Appendix J: Hydraulic Analysis

Appendices

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Preliminary Water System Hydraulic Analysis

Date: July 9, 2024

For: City of Brea
Water Division

By: Katie O'Connor, P.E.
Hunsaker & Associates Irvine, Inc.

Project: **Greenbriar**

Hunsaker & Associates Irvine, Inc. (H&A) is pleased to submit the Preliminary Water System Hydraulic Analysis for the Greenbriar project. This analysis has been prepared to describe the proposed water system for the aforementioned multifamily and high-density residential development project in the City of Brea. The project lies within the jurisdiction of the City of Brea and their standards have been used for this report. Hydraulic models were prepared using Haestad Methods software to model various flows during steady state conditions.

THE PRELIMINARY PROPOSED WATER SYSTEM FOR THE GREENBRIAR PROJECT MEETS THE DESIGN STANDARDS SPECIFIED BY THE CITY OF BREA. This evaluation is based on existing and known conditions and should be re-evaluated if these conditions change or new information becomes available. Any interpretation of the information presented in this report should be referred to H&A to ensure the integrity of the results.

Project Location

The Greenbriar project is located south of Greenbriar Lane and west of Associated Road in the City of Brea. The project location is shown on exhibit entitled, “Domestic Water Model Exhibit– Figure 1.”

Summary of Findings

1. The development will include 99 multifamily residential units and 80 high density residential units on approximately 9.5 acres.

2. Water supply is provided by the City of Brea through an existing water system. The Static Hydraulic grade was assumed to be 550 feet based on a fire hydrant flow test on Associate Road at Eucalyptus Lane and 531 feet based on a fire hydrant flow test on Greenbriar Lane, included in the Appendix.

3. The proposed onsite private water system consists of 4 and 8-inch diameter water mains and includes four connections to the City of Brea water mains surrounding the project. The four points of connection are located on Greenbriar Lane. Each entrance to the site has a domestic water connection with a 4-inch water meter and reduced pressure zone backflow assembly for domestic flows and a fire water connection with a 8-inch double check detector assembly. Proposed and existing water mains are identified on the attach water system schematic exhibit entitled “Domestic Water Model Exhibit– Figure 1.”

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4. Although the proposed water system is a private system, at the direction of the City of Brea Water Department, public demands and criteria were used to design the water system. Additionally, at the direction of the City Engineer, the existing onsite 12-inch water main that extends from Greenbriar Lane to Brea Plaza is to be removed and the connection to Brea Plaza through the site will not be restored. Brea Plaza is a private looped system and will be provided with a point of connection to the existing water main in Associated Road.

5. H&A estimated the flow constant "K" using Affinity Laws to determine the HGL of the water supply at static, peak hour demands, maximum day, and maximum day demands plus fire flow events. The flow constant for this water system is $K = Q / H_f^{\wedge 0.54}$ where H_f is the difference (in feet) of the measured static and residual pressure at the test flow. The "K" value for the water system is estimated to be **183** based on the fire flow test on Associated Road and **142** based on the fire flow test on Greenbriar Lane. Fire flow tests and calculations are included in the Appendix.

6. In order to calculate the pipe sizes, velocities and available pressure of the proposed water system for Greenbriar, we have prepared a hydraulic model using WaterCad by Haestad Methods. The summary of outputs from the model runs are included in the Appendix of this report.

7. The proposed water system provides pressures greater than 40 psi for all nodes during peak hour demands. The minimum in-track peak hour pressure experienced was **76 psi** with an estimated HGL of 531 feet at the fire flow test hydrant on Greenbriar Lane and 550 feet at the fire flow test on Associated Road. The following table summarizes the peak hour model run:

Table 1 – Summary of Peak Hour Model Run

Total Flow (gpm)	Minimum in-tract Residual Pressure	
	(node)	(psi)
49	J-57	**76**

8. Fire flow requirement was taken from 2022 California Fire Code (CFC), Brea Fire Department requirement, and the Orange County Fire Authority (OCFA) Fire Master Plans for commercial and Residential Developments. Fire flow requirement is based on the largest building size and construction type. The CFC, Brea Fire Department, and OCFA allows a 50% reduction for automatic sprinkler systems. The adjusted fire flow requirement is shown below:

Table 2 – Fire Flows Used for Model

Construction Type	Fire Flow
Type V-B – with automatic sprinkler system	2000 gpm

9. The proposed water system provides pressures greater than 20 psi during maximum day demands plus 2000 gpm fire flow events as required by the CFC, Brea Fire Department, and OCFA. The minimum residual pressure experience for the worst-case 2000 gpm fire flow event was **35 psi** with an estimated HGL

of 465 feet at the fire flow test hydrant on Associated Road and 394 feet at the fire flow test hydrant on Greenbriar Land. The following table summarizes the MDD plus Fire Flow events:

Table 3 - Summary of Worst Case Fire Flow Model Runs

Fire Flow Node	Node Elevation	MDD+FF at Node	Node HGL	Residual Pressure
Max Day Demand + 2000 gpm Fire Flow				
J-73	342 ft	1500 gpm	422 ft	**35 psi**
J-92	343 ft	500 gpm	425 ft	**36 psi**

We sincerely trust these calculations will provide sufficient evidence that the proposed water system is adequate for the proposed Greenbriar development. Please contact me at (949) 458-5437 if you have any questions.

KO
Enclosures
xc: Gary Jones, Lennar
Peter Carlson, CSLS
Kamal Karam, H&A
Sean Sanson, H&A

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MATCHLINE~ SEE SHEET 2

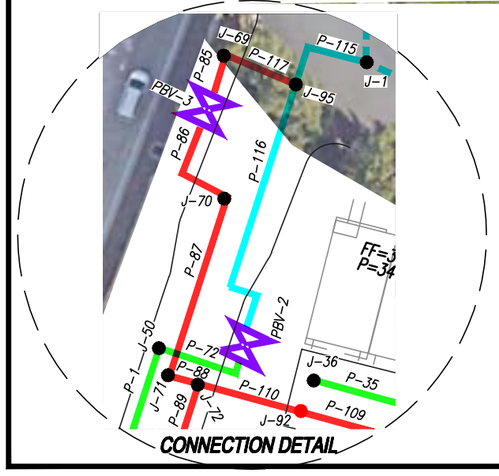
CONNECTION DETAIL ~ SEE BELOW LEFT

CA-57

GREENBRIAR LANE

ASSOCIATED RD

MATCHLINE~ SEE SHEET 2



LEGEND

- J-# — LOCATION OF MODELED PROPOSED FIRE FLOW
- MODELED RESERVOIR
- J-# — MODEL NODE/ JUNCTION
- PBV-# — MODELED METER & BACKFLOW ASSEMBLY
- P-# — PROPOSED 4" PRIVATE DOMESTIC WATER MAINS & PIPE NUMBER
- P-# — PROPOSED 8" PUBLIC DOMESTIC WATER MAINS & PIPE NUMBER
- P-# — EXISTING 8" PUBLIC DOMESTIC WATER MAINS & PIPE NUMBER
- P-# — PROPOSED 8" PRIVATE FIRE WATER MAINS & PIPE NUMBER

PREPARED FOR:

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2000 FIVEPOINT, 3RD FLOOR
IRVINE, CA 92618

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GREENBRIAR
DOMESTIC WATER MODEL EXHIBIT

WO NO. 3916-89X | DATE: 9 JULY 2024

FIGURE 1 SHT 1 OF 2

PLOTTED BY: katieo DATE: Jul. 09, 2024 TIME: 12:38 PM
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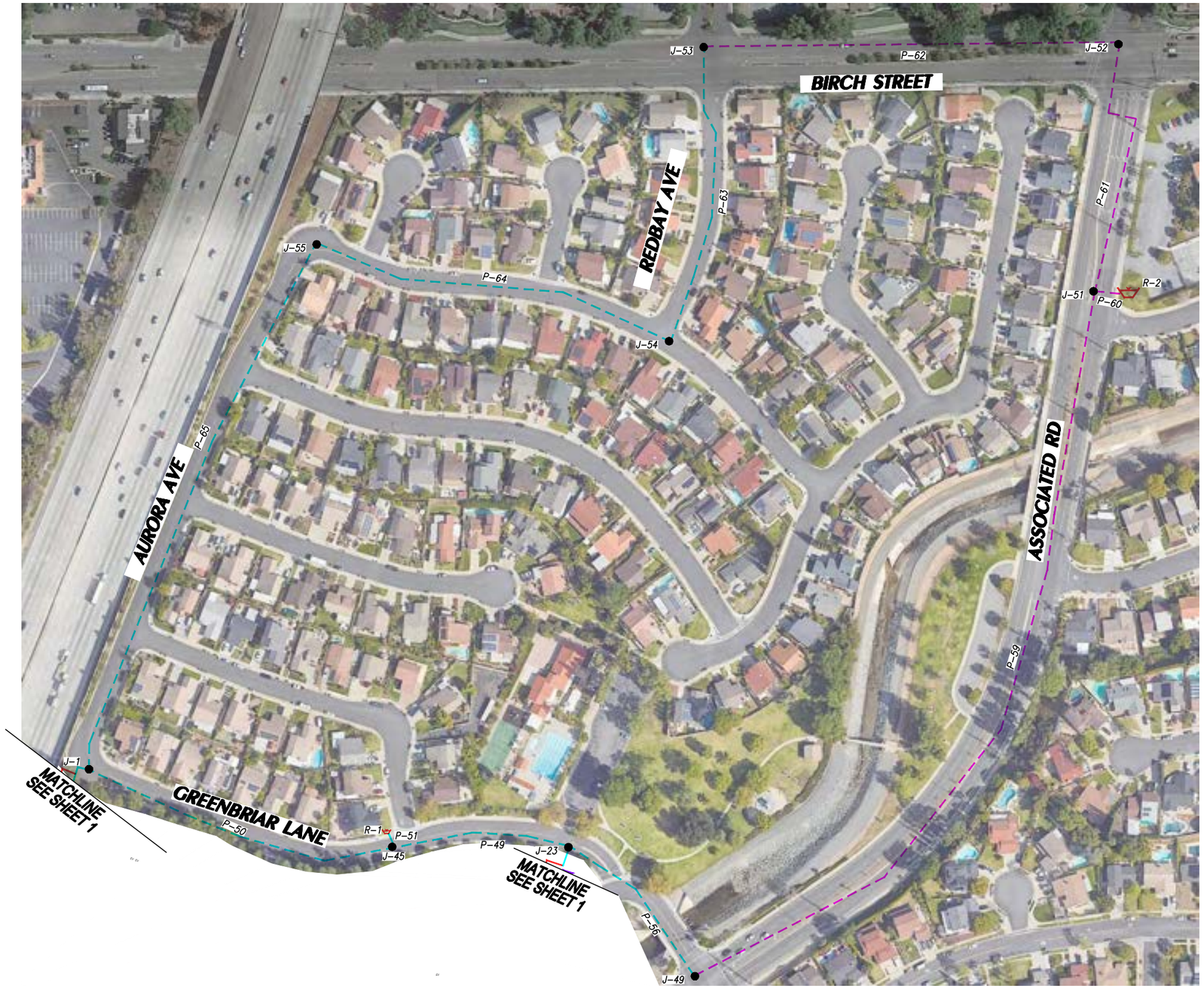

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GREENBRIAR DOMESTIC WATER MODEL EXHIBIT

WO NO. 3916-89X | DATE: 9 JULY 2024

FIGURE 1 SHT 2 OF 2

PLOTTED BY: katieo DATE: Jul. 09, 2024 TIME: 12:44 PM

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APPENDIX

GREENBRIAR WATER DEMAND SUMMARY

LAND USE	AREA (acres)	DUTY FACTOR (gpm/acre)	ADD (gpm)	MDD = 1.59*add (gpm)	PHD = 3*ADD (gpm)	NUMBER OF UNITS/ BUILDINGS*	ADD gpm/unit	MDD gpm/unit	PHD gpm/unit
Multi-family (MF)	5.66	1.44	8.15	12.96	24.45	99	0.08	0.13	0.25
High Density* (HD)	3.84	2.14	8.22	13.07	24.65	16	0.51	0.82	1.54
TOTAL	9.5		16.37	26.03	49.10				

*High Density Residential is classified by buildings

WATER DEMAND

DOMESTIC WATER NODE	NUMBER OF UNITS/ BUILDINGS	LAND USE	Duty Factor	ADD gpm	MDD gpm	PHD gpm
J- 1						
J- 2						
J- 3						
J- 4						
J- 5						
J- 6						
J- 7						
J- 8						
J- 9						
J- 10						
J- 11						
J- 12						
J- 13						
J- 14						
J- 15						
J- 16						
J- 17						
J- 18						
J- 19						
J- 20						
J- 21						
J- 22						
J- 23						
J- 24	4	MF	0.08	0.33	0.52	0.99
J- 25	9	MF	0.08	0.74	1.18	2.22
J- 26						
J- 27	4	MF	0.08	0.33	0.52	0.99
J- 28	4	MF	0.08	0.33	0.52	0.99
J- 29						
J- 30	4	MF	0.08	0.33	0.52	0.99
J- 31						
J- 32	4	MF	0.08	0.33	0.52	0.99
J- 33						
J- 34	3	MF	0.08	0.25	0.39	0.74
J- 35	4	MF	0.08	0.33	0.52	0.99
J- 36	4	MF	0.08	0.33	0.52	0.99
J- 37	5	MF	0.08	0.41	0.65	1.23
J- 38	10	MF	0.08	0.82	1.31	2.47
J- 40	4	MF	0.08	0.33	0.52	0.99
J- 41	9	MF	0.08	0.74	1.18	2.22
J- 42	9	MF	0.08	0.74	1.18	2.22
J- 43	8	MF	0.08	0.66	1.05	1.98
J- 44	7	MF	0.08	0.58	0.92	1.73
J- 45						
J- 49						
J- 50						
J- 51						
J- 52						
J- 53						
J- 54						
J- 55						

DOMESTIC WATER NODE	NUMBER OF UNITS/ BUILDINGS	LAND USE	Duty Factor	ADD gpm	MDD gpm	PHD gpm
J- 56	2	HD	0.51	1.03	1.63	3.08
J- 57	2	HD	0.51	1.03	1.63	3.08
J- 58	2	HD	0.51	1.03	1.63	3.08
J- 59	2	HD	0.51	1.03	1.63	3.08
J- 60	2	HD	0.51	1.03	1.63	3.08
J- 61						
J- 62	2	HD	0.51	1.03	1.63	3.08
J- 63						
J- 64	2	HD	0.51	1.03	1.63	3.08
J- 65	2	HD	0.51	1.03	1.63	3.08
J- 66	4	MF	0.08	0.33	0.52	0.98
J- 68	4	MF	0.08	0.33	0.52	0.98
			TOTAL	**16.37**	**26.03**	**49.10**

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-35	341	1	416	33
J-36	343	1	416	32
J-37	340	1	416	33
J-38	339	1	416	34
J-40	338	1	416	34
J-41	337	1	416	34
J-42	335	1	416	35
J-43	333	1	416	36
J-44	330	1	417	37
J-45	335	0	446	48
J-49	319	0	458	60
J-50	347	0	416	30
J-51	342	0	465	53
J-52	349	0	464	50
J-53	346	0	463	51
J-54	345	0	459	49
J-55	352	0	453	44
J-56	334	2	416	36
J-57	343	2	416	32
J-58	341	2	416	33
J-59	339	2	416	34
J-60	337	2	416	34
J-61	336	0	416	35
J-62	336	2	416	35
J-63	335	0	416	35
J-64	335	2	416	35
J-65	331	2	417	37
J-66	328	1	417	38
J-68	328	1	417	38
J-69	351	0	444	40
J-70	351	0	427	33
J-71	351	0	426	32
J-72	347	0	425	34
J-73	342	1500	422	35

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-74	342	0	422	35
J-75	338	0	424	37
J-76	338	0	425	38
J-77	338	0	425	38
J-78	336	0	425	38
J-79	336	0	425	39
J-80	336	0	426	39
J-81	335	0	426	39
J-82	332	0	427	41
J-83	332	0	427	41
J-84	327	0	428	44
J-85	327	0	429	44
J-86	326	0	429	45
J-87	325	0	447	53
J-88	330	0	428	42
J-89	334	0	427	40
J-90	338	0	426	38
J-91	340	0	425	37
J-92	343	500	425	36
J-93	340	0	425	37
J-94	338	0	426	38
J-95	351	0	444	40
J-97	326	0	447	52

Label	Diam. (in)	Length (ft)	Start Node	Stop Node	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (Friction) (ft)
P-1	4	102	J-50	J-2	130	0	0.00	0.0000
P-2	4	64	J-2	J-3	130	2	0.04	0.0000
P-3	4	77	J-3	J-4	130	2	0.04	0.0000
P-4	4	114	J-4	J-5	130	3	0.08	0.0020
P-5	4	63	J-5	J-6	130	3	0.08	0.0010
P-6	4	94	J-6	J-7	130	5	0.12	0.0030
P-7(1)	4	29	J-7	J-61	130	5	0.12	0.0010
P-7(2)	4	22	J-61	J-8	130	7	0.17	0.0010
P-8(1)	4	102	J-8	J-63	130	5	0.12	0.0030
P-8(2)	4	36	J-63	J-9	130	6	0.16	0.0020
P-9	4	41	J-9	J-10	130	6	0.16	0.0020
P-10	4	46	J-10	J-11	130	6	0.16	0.0020
P-11	4	32	J-11	J-12	130	8	0.20	0.0020
P-12	4	45	J-12	J-13	130	8	0.20	0.0030
P-13	4	47	J-13	J-14	130	8	0.20	0.0030
P-14	4	75	J-14	J-15	130	9	0.24	0.0070
P-15	4	14	J-15	J-16	130	9	0.23	0.0010
P-16	4	49	J-16	J-17	130	9	0.23	0.0040
P-17	4	81	J-17	J-18	130	11	0.27	0.0100
P-18	4	33	J-18	J-19	130	11	0.28	0.0040
P-19	4	48	J-19	J-20	130	12	0.29	0.0070
P-20	4	78	J-20	J-21	130	12	0.29	0.0110
P-21	4	112	J-21	J-22	130	12	0.31	0.0170
P-23	4	78	J-24	J-22	130	1	0.01	0.0000
P-24	4	99	J-22	J-25	130	13	0.34	0.0180
P-25	4	61	J-25	J-26	130	12	0.31	0.0090
P-26	4	66	J-26	J-27	130	12	0.31	0.0100
P-27	4	69	J-27	J-28	130	11	0.28	0.0090
P-28	4	53	J-28	J-29	130	11	0.27	0.0060
P-29	4	56	J-29	J-30	130	9	0.23	0.0050
P-30	4	66	J-30	J-31	130	9	0.22	0.0050

Label	Diam. (in)	Length (ft)	Start Node	Stop Node	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (Friction) (ft)
P-31	4	79	J-31	J-32	130	7	0.19	0.0050
P-32	4	53	J-32	J-33	130	7	0.17	0.0030
P-33	4	58	J-33	J-34	130	5	0.13	0.0020
P-34	4	45	J-34	J-35	130	5	0.12	0.0010
P-35	4	156	J-35	J-36	130	1	0.01	0.0000
P-36	4	91	J-35	J-37	130	4	0.10	0.0020
P-37	4	73	J-37	J-38	130	3	0.08	0.0010
P-38	4	127	J-38	J-8	130	2	0.05	0.0010
P-40	4	40	J-33	J-40	130	2	0.04	0.0000
P-41	4	76	J-40	J-41	130	1	0.03	0.0000
P-42	4	120	J-41	J-10	130	0	0.00	0.0000
P-43	4	81	J-31	J-42	130	1	0.03	0.0000
P-44	4	104	J-42	J-13	130	0	0.00	0.0000
P-45	4	76	J-29	J-43	130	1	0.04	0.0000
P-46	4	92	J-43	J-15	130	0	0.01	0.0000
P-47	4	94	J-27	J-44	130	1	0.02	0.0000
P-48	4	87	J-44	J-18	130	0	0.01	0.0000
P-49(1)	8	31	J-23	J-87	130	373	2.38	0.0900
P-49(2)	8	291	J-87	J-45	130	373	2.38	0.8590
P-50	8	552	J-45	J-1	130	373	2.38	1.6260
P-51	8	18	R-1	J-45	130	0	0.00	0.0000
P-56	8	323	J-49	J-23	130	1370	8.74	10.5500
P-59	12	1489	J-49	J-51	130	1370	3.89	6.7610
P-60	12	44	R-2	J-51	130	2026	5.75	0.4130
P-61	12	483	J-51	J-52	130	656	1.86	0.5620
P-62	12	731	J-52	J-53	130	656	1.86	0.8490
P-63	8	544	J-53	J-54	130	0	4.19	4.5560
P-64	8	646	J-54	J-55	130	656	4.19	5.4090
P-65	8	1017	J-55	J-1	130	656	4.19	8.5110
P-67	4	103	J-14	J-56	130	2	0.04	0.0000
P-69	4	65	PBV-1	J-22	130	26	0.66	0.0400

Label	Diam. (in)	Length (ft)	Start Node	Stop Node	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (Friction) (ft)
P-72	4	48	PBV-2	J-50	130	0	0.00	0.0000
P-73	4	100	J-57	J-2	130	2	0.04	0.0000
P-74	4	103	J-58	J-4	130	2	0.04	0.0000
P-75	4	103	J-59	J-6	130	2	0.04	0.0000
P-76	4	108	J-60	J-61	130	2	0.04	0.0000
P-77	4	106	J-62	J-63	130	2	0.04	0.0000
P-78	4	107	J-64	J-11	130	2	0.04	0.0000
P-79	4	107	J-65	J-17	130	2	0.04	0.0000
P-80	4	51	J-66	J-19	130	1	0.01	0.0000
P-82	4	57	J-68	J-21	130	1	0.01	0.0000
P-85	8	31	J-69	PBV-3	130	1030	6.57	0.6070
P-86	8	20	PBV-3	J-70	130	1030	6.57	0.3940
P-87	8	47	J-70	J-71	130	1030	6.57	0.9090
P-88	8	64	J-71	J-72	130	1030	6.57	1.2280
P-89	8	156	J-72	J-73	130	912	5.82	2.3990
P-90	8	9	J-73	J-74	130	588	3.75	0.0630
P-91	8	187	J-74	J-75	130	588	3.75	1.2800
P-92	8	134	J-75	J-76	130	588	3.75	0.9180
P-93	8	17	J-76	J-77	130	588	3.75	0.1180
P-94	8	56	J-77	J-78	130	588	3.75	0.3850
P-95	8	107	J-78	J-79	130	449	2.86	0.4450
P-96	8	28	J-79	J-80	130	449	2.86	0.1140
P-97	8	45	J-80	J-81	130	449	2.86	0.1870
P-98	8	238	J-81	J-82	130	469	2.99	1.0670
P-99	8	19	J-82	J-83	130	469	2.99	0.0880
P-100	8	213	J-83	J-84	130	469	2.99	0.9550
P-101	8	163	J-84	J-85	130	469	2.99	0.7310
P-102	8	40	J-85	J-86	130	970	6.19	0.6990
P-103	8	37	J-86	PBV-4	130	970	6.19	0.6400
P-105	8	128	J-85	J-88	130	502	3.20	0.6540
P-106	8	228	J-88	J-89	130	502	3.20	1.1630

Label	Diam. (in)	Length (ft)	Start Node	Stop Node	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (Friction) (ft)
P-107	8	202	J-89	J-90	130	502	3.20	1.0260
P-108	8	111	J-90	J-91	130	521	3.33	0.6060
P-109	8	166	J-91	J-92	130	382	2.44	0.5100
P-110	8	25	J-92	J-72	130	118	0.75	0.0090
P-111	8	83	J-91	J-93	130	139	0.89	0.0390
P-112	8	207	J-93	J-78	130	139	0.89	0.0980
P-113	8	29	J-90	J-94	130	20	0.13	0.0000
P-114	8	203	J-94	J-81	130	20	0.13	0.0030
P-115	8	12	J-1	J-95	130	1030	6.57	0.2300
P-116	4	53	J-95	PBV-2	130	0	0.00	0.0000
P-117	8	25	J-95	J-69	130	1030	6.57	0.4800
P-120	8	35	J-23	J-97	130	996	6.36	0.6360
P-121	4	13	J-97	PBV-1	130	26	0.66	0.0080
P-122	8	29	J-97	PBV-4	130	970	6.19	0.4990

Label	Elevation (ft)	Valve Diam (in)	Pressure Setting (psi)	Flow (gpm)	Headloss (ft)
PBV-1	326	4	13	26	30
PBV-2	351	4	13	0	30
PBV-3	351	8	7	1,030	16
PBV-4	326	8	7	970	16

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
R-1	394	0	394
R-2	465	2,026	465

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	351	0	550	86
J-2	344	0	520	76
J-3	342	0	520	77
J-4	340	0	520	78
J-5	339	0	520	78
J-6	337	0	520	79
J-7	337	0	520	79
J-8	336	0	520	79
J-9	335	0	520	80
J-10	334	0	520	80
J-11	334	0	520	81
J-12	334	0	520	81
J-13	331	0	520	82
J-14	332	0	520	81
J-15	332	0	520	81
J-16	331	0	520	82
J-17	330	0	520	82
J-18	328	0	520	83
J-19	328	0	520	83
J-20	327	0	520	83
J-21	327	0	520	83
J-22	326	0	520	84
J-23	324	0	550	98
J-24	326	1	520	84
J-25	328	2	520	83
J-26	330	0	520	82
J-27	332	1	520	81
J-28	333	1	520	81
J-29	334	0	520	81
J-30	334	1	520	80
J-31	336	0	520	80
J-32	338	1	520	79
J-33	339	0	520	78
J-34	340	1	520	78

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-35	341	1	520	78
J-36	343	1	520	77
J-37	340	1	520	78
J-38	339	2	520	78
J-40	338	1	520	79
J-41	337	2	520	79
J-42	335	2	520	80
J-43	333	2	520	81
J-44	330	2	520	82
J-45	335	0	550	93
J-49	319	0	550	100
J-50	347	0	520	75
J-51	342	0	550	90
J-52	349	0	550	87
J-53	346	0	550	88
J-54	345	0	550	89
J-55	352	0	550	86
J-56	334	3	520	81
J-57	343	3	520	76
J-58	341	3	520	77
J-59	339	3	520	78
J-60	337	3	520	79
J-61	336	0	520	79
J-62	336	3	520	79
J-63	335	0	520	80
J-64	335	3	520	80
J-65	331	3	520	82
J-66	328	1	520	83
J-68	328	1	520	83
J-69	351	0	550	86
J-70	351	0	534	79
J-71	351	0	534	79
J-72	347	0	534	81
J-73	342	0	534	83

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-74	342	0	534	83
J-75	338	0	534	85
J-76	338	0	534	85
J-77	338	0	534	85
J-78	336	0	534	85
J-79	336	0	534	86
J-80	336	0	534	86
J-81	335	0	534	86
J-82	332	0	534	88
J-83	332	0	534	88
J-84	327	0	534	89
J-85	327	0	534	90
J-86	326	0	534	90
J-87	325	0	550	97
J-88	330	0	534	88
J-89	334	0	534	86
J-90	338	0	534	85
J-91	340	0	534	84
J-92	343	0	534	83
J-93	340	0	534	84
J-94	338	0	534	85
J-95	351	0	550	86
J-97	326	0	550	97

Label	Diam. (in)	Length (ft)	Start Node	Stop Node	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (Friction) (ft)
P-1	4	102	J-50	J-2	130	18	0.47	0.0340
P-2	4	64	J-2	J-3	130	15	0.39	0.0150
P-3	4	77	J-3	J-4	130	15	0.39	0.0180
P-4	4	114	J-4	J-5	130	12	0.31	0.0180
P-5	4	63	J-5	J-6	130	12	0.31	0.0100
P-6	4	94	J-6	J-7	130	9	0.24	0.0090
P-7(1)	4	29	J-7	J-61	130	9	0.24	0.0030
P-7(2)	4	22	J-61	J-8	130	6	0.16	0.0010
P-8(1)	4	102	J-8	J-63	130	3	0.07	0.0010
P-8(2)	4	36	J-63	J-9	130	0	0.01	0.0000
P-9	4	41	J-9	J-10	130	0	0.01	0.0000
P-10	4	46	J-10	J-11	130	2	0.06	0.0000
P-11	4	32	J-11	J-12	130	5	0.14	0.0010
P-12	4	45	J-12	J-13	130	5	0.14	0.0010
P-13	4	47	J-13	J-14	130	6	0.14	0.0020
P-14	4	75	J-14	J-15	130	9	0.22	0.0060
P-15	4	14	J-15	J-16	130	8	0.21	0.0010
P-16	4	49	J-16	J-17	130	8	0.21	0.0040
P-17	4	81	J-17	J-18	130	11	0.29	0.0110
P-18	4	33	J-18	J-19	130	12	0.31	0.0050
P-19	4	48	J-19	J-20	130	13	0.33	0.0080
P-20	4	78	J-20	J-21	130	13	0.33	0.0130
P-21	4	112	J-21	J-22	130	14	0.36	0.0220
P-23	4	78	J-24	J-22	130	1	0.03	0.0000
P-24	4	99	J-22	J-25	130	16	0.40	0.0240
P-25	4	61	J-25	J-26	130	14	0.35	0.0110
P-26	4	66	J-26	J-27	130	14	0.35	0.0120
P-27	4	69	J-27	J-28	130	11	0.29	0.0090
P-28	4	53	J-28	J-29	130	10	0.27	0.0060
P-29	4	56	J-29	J-30	130	8	0.21	0.0040
P-30	4	66	J-30	J-31	130	7	0.18	0.0040

Label	Diam. (in)	Length (ft)	Start Node	Stop Node	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (Friction) (ft)
P-31	4	79	J-31	J-32	130	5	0.13	0.0030
P-32	4	53	J-32	J-33	130	4	0.11	0.0010
P-33	4	58	J-33	J-34	130	3	0.07	0.0010
P-34	4	45	J-34	J-35	130	2	0.05	0.0000
P-35	4	156	J-35	J-36	130	1	0.03	0.0000
P-36	4	91	J-35	J-37	130	0	0.00	0.0000
P-37	4	73	J-37	J-38	130	1	0.03	0.0000
P-38	4	127	J-38	J-8	130	4	0.09	0.0020
P-40	4	40	J-33	J-40	130	1	0.04	0.0000
P-41	4	76	J-40	J-41	130	0	0.01	0.0000
P-42	4	120	J-41	J-10	130	2	0.05	0.0000
P-43	4	81	J-31	J-42	130	2	0.05	0.0000
P-44	4	104	J-42	J-13	130	0	0.01	0.0000
P-45	4	76	J-29	J-43	130	2	0.06	0.0010
P-46	4	92	J-43	J-15	130	0	0.01	0.0000
P-47	4	94	J-27	J-44	130	1	0.03	0.0000
P-48	4	87	J-44	J-18	130	1	0.01	0.0000
P-49(1)	8	31	J-23	J-87	130	3	0.02	0.0000
P-49(2)	8	291	J-87	J-45	130	3	0.02	0.0000
P-50	8	552	J-45	J-1	130	3	0.02	0.0000
P-51	8	18	R-1	J-45	130	0	0.00	0.0000
P-56	8	323	J-49	J-23	130	34	0.22	0.0110
P-59	12	1489	J-49	J-51	130	34	0.10	0.0070
P-60	12	44	R-2	J-51	130	49	0.14	0.0000
P-61	12	483	J-51	J-52	130	15	0.04	0.0010
P-62	12	731	J-52	J-53	130	15	0.04	0.0010
P-63	8	544	J-53	J-54	130	15	0.10	0.0040
P-64	8	646	J-54	J-55	130	15	0.10	0.0050
P-65	8	1017	J-55	J-1	130	15	0.10	0.0080
P-67	4	103	J-14	J-56	130	3	0.08	0.0010
P-69	4	65	PBV-1	J-22	130	31	0.78	0.0540

Label	Diam. (in)	Length (ft)	Start Node	Stop Node	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (Friction) (ft)
P-72	4	48	PBV-2	J-50	130	18	0.47	0.0160
P-73	4	100	J-57	J-2	130	3	0.08	0.0010
P-74	4	103	J-58	J-4	130	3	0.08	0.0010
P-75	4	103	J-59	J-6	130	3	0.08	0.0010
P-76	4	108	J-60	J-61	130	3	0.08	0.0010
P-77	4	106	J-62	J-63	130	3	0.08	0.0010
P-78	4	107	J-64	J-11	130	3	0.08	0.0010
P-79	4	107	J-65	J-17	130	3	0.08	0.0010
P-80	4	51	J-66	J-19	130	1	0.03	0.0000
P-82	4	57	J-68	J-21	130	1	0.03	0.0000
P-85	8	31	J-69	PBV-3	130	0	0.00	0.0000
P-86	8	20	PBV-3	J-70	130	0	0.00	0.0000
P-87	8	47	J-70	J-71	130	0	0.00	0.0000
P-88	8	64	J-71	J-72	130	0	0.00	0.0000
P-89	8	156	J-72	J-73	130	0	0.00	0.0000
P-90	8	9	J-73	J-74	130	0	0.00	0.0000
P-91	8	187	J-74	J-75	130	0	0.00	0.0000
P-92	8	134	J-75	J-76	130	0	0.00	0.0000
P-93	8	17	J-76	J-77	130	0	0.00	0.0000
P-94	8	56	J-77	J-78	130	0	0.00	0.0000
P-95	8	107	J-78	J-79	130	0	0.00	0.0000
P-96	8	28	J-79	J-80	130	0	0.00	0.0000
P-97	8	45	J-80	J-81	130	0	0.00	0.0000
P-98	8	238	J-81	J-82	130	0	0.00	0.0000
P-99	8	19	J-82	J-83	130	0	0.00	0.0000
P-100	8	213	J-83	J-84	130	0	0.00	0.0000
P-101	8	163	J-84	J-85	130	0	0.00	0.0000
P-102	8	40	J-85	J-86	130	0	0.00	0.0000
P-103	8	37	J-86	PBV-4	130	0	0.00	0.0000
P-105	8	128	J-85	J-88	130	0	0.00	0.0000
P-106	8	228	J-88	J-89	130	0	0.00	0.0000

Label	Diam. (in)	Length (ft)	Start Node	Stop Node	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (Friction) (ft)
P-107	8	202	J-89	J-90	130	0	0.00	0.0000
P-108	8	111	J-90	J-91	130	0	0.00	0.0000
P-109	8	166	J-91	J-92	130	0	0.00	0.0000
P-110	8	25	J-92	J-72	130	0	0.00	0.0000
P-111	8	83	J-91	J-93	130	0	0.00	0.0000
P-112	8	207	J-93	J-78	130	0	0.00	0.0000
P-113	8	29	J-90	J-94	130	0	0.00	0.0000
P-114	8	203	J-94	J-81	130	0	0.00	0.0000
P-115	8	12	J-1	J-95	130	18	0.12	0.0000
P-116	4	53	J-95	PBV-2	130	18	0.47	0.0170
P-117	8	25	J-95	J-69	130	0	0.00	0.0000
P-120	8	35	J-23	J-97	130	31	0.20	0.0010
P-121	4	13	J-97	PBV-1	130	31	0.78	0.0110
P-122	8	29	J-97	PBV-4	130	0	0.00	0.0000

Label	Elevation (ft)	Valve Diam (in)	Pressure Setting (psi)	Flow (gpm)	Headloss (ft)
PBV-1	326	4	13	31	30
PBV-2	351	4	13	18	30
PBV-3	351	8	7	0	16
PBV-4	326	8	7	0	16

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
R-1	531	0	531
R-2	550	49	550

HUNSAKER
& ASSOCIATES
IRVINE, INC.

HGL Calculation Based on Hydrant Test on ASSOCIATED RD

Description	Desired Flow Q_F (gpm)	Dynamic Loss H_F (feet)*	Available HGL_F (feet)**	Test Run
Static	0	0.00	550	1
Peak Hour	49	0.09	550	2
MDD	26	0.03	550	3
MDD+ 2000 FF	2,026	85.22	465	4

* H_F is Static minus Residual (in feet) at Desired Flow

** HGL_F = Test Elevation + Static Pressure - H_F

Hydrant Test Data:

Orifice Dia	2.5 in.	
Static Pressure	90 psi	*208* feet
Residual Pressure	75 psi	*173* feet
Pitot Reading	0 psi	
Observed Flow	1,250 gpm	
Test Elevation	342 feet	

Affinity Equations:

$$K = \frac{Q_R}{H_R^{\wedge 0.54}}$$

- K is Affinity Constant
- Q_R is Test Flow
- Q_F is Desired Flow
- H_R is Static minus Residual (in feet) at Test Flow

$$H_F = \left(\frac{Q_F}{K}\right)^{\wedge 1.85}$$

Affinity Constant: (Using Flow Test Values)

K = 183

HUNSAKER
& ASSOCIATES
IRVINE, INC.

HGL Calculation Based on Hydrant Test on Greenbriar Lane

Description	Desired Flow Q_F (gpm)	Dynamic Loss H_F (feet)*	Available HGL_F (feet)**	Test Run
Static	0	0.00	531	1
Peak Hour	49	0.14	531	2
MDD	26	0.04	531	3
MDD+ 2000 FF	2,026	136.96	394	4

* H_F is Static minus Residual (in feet) at Desired Flow

** HGL_F = Test Elevation + Static Pressure - H_F

Hydrant Test Data:

Orifice Dia	2.5 in.	
Static Pressure	85 psi	*196* feet
Residual Pressure	65 psi	*150* feet
Pitot Reading	0 psi	
Observed Flow	1,121 gpm	
Test Elevation	335 feet	

Affinity Equations:

$$K = \frac{Q_R}{H_R^{\wedge 0.54}}$$

- K is Affinity Constant
- Q_R is Test Flow
- Q_F is Desired Flow
- H_R is Static minus Residual (in feet) at Test Flow

$$H_F = \left(\frac{Q_F}{K}\right)^{\wedge 1.85}$$

Affinity Constant: (Using Flow Test Values)

K = 142

Hydrant Flow Test Report

Test Date 3/13/2024 **Test Time** 9:00AM

Location

Associated & Eucalyptus

Tested by

Legion Fire Protection
2101 W Crescent Ave Ste M
Anaheim, CA 92801

Notes

Witnessed by Brea Fire Inspector, Kevin Haines

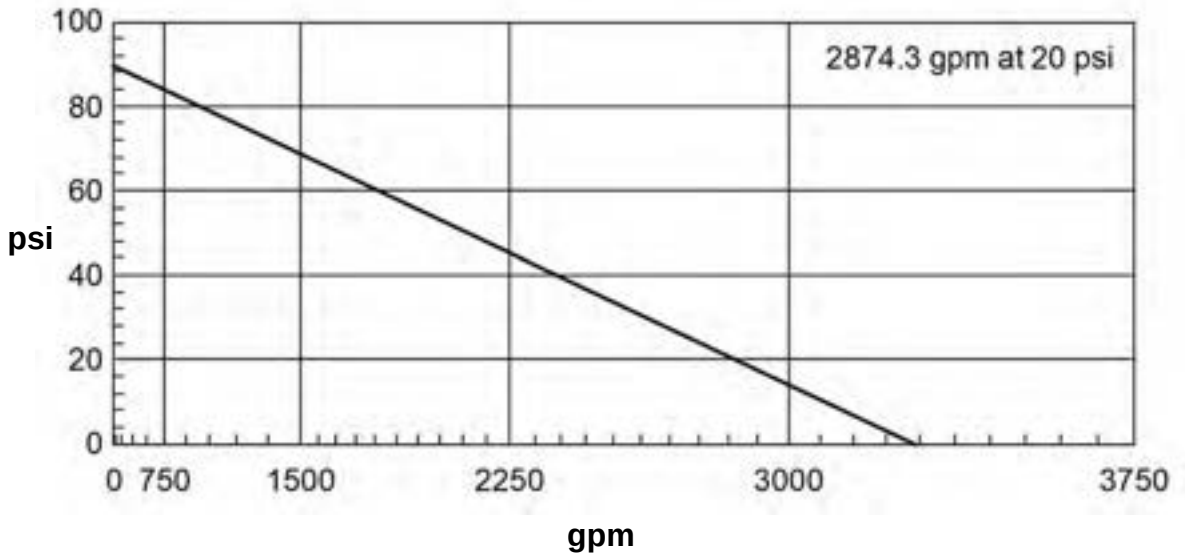
Read Hydrant

90 psi **static pressure**
75 psi **residual pressure**
335 ft **hydrant elevation**

Flow Hydrant(s)

Outlet	Elev	Size	C	Pitot Pressure	Flow
#1		2.5			1250 gpm

Flow Graph



Hydrant Flow Test Report

Test Date 2/14/2024 **Test Time** 1:30PM

Location

Greenbriar lane Brea, CA

Tested by

Legion Fire Protection
2101 W. Crescent Ave. Suite M
Anaheim, CA 92801

Notes

Witnessed by fire inspector Kevin Haines

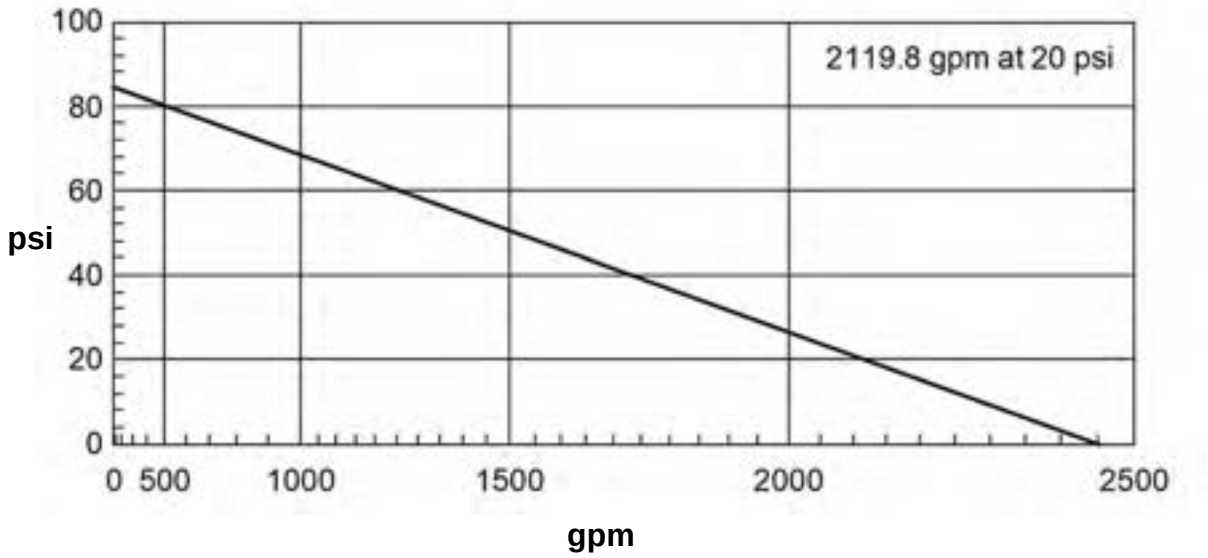
Read Hydrant

85 psi **static pressure**
65 psi **residual pressure**
100 ft **hydrant elevation**

Flow Hydrant(s)

Outlet	Elev	Size	C	Pitot Pressure	Flow
#1		2.5			1121 gpm

Flow Graph



ATTACHMENT 23

CFC TABLE B105.1(2): Minimum Required Fire Flow and Flow Duration for Buildings in OCFA Jurisdiction

FIRE FLOW CALCULATION AREA (square feet)					DETACHED SINGLE-FAMILY RESIDENCE/DUPLEX			OTHER BUILDINGS		
					FIRE FLOW (gallons per minute at 20 psi residual)		DURATION (hours)	FIRE FLOW (gallons per minute at 20 psi residual)		DURATION (hours)
Type IA/IB	Type IIA/IIIA	Type IV/VA	Type IIB/IIIB	Type VB	NS	S		NS	S	
0-22700	0-12700	0-8200	0-5900	0-3600	1000	1000	1	1500	1500	2
22701-30200	12701-17000	8201-10900	5901-7900	3601-4800	1750	1000	NS: 2 S: 1	1750	1500	
30201-38700	17001-21800	10901-12900	7901-9800	4801-6200	2000	1000		2000	1500	
38701-48300	21801-24200	12901-17400	9801-12600	6201-7700	2250	1125		2250	1500	
48301-59000	24201-33200	17401-21300	12601-15400	7701-9400	2500	1250		2500	1500	
59001-70900	33201-39700	21301-25500	15401-18400	9401-11300	2750	1375		2750	1500	
70901-83700	39701-47100	25501-30100	18401-21800	11301-13400	3000	1500	NS: 3 S: 1	3000	1500	3
83701-97700	47101-54900	30101-35200	21801-25900	13401-15600	3250	1625		3250	1625	
97701-112700	54901-63400	35201-40600	25901-29300	15601-18000	3500	1750		3500	1750	
112701-128700	63401-72400	40601-46400	29301-33500	18001-20600	3750	1875		3750	1875	
128701-145900	72401-82100	46401-52500	33501-37900	20601-23300	4000	2000	NS: 4 S: 1	4000	2000	4
145901-164200	82101-92400	52501-59100	37901-42700	23301-26300	4250	2125		4250	2125	
164201-183400	92401-103100	59101-66000	42701-47700	26301-29300	4500	2250		4500	2250	
183401-203700	103101-114600	66001-73300	47701-53000	29301-32600	4750	2375		4750	2375	
203701-225200	114601-126700	73301-81100	53001-58600	32601-36000	5000	2500		5000	2500	
225201-247700	126701-139400	81101-89200	58601-65400	36001-39600	5250	2625		5250	2625	
247701-271200	139401-152600	89201-97700	65401-70600	39601-43400	5500	2750		5500	2750	
271201-295900	152601-166500	97701-106500	70601-77000	43401-47400	5750	2875		5750	2875	
295901+	166501+	106501-115800	77001-83700	47401-51500	6000	3000		6000	3000	
		115801-125500	83701-90600	51501-55700	6250	3125		6250	3125	
		125501-135500	90601-97900	55701-60200	6500	3250		6500	3250	
		135501-145800	97901-106800	60201-64800	6750	3375		6750	3375	
		145801-156700	106801-113200	64801-69600	7000	3500		7000	3500	
		156701-167900	113201-121300	69601-74600	7250	3625		7250	3625	
		167901-179400	121301-129600	74601-79800	7500	3750		7500	3750	
		179401-191400	129601-138300	79801-85100	7750	3875		7750	3875	
		191401+	138301+	85101+	8000	4000		8000	4000	

S: Provided with an approved sprinkler system throughout the structure NS: No fire sprinklers or partially protected with a sprinkler system

ATTACHMENT 24

CFC TABLE C102.1:
Hydrant Quantity and Spacing in OCFA Jurisdiction

DETACHED SINGLE FAMILY RESIDENCES/DUPLEXES *with* SPRINKLERS

Flow Requirement from Table B105.1(2)	Minimum Number of Hydrants	Maximum Distance to a Hydrant		Maximum Distance between Hydrants [1]		Average Distance between Hydrants[1]	
		Thru road	*Dead-end*	Thru road	*Dead-end*	Thru road	*Dead-end*
1000 - 1750	1	300	*250*	600	*500*	600	*500*
1751+	Use the table below						

ALL OTHER STRUCTURES

Flow Requirement from Table B105.1(2)	Minimum Number of Hydrants	Maximum Distance to a Hydrant		Maximum Distance between Hydrants [1,2]		Average Distance between Hydrants[1,2]	
		Thru road	*Dead-end*	Thru road	*Dead-end*	Thru road	*Dead-end*
1000 - 1750	1	250	*200*	500	*400*	500	*400*
1751 - 2250	2	225	*175*	450	*350*	450	*350*
2251 - 2500	3	225	*175*	450	*350*	450	*350*
2501 - 3000	3	225	*175*	450	*350*	400	*300*
3001 - 4000	4	210	*160*	420	*320*	350	*250*
4001 - 5000	5	180	*130*	360	*260*	300	*200*
5001 - 5500	6	180	*130*	360	*260*	300	*200*
5501 - 6000	6	150	*100*	300	*200*	250	*150*
6001 - 7000	7	150	*100*	300	*200*	250	*150*
7001+	1 per 1000 gpm or fraction thereof	120	*70*	240	*140*	200	*100*

All distances are in feet.

[1] Where streets are provided with median dividers which cannot be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis.

[2] Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards.

Recordall® Turbo Series Meters

Models 160 (1-1/2 in.), 200 (2 in.), 450 (3 in.), 1000 (4 in.), 2000 (6 in.), 3500 (8 in.), 5500 (10 in.) and 6200 (12 in.) NSF/ANSI Standards 61 and 372 Certified

DESCRIPTION

Recordall Turbo Series meters meet or exceed the most recent revision of AWWA Standard C701 Class II Standards and are available in a lead-free bronze alloy for sizes 1-1/2 in. through 10 in. and cast iron for 12 in. meters. Turbo Series meters comply with the lead-free provisions of the Safe Drinking Water Act. Sizes 1-1/2 in. through 10 in. meters are also certified to NSF/ANSI Standards 61 and 372 (Trade Designation: Turbo Series LL-NS) and carry the NSF-61 mark on the housing. All components of the lead-free alloy meter (housing, measuring element, seals and so on) comprise the certified system.

Models 160 through 6200 are designed for 1-1/2 in. through 12 in. applications. These meters feature:

- Direct coupled turbine based on an exclusive in.floating rotor in. design that reduces bearing friction—and associated wear and tear.
- Low pressure loss for improved system efficiency.
- Exceptional registration accuracy across low flow rate, normal operating flow rate and maximum continuous operation flow.
- Permanently sealed, tamper-resistant register or encoder.
- Integral strainer option for sizes 1-1/2 in. through 4 in. help protect your system from damaging debris and related downtime.
- Meters and encoders are compatible with Badger Meter AMR/AMI meter reading systems and other approved reading technologies.

Applications: Recordall Turbo Series meters are designed for cold water, commercial and industrial applications where flows are consistent medium to high flows. Applications include hotels, apartment buildings, irrigations centers and manufacturing and processing plants. Turbo Series meters help reduce day-to-day maintenance costs while delivering accurate and efficient performance.

Operation & Performance: Direct magnetic drive is achieved when the magnet carrier is driven by a gear train coupled to the rotor. The gear train consists of two sets of gears connected by a vertical transmission shaft. One gear set is at the magnet carrier, the other is a worm gear set at the rotor shaft. When water flows into the Turbo Series meter measuring element, it contacts the multi-vaned rotor. The resulting rotor rotation is then transmitted by magnetic coupling to a sealed register or encoder. The direct magnetic drive is built to provides a reliable meter-to-registration coupling.

Tamper-Proof Features: Unauthorized removal of the register or encoder is inhibited by the option of a tamper detection seal wire screw, TORX® tamper-resistant seal screw or the proprietary tamper-resistant keyed seal screw. Each can be installed at the meter site or at the factory.

Construction: The Recordall Turbo Series meter is constructed in compliance with ANSI and AWWA C701 standards. It consists of the following basic components: meter housing, interchangeable, unitized measuring element and permanently sealed direct reading registers or encoders.

The measuring element consists of the transmission coupling, rotor, inlet and outlet straightening vanes with nose cones, and calibration ring assembly. The unique inlet and outlet straightening vanes minimize swirl from piping arrangements upstream as well as downstream.

A strainer is recommended to help ensure optimal flow conditioning and protection for the measuring element. An integral strainer is available as an option for 1-1/2 in. through 4 in. meter sizes. The stainless steel strainer is built into the inlet end and includes a removable cover plate to permit easy access for routine cleaning. External strainers are available in sizes 2 in. through 12 in.

To simplify maintenance, the registers or encoders and measuring elements can be removed without removing the meter housing. Interchangeability of certain parts between meters also minimizes spare parts inventory investment.

Meter Installation: The meter is designed for installations where flow is in one direction only. Companion flanges for installation of meters on various pipe types and sizes are available in cast iron or NL bronze as an option. See the *"Recordall Turbo Series Meters User Manual"* for specific instructions.

SPECIFICATIONS

Turbo Series Model	**160** 1-1/2 in. (40 mm)	**200** 2 in. (50 mm)	**450** 3 in. (80 mm)	**1000** 4 in. (100 mm)	**2000** 6 in. (150 mm)	**3500** 8 in. (200 mm)	**5500** 10 in. (250 mm)	**6200** 12 in. (300 mm)
Meter Flanges AWWA 125 Pound Class	Elliptical	Elliptical or Round	Round	Round	Round	Round	Round	Round AWWA 125 lb class
Typical Operating Range (100% ± 1.5%)	4…200 gpm (0.9…45.4 m^3/h)	4…310 gpm (0.9…70.4 m^3/h)	5…550 gpm (1.1…124.9 m^3/h)	10…1250 gpm (2.3…284 m^3/hr)	20…2500 gpm (4.5…568 m^3/h)	30…4500 gpm (6.8…1022 m^3/h)	50…7000 gpm (11.4…1590 m^3/h)	90…8800 gpm (20.5…1998 m^3/h)
Typical Low Flow (95% min.)	2.5 gpm (0.6 m^3/h)	2.5 gpm (0.6 m^3/h)	4 gpm (0.9 m^3/h)	6 gpm (1.4 m^3/h)	12 gpm (2.7 m^3/h)	20 gpm (4.5 m^3/h)	30 gpm (6.8 m^3/h)	65 gpm (14.8 m^3/h)
Max. Continuous Flow	160 gpm (36 m^3/h)	200 gpm (45.4 m^3/h)	450 gpm (102.2 m^3/h)	1000 gpm (227.1 m^3/h)	2000 gpm (454 m^3/h)	3500 gpm (795 m^3/h)	5500 gpm (1250 m^3/h)	6200 gpm (1408 m^3/h)
Maximum Intermittent Flow	200 gpm (45.4 m^3/h)	310 gpm (70.4 m^3/h)	550 gpm (124.9 m^3h)	1250 gpm (284 m^3h)	2500 gpm (568 m^3/h)	4500 gpm (1022 m^3/h)	7000 gpm (1590 m^3h)	8800 gpm (1988 m^3/h)
Pressure Loss at Max. Continuous Flow	3.8 psi (0.26 bar)	3.1 psi (0.21 bar)	1.8 psi (0.12 bar)	7.3 psi (0.50 bar)	4.8 psi (0.33 bar)	2.5 psi (0.17 bar)	1.6 psi (0.11 bar)	0.8 psi (0.05 bar)
Pressure Loss at Max. Continuous Flow: With Integral Strainer	9.9 psi (0.68 bar)	8.3 psi (0.57 bar)	5 psi (0.43 bar)	17.8 psi (1.2 bar)	—			
Max. Operating Pressure	150 psi (10 bar)							
Max. Operating Temperature	120° F (49° C)							
Optional Integral Strainer	Built into inlet end. Removable cover plate permits access to strainer for cleaning.				—			
Optional External Strainer	—	Available for Models 200, 450, 1000, 2000, 3500, 5500 and 6200.						
Test Plug	Standard with integral strainer; optional for other models.				Optional for Models 2000 and 3500.		—	

MATERIALS

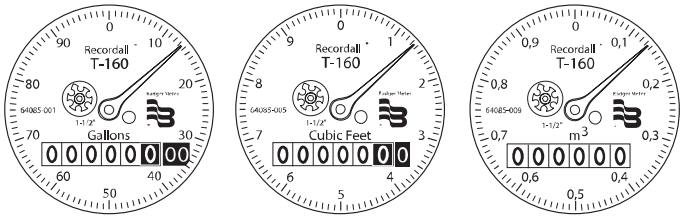
Meter Housing	Lead-free alloy (**EXCEPTION**: Model 6200 meter housing is blue epoxy-coated cast iron)
Turbo Head	Lead-free alloy
Nose Cone & Straightening Vanes	Thermoplastic
Rotor	Thermoplastic
Rotor Radial Bearings	Lubricated thermoplastic
Rotor Thruster Bearing	Sapphire jewels
Rotor Bearing Pivots	Passivated 316 stainless steel
Calibration Mechanism	Stainless steel & thermoplastic
Magnet	Ceramic
Trim	Stainless steel
Register Housing & Cover	Thermoplastic or bronze
Optional Strainer and Trim	Stainless steel

REGISTERS / ENCODERS

Standard—Sweep-Hand Registration

The standard register is a straight-reading, permanently sealed magnetic drive register. Dirt, moisture, tampering and lens fogging problems are eliminated. The register has a six-odometer wheel totalization display, 360° test circle with center sweep hand, and flow finder to detect leaks. Register gearing is made of self-lubricating engineered polymer, which minimizes friction and provides long life. The multi-position register simplifies meter installation and reading. The register capacity for the 1-1/2 in., 2 in., 3 in. and 4 in. meters is 100,000,000 gallons (10,000,000 ft³, 1,000,000 m³). The register capacity for the 6 in., 8 in., and 10 in. meters is 1,000,000,000 gallons (100,000,000 ft³, 10,000,000 m³). The high-flow register capacity for the 12 in. meter is 10,000,000,000 gallons (1,000,000,000 ft³, 10,000,000 m³).

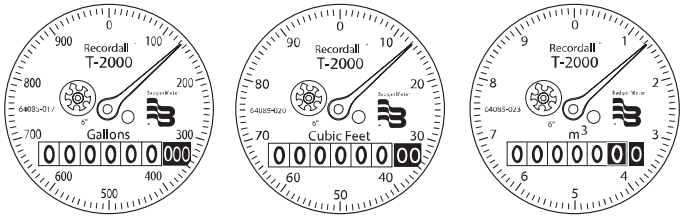
Registers for 1-1/2 in., 2 in., 3 in. and 4 in. Meters



Sweep Hand Revolution

Meter Model	Gallon	Cubic Feet	Cubic Meter
160	100	10	1
200	100	10	1
450	100	10	1
1000	100	10	1

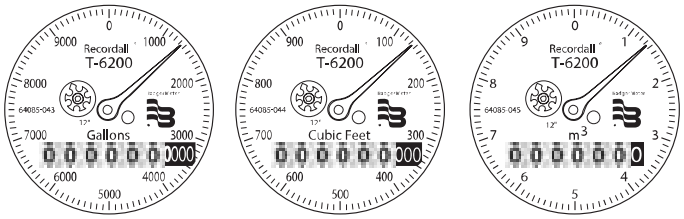
Registers for 6 in., 8 in. and 10 in. Meters



Sweep Hand Revolution

Meter Model	Gallon	Cubic Feet	Cubic Meter
2000	1000	100	10
3500	1000	100	10
5500	1000	100	10

Registers for 12 in. Meters



Sweep Hand Revolution

Meter Model	Gallon	Cubic Feet	Cubic Meter
6200	10000	1000	10

Optional—Encoders for AMR/AMI Reading Solutions

AMR/AMI solutions are available for all Recordall Disc Series meters. All reading options can be removed from the meter without disrupting water service. Badger Meter encoders provide years of reliable, accurate readings for a variety of applications and are also available pre-wired to Badger Meter approved AMR/AMI solutions. See details at **www.badgermeter.com**.

PHYSICAL DIMENSIONS OF METERS WITHOUT STRAINER

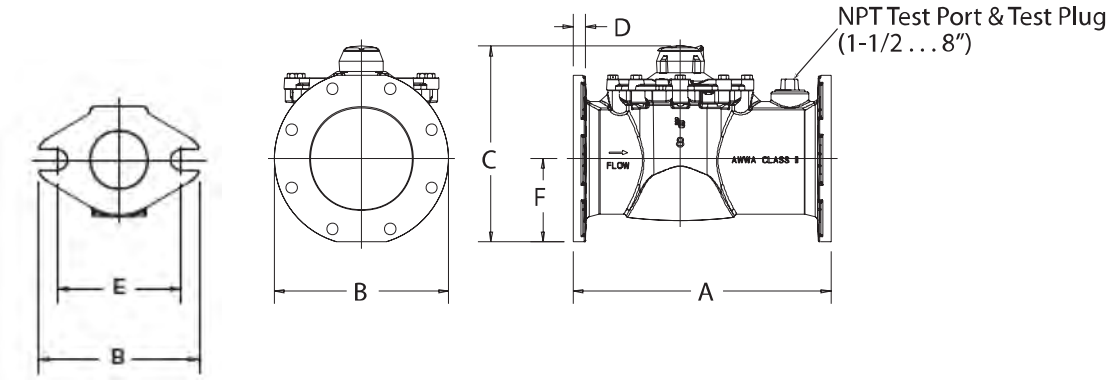


Figure 1: Sample Illustration from 8 in. Model 3500

Turbo Series Model	160	200	200	450	1000	2000	3500	5500	6200
Meter Flanges	1-1/2 in. Elliptical	2 in. Elliptical	2 in. Round	3 in. Round	4 in. Round	6 in. Round	8 in. Round	10 in. Round	12 in. Round
Meter & Pipe Size	1-1/2 in. (40 mm)	2 in. (50 mm)	2 in. (50 mm)	3 in. (80 mm)	4 in. (100 mm)	6 in. (150 mm)	8 in. (200 mm)	10 in. (250 mm)	12 in. (300 mm)
Net Weight	14.3 lb (6.5 kg)	14.9 lb (6.8 kg)	17.4 lb (7.9 kg)	31 lb (14.1 kg)	40 lb (18.1 kg)	77 lb (35 kg)	123 lb (55.7 kg)	210 lb (95.3 kg)	262 lb (118.8 kg)
Shipping Weight	16.8 lb (7.6 kg)	16.4 lb (7.4 kg)	18.9 lb (8.6 kg)	34 lb (15.4 kg)	45 lb (20.4 kg)	89 lb (40.4 kg)	147 lb (66.6 kg)	235 lb (106.6 kg)	286 lb (129.7 kg)
Qty. of Bolts	2	2	4	4	8	8	8	12	12
NPT Test Port & Test Plug (optional)	1 in. (25.4 mm)	1-1/2 in. (40 mm)	1-1/2 in. (40 mm)	2 in. (50 mm)	2 in. (50 mm)	2 in. (50 mm)	2 in. (50 mm)	—	—
Length (A)	13 in. (330 mm)	10 in. (254 mm)	10 in. (254 mm)	12 in. (305 mm)	14 in. (356 mm)	18 in. (457 mm)	20 in. (508 mm)	26 in. (660.4 mm)	19-11/16 in. (500 mm)
Width (B)	5-7/32 in. (133 mm)	5-27/32 in. (148 mm)	6 in. (152 mm)	7-1/2 in. (191 mm)	9 in. (229 mm)	11 in. (280 mm)	13-1/2 in. (343 mm)	16 in. (406.4 mm)	19 in. (482 mm)
Height (C)	6-9/32 in. (159 mm)	6-1/2 in. (165 mm)	7-3/32 in. (180 mm)	8-11/16 in. (220 mm)	9-21/32 in. (245 mm)	13-5/16 in. (338 mm)	15-3/16 in. (385 mm)	17-15/32 in. (443 mm)	19-11/16 in. (500 mm)
Flange (D)	51/64 in. (20 mm)	25/32 in. (20 mm)	5/8 in. (16 mm)	3/4 in. (19 mm)	13/16 in. (21 mm)	7/8 in. (22 mm)	1 in. (25 mm)	1-1/16 in. (27 mm)	1.26 in. (32 mm)
Bolt Circle (E)	4 in. (102 mm)	4-1/2 in. (114 mm)	4-3/4 in. (121 mm)	6 in. (152 mm)	7-1/2 in. (191 mm)	9-1/2 in. (241 mm)	11-3/4 in. (298 mm)	14-1/4 in. (362 mm)	17 in. (432 mm)
Centerline (F)	1-27/32 in. (47 mm)	2-1/16 in. (52 mm)	2-5/8 in. (67 mm)	3-11/32 in. (85 mm)	4-5/16 in. (109 mm)	5-1/4 in. (133 mm)	6-3/8 in. (162 mm)	7-7/8 in. (199.4 mm)	8-7/8 in. (226 mm)

PHYSICAL DIMENSIONS OF METERS WITH INTEGRAL STRAINER

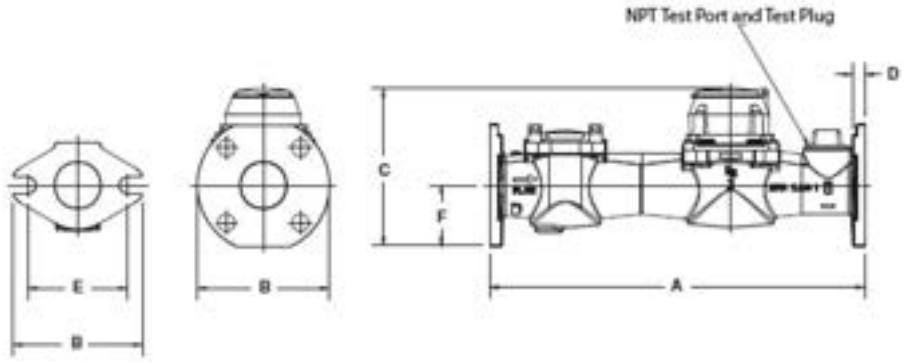
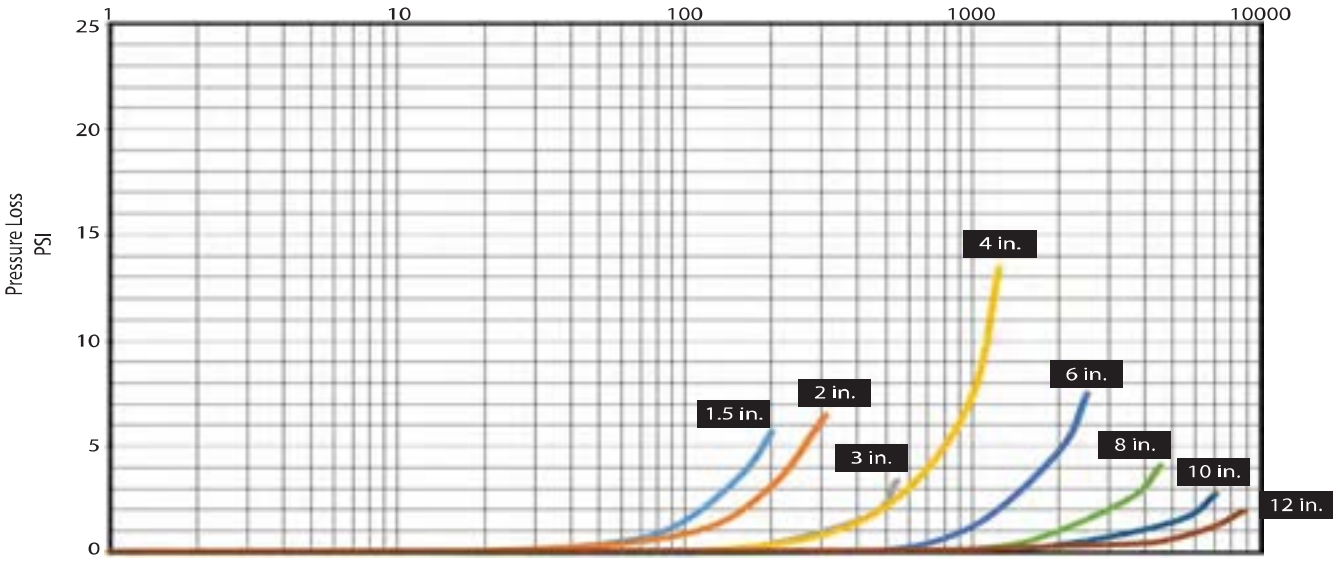


Figure 2: Physical dimensions

Turbo Series Model	160	200	200	450	1000
Meter Flanges	Elliptical	Elliptical	Round	Round	Round
Meter & Pipe Size	1-1/2 in. (40 mm)	2 in. (50 mm)	2 in. (50 mm)	3 in. (80 mm)	4 in. (100 mm)
Net Weight	14.3 lb (6.5 kg)	24 lb (11 kg)	26 lb (12 kg)	49 lb (22 kg)	60 lb (27.22 kg)
Shipping Weight	16.8 lb (7.6 kg)	28 lb (13 kg)	30 lb (14 kg)	55 lb (25 kg)	70 lb (31.75 kg)
Number of Bolts	2	2	4	4	8
NPT Test Port & Test Plug (Standard)	1 in. (25.4 mm)	1-1/2 in. (40 mm)	1-1/2 in. (40 mm)	2 in. (50 mm)	2 in. (50 mm)
Length (A)	13 in. (330 mm)	17 in. (432 mm)	17 in. (432 mm)	19 in. (483 mm)	23 in. (584 mm)
Width (B)	5-7/32 in. (133 mm)	5-27/32 in. (148 mm)	6 in. (152 mm)	7-1/2 in. (191 mm)	9 in. (229 mm)
Height (C)	6-9/32 in. (159 mm)	6-1/2 in. (165 mm)	7-3/32 in. (180 mm)	8-15/16 in. (227 mm)	9-21/32 in. (245 mm)
Flange (D)	51/64 in. (20 mm)	27/32 in. (47 mm)	5/8 in. (16 mm)	27/32 in. (21 mm)	13/16 in. (21 mm)
Bolt Circle (E)	4 in. (102 mm)	4-1/2 in. (114 mm)	4-3/4 in. (121 mm)	6 in. (152 mm)	7-1/2 in. (191 mm)
Centerline (F)	1-27/32 in. (47 mm)	2-1/16 in. (52 mm)	2-5/8 in. (67 mm)	3-19/32 in. (91 mm)	4-5/16 in. (109 mm)

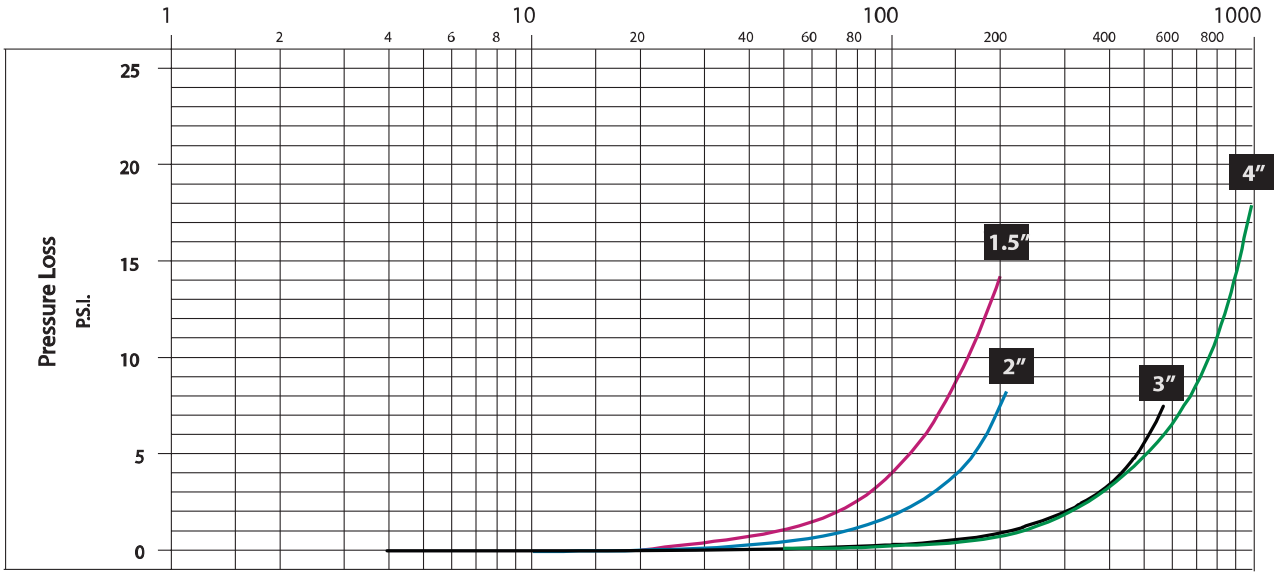
PRESSURE LOSS CHART FOR METERS WITHOUT STRAINER

Rate of flow in gallons per minute (gpm)



PRESSURE LOSS CHART FOR METERS WITH INTEGRAL STRAINER

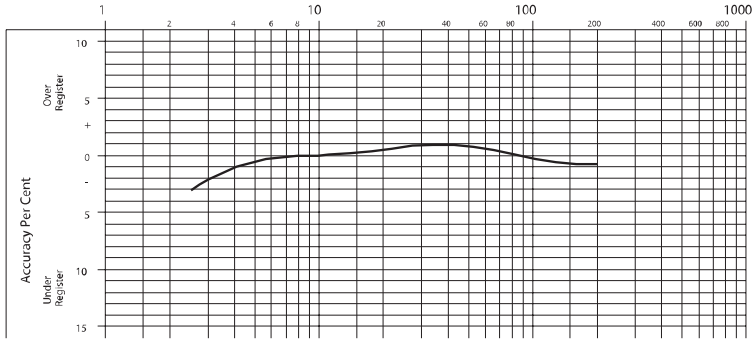
Rate of flow in gallons per minute (gpm)



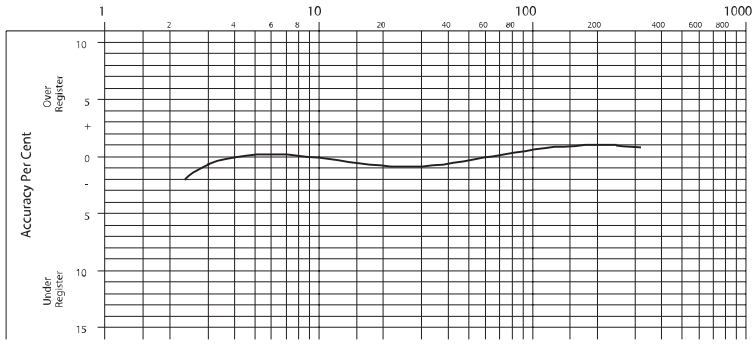
ACCURACY CHARTS FOR METERS WITHOUT STRAINER

Rate of flow in gallons per minute (gpm)

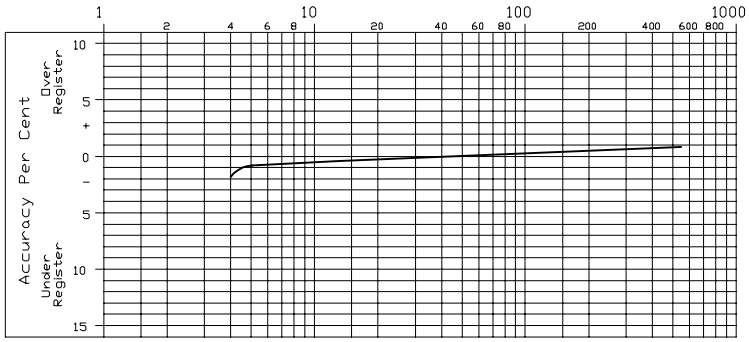
1-1/2 in. Meter



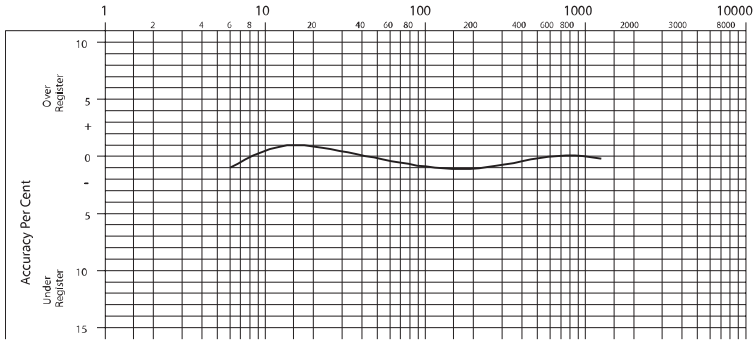
2 in. Meter



3 in. Meter



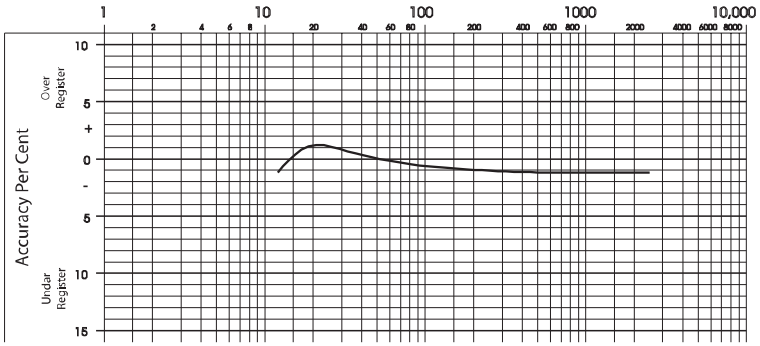
4 in. Meter



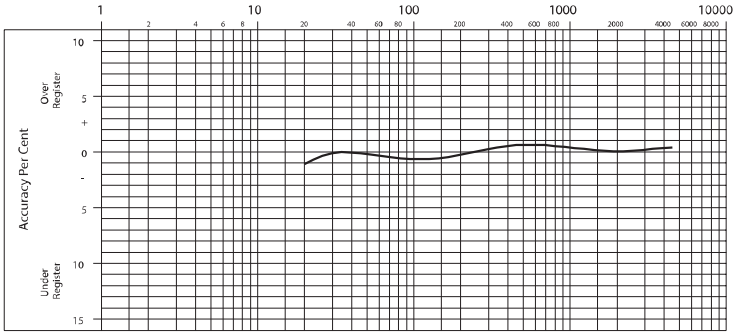
ACCURACY CHARTS FOR METERS WITHOUT STRAINER (CONTINUED)

Rate of flow in gallons per minute (gpm)

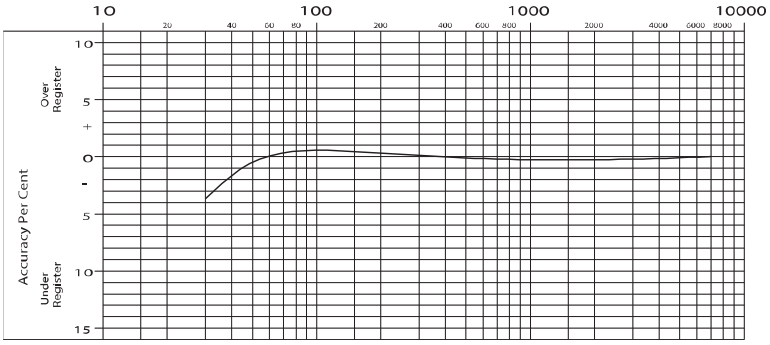
6 in. Meter



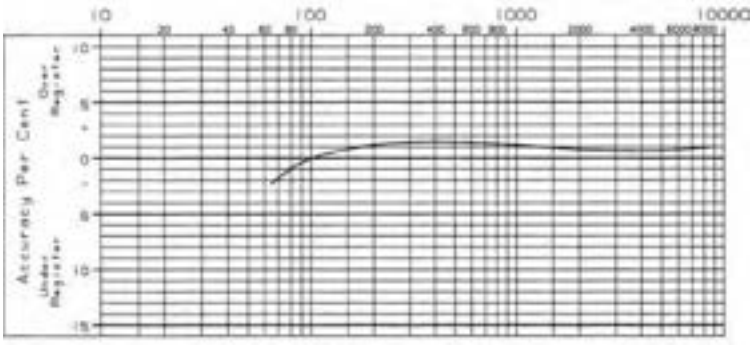
8 in. Meter



10 in. Meter



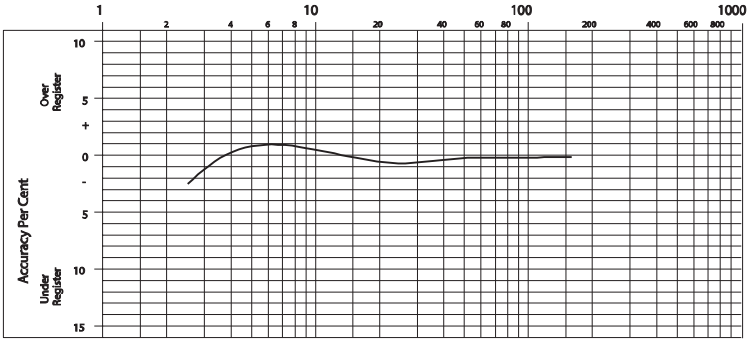
12 in. Meter



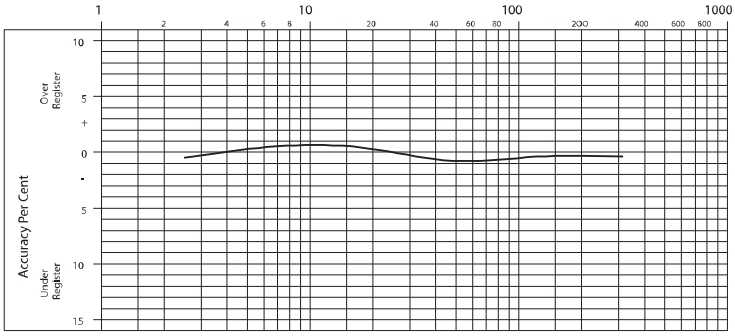
ACCURACY CHARTS FOR METERS WITH INTEGRAL STRAINER

Rate of flow in gallons per minute (gpm)

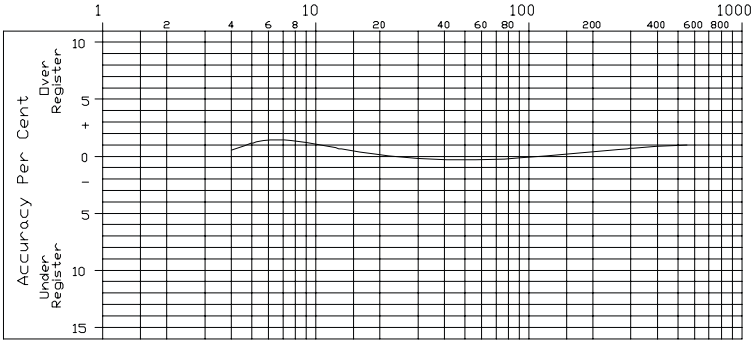
1-1/2 in. Meter



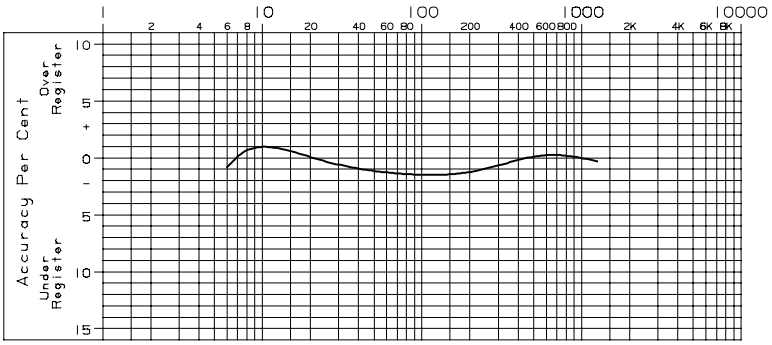
2 in. Meter



3 in. Meter



4 in. Meter



For Non-Health Hazard Applications

Job Name _____ Contractor _____

Job Location _____ Approval _____

Engineer _____ Contractor's P.O. No. _____

Approval _____ Representative _____

LEAD FREE*

MasterSeries® LF860

Reduced Pressure Zone Backflow Prevention Assemblies

Size: 2½" - 10" (65mm - 250mm)

The FEBCO MasterSeries LF860 Reduced Pressure Zone Assembly is specifically designed to protect against possible backpressure and backsiphonage conditions for high hazard [i.e., toxic] application in accordance with Local Governing Water Utility Code. This Backflow Prevention Assembly is primarily used on potable drinking water systems where Local Governing Code mandates protection from non-potable water being pumped or siphoned back into the potable water system.

The LF860 features Lead Free* construction to comply with low lead installation requirements. The Lead Free* Reduced Pressure Zone Assemblies shall comply with state codes and standards, where applicable, requiring reduced lead content.

Features

- Inline Serviceable Assembly
- No Special Tools Required for Servicing
- Captured Modular Spring Assembly
- Reversible & Replaceable Discs
- Field Replaceable Seats
- Ductile Iron Valve Body Design
- Stainless Steel Check Components
- Modular Pressure Differential Relief Valve
- Repairable Pressure Differential Relief Valve
- Clapper Check Assembly
- Captured O-ring Design

Series LF860 Reduced Pressure Zone Assembly

Specifications

The FEBCO MasterSeries LF860 Reduced Pressure Zone Assembly shall be installed on the potable water supply and at each point of cross-connection to protect against possible back-pressure and backsiphonage conditions for high hazard [i.e., toxic] applications. The assembly shall consist of a main line valve body composed of a pressure differential relief valve located in a zone between two (2) independently acting approved clapper style check modules with replaceable seats and disc rubbers. Servicing of the pressure differential relief valve and both check modules does not require any special tools; both check modules are accessed through independently top entry covers. This assembly shall be fitted with AWWA Compliant inlet/outlet resilient seated shutoff valves; when used on a Fire-Sprinkler application, the assembly shall be fitted with approved UL/FM inlet/outlet resilient seated shutoff valves and contain four (4) properly located resilient seated test cocks as specified by AWWA Standard C511. Flow and pressure loss performance parameters shall meet the requirements of AWWA Standard C511.

NOTICE

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.

NOTICE

Inquire with governing authorities for local installation requirements

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

FEBCO®

A WATTS Brand

Options - Suffix

OSY: UL/FM Approved OS&Y Gate Valves (ANSI/AWWA C515 Compliant)

NRS: Non-Rising Stem Gate Valves (ANSI/AWWA C509 Compliant)

LG: Less Shut-off valves; This is NOT an APPROVED ASSEMBLY

Example Ordering Descriptions:

4" LF860-OSY - Valve Assembly fitted with OS&Y Shutoff Valves

4" LF860-NRS - Valve Assembly fitted with NRS Shutoff Valves

Assembly Flow Orientation:

- Horizontal (2½" – 10") - Approved by FCCCHR-USC, ASSE, cULus, FM, IAPMO and CSA

Approvals - Standards

- Approved by the Foundation for Cross-Connection Control and Hydraulic Research at The University of Southern California (FCCCHR-USC)
- ASSE 1013 Listed
- **UL Classified (US & Canada)
- **FM Approved
- IAPMO
- AWWA Standard C511 Compliant
- End Connections: Compliant to ASME B16.1 Class 125 & AWWA Class D Flange

**Assembly configured with UL/FM Approved OS&Y RW Gate Valves. Less gate valve assemblies are not UL/FM approved configurations.

1013 B64.4

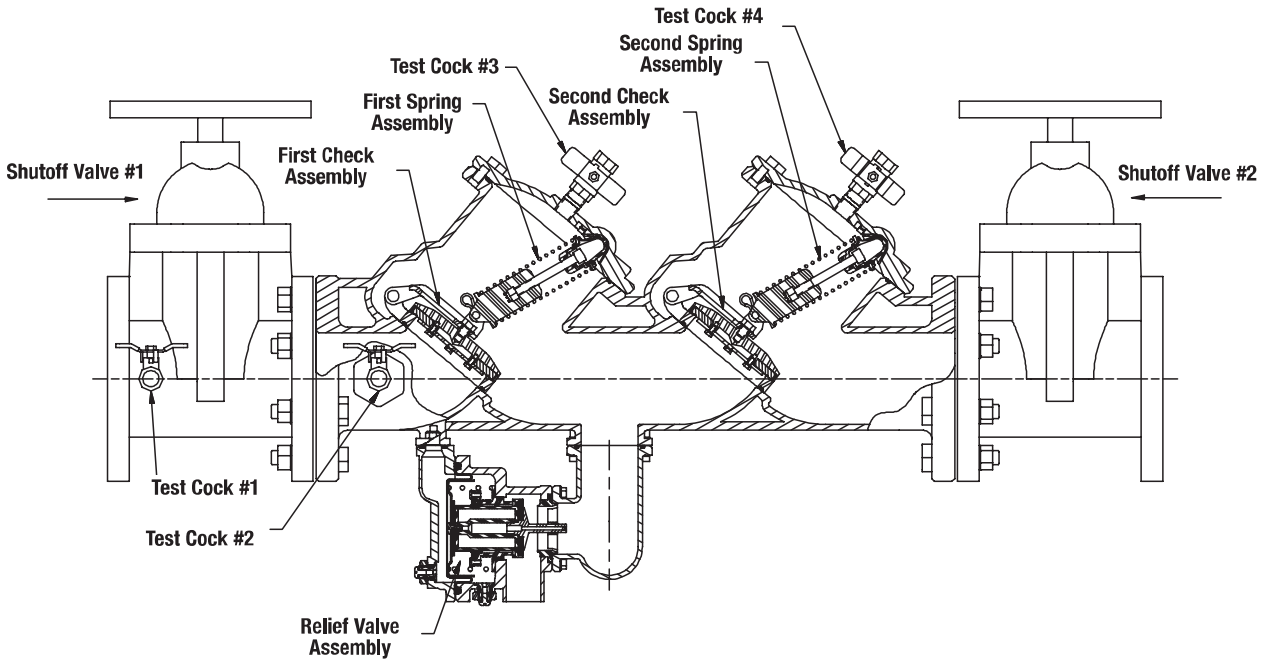
Materials

Below is a general materials list of the Series LF860. All assemblies size 2½" through 10" is similar in materials and construction. Please contact your local FEBCO Representative if you require further information.

Main Valve Body:	Ductile iron Grade 65-45-12
Relief Valve Body:	Ductile iron Grade 65-45-12
Coating:	Fusion epoxy coated internal and external AWWA C550
Shutoff Valves:	NRS resilient wedge gate valve AWWA C509 (Standard) OSY resilient wedge gate valve AWWA C515 (UL/FM)
Check Seats:	Stainless Steel
Disc Holder:	Stainless Steel
Elastomer Disc:	Silicone
Spring:	Stainless Steel
Clamp:	AWWA C606 (10" Only)

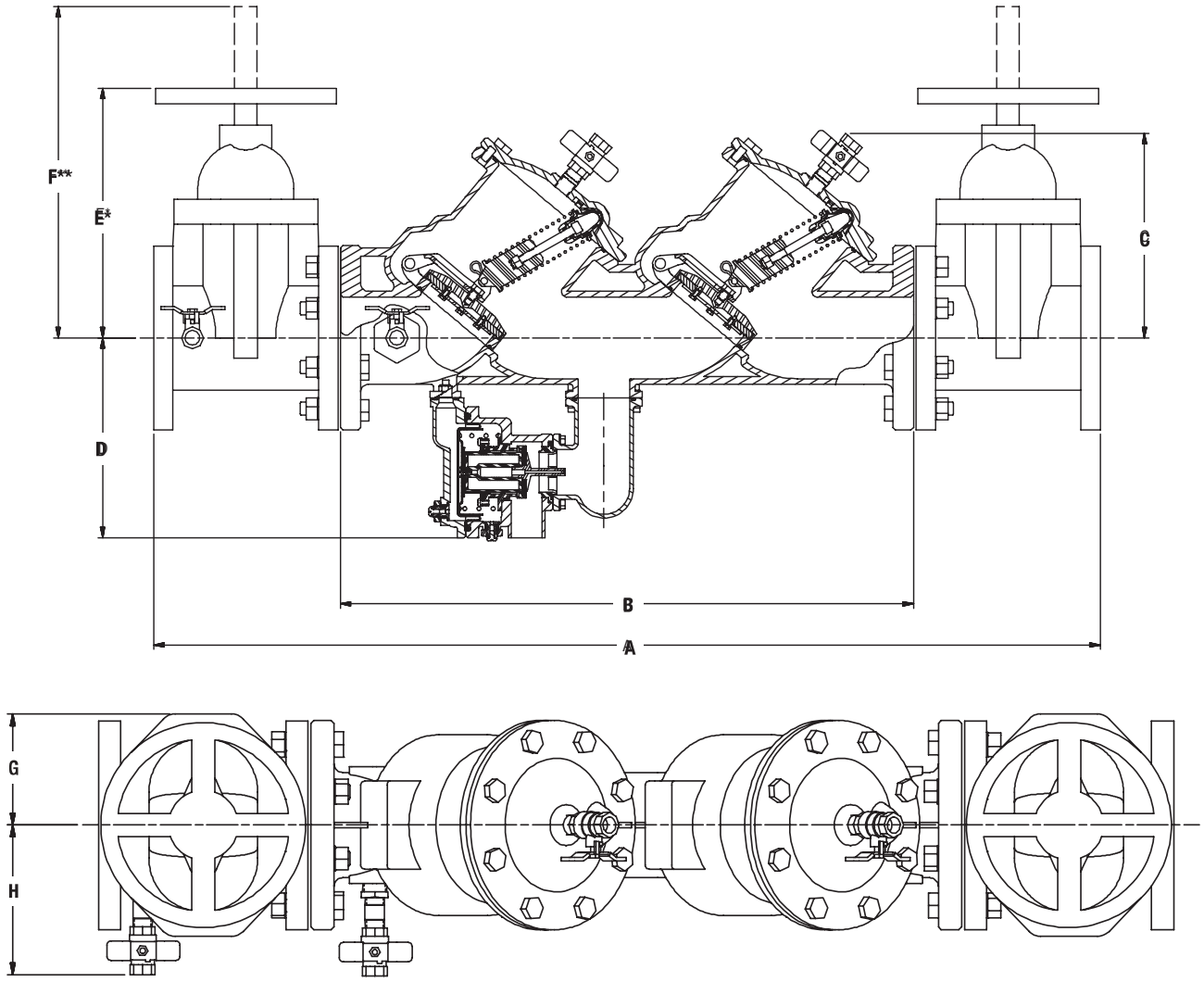
Pressure - Temperature

Max. Working Pressure:	175 psi (12.1 bar)
Min. Working Pressure:	20 psi (1.4 bar)
Hydrostatic Test Pressure:	350 psi (24.1 bar)
Hydrostatic Safety Pressure:	700 psi (48.3 bar)
Temperature Range:	33°F - 140°F (0.5°C - 60°C) Continuous



Dimensions & Weights

Below are the nominal dimensions and physical weights for the Series LF860 size 2½" through 10". Allowances must be made for normal manufacturing tolerances. Please visit our website to download a copy of this product's installation instructions, or contact your local FEBCO Representative for more information.



LF860

SIZE (DN)		DIMENSIONS																WEIGHT***			
		A		B		C		D		E*		F**		G		H		NRS		OSY	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	kg.	lbs.	kg.
2½	65	40¾	1035	25½	648	10	254	10	254	12⅝	321	16⅜	416	4½	114	7⅛	181	250	113	254	115
3	80	41⅞	1064	25⅝	651	10	254	10	254	12⅞	327	22¼	565	4½	114	7⅜	187	276	125	280	127
4	100	46¼	1175	28	711	10⅛	257	10⅛	257	14⅜	365	23¼	591	5½	140	8⅛	206	335	152	347	157
6	150	56	1422	34¾	883	12¾	324	11⅛	283	18⅞	479	30⅛	765	6½	165	9⅞	251	503	228	523	237
8	200	65	1651	41¾	1061	15⅝	397	12¼	311	23½	597	37¾	959	7	178	11⅛	283	807	366	835	379
10	250	72⅝	1845	46⅜	1178	15⅝	397	12⅜	314	27½	699	48	1219	9	229	12⅜	314	1205	547	1243	564

* Indicates nominal dimensions with NRS Gate Valves
** Indicates nominal dimensions with OSY Gate Valves (Full Open Position)
*** Indicates weight of complete Backflow Assemblies with specified Gate Valves

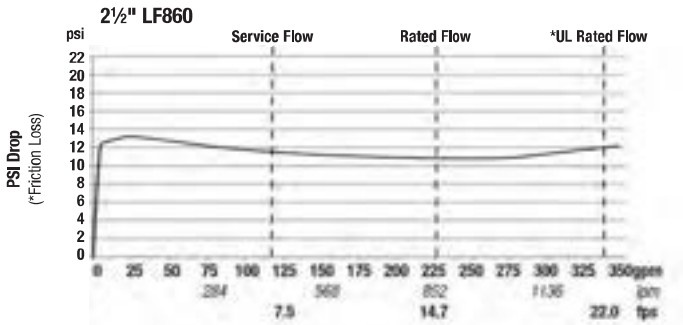
The gap drain is not designed to catch the maximum discharge possible from the relief valve. The installation of the FEBCO air gap with the drain line terminating above a floor drain will handle any normal discharge or nuisance spitting through the relief valve. However, floor drain size may need to be designed to prevent water damage caused by a catastrophic failure condition. Do not reduce the size of the drain line from the air gap fitting.

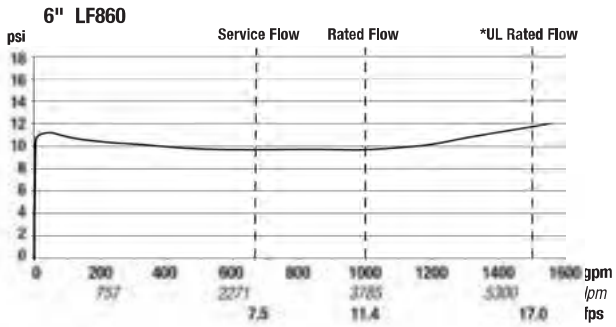
Performance

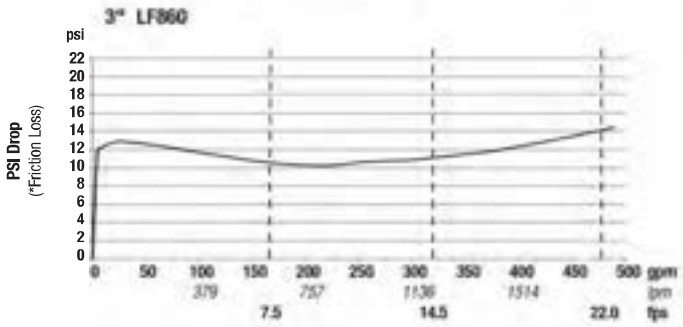
Flow capacity chart identifies valve performance based upon rated water Velocity up to 20fps

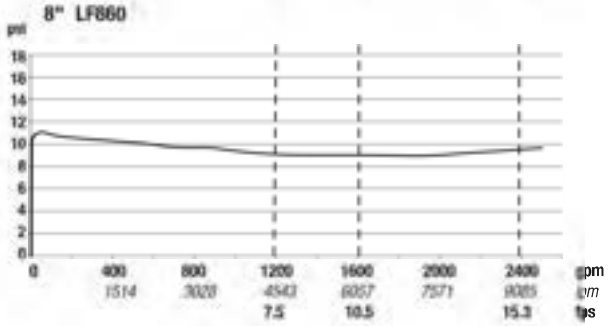
- Maximum service flow rate is determined by maximum rated Velocity of 7.5fps.
- AWWA Manual M-22 (Appendix C) recommends that the maximum water Velocity in the services be not more than 10fps.
- UL flow rate is determined by typically rated Velocity of 15 feet/sec.

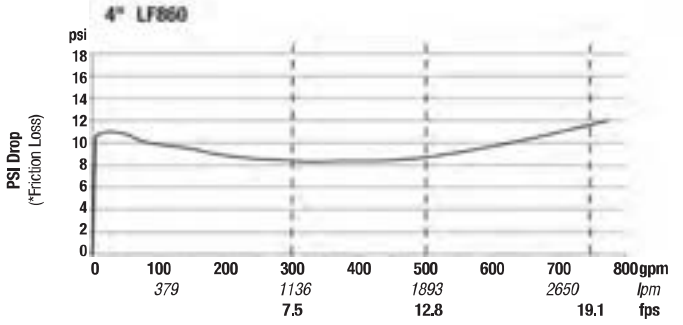
Capacity

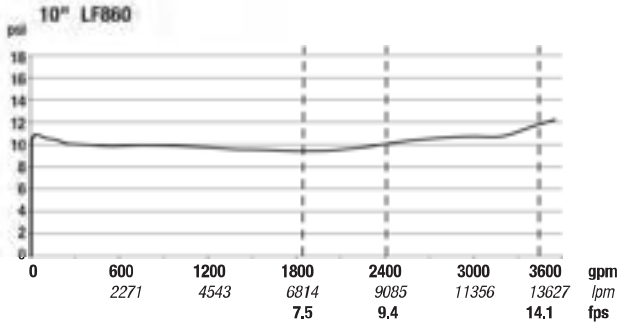












Job Name _____ Contractor _____

Job Location _____ Approval _____

Engineer _____ Contractor's P.O. No. _____

Approval _____ Representative _____

LEAD FREE*

MasterSeries® LF876V

Double Check Detector Backflow Prevention Assemblies (Type II)

Size: 2½" - 10"

The FEBCO MasterSeries LF876V Double Check Detector Assembly is specifically designed to protect against possible backpressure and backsiphonage conditions for non-health hazard (i.e., pollutant) application in accordance with Local Governing Water Utility Code.

The coating on this backflow assembly uses ArmorTek™ technology to resist corrosion due to microbial induced corrosion (MIC) or exposed metal substrate. This Backflow Assembly is primarily used on potable drinking water systems and fire sprinkler systems, where Local Governing Code mandates protection from non-potable quality water being pumped or siphoned back into the potable water system.

Features

Main Valve:

- Inline Serviceable Assembly
- Horizontal "N-Pattern" Installations
- Vertical-Up "Z-Pattern" Installations
- No Special Tools Required for Servicing
- Captured Modular Spring Assembly
- Reversible & Replaceable Discs
- Field Replaceable Seats
- Ductile Iron Valve Body Design
- Stainless Steel Check Components
- Utilizes advanced ArmorTek™ coating technology to resist corrosion of internals
- Winterization feature with disc retainers and valve body drain ports
- Clapper Check Assembly
- Commonality between 1st & 2nd Check Components
- Captured O-ring Design

Auxiliary Bypass:

- Compact Bypass Design; Remains within Main Valve Assembly Profile
- Inline Serviceable ¾" Check Assembly
- No Special Tools Required for Servicing
- Field Replaceable Seat & Disc
- Detect Potential Underground Water Leaks
- Detect Unauthorized Water Usage

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

Model LF876V Double Check Detector Assembly

Specifications

The FEBCO MasterSeries LF876V Double Check Detector Valve Assembly shall be installed on the potable water supply and at each point of cross-connection to protect against possible backpressure and backsiphonage conditions for non-health hazard (i.e., pollutant) applications. The assembly shall consist of a main line valve body composed of two (2) independently acting approved clapper style check modules with replaceable seats and disc rubbers. Servicing of both check modules does not require any special tools and are accessed through independent top entry covers. This assembly shall be fitted with approved UL/FM inlet/outlet resilient seated shutoff valves and contain four (4) properly located resilient seated test cocks as specified by AWWA Standard C510. The auxiliary bypass line contains a ⅝"x¾" Water Meter that complies with ANSI/AWWA Standard C700 coupled with an approved check assembly. The bypass line is designed to detect leaks or unauthorized water usage of the water system while protecting against possible backpressure and backsiphonage conditions for non-health hazard (i.e., pollutant) application. The valve body shall utilize a coating system with built-in electrochemical corrosion inhibitor and microbial inhibitor. The assembly shall be approved for horizontal and/or vertical-up installations while meeting the requirements of AWWA Standard C510 flow and pressure loss performance parameters.

NOTICE

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.

NOTICE

Inquire with governing authorities for local installation requirements

FEBCO®

A WATTS Brand

Options - Suffix

OSY: UL/FM Approved OS&Y Gate Valves [ANSI/AWWA C515 Compliant]

DNRS: Domestic Non-Rising Stem Gate Valves [ANSI/AWWA C509 Compliant]

CFM: Totalizing Cubic feet/min ⅝"x ¾" Water Meter [ANSI/AWWA C700 Compliant]

GPM: Totalizing Gallons/min ⅝"x ¾" Water Meter [ANSI/AWWA C700 Compliant]

LG: Less Shutoff valves; This is NOT an APPROVED ASSEMBLY

Example Ordering Description:

4" LF876V-OSY-GPM - Valve Assembly fitted with OS&Y Shutoff Valves & Gallons per Minute Water Meter

4" LF876V-OSY-CFM - Valve Assembly fitted with OS&Y Shutoff Valves & Cubic Feet per Minute Water Meter

Available Components

Wye Strainer: FDA Approved [ASME B16.1 Class 125 & AWWA Class D Flange]

Series 611 Valve Setter: MJ x MJ - Mechanical Joint x Mechanical Joint [AWWA C111/A21.11]

MJ x FL - Mechanical Joint x Flange [AWWA C111/A21.11; ASME B16.1 Class 125/AWWA Class D Flange]

FL x FL – Flange x Flange [ASME B16.1 Class 125 & AWWA Class D Flange]

Materials

Below is a general materials list of the Model LF876V. All assemblies size 2½" through 10" is similar in materials and construction. Please contact your local FEBCO Representative if you require further information.

Main Valve Body:	Ductile iron Grade 65-45-12
Coating:	Fusion epoxy coated internal and external AWWA C550-90
Shutoff Valves:	OSY resilient wedge gate valve AWWA C515 (UL/FM)
Check Seats:	Stainless Steel
Disc Holder:	Stainless Steel
Elastomer Disc:	Silicone
Spring:	Stainless Steel
Clamp:	AWWA C606

Approvals – Standards:

- Approved by the Foundation for Cross-Connection Control and Hydraulic Research at The University of Southern California [FCCCHR-USC]
- ASSE 1048 Listed
- **UL Classified [US & Canada]
- **FM Approved
- IAPMO/cUPC
- AWWA Standard C510 Compliant
- End Connections: Compliant to ASME B16.1 Class 125 & AWWA Class D Flange

**Assembly configured with UL/FM Approved OS&Y RW Gate Valves. Less gate valve assemblies are not UL/FM approved configurations.

Assembly Flow Orientation:

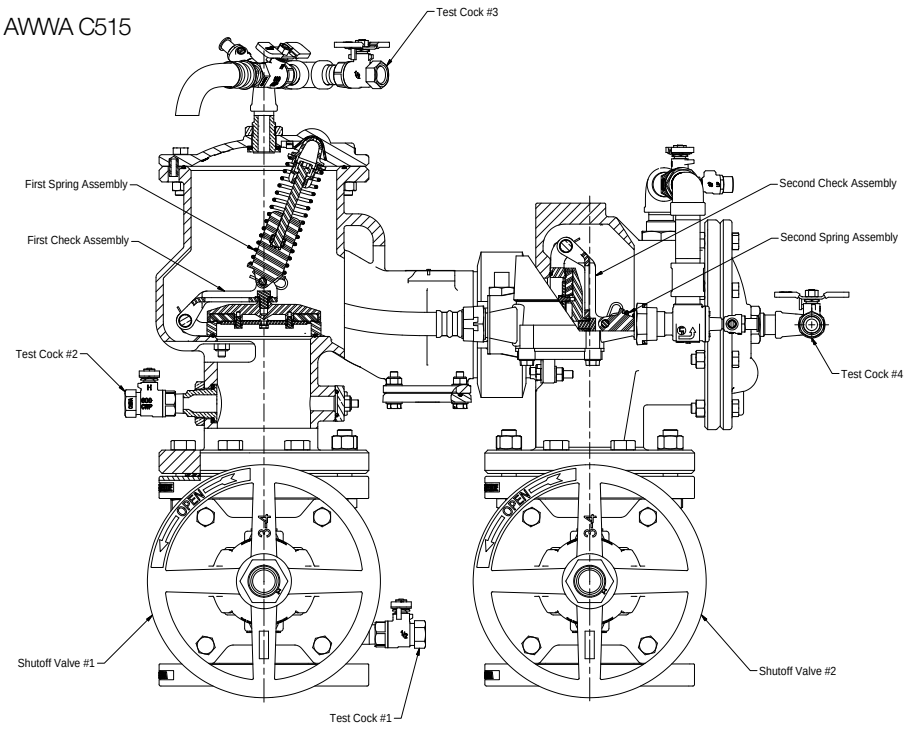
Horizontal (N-Pattern 2½" – 10") - Approved by FCCCHR-USC, ASSE, cULus, FM, IAPMO/cUPC

Vertical Up (Z-Pattern 2½" – 10") - Approved by FCCCHR-USC, ASSE, cULus, FM, IAPMO/cUPC

1048 B64.5

Pressure - Temperature

Max. Working Pressure:	175psi (12.1 bar)
Min. Working Pressure:	10psi (0.7 bar)
Hydrostatic Test Pressure:	350psi (24.1 bar)
Hydrostatic Safety Pressure:	700psi (48.3 bar)
Temperature Range:	33°F - 140°F [0.5°C- 60°C] Continuous

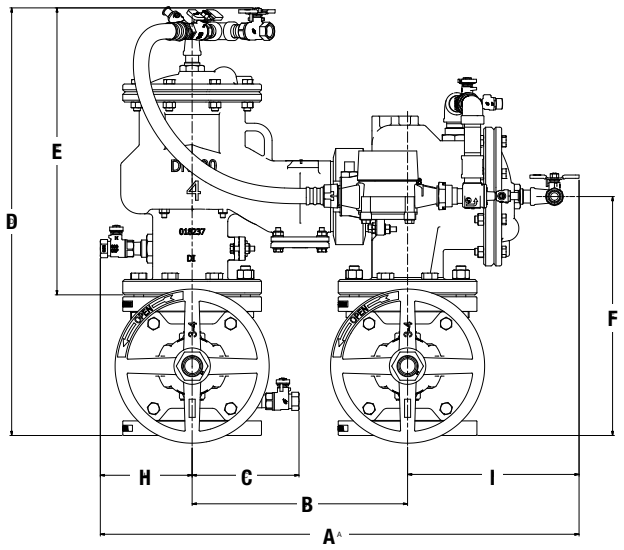


Dimensions – Weights

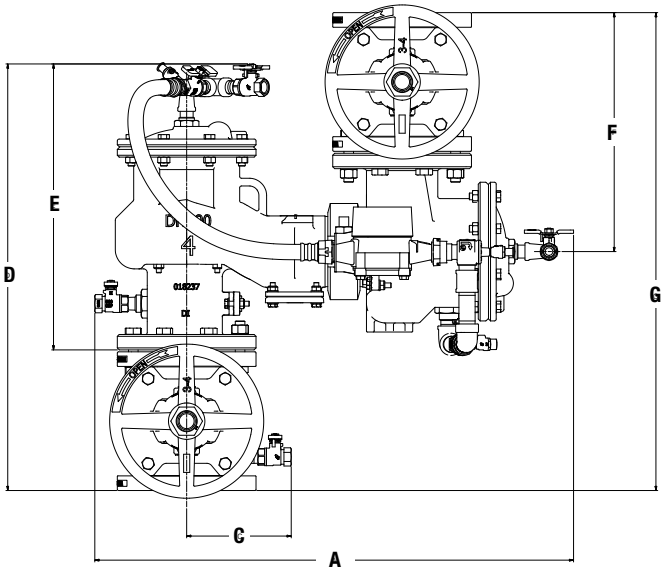
Size: 2½" - 10"

Below are the nominal dimensions and physical weights for the Model LF876V size 2½" through 10". Allowances must be made for normal manufacturing tolerances. Please visit our website to download a copy of this product's installation instructions, or contact your local FEBCO Representative for more information.

Model LF876V Standard Orientation (N-Pattern)

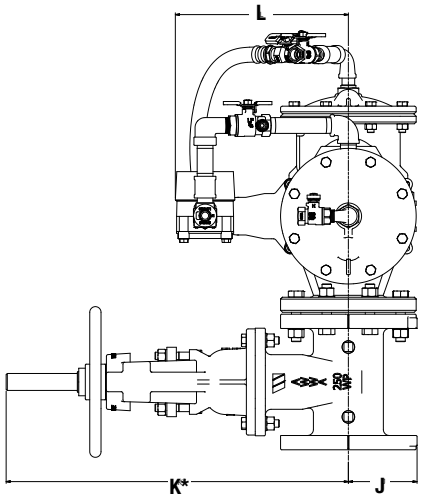


Model LF876V Vertical Orientation (Z-Pattern)



Note: The Series LF876V is shipped in the standard (N-Pattern) orientation as shown above.

Gate Valve Side View Clearance



LF876V

SIZE	DIMENSIONS																								WEIGHT**	
	A		B		C		D		E		F		G		H		I		J		K*		L		OSY	
in.	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*lbs.*	*kg.*
2½	29⅛	740	12½	318	6¼	159	25¼	642	17½	445	13⅝	346	27¼	692	5½	140	11⅛	283	3½	89	16⅜	416	11½	292	216	98
3	29⅛	740	12½	318	6¼	159	25¾	654	17¾	451	14⅛	359	28¼	718	5½	140	11⅛	283	3¾	95	18⅞	479	11½	292	242	110
4	31⅛	791	14	356	7	178	27¾	705	18¾	476	15½	394	31	787	6	152	11⅛	283	4½	114	22¾	578	13	330	347	157
6	35¾	908	16	406	8	203	32¾	831	22⅛	562	18⅝	473	37¼	946	7¼	184	12½	316	5½	140	30⅛	765	13	330	529	240
8	40¾	1035	18½	470	9¼	235	36¾	933	25⅛	638	20¾	527	41½	1054	8½	216	14	356	6¾	172	37¾	959	14½	368	827	375
10	46¼	1175	21	533	10⁷⁄₁₆	264	41³⁄₁₆	1047	28⅛	714	23¹¹⁄₁₆	601	47 3/8	1202	9 5/8	244	15¹¹⁄₁₆	398	8	203	45¾	1162	13⅛	333	1335	606

Notes:

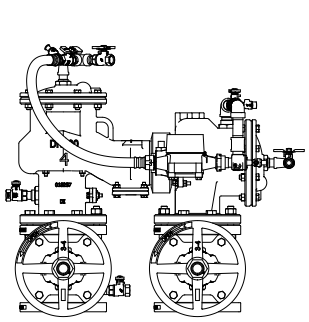
* Indicates nominal dimensions with OSY Gate Valves (Full Open Position)

** Indicates weight of complete Backflow Assemblies with specified Gate Valves

Performance

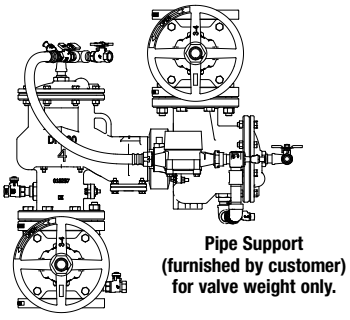
Flow capacity chart identifies valve performance based upon rated water Velocity up to 20fps

- Maximum service flow rate is determined by maximum rated Velocity of 7.5fps.
- AWWA Manual M-22 (Appendix C) recommends that the maximum water Velocity in the services be not more than 10fps.
- UL flow rate is determined by typically rated Velocity of 15 feet/sec.



Standard Orientation "N-Pattern"

Flow Curve N

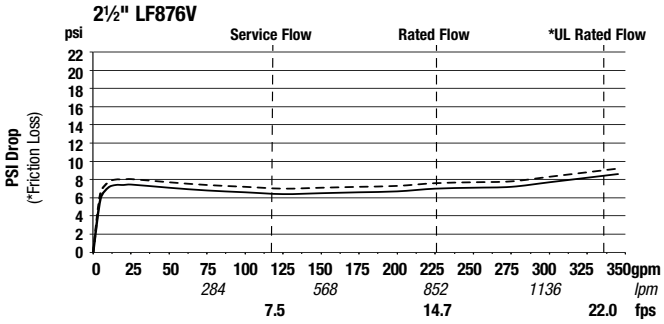


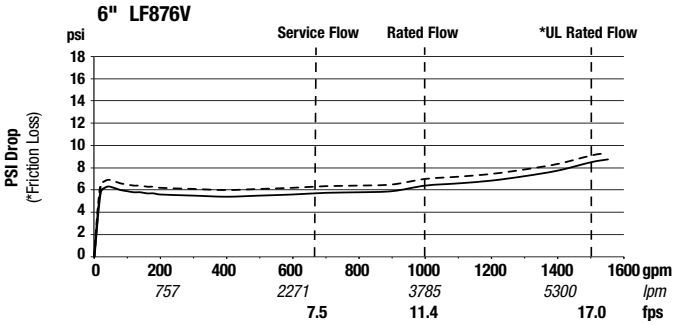
Vertical Orientation "Z-Pattern"

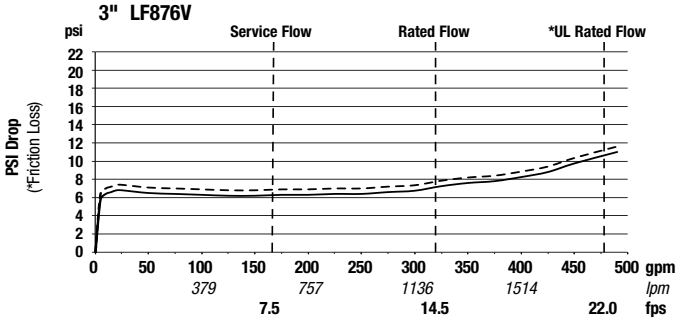
Flow Curve Z

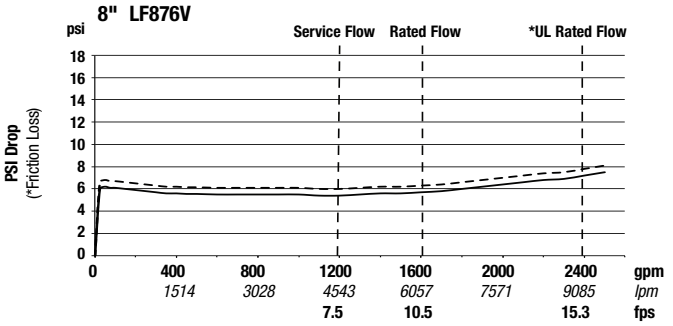
Capacity

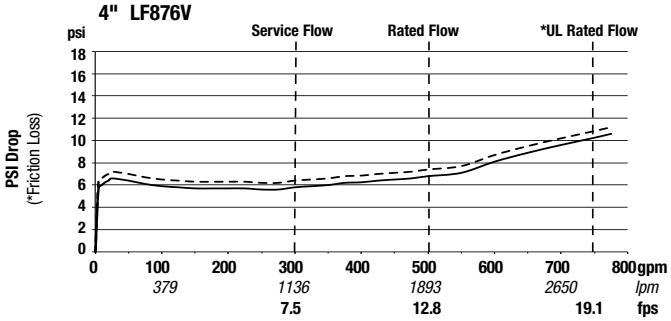
N-Pattern Z-Pattern

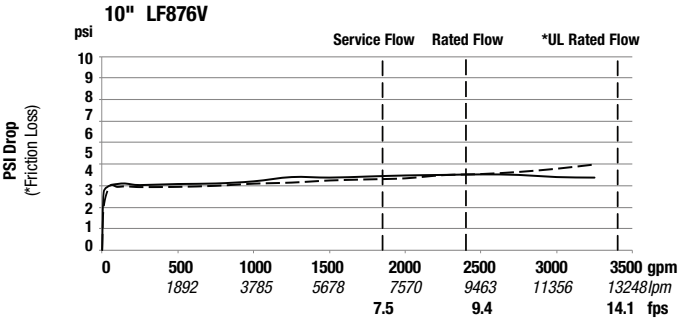












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