Calculation

Table 1: Inherent Characteristics

Voltage (v)	Opening fraction	Flow rate (LPH)	Flow rate (m3/s)	Flow fraction Q_frac	ΔP (mmHg)	ΔP (N/m^2)	y = Q*sqrt(rho/ΔP)	ln(y)	Predcted y	Predicted Fractional Flow Rate	%Error
5	1	296	8.22222E-05	1.000	24	3199.74	4.59655E-05	-9.99	4.76037E-05	1.000	3.564
4.8	0.96	269	7.47222E-05	0.909	24	3199.74	4.17727E-05	-10.08	4.05516E-05	0.852	2.923
4.6	0.92	225	0.0000625	0.760	24	3199.74	3.494E-05	-10.26	3.45442E-05	0.726	1.133
4.4	0.88	193	5.36111E-05	0.652	24	3199.74	2.99708E-05	-10.42	2.94267E-05	0.618	1.815
4.2	0.84	156	4.33333E-05	0.527	24	3199.74	2.42251E-05	-10.63	2.50674E-05	0.527	3.477
4	0.8	137	3.80556E-05	0.463	24	3199.74	2.12746E-05	-10.76	2.13538E-05	0.449	0.372
3.8	0.76	119	3.30556E-05	0.402	24	3199.74	1.84794E-05	-10.90	1.81904E-05	0.382	1.564
3.6	0.72	100	2.77778E-05	0.338	24	3199.74	1.55289E-05	-11.07	1.54956E-05	0.326	0.214
3.4	0.68	85	2.36111E-05	0.287	24	3199.74	1.31996E-05	-11.24	1.32001E-05	0.277	0.004
3.2	0.64	75	2.08333E-05	0.253	24	3199.74	1.16467E-05	-11.36	1.12446E-05	0.236	3.452
3	0.6	59.5	1.65278E-05	0.201	24	3199.74	9.23969E-06	-11.59	9.57878E-06	0.201	3.670

Table 2: Inherent Characteristics

Voltage (v)	Opening fraction	Flow rate (LPH)	Flow rate (m3 /s)	Flow fraction Q_frac	ΔP (mm Hg)	ΔP (N/m ^2)	y = Q*sqrt(rho/Δ	ln(y)	Predicted y	Predicted Fractional Flow Rate	%ErrorP)
3	0.6	59.5	1.65278E-05	0.202	24	3199.74	9.23969E-06	-11.59	9.58223E-06	0.210	3.707
3.2	0.64	74	2.05556E-05	0.251	24	3199.74	1.14914E-05	-11.37	1.12018E-05	0.245	2.520
3.4	0.68	87	2.41667E-05	0.295	24	3199.74	1.35101E-05	-11.21	1.3095E-05	0.287	3.073
3.6	0.72	98	2.72222E-05	0.332	24	3199.74	1.52183E-05	-11.09	1.53082E-05	0.335	0.591
3.8	0.76	119	3.30556E-05	0.403	24	3199.74	1.84794E-05	-10.90	1.78955E-05	0.392	3.159
4	0.8	130	3.61111E-05	0.441	24	3199.74	2.01876E-05	-10.81	2.09201E-05	0.458	3.629
4.2	0.84	152	4.22222E-05	0.515	24	3199.74	2.36039E-05	-10.65	2.44559E-05	0.535	3.609
4.4	0.88	185	5.13889E-05	0.627	24	3199.74	2.87284E-05	-10.46	2.85892E-05	0.626	0.485
4.6	0.92	218	6.05556E-05	0.739	24	3199.74	3.3853E-05	-10.29	3.34212E-05	0.732	1.275
4.8	0.96	252	0.00007	0.854	24	3199.74	3.91328E-05	-10.15	3.90698E-05	0.855	0.161
5	1	295	8.19444E-05	1.000	24	3199.74	4.58102E-05	-9.99	4.56731E-05	1.000	0.299

Table 3: Installed Characteristics

Voltage (v)	Opening fraction	Flow rate (LPH)	Flow rate (m3 /s)	Flow fraction Q_frac	ΔP (mmHg)	ΔP (N/m^2)	y = Q*sqrt(rho/ΔP)	ln(y)	Predicted y	Predicted Fractional Flow Rate	%Error
5	1	300	8.33333E-05	1.00	23	3066.41	4.75886E-05	-9.95	4.54136E-05	1.000	4.57
4.8	0.96	280	7.77778E-05	0.93	30	3999.67	3.88905E-05	-10.15	3.88784E-05	0.856	0.03
4.6	0.92	270	0.000075	0.90	35	4666.28	3.47197E-05	-10.27	3.32837E-05	0.733	4.14
4.4	0.88	252	0.00007	0.84	42	5599.54	2.95816E-05	-10.43	2.8494E-05	0.627	3.68
4.2	0.84	236	6.55556E-05	0.79	48	6399.47	2.59142E-05	-10.56	2.43936E-05	0.537	5.87
4	0.8	217	6.02778E-05	0.72	55	7332.73	2.226E-05	-10.71	2.08833E-05	0.460	6.18
3.8	0.76	195	5.41667E-05	0.65	63	8399.31	1.869E-05	-10.89	1.78781E-05	0.394	4.34
3.6	0.72	176	4.88889E-05	0.59	70	9332.57	1.60033E-05	-11.04	1.53054E-05	0.337	4.36
3.4	0.68	158	4.38889E-05	0.53	76	10132.50	1.37878E-05	-11.19	1.31029E-05	0.289	4.97
3.2	0.64	137	3.80556E-05	0.46	82	10932.43	1.15096E-05	-11.37	1.12174E-05	0.247	2.54
3	0.6	121	3.36111E-05	0.40	88	11732.37	9.81273E-06	-11.53	9.60314E-06	0.211	2.14

Table 4: Installed Characteristics

Voltage (v)	Opening fraction	Flow rate (LPH)	Flow rate (m3 /s)	Flow fraction Q_frac	ΔP (mmHg)	ΔP (N/m^2)	y = Q*sqrt(rho/ΔP)	ln(y)	Predicted y	Predicted Fractional Flow Rate	%Error
3	0.6	121	3.36111E-05	0.41	88	11732.37	9.81273E-06	-11.53	9.92474E-06	0.211	1.14
3.2	0.64	136	3.77778E-05	0.46	83	11065.76	1.13565E-05	-11.39	1.1593E-05	0.247	2.08
3.4	0.68	155	4.30556E-05	0.52	75	9999.18	1.36159E-05	-11.20	1.35416E-05	0.289	0.55
3.6	0.72	175	4.86111E-05	0.59	69	9199.24	1.60273E-05	-11.04	1.58178E-05	0.337	1.31
3.8	0.76	198	0.000055	0.67	63	8399.31	1.89776E-05	-10.87	1.84766E-05	0.394	2.64
4	0.8	214	5.94444E-05	0.72	59	7866.02	2.1195E-05	-10.76	2.15822E-05	0.460	1.83
4.2	0.84	236	6.55556E-05	0.80	50	6666.12	2.53906E-05	-10.58	2.52099E-05	0.537	0.71
4.4	0.88	257	7.13889E-05	0.87	41	5466.22	3.05342E-05	-10.40	2.94474E-05	0.627	3.56
4.6	0.92	269	7.47222E-05	0.91	36	4799.61	3.41073E-05	-10.29	3.43972E-05	0.733	0.85
4.8	0.96	283	7.86111E-05	0.96	29	3866.35	3.99791E-05	-10.13	4.01789E-05	0.856	0.50
5	1	296	8.22222E-05	1.00	24	3199.74	4.59655E-05	-9.99	4.69325E-05	1.000	2.10

Table 5: Installed Characteristics for y=ax^b

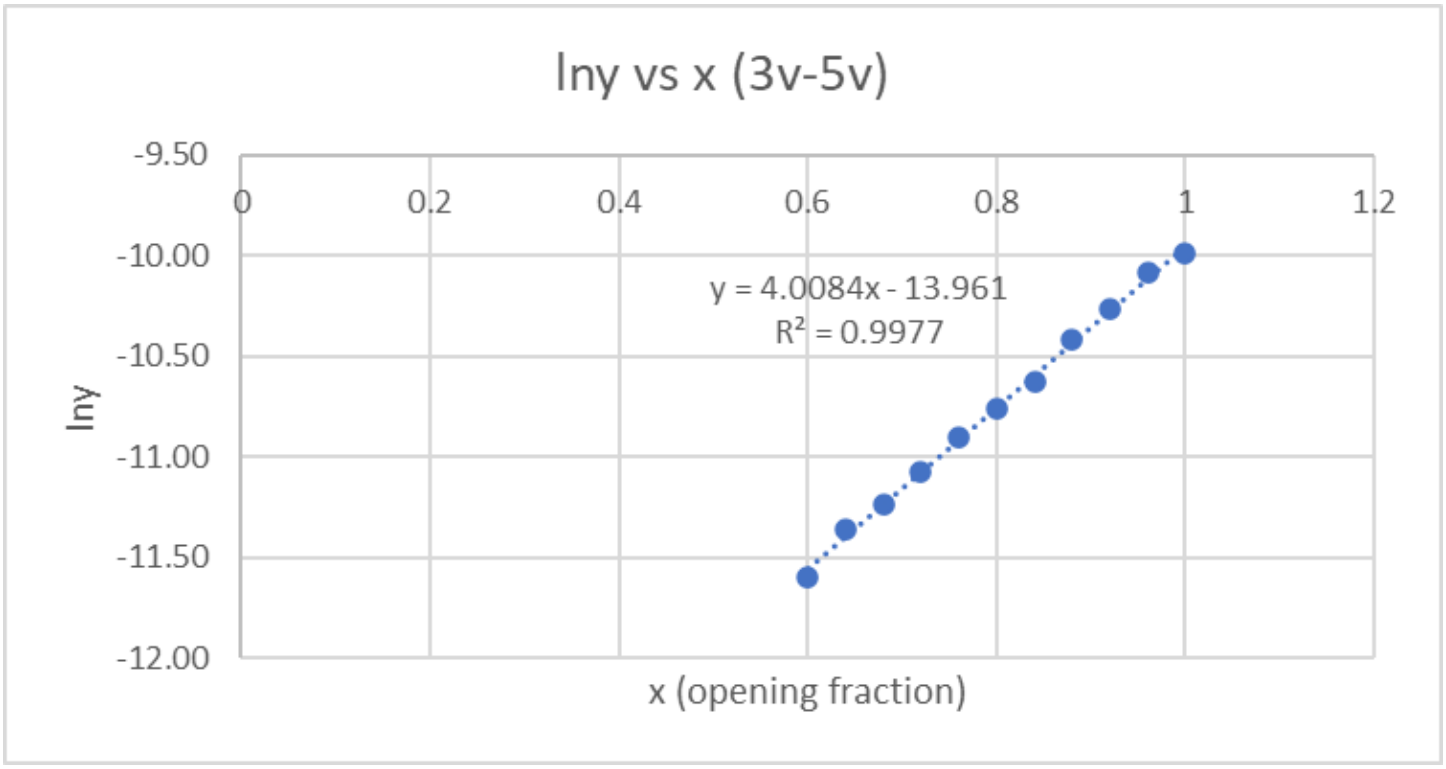
Also Corresponding to the values of Table 3:

ln(y)	ln(x)	Predicted y	%Error in y
-9.9529	0	4.97898E-05	4.62543
-10.155	-0.0408	4.42215E-05	13.7077
-10.268	-0.0834	3.90781E-05	12.5531
-10.428	-0.1278	3.43436E-05	16.0979
-10.561	-0.1744	3.00019E-05	15.7742
-10.713	-0.2231	2.60368E-05	16.967
-10.888	-0.2744	2.2432E-05	20.0212
-11.043	-0.3285	1.91712E-05	19.7951
-11.192	-0.3857	1.62379E-05	17.7694
-11.372	-0.4463	1.36156E-05	18.2975
-11.532	-0.5108	1.12876E-05	15.0306
		Mean Error=	15.5126

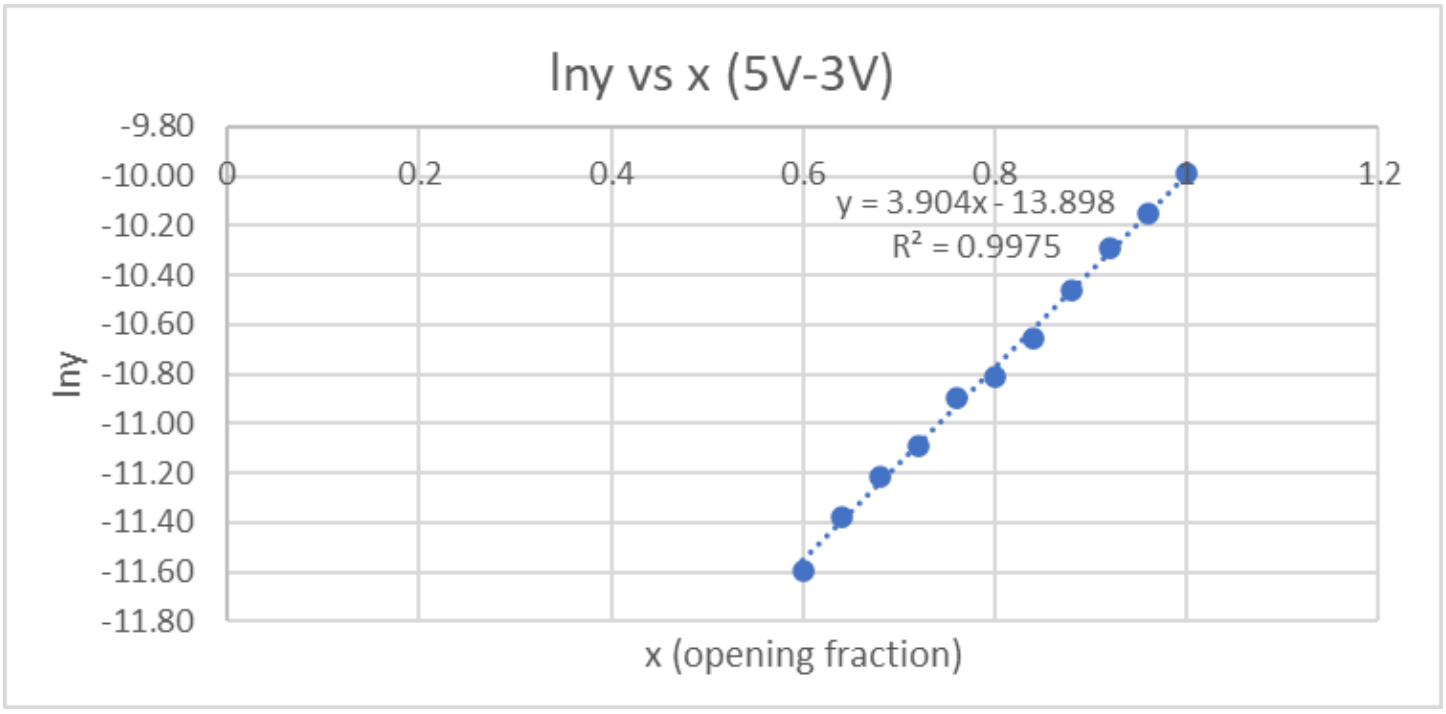
A regression model was fit for y = ax^b

Plots

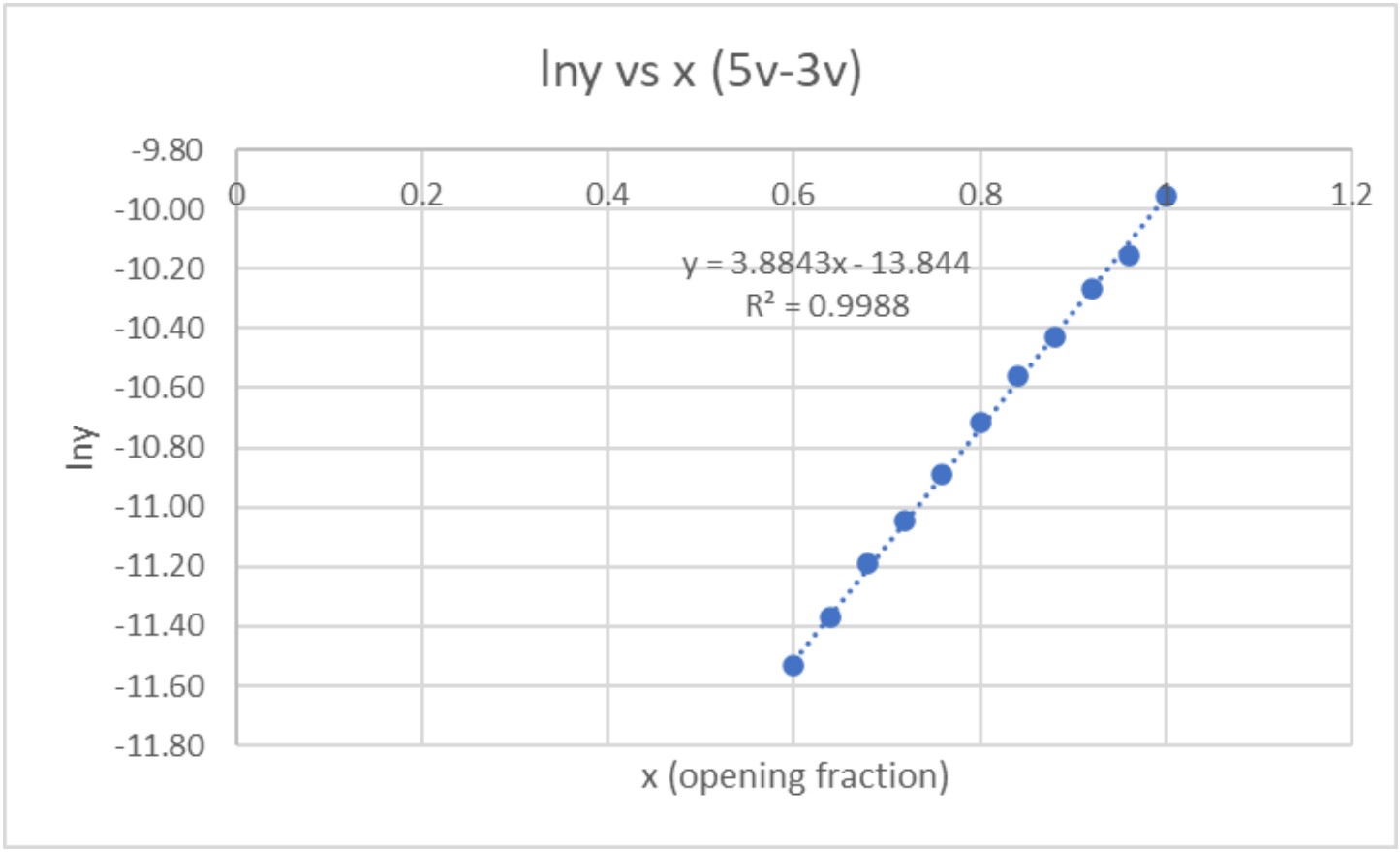
Corresponding with Table1: For inherent Characteristics



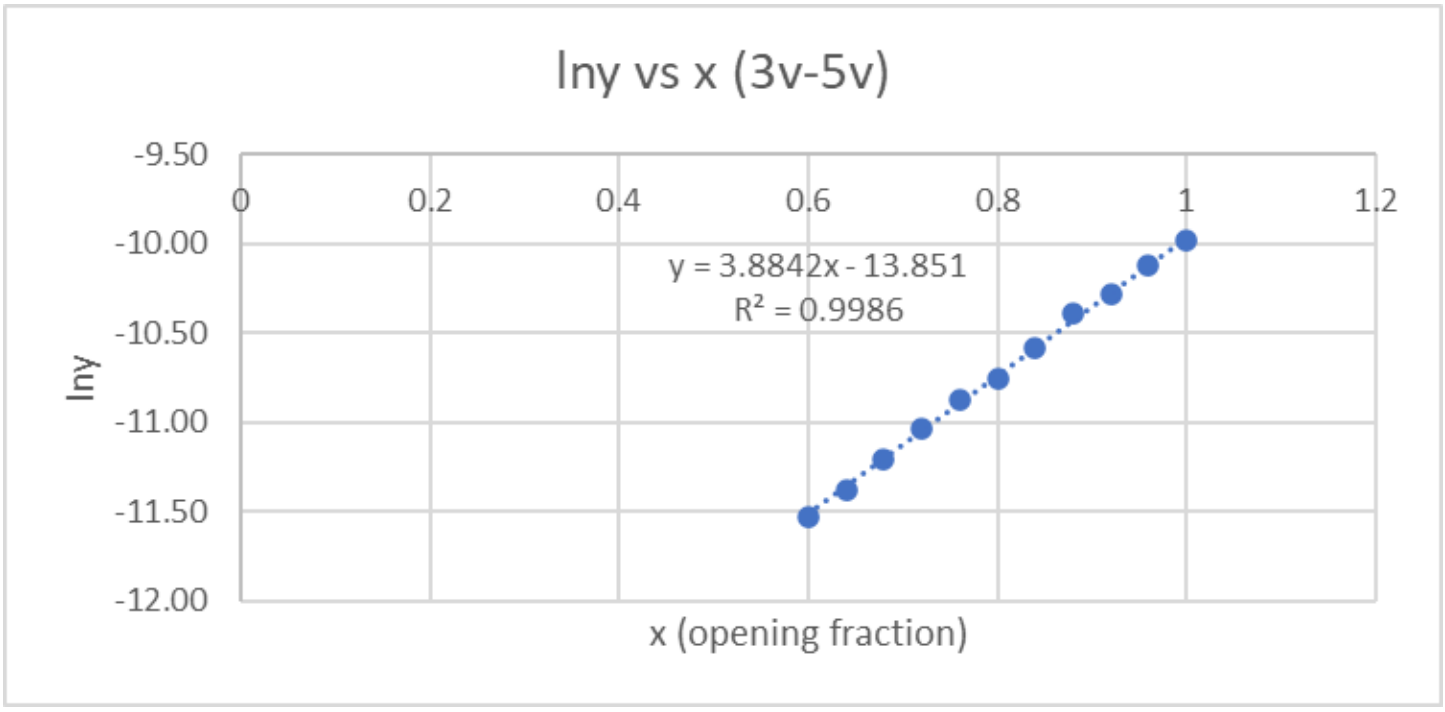
Corresponding with Table 2: For inherent Characteristics



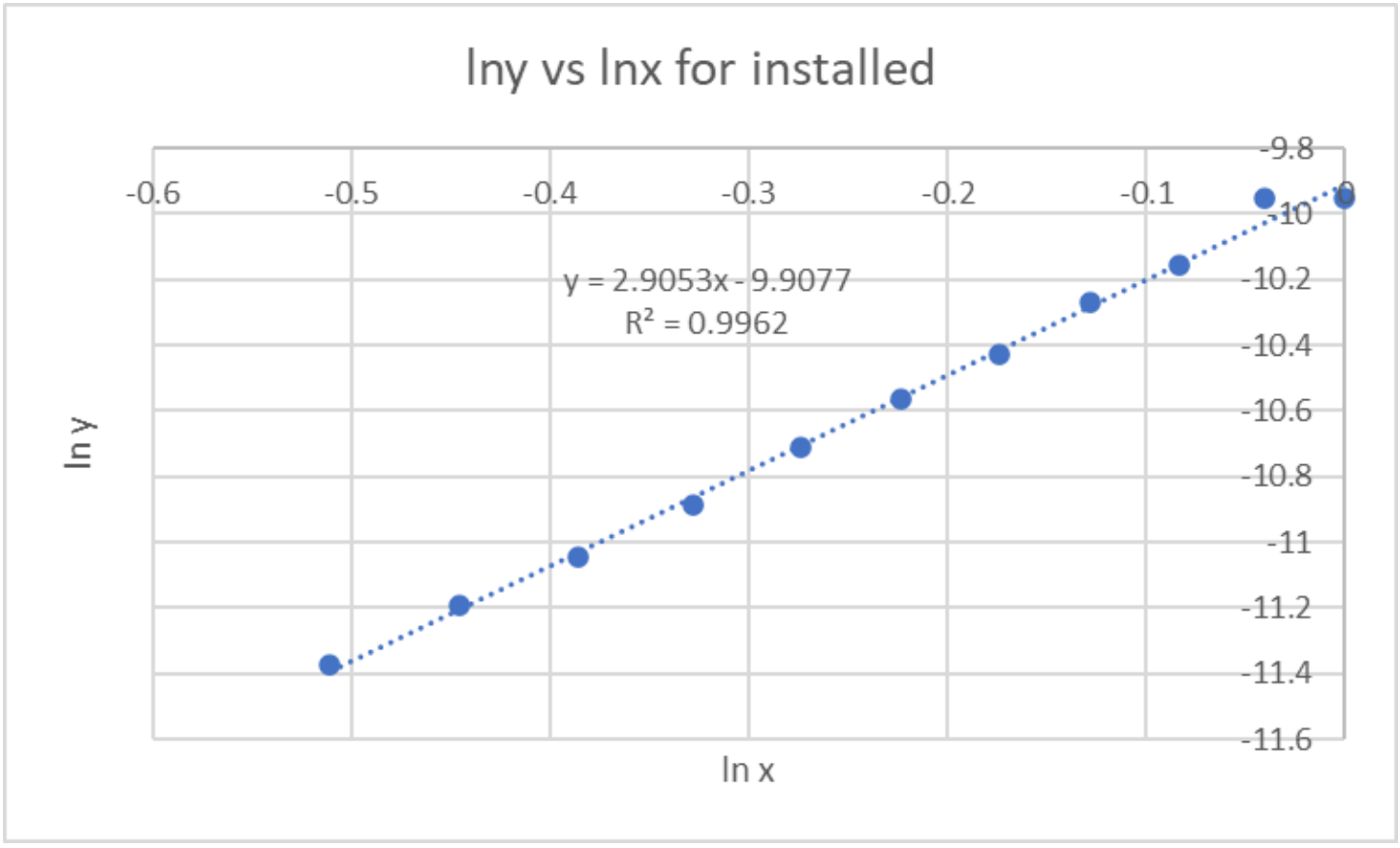
Corresponding with Table 3: For Installed Characteristics

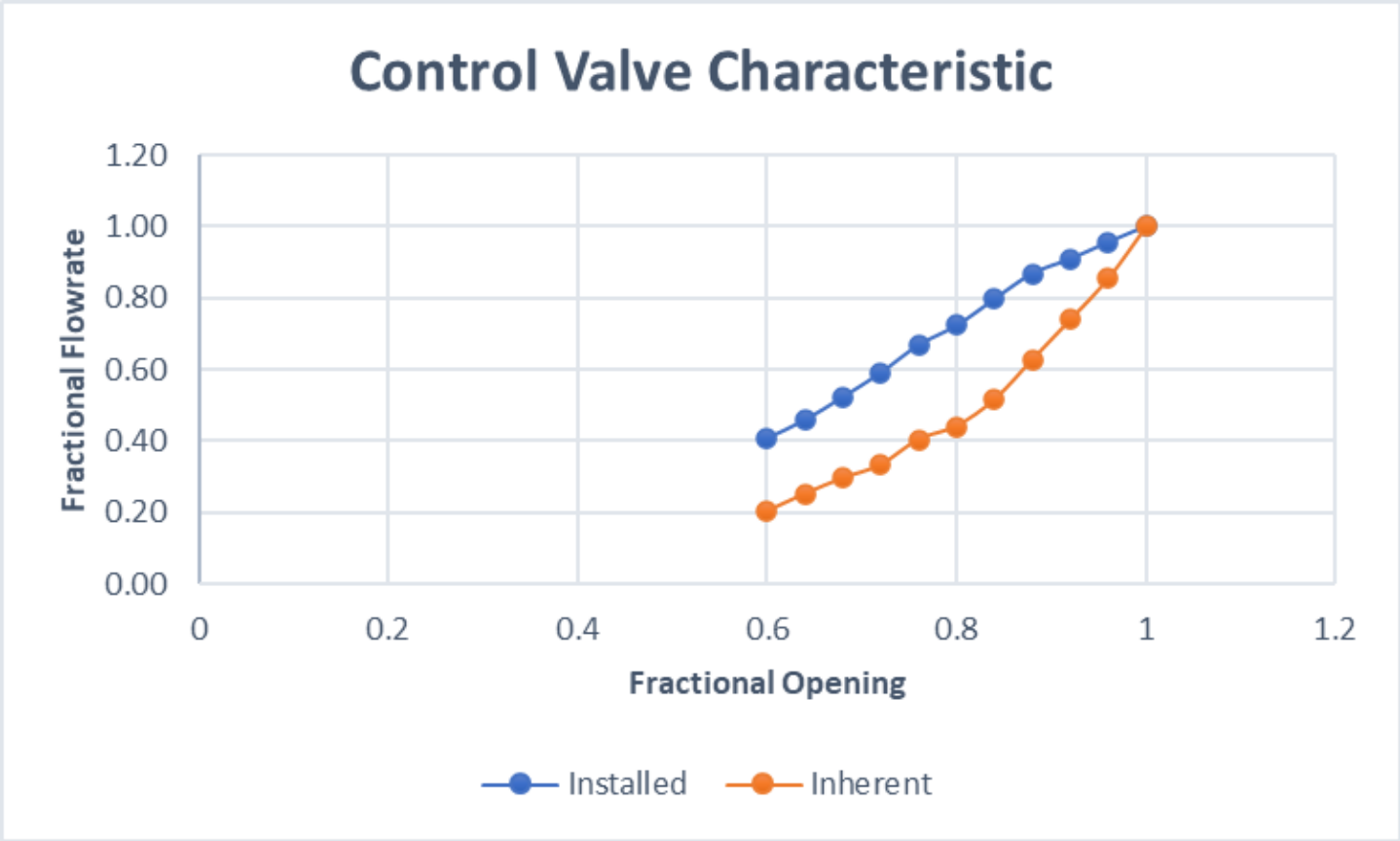


Corresponding with Table 4: For Installed Characteristics



Corresponding to Table 5: for y = ax^b





Plot for corresponding 3v - 5v values

Observations & Conclusions.

With maximum error lying well under 10% the model for equal % value was validated.

as eqn : $(4.71 \times 10^{-5})(51.7)^{n-1} \sqrt{\Delta P / \rho}$

The model for equal % valve was used to fit the data obtained while studying the inherent characteristics.

It was observed that the model was able to predict the installed characteristics of the control valve.