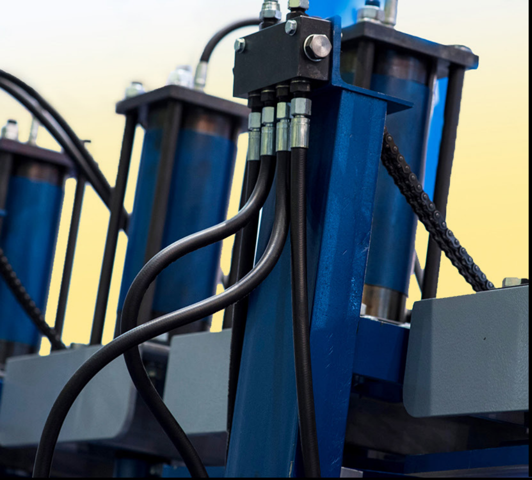
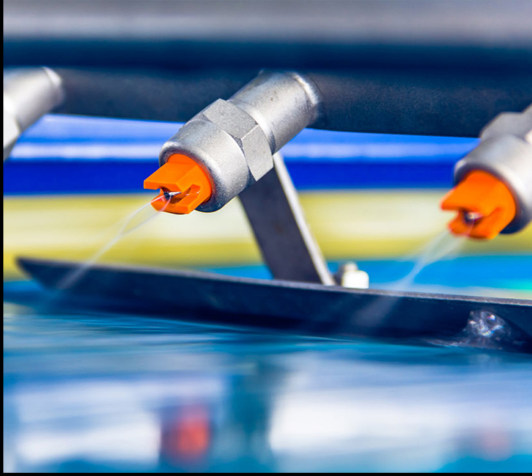
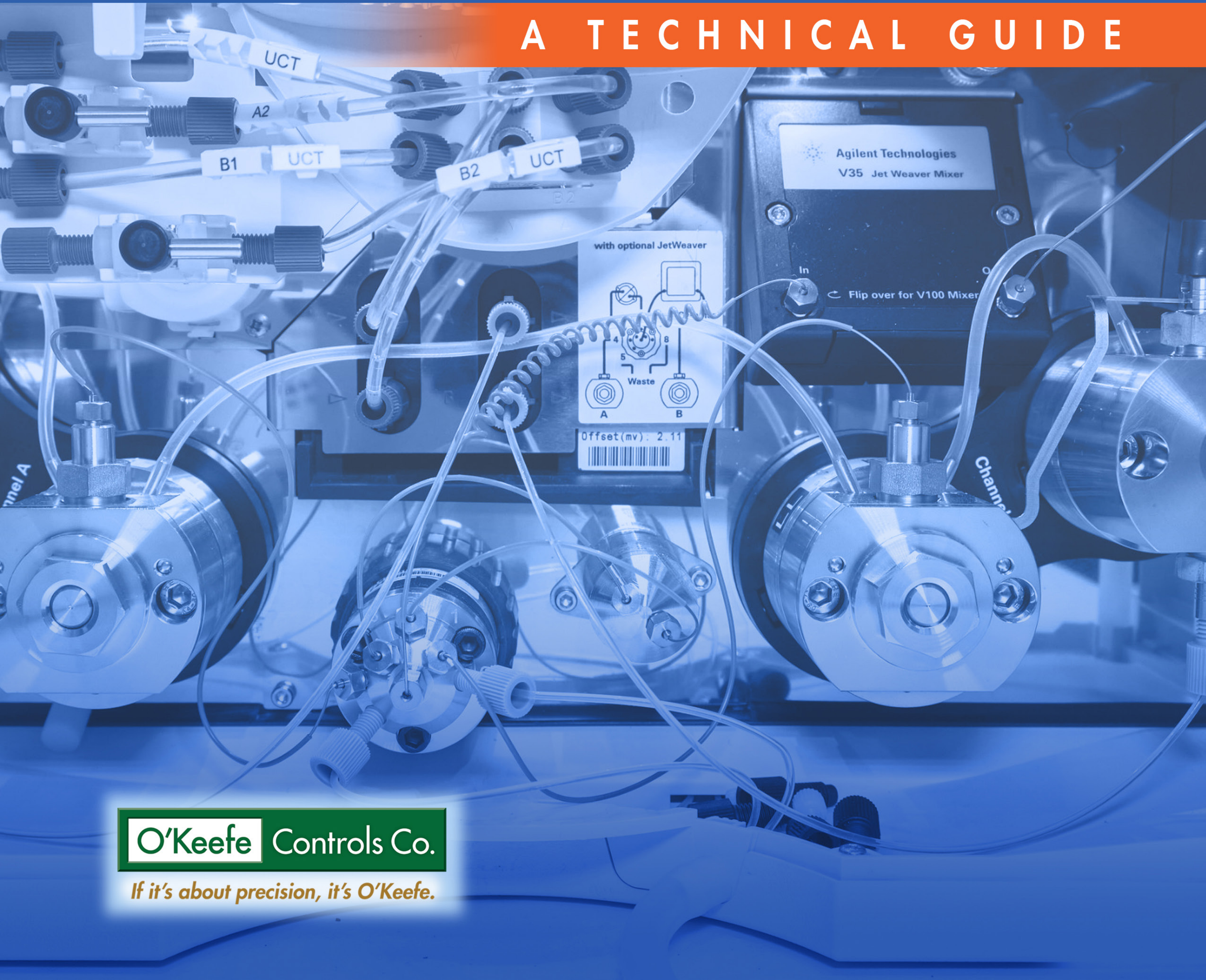




Calculating Liquid Flow
Through Orifices

A TECHNICAL GUIDE



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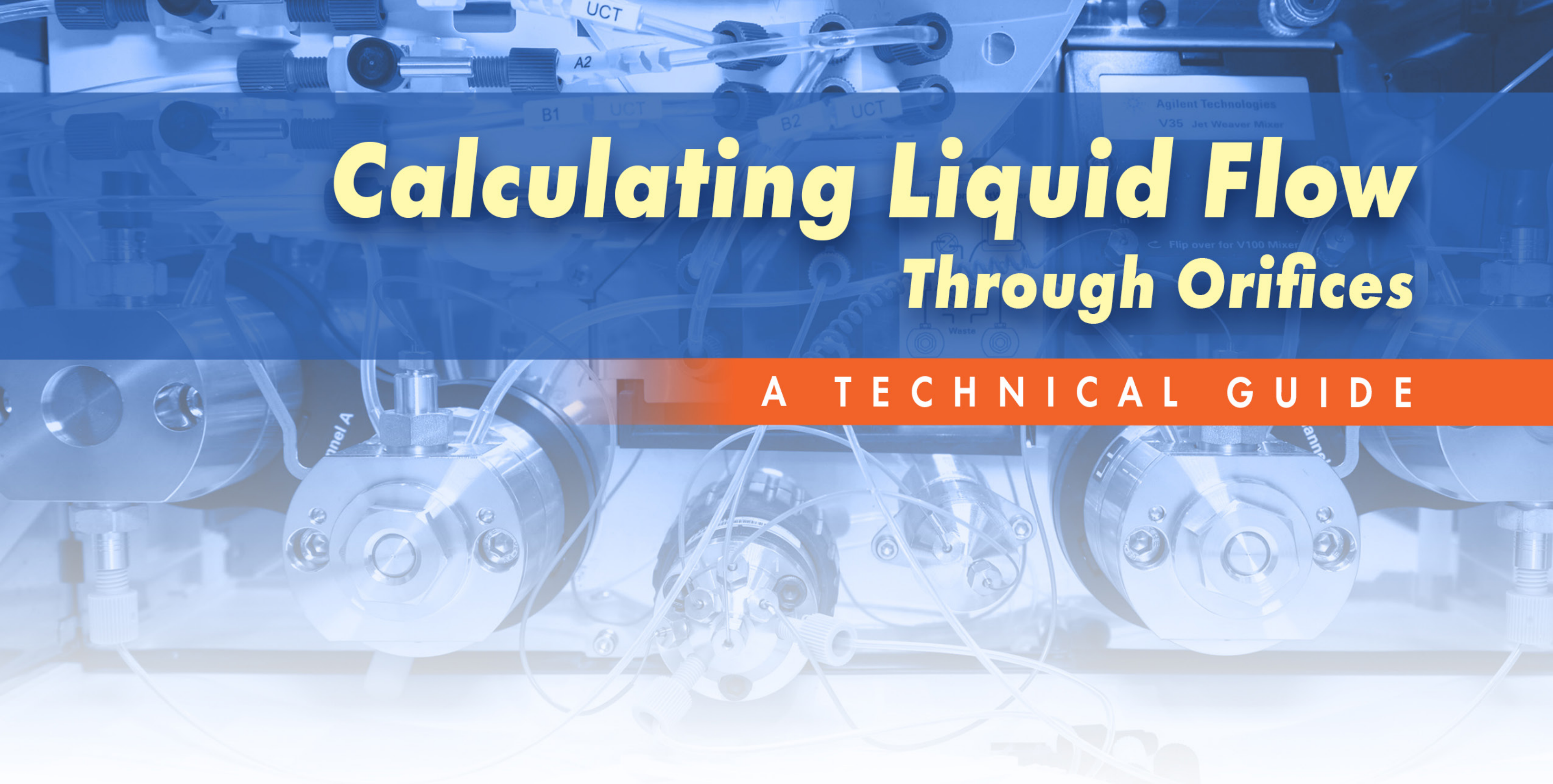

Calculating Liquid Flow Through Orifices

A TECHNICAL GUIDE

For the broad array of industrial applications concerned with liquid flow control, extremely accurate, repeatable results are necessary to successful operation. To achieve such precision, it is crucial to understand the various factors that are involved in determining the correct orifice size that will create the desired results.

Technical factors which must be considered when calculating liquid flow through orifices include pressure, temperature, type of liquid, and others. To help simplify the selection process, precision orifice manufacturers often provide flow charts within a common range to help engineers specify the correct orifice size for their application. However, not all applications fall within the data set included on the charts.

In addition to providing such charts, our Technical Guide details a number of formulas which can be used to extend orifice flow data beyond the charts, when specific factors of the application require it. These include pressure conversions, liquids other than water, and more. Examples are shown for each, making this a valuable resource for engineers and system designers. If further help is needed regarding a specific application, the engineers at O'Keefe Controls Co. are readily available.

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LIQUID FLOW RATE – C_V METHOD

The C_V method of rating flow capacity of various devices employs empirical data based on water flow.

The basic formula for water flow is:

$$Q = C_V\sqrt{\Delta P}$$

Q = flow in GPM
ΔP = pressure differential in psi
C_V = flow factor

For a flow of 1 GPM at $\Delta P = 1$, the $C_V = 1$

To obtain the water flow rate through precision orifices, use the above equation and obtain the C_V value from the charts on pages 5-6.

Example:

Size No. 100 (.100″ dia.) has a $C_V = .23$

For a 25 psig pressure differential: $Q = C_V \; \Delta P = .23 \; 25 = 1.15$ GPM

Selected flow data is presented on pages 5-6. The chart data assumes flooded conditions on both sides of the orifice. This is particularly important for orifices less than .020″ diameter because of surface tension influences.

FLOW CONVERSIONS

GPM	x	**3.785**	=	LPM
GPM	x	**3785**	=	CCM
GPM	x	**.1337**	=	CFM
GPM	x	**8.021**	=	CFH
CCM	x	**.001**	=	LPM

GPM – gallons per minute
LPM – liters per minute
CCM – cubic centimeters per minute
CFH – cubic feet per hour
CFM – cubic feet per min.

Example:

25 GPM x 3.785 = 94.625 LPM

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SPECIFIC GRAVITY — OTHER LIQUIDS

Specific gravity (SG) measures a liquid's density relative to water. Fluids with higher SG (heavier than water) flow more slowly at a given pressure, while lower SG (lighter) fluids flow faster. It acts as a correction factor for calculating volumetric flow rates, pump motor power, and pipe pressure drops.

For liquids other than water, the equation becomes:

$$Q = C_V \sqrt{\frac{\Delta P}{SG}}$$

Where:
SG = Specific gravity of the liquid
(The specific gravity of water is 1.0)

To obtain the flow rate of an oil with S.G. = .85, use the above equation and obtain the C_V value from the charts on pages 5-6.

Example: Size No. 100 (.100" dia.) has a C_V=.23

For a 25 psig pressure differential:

$$Q = C_V \sqrt{\frac{\Delta P}{S.G}} = .23 \sqrt{\frac{25}{.85}} = 1.25 \text{ GPM}$$

Specific Gravity of Various Liquids Relative to Water @ 60ºF			
Alcohol, Ethyl	.79	Diesel Oil	.85
Gasoline	.75	Lube Oil	.90
Glycerine	1.26	Turpentine	.87
Kerosene	.80	Water	1.00

OTHER ORIFICE SIZES (not on charts)

Using the C_V method for liquid flow, and using measured C_V data we can derive the following formula to calculate required orifice sizes.

$$d_L = \sqrt{\frac{1}{22.5}\frac{Q_L}{\sqrt{\Delta P}}}$$

Where:
d_L = diameter of unknown orifice (in.)
Q_L = required flow (gpm)

Example: Flow rate required = .5 GPM @ ΔP = 1.0 psi

$$d_L = \sqrt{\frac{1}{22.5}\frac{.5}{\sqrt{1}}} = .149 \text{ in. dia.}$$

Also, to obtain the C_V

$$C_{VL} = \frac{Q_L}{\sqrt{\Delta P}} = \frac{.5}{1} = .5$$

C_{VL} = the C_V for the orifice with diameter = d_L

PRESSURE CONVERSIONS

PSIG x **.0703** = Kg/CM^2
PSIG x **6.895** = KPA
PSIG x **.0689** = Bars
PSIG x **27.68** = In. H_2O

Example:
25 psig x 6.895 = 172.37 KPA

PSIG - pounds per square inch gage
Kg/CM^2 - kilograms per square centimeters
KPA - kilo pascals
Bar - unit of pressure equal to 1 atmospheric pressure at sea level
In-H_2O - pressure produced by 1" H_2O

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Metal Orifice Water Flow – Gallons/Minute

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	Orifice Diameter Inches	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019	0.020	0.021	0.022	0.023	0.024	0.025	0.026	0.027	0.028	0.029	0.031	0.032	0.033
	Size Number	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	31	32	33
	C_v	0.00035	0.0006	0.0009	0.0012	0.0015	0.0019	0.0025	0.0028	0.0034	0.0038	0.0043	0.0050	0.0055	0.0067	0.0073	0.0080	0.009	0.010	0.011	0.012	0.013	0.014	0.016	0.017	0.018	0.019	0.022	0.024	0.025
Supply Pressure – psig	1	0.00035	0.0006	0.0009	0.0012	0.0015	0.0019	0.0025	0.0028	0.0034	0.0038	0.0043	0.0050	0.0055	0.0067	0.0073	0.0080	0.009	0.010	0.011	0.012	0.013	0.014	0.016	0.017	0.018	0.019	0.022	0.024	0.025
	2	0.00049	0.0009	0.0012	0.0017	0.0021	0.0027	0.0035	0.0040	0.0048	0.0054	0.0061	0.0071	0.0078	0.0095	0.0103	0.0113	0.012	0.014	0.016	0.017	0.018	0.020	0.023	0.024	0.025	0.027	0.031	0.034	0.035
	3	0.00061	0.0011	0.0015	0.0021	0.0026	0.0033	0.0043	0.0048	0.0059	0.0066	0.0074	0.0087	0.0095	0.0116	0.0126	0.0139	0.015	0.017	0.019	0.021	0.023	0.024	0.028	0.029	0.031	0.033	0.038	0.042	0.043
	4	0.00070	0.0012	0.0017	0.0024	0.0030	0.0038	0.0050	0.0056	0.0068	0.0076	0.0086	0.0100	0.0110	0.0134	0.0146	0.0160	0.018	0.019	0.022	0.024	0.026	0.028	0.032	0.034	0.036	0.038	0.044	0.048	0.050
	5	0.00078	0.0014	0.0019	0.0027	0.0034	0.0042	0.0056	0.0063	0.0076	0.0085	0.0096	0.0112	0.0123	0.0150	0.0163	0.0179	0.020	0.021	0.025	0.027	0.029	0.031	0.036	0.038	0.040	0.042	0.049	0.054	0.056
	6	0.00086	0.0015	0.0021	0.0029	0.0037	0.0047	0.0061	0.0069	0.0083	0.0093	0.0105	0.0122	0.0135	0.0164	0.0179	0.0196	0.022	0.024	0.027	0.029	0.032	0.034	0.039	0.042	0.044	0.047	0.054	0.059	0.061
	7	0.00093	0.0016	0.0023	0.0032	0.0040	0.0050	0.0066	0.0074	0.0090	0.0101	0.0114	0.0132	0.0146	0.0177	0.0193	0.0212	0.023	0.025	0.029	0.032	0.034	0.037	0.042	0.045	0.048	0.050	0.058	0.063	0.066
	8	0.00099	0.0017	0.0024	0.0034	0.0042	0.0054	0.0071	0.0079	0.0096	0.0107	0.0122	0.0141	0.0156	0.0190	0.0206	0.0226	0.025	0.027	0.031	0.034	0.037	0.040	0.045	0.048	0.051	0.054	0.062	0.068	0.071
	9	0.00105	0.0018	0.0026	0.0036	0.0045	0.0057	0.0075	0.0084	0.0102	0.0114	0.0129	0.0150	0.0165	0.0201	0.0219	0.0240	0.026	0.029	0.033	0.036	0.039	0.042	0.048	0.051	0.054	0.057	0.066	0.072	0.075
	10	0.00111	0.0019	0.0027	0.0038	0.0047	0.0060	0.0079	0.0089	0.0108	0.0120	0.0136	0.0158	0.0174	0.0212	0.0231	0.0253	0.028	0.030	0.035	0.038	0.041	0.044	0.051	0.054	0.057	0.060	0.070	0.076	0.079
	15	0.00136	0.0024	0.0033	0.0046	0.0058	0.0074	0.0097	0.0108	0.0132	0.0147	0.0167	0.0194	0.0213	0.0259	0.0283	0.0310	0.034	0.037	0.043	0.046	0.050	0.054	0.062	0.066	0.070	0.074	0.085	0.093	0.097
	20	0.00157	0.0027	0.0038	0.0054	0.0067	0.0085	0.0112	0.0125	0.0152	0.0170	0.0192	0.0224	0.0246	0.0300	0.0326	0.0358	0.039	0.043	0.049	0.054	0.058	0.063	0.072	0.076	0.080	0.085	0.098	0.107	0.112
	30	0.00192	0.0033	0.0047	0.0066	0.0082	0.0104	0.0137	0.0153	0.0186	0.0208	0.0236	0.0274	0.0301	0.0367	0.0400	0.0438	0.048	0.053	0.060	0.066	0.071	0.077	0.088	0.093	0.099	0.104	0.120	0.131	0.137
	40	0.00221	0.0039	0.0054	0.0076	0.0095	0.0120	0.0158	0.0177	0.0215	0.0240	0.0272	0.0316	0.0348	0.0424	0.0462	0.0506	0.056	0.061	0.070	0.076	0.082	0.089	0.101	0.108	0.114	0.120	0.139	0.152	0.158
	50	0.00247	0.0043	0.0061	0.0085	0.0106	0.0134	0.0177	0.0198	0.0240	0.0269	0.0304	0.0354	0.0389	0.0474	0.0516	0.0566	0.062	0.068	0.078	0.085	0.092	0.099	0.113	0.120	0.127	0.134	0.156	0.170	0.177
	60	0.00271	0.0047	0.0067	0.0093	0.0116	0.0147	0.0194	0.0217	0.0263	0.0294	0.0333	0.0387	0.0426	0.0519	0.0565	0.0620	0.068	0.074	0.085	0.093	0.101	0.108	0.124	0.132	0.139	0.147	0.170	0.186	0.194
	70	0.00293	0.0051	0.0072	0.0100	0.0125	0.0159	0.0209	0.0234	0.0284	0.0318	0.0360	0.0418	0.0460	0.0561	0.0611	0.0669	0.074	0.080	0.092	0.100	0.109	0.117	0.134	0.142	0.151	0.159	0.184	0.201	0.209
	80	0.00313	0.0055	0.0077	0.0107	0.0134	0.0170	0.0224	0.0250	0.0304	0.0340	0.0385	0.0447	0.0492	0.0599	0.0653	0.0716	0.079	0.086	0.098	0.107	0.116	0.125	0.143	0.152	0.161	0.170	0.197	0.215	0.224
	90	0.00332	0.0058	0.0082	0.0114	0.0142	0.0180	0.0237	0.0266	0.0323	0.0360	0.0408	0.0474	0.0522	0.0636	0.0693	0.0759	0.083	0.091	0.104	0.114	0.123	0.133	0.152	0.161	0.171	0.180	0.209	0.228	0.237
	100	0.00350	0.0061	0.0086	0.0120	0.0150	0.0190	0.0250	0.0280	0.0340	0.0380	0.0430	0.0500	0.0550	0.0670	0.0730	0.0800	0.088	0.096	0.110	0.120	0.130	0.140	0.160	0.170	0.180	0.190	0.220	0.240	0.250

	Orifice Diameter Inches	0.035	0.037	0.038	0.039	0.04	0.041	0.042	0.043	0.047	0.052	0.055	0.06	0.063	0.067	0.07	0.073	0.076	0.079	0.081	0.086	0.089	0.094	0.096	0.1	0.104	0.109	0.113	0.12	0.125
	Size Number	35	37	38	39	40	41	42	43	47	52	55	60	63	67	70	73	76	79	81	86	89	94	96	100	104	109	113	120	125
	C_v	0.028	0.031	0.032	0.033	0.036	0.038	0.039	0.041	0.048	0.059	0.068	0.081	0.088	0.100	0.110	0.120	0.130	0.140	0.150	0.170	0.180	0.200	0.210	0.230	0.250	0.270	0.310	0.340	0.370
Supply Pressure – psig	1	0.028	0.031	0.032	0.033	0.036	0.038	0.039	0.041	0.048	0.059	0.068	0.081	0.088	0.100	0.110	0.120	0.130	0.140	0.150	0.170	0.180	0.200	0.210	0.230	0.250	0.270	0.310	0.340	0.370
	2	0.040	0.044	0.045	0.047	0.051	0.054	0.055	0.058	0.068	0.083	0.096	0.115	0.124	0.141	0.156	0.170	0.184	0.198	0.212	0.240	0.255	0.283	0.297	0.325	0.354	0.382	0.438	0.481	0.523
	3	0.048	0.054	0.055	0.057	0.062	0.066	0.068	0.071	0.083	0.102	0.118	0.140	0.152	0.173	0.191	0.208	0.225	0.242	0.260	0.294	0.312	0.346	0.364	0.398	0.433	0.468	0.537	0.589	0.641
	4	0.056	0.062	0.064	0.066	0.072	0.076	0.078	0.082	0.096	0.118	0.136	0.162	0.176	0.200	0.220	0.240	0.260	0.280	0.300	0.340	0.360	0.400	0.420	0.460	0.500	0.540	0.620	0.680	0.740
	5	0.063	0.069	0.072	0.074	0.080	0.085	0.087	0.092	0.107	0.132	0.152	0.181	0.197	0.224	0.246	0.268	0.291	0.313	0.335	0.380	0.402	0.447	0.470	0.514	0.559	0.604	0.693	0.760	0.827
	6	0.069	0.076	0.078	0.081	0.088	0.093	0.096	0.100	0.118	0.145	0.167	0.198	0.216	0.245	0.269	0.294	0.318	0.343	0.367	0.416	0.441	0.490	0.514	0.563	0.612	0.661	0.759	0.833	0.906
	7	0.074	0.082	0.085	0.087	0.095	0.101	0.103	0.108	0.127	0.156	0.180	0.214	0.233	0.265	0.291	0.317	0.344	0.370	0.397	0.450	0.476	0.529	0.556	0.609	0.661	0.714	0.820	0.900	0.979
	8	0.079	0.088	0.091	0.093	0.102	0.107	0.110	0.116	0.136	0.167	0.192	0.229	0.249	0.283	0.311	0.339	0.368	0.396	0.424	0.481	0.509	0.566	0.594	0.651	0.707	0.764	0.877	0.962	1.047
	9	0.084	0.093	0.096	0.099	0.108	0.114	0.117	0.123	0.144	0.177	0.204	0.243	0.264	0.300	0.330	0.360	0.390	0.420	0.450	0.510	0.540	0.600	0.630	0.690	0.750	0.810	0.930	1.020	1.110
	10	0.089	0.098	0.101	0.104	0.114	0.120	0.123	0.130	0.152	0.187	0.215	0.256	0.278	0.316	0.348	0.379	0.411	0.443	0.474	0.538	0.569	0.632	0.664	0.727	0.791	0.854	0.980	1.075	1.170
	15	0.108	0.120	0.124	0.128	0.139	0.147	0.151	0.159	0.186	0.229	0.263	0.314	0.341	0.387	0.426	0.465	0.503	0.542	0.581	0.658	0.697	0.775	0.813	0.891	0.968	1.046	1.201	1.317	1.433
	20	0.125	0.139	0.143	0.148	0.161	0.170	0.174	0.183	0.215	0.264	0.304	0.362	0.394	0.447	0.492	0.537	0.581	0.626	0.671	0.760	0.805	0.894	0.939	1.029	1.118	1.207	1.386	1.521	1.655
	30	0.153	0.170	0.175	0.181	0.197	0.208	0.214	0.225	0.263	0.323	0.372	0.444	0.482	0.548	0.602	0.657	0.712	0.767	0.822	0.931	0.986	1.095	1.150	1.260	1.369	1.479	1.698	1.862	2.027
	40	0.177	0.196	0.202	0.209	0.228	0.240	0.247	0.259	0.304	0.373	0.430	0.512	0.557	0.632	0.696	0.759	0.822	0.885	0.949	1.075	1.138	1.265	1.328	1.455	1.581	1.708	1.961	2.150	2.340
	50	0.198	0.219	0.226	0.233	0.255	0.269	0.276	0.290	0.339	0.417	0.481	0.573	0.622	0.707	0.778	0.849	0.919	0.990	1.061	1.202	1.273	1.414	1.485	1.626	1.768	1.909	2.192	2.404	2.616
	60	0.217	0.240	0.248	0.256	0.279	0.294	0.302	0.318	0.372	0.457	0.527	0.627	0.682	0.775	0.852	0.930	1.007	1.084	1.162	1.317	1.394	1.549	1.627	1.782	1.936	2.091	2.401	2.634	2.866
	70	0.234	0.259	0.268	0.276	0.301	0.318	0.326	0.343	0.402	0.494	0.569	0.678	0.736	0.837	0.920	1.004	1.088	1.171	1.255	1.422	1.506	1.673	1.757	1.924	2.092	2.259	2.594	2.845	3.096
	80	0.250	0.277	0.286	0.295	0.322	0.340	0.349	0.367	0.429	0.528	0.608	0.724	0.787	0.894	0.984	1.073	1.163	1.252	1.342	1.521	1.610	1.789	1.878	2.057	2.236	2.415	2.773	3.041	3.309
	90	0.266	0.294	0.304	0.313	0.342	0.360	0.370	0.389	0.455	0.560	0.645	0.768	0.835	0.949	1.044	1.138	1.233	1.328	1.423	1.613	1.708	1.897	1.992	2.182	2.372	2.561	2.941	3.226	3.510
	100	0.280	0.310	0.320	0.330	0.360	0.380	0.390	0.410	0.480	0.590	0.680	0.810	0.880	1.000	1.100	1.200	1.300	1.400	1.500	1.700	1.800	2.000	2.100	2.300	2.500	2.700	3.100	3.400	3.700

Above chart data calculated based on the C_v for each orifice. Flow = $C_v \sqrt{\Delta P}$. ΔP = differential pressure in psid. It is assumed that the region on either side of the orifice is fully flooded with no air pockets.

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Metal Orifice Water Flow – Liters/Minute

O'Keefe Controls Co.

If it's about precision, it's O'Keefe.

Orifice Diameter Inches		0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019	0.02	0.021	0.022	0.023	0.024	0.025	0.026	0.027	0.028	0.029	0.031	0.032	0.033
Size Number	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	31	32	33
C_v	0.00035	0.0006	0.0009	0.0012	0.0015	0.0019	0.0025	0.0028	0.0034	0.0038	0.0043	0.0050	0.0055	0.0067	0.0073	0.0080	0.009	0.010	0.011	0.012	0.013	0.014	0.016	0.017	0.018	0.019	0.022	0.024	0.025
Supply Pressure – psig 1	0.0013	0.0023	0.0033	0.0045	0.0057	0.0072	0.0095	0.0106	0.0129	0.0144	0.0163	0.0189	0.0208	0.0254	0.0276	0.0303	0.033	0.036	0.042	0.045	0.049	0.053	0.061	0.064	0.068	0.072	0.083	0.091	0.095
2	0.0019	0.0033	0.0046	0.0064	0.0080	0.0102	0.0134	0.0150	0.0182	0.0203	0.0230	0.0268	0.0294	0.0359	0.0391	0.0428	0.047	0.051	0.059	0.064	0.070	0.075	0.086	0.091	0.096	0.102	0.118	0.128	0.134
3	0.0023	0.0040	0.0056	0.0079	0.0098	0.0125	0.0164	0.0184	0.0223	0.0249	0.0282	0.0328	0.0361	0.0439	0.0479	0.0525	0.058	0.063	0.072	0.079	0.085	0.092	0.105	0.111	0.118	0.125	0.144	0.157	0.164
4	0.0026	0.0046	0.0065	0.0091	0.0114	0.0144	0.0189	0.0212	0.0257	0.0288	0.0326	0.0379	0.0416	0.0507	0.0553	0.0606	0.067	0.073	0.083	0.091	0.098	0.106	0.121	0.129	0.136	0.144	0.167	0.182	0.189
5	0.0030	0.0052	0.0073	0.0102	0.0127	0.0161	0.0212	0.0237	0.0288	0.0322	0.0364	0.0423	0.0466	0.0567	0.0618	0.0677	0.074	0.081	0.093	0.102	0.110	0.119	0.135	0.144	0.152	0.161	0.186	0.203	0.212
6	0.0032	0.0057	0.0080	0.0111	0.0139	0.0176	0.0232	0.0260	0.0315	0.0352	0.0399	0.0464	0.0510	0.0621	0.0677	0.0742	0.082	0.089	0.102	0.111	0.121	0.130	0.148	0.158	0.167	0.176	0.204	0.223	0.232
7	0.0035	0.0061	0.0086	0.0120	0.0150	0.0190	0.0250	0.0280	0.0341	0.0381	0.0431	0.0501	0.0551	0.0671	0.0731	0.0801	0.088	0.096	0.110	0.120	0.130	0.140	0.160	0.170	0.180	0.190	0.220	0.240	0.250
8	0.0037	0.0065	0.0092	0.0128	0.0161	0.0203	0.0268	0.0300	0.0364	0.0407	0.0460	0.0535	0.0589	0.0717	0.0782	0.0857	0.094	0.103	0.118	0.128	0.139	0.150	0.171	0.182	0.193	0.203	0.236	0.257	0.268
9	0.0040	0.0069	0.0098	0.0136	0.0170	0.0216	0.0284	0.0318	0.0386	0.0432	0.0488	0.0568	0.0625	0.0761	0.0829	0.0908	0.100	0.109	0.125	0.136	0.148	0.159	0.182	0.193	0.204	0.216	0.250	0.273	0.284
10	0.0042	0.0073	0.0103	0.0144	0.0180	0.0227	0.0299	0.0335	0.0407	0.0455	0.0515	0.0599	0.0658	0.0802	0.0874	0.0958	0.105	0.115	0.132	0.144	0.156	0.168	0.192	0.203	0.215	0.227	0.263	0.287	0.299
15	0.0051	0.0089	0.0126	0.0176	0.0220	0.0279	0.0367	0.0411	0.0498	0.0557	0.0630	0.0733	0.0806	0.0982	0.1070	0.1173	0.129	0.141	0.161	0.176	0.191	0.205	0.235	0.249	0.264	0.279	0.323	0.352	0.367
20	0.0059	0.0103	0.0146	0.0203	0.0254	0.0322	0.0423	0.0474	0.0576	0.0643	0.0728	0.0846	0.0931	0.1134	0.1236	0.1354	0.149	0.163	0.186	0.203	0.220	0.237	0.271	0.288	0.305	0.322	0.372	0.406	0.423
30	0.0073	0.0126	0.0178	0.0249	0.0311	0.0394	0.0518	0.0581	0.0705	0.0788	0.0892	0.1037	0.1140	0.1389	0.1514	0.1659	0.182	0.199	0.228	0.249	0.270	0.290	0.332	0.352	0.373	0.394	0.456	0.498	0.518
40	0.0084	0.0146	0.0206	0.0287	0.0359	0.0455	0.0599	0.0670	0.0814	0.0910	0.1029	0.1197	0.1317	0.1604	0.1748	0.1915	0.211	0.230	0.263	0.287	0.311	0.335	0.383	0.407	0.431	0.455	0.527	0.575	0.599
50	0.0094	0.0163	0.0230	0.0321	0.0402	0.0509	0.0669	0.0749	0.0910	0.1017	0.1151	0.1338	0.1472	0.1793	0.1954	0.2141	0.236	0.257	0.294	0.321	0.348	0.375	0.428	0.455	0.482	0.509	0.589	0.642	0.669
60	0.0103	0.0179	0.0252	0.0352	0.0440	0.0557	0.0733	0.0821	0.0997	0.1114	0.1261	0.1466	0.1613	0.1965	0.2140	0.2346	0.258	0.281	0.323	0.352	0.381	0.411	0.469	0.498	0.528	0.557	0.645	0.704	0.733
70	0.0111	0.0193	0.0272	0.0380	0.0475	0.0602	0.0792	0.0887	0.1077	0.1203	0.1362	0.1584	0.1742	0.2122	0.2312	0.2534	0.279	0.304	0.348	0.380	0.412	0.443	0.507	0.538	0.570	0.602	0.697	0.760	0.792
80	0.0119	0.0207	0.0291	0.0406	0.0508	0.0643	0.0846	0.0948	0.1151	0.1287	0.1456	0.1693	0.1862	0.2268	0.2472	0.2709	0.298	0.325	0.372	0.406	0.440	0.474	0.542	0.576	0.609	0.643	0.745	0.813	0.846
90	0.0126	0.0219	0.0309	0.0431	0.0539	0.0682	0.0898	0.1006	0.1221	0.1365	0.1544	0.1796	0.1975	0.2406	0.2622	0.2873	0.316	0.345	0.395	0.431	0.467	0.503	0.575	0.610	0.646	0.682	0.790	0.862	0.898
100	0.0132	0.0231	0.0326	0.0454	0.0568	0.0719	0.0946	0.1060	0.1287	0.1438	0.1628	0.1893	0.2082	0.2536	0.2763	0.3028	0.333	0.363	0.416	0.454	0.492	0.530	0.606	0.644	0.681	0.719	0.833	0.908	0.946

Orifice Diameter Inches	0.035	0.037	0.038	0.039	0.04	0.041	0.042	0.043	0.047	0.052	0.055	0.06	0.063	0.067	0.07	0.073	0.076	0.079	0.081	0.086	0.089	0.094	0.096	0.1	0.104	0.109	0.113	0.12	0.125
Size Number	35	37	38	39	40	41	42	43	47	52	55	60	63	67	70	73	76	79	81	86	89	94	96	100	104	109	113	120	125
C_v	0.028	0.031	0.032	0.033	0.036	0.038	0.039	0.041	0.048	0.059	0.068	0.081	0.088	0.100	0.110	0.120	0.130	0.140	0.150	0.170	0.180	0.200	0.210	0.230	0.250	0.270	0.310	0.340	0.370
Supply Pressure – psig 1	0.106	0.117	0.121	0.125	0.136	0.144	0.148	0.155	0.182	0.223	0.257	0.307	0.333	0.379	0.416	0.454	0.492	0.530	0.568	0.644	0.681	0.757	0.795	0.871	0.946	1.022	1.173	1.287	1.401
2	0.150	0.166	0.171	0.177	0.193	0.203	0.209	0.219	0.257	0.316	0.364	0.434	0.471	0.535	0.589	0.642	0.696	0.749	0.803	0.910	0.964	1.071	1.124	1.231	1.338	1.445	1.660	1.820	1.981
3	0.184	0.203	0.210	0.216	0.236	0.249	0.256	0.269	0.315	0.387	0.446	0.531	0.577	0.656	0.721	0.787	0.852	0.918	0.983	1.115	1.180	1.311	1.377	1.508	1.639	1.770	2.033	2.229	2.426
4	0.212	0.235	0.242	0.250	0.273	0.288	0.295	0.310	0.363	0.447	0.515	0.613	0.666	0.757	0.833	0.908	0.984	1.060	1.136	1.287	1.363	1.514	1.590	1.741	1.893	2.044	2.347	2.574	2.801
5	0.237	0.262	0.271	0.279	0.305	0.322	0.330	0.347	0.406	0.499	0.576	0.686	0.745	0.846	0.931	1.016	1.100	1.185	1.270	1.439	1.524	1.693	1.778	1.947	2.116	2.285	2.624	2.878	3.132
6	0.260	0.287	0.297	0.306	0.334	0.352	0.362	0.380	0.445	0.547	0.631	0.751	0.816	0.927	1.020	1.113	1.205	1.298	1.391	1.576	1.669	1.854	1.947	2.133	2.318	2.504	2.874	3.153	3.431
7	0.280	0.310	0.320	0.331	0.361	0.381	0.391	0.411	0.481	0.591	0.681	0.811	0.881	1.002	1.102	1.202	1.302	1.402	1.502	1.703	1.803	2.003	2.103	2.304	2.504	2.704	3.105	3.405	3.706
8	0.300	0.332	0.343	0.353	0.385	0.407	0.418	0.439	0.514	0.632	0.728	0.867	0.942	1.071	1.178	1.285	1.392	1.499	1.606	1.820	1.927	2.141	2.248	2.463	2.677	2.891	3.319	3.640	3.961
9	0.318	0.352	0.363	0.375	0.409	0.432	0.443	0.466	0.545	0.670	0.772	0.920	0.999	1.136	1.249	1.363	1.476	1.590	1.703	1.931	2.044	2.271	2.385	2.612	2.839	3.066	3.520	3.861	4.202
10	0.335	0.371	0.383	0.395	0.431	0.455	0.467	0.491	0.575	0.706	0.814	0.970	1.053	1.197	1.317	1.436	1.556	1.676	1.796	2.035	2.155	2.394	2.514	2.753	2.993	3.232	3.711	4.070	4.429
15	0.411	0.454	0.469	0.484	0.528	0.557	0.572	0.601	0.704	0.865	0.997	1.188	1.290	1.466	1.613	1.759	1.906	2.053	2.199	2.492	2.639	2.932	3.079	3.372	3.665	3.958	4.545	4.985	5.424
20	0.474	0.525	0.542	0.559	0.609	0.643	0.660	0.694	0.813	0.999	1.151	1.371	1.490	1.693	1.862	2.031	2.201	2.370	2.539	2.878	3.047	3.386	3.555	3.894	4.232	4.571	5.248	5.756	6.264
30	0.581	0.643	0.663	0.684	0.746	0.788	0.809	0.850	0.995	1.223	1.410	1.679	1.825	2.073	2.281	2.488	2.695	2.903	3.110	3.525	3.732	4.147	4.354	4.769	5.183	5.598	6.427	7.049	7.671
40	0.670	0.742	0.766	0.790	0.862	0.910	0.934	0.982	1.149	1.413	1.628	1.939	2.107	2.394	2.634	2.873	3.112	3.352	3.591	4.070	4.309	4.788	5.028	5.506	5.985	6.464	7.422	8.140	8.858
50	0.749	0.830	0.857	0.883	0.964	1.017	1.044	1.097	1.285	1.579	1.820	2.168	2.355	2.677	2.944	3.212	3.480	3.747	4.015	4.550	4.818	5.353	5.621	6.156	6.692	7.227	8.298	9.101	9.904
60	0.821	0.909	0.938	0.968	1.056	1.114	1.144	1.202	1.407	1.730	1.994	2.375	2.580	2.932	3.225	3.519	3.812	4.105	4.398	4.985	5.278	5.864	6.158	6.744	7.330	7.917	9.090	9.969	10.849
70	0.887	0.982	1.013	1.045	1.140	1.203	1.235	1.299	1.520	1.869	2.154	2.565	2.787	3.167	3.484	3.801	4.117	4.434	4.751	5.384	5.701	6.334	6.651	7.284	7.918	8.551	9.818	10.768	11.718
80	0.948	1.050	1.083	1.117	1.219	1.287	1.320	1.388	1.625	1.998	2.302	2.742	2.979	3.386	3.724	4.063	4.401	4.740	5.079	5.756	6.094	6.772	7.110	7.787	8.464	9.142	10.496	11.512	12.527
90	1.006	1.113	1.149	1.185	1.293	1.365	1.401	1.472	1.724	2.119	2.442	2.909	3.160	3.591	3.950	4.309	4.668	5.028	5.387	6.105	6.464	7.182	7.541	8.260	8.978	9.696	11.133	12.210	13.287
100	1.060	1.173	1.211	1.249	1.363	1.438	1.476	1.552	1.817	2.233	2.574	3.066	3.331	3.785	4.164	4.542	4.921	5.300	5.678	6.435	6.814	7.571	7.949	8.706	9.464	10.221	11.735	12.870	14.006

Above chart data calculated based on the C_v for each orifice. Flow = $3.875\ C_v \sqrt{\Delta P}$. ΔP = differential pressure in psid. It is assumed that the region on either side of the orifice is fully flooded with no air pockets.

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