48	1.57	1.86	2.09	2.59	3.51	3.66	4.04	4.68	5.28	5.93	6.69	8.65	10.4	12.3	14.3	14.8	17.9	22.6	
90	0.053	0.089	0.175	0.244	0.324	0.396	0.502	0.632	0.757	0.891	1.06	1.24	1.42	1.64	1.75	2.06	2.32	2.87	3.89	4.05	4.47	5.07	5.83	6.56	7.41	9.60	11.5	13.7	15.7	16.4	19.7	24.9	
100	0.058	0.098	0.193	0.269	0.356	0.435	0.551	0.692	0.830	0.978	1.17	1.36	1.56	1.80	1.92	2.27	2.55	3.15	4.26	4.44	4.89	5.57	6.38	7.18	8.12	10.6	12.6	15.0	17.2	18.0	21.6	27.3	
5	0.003	0.006	0.014	0.020	0.028	0.036	0.047	0.057	0.073	0.085	0.100	0.116	0.137	0.156	0.169	0.199	0.229	0.277	0.377	0.401	0.451	0.510	0.591	0.673	0.764	0.982	1.16	1.38	1.61	1.64	2.13	2.61	
10	0.004	0.008	0.018	0.027	0.036	0.046	0.061	0.073	0.093	0.109	0.128	0.149	0.175	0.200	0.217	0.253	0.292	0.352	0.482	0.503	0.556	0.638	0.734	0.833	0.955	1.26	1.51	1.80	2.06	2.11	2.55	3.19	
15	0.006	0.010	0.021	0.030	0.040	0.050	0.065	0.079	0.100	0.117	0.138	0.159	0.188	0.214	0.235	0.269	0.320	0.390	0.525	0.554	0.626	0.711	0.818	0.921	1.07	1.39	1.65	1.99	2.31	2.39	2.77	3.48	
20	0.006	0.010	0.021	0.030	0.040	0.050	0.065	0.079	0.100	0.117	0.138	0.159	0.188	0.214	0.235	0.269	0.320	0.390	0.525	0.554	0.626	0.711	0.818	0.921	1.07	1.39	1.65	1.99	2.31	2.39	2.77	3.48	
30	0.006	0.010	0.021	0.030	0.040	0.050	0.065	0.079	0.100	0.117	0.138	0.159	0.188	0.214	0.235	0.269	0.320	0.390	0.525	0.554	0.626	0.711	0.818	0.921	1.07	1.39	1.65	1.99	2.31	2.39	2.77	3.48	

# Sapphire Orifice Air Flow – SCFH

Orifice Diameter Inches	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	22	24	26	28	30	32	34	36	40	44	48	52	54	58	64	
0.0012	0.0016	0.0020	0.0024	0.0028	0.0031	0.0035	0.0039	0.0043	0.0047	0.0051	0.0055	0.0059	0.0063	0.0067	0.0071	0.0079	0.0087	0.0094	0.0102	0.0110	0.0118	0.0126	0.0134	0.0142	0.0157	0.0173	0.0189	0.0205	0.0213	0.0228	0.0252		
0.00030	0.00053	0.00080	0.00112	0.0017	0.0022	0.0028	0.0035	0.0044	0.0050	0.0061	0.0071	0.0084	0.0094	0.0111	0.0122	0.0139	0.0161	0.0194	0.0229	0.0275	0.0300	0.0340	0.0393	0.0446	0.0499	0.0677	0.0822	0.0965	1.10	1.12	1.18	1.69	
5	0.009	0.013	0.027	0.036	0.047	0.059	0.076	0.093	0.108	0.136	0.159	0.192	0.223	0.256	0.300	0.340	0.350	0.430	0.584	0.623	0.695	0.800	0.933	1.06	1.20	1.51	1.81	2.16	2.50	2.57	3.26	4.06	
10	0.010	0.016	0.036	0.049	0.065	0.082	0.107	0.132	0.164	0.193	0.228	0.264	0.308	0.357	0.382	0.430	0.480	0.590	0.830	0.868	0.968	1.09	1.27	1.45	1.63	2.01	2.43	2.90	3.32	3.45	4.43	5.58	
15	0.014	0.021	0.046	0.062	0.082	0.104	0.134	0.166	0.205	0.240	0.285	0.329	0.386	0.443	0.482	0.535	0.613	0.755	1.05	1.11	1.24	1.42	1.62	1.85	2.09	2.56	3.08	3.69	4.26	4.43	5.55	7.08	
20	0.016	0.025	0.055	0.074	0.099	0.125	0.159	0.197	0.243	0.284	0.337	0.390	0.457	0.525	0.569	0.635	0.730	0.910	1.25	1.32	1.48	1.70	1.95	2.20	2.48	3.04	3.64	4.36	5.06	5.31	6.55	8.33	
25	0.019	0.030	0.063	0.087	0.115	0.144	0.184	0.229	0.280	0.327	0.389	0.450	0.526	0.605	0.654	0.733	0.843	1.05	1.44	1.52	1.70	1.96	2.24	2.52	2.84	3.50	4.19	5.03	5.81	6.11	7.53	9.55	
30	0.022	0.034	0.072	0.098	0.132	0.164	0.208	0.260	0.317	0.370	0.440	0.511	0.595	0.685	0.710	0.838	0.958	1.19	1.63	1.69	1.91	2.19	2.52	2.84	3.19	3.96	4.75	5.69	6.57	6.90	8.48	10.7	
40	0.027	0.043	0.089	0.122	0.163	0.203	0.257	0.321	0.390	0.466	0.543	0.632	0.724	0.845	0.880	1.04	1.18	1.47	2.02	2.11	2.35	2.67	3.07	3.46	3.90	4.89	5.86	7.02	8.10	8.50	10.4	13.1	
50	0.032	0.052	0.106	0.147	0.195	0.241	0.306	0.383	0.463	0.542	0.652	0.753	0.872	1.00	1.05	1.24	1.41	1.75	2.39	2.50	2.78	3.16	3.63	4.09	4.59	5.83	6.96	8.35	9.63	10.1	12.3	15.5	
60	0.037	0.061	0.123	0.171	0.227	0.280	0.356	0.445	0.536	0.630	0.751	0.875	1.01	1.16	1.23	1.45	1.64	2.03	2.77	2.89	3.28	3.62	4.12	4.72	5.31	5.99	7.71	9.23	11.0	12.7	13.3	16.0	20.2
70	0.042	0.070	0.141	0.195	0.259	0.318	0.403	0.507	0.609	0.717	0.855	0.996	1.15	1.32	1.40	1.68	1.87	2.31	3.14	3.28	3.62	4.12	4.72	5.31	5.99	7.71	9.23	11.0	12.7	13.3	16.0	20.2	
80	0.047	0.080	0.158	0.200	0.292	0.357	0.453	0.569	0.683	0.804	0.959	1.12	1.28	1.48	1.57	1.86	2.09	2.59	3.51	3.66	4.04	4.68	5.28	5.93	6.69	8.65	10.4	12.3	14.3	14.8	17.9	22.6	
90	0.053	0.089	0.175	0.244	0.324	0.396	0.502	0.632	0.757	0.891	1.06	1.24	1.42	1.64	1.75	2.06	2.32	2.87	3.89	4.05	4.47	5.07	5.83	6.56	7.41	9.60	11.5	13.7	15.7	16.4	19.7	24.9	
100	0.058	0.098	0.193	0.269	0.356	0.435	0.551	0.692	0.830	0.978	1.17	1.36	1.56	1.80	1.92	2.27	2.55	3.15	4.26	4.44	4.89	5.57	6.38	7.18	8.12	10.6	12.6	15.0	17.2	18.0	21.6	27.3	
5	0.003	0.006	0.014	0.020	0.028	0.036	0.047	0.057	0.073	0.085	0.100	0.116	0.137	0.156	0.169	0.199	0.229	0.277	0.377	0.401	0.451	0.510	0.591	0.673	0.764	0.982	1.16	1.38	1.61	1.			