$$\dot{m}_{Theoretical} = A_2\sqrt{\frac{2\rho(P_1 - P_2)}{1-\beta^4}} \qquad C_d = \frac{\dot{m}_{actual}}{\dot{m}_{Theoretical}}$$

$$C_d = 0.5959 + 0.0312\beta^{2.1} - 0.184\beta^8 + 0.0029\beta^{2.5}\left(\frac{10^6}{Re_D}\right)^{0.75} + 0.09L_1\beta^4(1-\beta^4)^{-1} - 0.0337L_2'\beta^3$$

Corner Tappings $L_1 = L_2' = 0$

$D - D/2$ Tappings $L_1 = 1.0 \;\; L_2' = 0.47$

Flange Tappings $L_1 = L_2' = \frac{25.4}{D \text{ in } mm}$

If $L_1 \geq \frac{0.039}{0.09} = 0.4333$ use 0.039 for the coefficient of $\beta^4(1-\beta^4)^{-1}$

$\frac{\Delta P_{Loss}}{\Delta P} = \frac{\sqrt{1-\beta^4(1-C_d^2)} - C_d\beta^2}{\sqrt{1-\beta^4(1-C_d^2)} + C_d\beta^2}$ **Orifice**	$For\ 15^o, \frac{\Delta P_{Loss}}{\Delta P} = 0.436 - 0.86\beta + 0.59\beta^2$ **Venturimeter**
$For\ 7^o, \frac{\Delta P_{Loss}}{\Delta P} = 0.218 - 0.42\beta + 0.38\beta^2$ **Venturimeter**	$\frac{\Delta P_{Loss}}{\Delta P} = 1 + 0.014\beta - 2.06\beta^2 + 1.18\beta^3$ **Nozzle**
$\varepsilon = \sqrt{\frac{\frac{\gamma}{\gamma-1}(1-\beta^4)\frac{1}{1-\frac{P_2}{P_1}}\left[\left(\frac{P_2}{P_1}\right)^{\frac{2}{\gamma}} - \left(\frac{P_2}{P_1}\right)^{\frac{\gamma+1}{\gamma}}\right]}{1-\beta^4\left(\frac{P_2}{P_1}\right)^{\frac{2}{\gamma}}}}$	$\varepsilon = 1 - (0.41 + 0.35\beta^4)\frac{1}{\gamma}\left(1 - \frac{P_2}{P_1}\right)$
$\dot{Q} = \frac{\pi D^4}{128\mu L}\Delta p$ **Laminar flow meter**	$\dot{Q} = (A_t - A_b)\sqrt{\frac{2V_b g}{C_D A_b}\left(\frac{\rho_b}{\rho} - 1\right)}$ **Rotameter**
$\dot{Q} = \bar{U}\frac{\pi D^2}{4} = \frac{e}{BL}\frac{\pi D^2}{4} = K_1 e$ **Electromagnetic flowmeter**	
$f_{X,\sigma}(x) = \frac{1}{\sigma\sqrt{2\pi}}e^{-\frac{(x-X)^2}{2\sigma^2}}$ **Normal distribution curve**	

$z_1 = \frac{x_1 - x'}{\sigma}$	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1809	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2794	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4292	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4758	0.4761	0.4767
2.0	0.4772	0.4778	0.4803	0.4788	0.4793	0.4799	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.49865	0.4987	0.4987	0.4988	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990