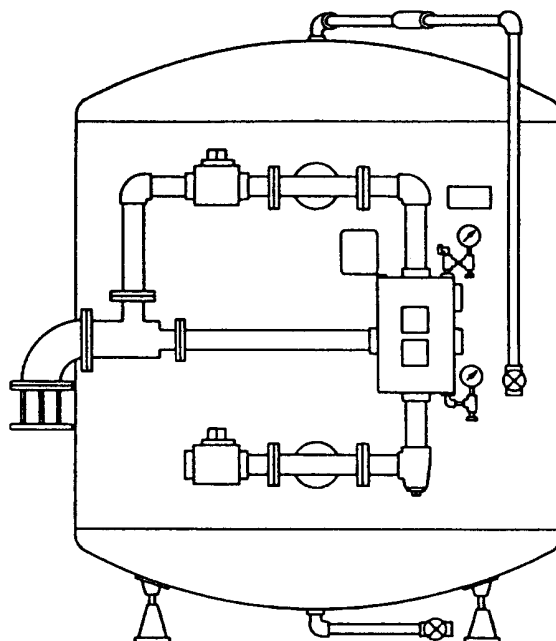


Section H8

FILTERS



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This section contains information on water filters used for the removal of impurities from raw water. Filters discussed here remove:

- Chlorine and organics.
- Particles down to 10-micron size.
- Sand and heavy sediment.
- Iron.

FEATURES AND BENEFITS

Complete Range of Sizes and Filter Media Available:

- Precisely match customer needs (system specific).

Pre-Engineered Packaged Units Shipped From Stock:

- Short lead times.
- Minimum down time.

Industrial Grade Multiport Control Valve:

- Long lasting.
- High reliability.
- Easy maintenance.

Backwash Control Actuated On a Time Clock, Pressure Differential Switch, or Water Meter Basis:

- Versatility.

Inlet and Outlet Pressure Gauges and Sample Cocks:

- Easy monitoring of system performance.

Fully Assembled Manifold Piping:

- Ease of installation, lower installation costs.

Heavy Duty Steel Tanks With Galvanized or Prime Coat Exterior Finish (Specialty Linings Optional):

- Corrosion resistance and longer life.

Premium Grades of Filter Media:

- Optimum performance.

PRODUCT OFFERING

The need for special filter equipment for removal of impurities can be readily determined by raw water analysis. Where filters are recommended, cost is quickly recovered by eliminating need for frequent equipment cleaning and servicing, inefficient performance, damage to system components, and premature equipment failure.

Standard Equipment

Automatic Units 12" - 16" Diameter:

- Skirt type tanks.
- Epoxy lined interior.
- Painted exterior.
- Locking bayonet cover.
- Fine slotted tubular PVC distributor.
- Automatic time clock operation.

Automatic Units 20" - 42" Diameter:

- Structural steel legs.
- Double hot-dipped galvanized interior and exterior.
- ML and AC filters are epoxy lined with prime coat exterior.
- 20" - 30" have access handhole in top head and lower sideshell.
- 36" - 42" have 11" x 15" elliptical manhole in top head.
- PVC radial distribution.
- Automatic time clock operation.

Automatic Units 48" Diameter and Larger:

- Adjustable jack support legs.
- Prime coat exterior.
- 12" x 16" elliptical manhole in top head.
- Header and lateral distribution system.
- Inlet and outlet pressure gauges.
- Air relief valve.
- Flanged tank openings.
- Automatic time clock operation.

Optional Equipment

- ASME code tanks.
- Specialty tank linings.
- Skid mounted, fully pre-piped and wired.
- Automatic operation by pressure differential or water meter.
- Manual backwash controls.
- Backwash with water from auxiliary source.

DIMENSIONS, RATINGS, AND SIZING

Dimensions for filter systems without regenerant tanks are shown in Figure H8-1.

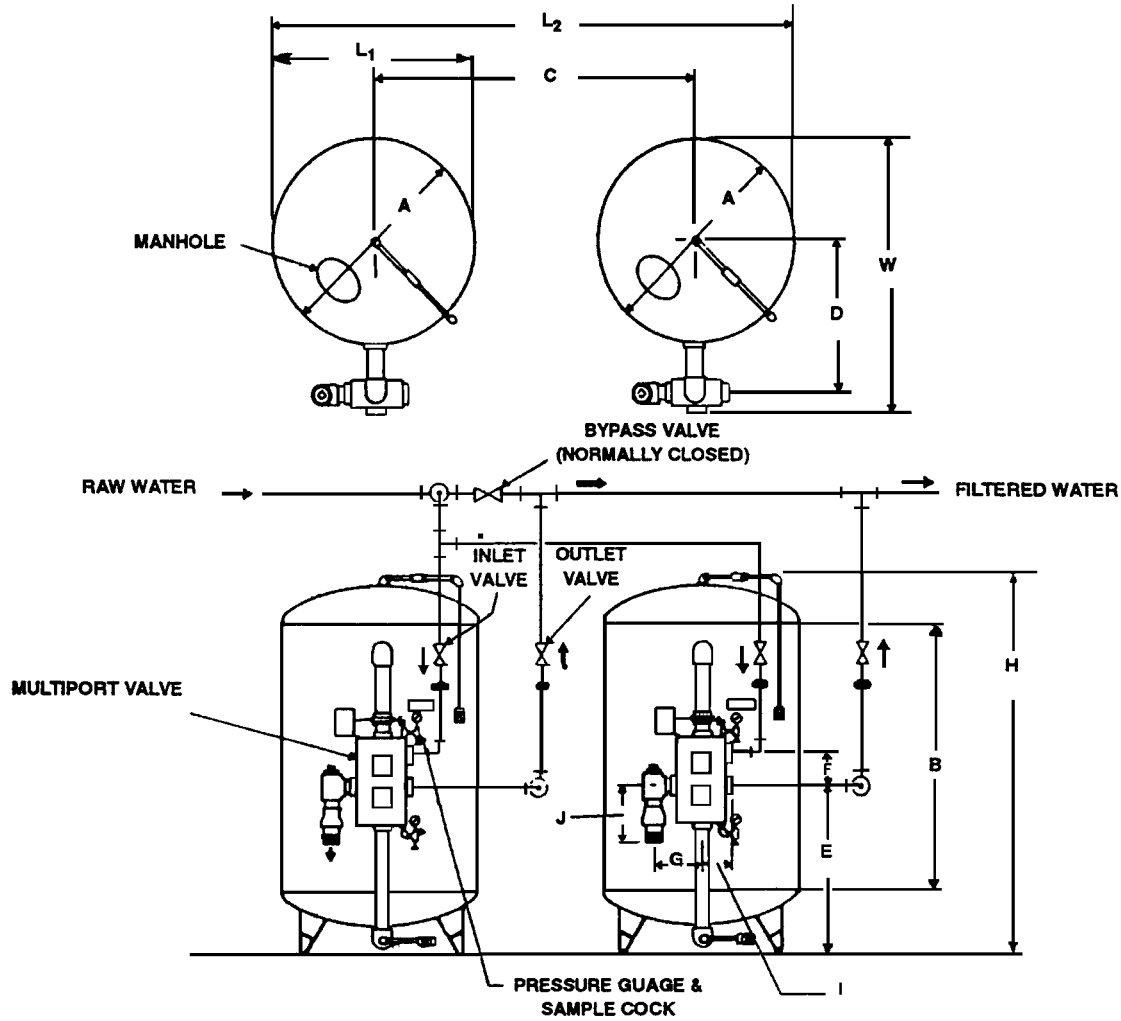
Sizing

In addition to service flow, the selection of a filter system must take into account the available backwash flow rate. This is the most important function in the proper operation of a filter. A periodic backwash and rinse is required to cleanse and reclassify the filter media.

Backwash flow rates are always higher than service flow rates and therefore limit the filter size that can be installed. As a general rule, select the largest filter that can be back washed with the flow rate available at the point of filter installation. Then note the service flow rate for the filter selected. If it is not adequate for the flow to be treated, a twin filter installed in parallel is required.

A parallel installation will increase the service flow and permit each filter to be back washed separately with the existing water supply.

Generally, lower flows produce higher quality water and a larger volume of "treated" water between backwashing.



FILTER TANK SIZE (IN) A x B	SYSTEM DIMENSIONS				OTHER APPLICABLE DIMENSIONS								
	SINGLE	TWIN	TRIPLE	QUAD	W	H	C	D	E	F	G	I	J
	L ₁	L ₂	L ₃	L ₄									
20x54	20	58	96	134	28-1/2	72	38	15-1/2	43	3-1/4	5-3/8	3-9/16	4/12
24x54	24	66	108	150	33	75	42	18	43	3-1/4	5-7/8	3-9/16	4-1/2
30x54	30	78	126	174	40	78	48	21-1/8	43	4-5/8	11	4-1/2	9
36x60	36	90	144	198	46	89	54	24-1/8	43	4-5/8	11-1/4	4-1/2	9-1/2
42x60	42	102	162	222	53-1/2	91	60	27-1/8	43	6-5/8	14-1/4	6-7/16	10-7/8
48x60	48	114	180	246	64	86	66	35	36-1/2	6-5/8	14-1/2	6-7/16	11-1/4
54x60	54	126	198	270	70	87	72	38	37-1/4	6-5/8	14-1/2	6-7/16	12-7/8
60x60	60	138	216	294	76	89	78	41	38	6-5/8	14-1/2	6-7/16	12-7/8
72x60	72	162	252	342	88	93	90	47	41-1/4	6-5/8	14-1/2	6-7/16	12-7/8
84x60	84	186	288	390	100	97	102	53	43	6-5/8	53-1/4	6-7/16	17-3/4
96x60	96	210	324	438	114	101	114	41-1/4	45	6-5/8	53-1/4	6-7/16	17-3/4

NOTES:
 1. All values are in inches.
 2. System dimensions based on 18" space between pressure tanks.

Figure H8-1. Dimensional Data, Filter System Without Regeneration Tanks

Cleaver-Brooks rates the performance of each filter as follows:

Superior

Recommended for most applications under all operating conditions.

Best quality water.

Maximum on line time between backwashing.

Lowest pressure loss.

Recommended for influent suspended solids loads up to or greater than 300 ppm.

High

- Well suited for many applications.
- Very good quality water.
- Moderate on line time between backwashing.
- Increased pressure loss.
- Recommended for influent suspended solids loads less than 300 ppm.

Utility

- Flow rates listed are at peak design: operation at higher flows not recommended.
- Satisfactory water quality.
- Shorter on line time.
- Higher pressure loss.
- Recommended for influent suspended solids loads less than 150 ppm.

Chlorine, Organics

CB activated carbon filters (Table H8-11) remove free chlorine, some dissolved organics and sediment, down to 40-micron particle size, from boiler makeup water. By removing sediment, activated carbon filters also help control sludge buildup in boilers. They protect pretreatment equipment by: 1) removal of free chlorine, which is corrosive and attacks the ion exchange resin cross-linking agent in water softeners and dealkalizers, and the membranes in reverse osmosis equipment, and 2) removing organics which promote fouling in ion exchange beds, that can contaminate water supplies and cause foaming in boilers and heat exchange equipment.

Periodic backwashing is required to remove collected matter from the filter bed.

- Flow rates: 3 to 226 gpm.
- Tank sizes: 12" to 72" dia.
- Operating temperatures: 40 °F to 120 °F.

Particles Down to 10-Micron Size

Multilayered filters (Table H8-2) are used for finer levels of filtration and for handling heavy flow rates. They remove sediment, suspended solids and colloidal matter, down to 10-micron particle size, from boiler makeup water. They are highly effective in controlling sludge buildup. Periodic backwashing is required to remove collected matter from the filter bed.

- Flow rates: 8 to 393 gpm.
- Tank sizes: 12" to 60" dia.
- Operating temperatures: 40 °F to 120 °F.

Sand, Heavy Sediment

Sand filters (Table H8-3) can handle heavy loads in controlling sludge buildup. They remove heavy, large-particle sediment and suspended solids, down to 40-micron size, from makeup water. Periodic backwashing is required to remove collected matter from the filter bed.

- Flow rates: 3 to 170 gpm.
- Tank sizes: 12" to 72" dia.
- Operating temperatures: 40 °F to 130 °F.

Iron

Cleaver-Brooks iron filters (Table H8-4) remove both soluble and insoluble iron, suspended solids and colloidal matter down to 40-micron particle size from boiler makeup water. They are used to control sludge buildup caused by iron precipitation. Water pH must be at least 6.2. Occasional regeneration with potassium permanganate may be required.

- Flow rates: 3 to 226 gpm.
- Tank sizes: 12" to 72" dia.
- Operating temperatures: 40 °F to 120 °F.

ENGINEERING DATA

Select a filter from the tables to produce the desired flow rate and pressure drop. Check to assure the required backwash flow rate is available. Twin filters may be required to produce maximum flow rate and still enable backwash with the existing piping system.

Table H8-1. Model CF Activated Carbon Media Filter

MODEL NUMBER	PIPE SIZE	WATER QUALITY						BACK-WASH RATE	TANK SIZE DIA X SIDE SHELL	FILTER MEDIA LOAD	FLOOR SPACE REQ'D	HEIGHT	OPER WT
		SUPERIOR		HIGH		UTILITY							
		FLOW RATE	PRESS. LOSS	FLOW RATE	PRESS. LOSS	FLOW RATE	PRESS. LOSS						
CFB-	IN.	GPM	PSIG	GPM	PSIG	GPM	PSIG	GPM	IN.	CU FT	IN.	IN.	LBS
2-1	1	3	1	4.5	2	6	3	8.3	12x54	2	13x21	60	450
3-1	1	4	1	6	3	9	4	10	14x60	3	15x23	66	550
4-1	1	6	1	8	3	11	4	13.5	16x60	4	17x25	66	700
5-1/2-1	1	9	1	13	2	17	3	20	20x54	5.5	21x29	72	100
7-1-1/4	1-1/4	13	2	19	3	25	6	30	24x54	7	25x33	74	1650
12-1/2-1-1/2	1-1/2	20	3	29	4	39	7	46	30x54	12.5	31x40	79	2700
18-2	2	28	2	42	4	57	7	70	36x60	18	37x48	90	4200
25-2	2	38	3	58	6	77	9	95	42x60	25	43x56	92	5800
25-2-1/2	2-1/2	38	2	58	3	77	5	95	42x60	25	43x57	92	5900
34-3	3	50	1	75	2	100	3	115	48x60	34	49x64	86	7100
44-3	3	64	2	95	3	127	5	150	54x60	44	55x70	87	9100
54-3	3	79	2	118	4	157	7	180	60x60	54	61x76	89	11400
78-3	3	113	3	170	7	226	11	270	72x60	78	73x88	93	15700
78-4	4	113	2	170	3	226	5	270	72x60	78	73x90	93	15800

NOTES:
 Filter Media Consists of Granular Activated Carbon.
 For chlorine removal only use the flow rates from the utility water quality column. For sediment and organic removal use the flow rates from the superior water quality column.

Table H8-2. Model MF Multi-Layered Media Filter

MODEL NUMBER	PIPE SIZE	WATER QUALITY						BACK-WASH RATE	TANK SIZE DIA x SIDE SHELL	FILTER MEDIA LOAD	FLOOR SPACE REQ'D	HEIGHT	OPER WT
		SUPERIOR		HIGH		UTILITY							
		FLOW RATE	PRESS. LOSS	FLOW RATE	PRESS. LOSS	FLOW RATE	PRESS. LOSS						
MFB-	IN.	GPM	PSIG	GPM	PSIG	GPM	PSIG	GPM	IN.	CU-FT	IN.	IN.	LBS
2-1	1	8	5	12	8	16	12	11.5	12x54	2	13x21	60	500
2-1/2-1	1	11	6	16	11	21	17	15	14x60	2.5	15x23	66	690
4-1-1/4	1-1/4	14	7	21	12	28	18	20	16x60	4	17x25	66	850
5-1-1/4	1-1/4	22	6	33	12	44	19	30	20x54	5	21x29	72	1800
5-1-1/2	1-1/2	22	3	33	6	44	10	30	20x54	5	21x30	72	1850
7-1-1/4	1-1/4	31	9	47	18	63	29	45	24x54	7	25x33	74	2350
7-1-1/2	1-1/2	31	5	47	9	63	16	45	24x54	7	25x34	74	2400
10-1-1/2	1-1/2	49	10	74	19	98	26	75	30x54	10	31x40	79	3675
10-2	2	49	6	74	13	98	20	75	30x54	10	31x41	79	3700
15-2	2	71	9	106	17	141	27	105	36x60	15	37x46	90	5550
15-2-1/2	2-1/2	71	5	106	10	141	15	105	36x60	15	37x48	90	5650
21-2-1/2	2-1/2	96	7	144	13	192	20	150	42x60	21	43x53	92	8295
21-3	3	96	6	144	11	192	16	150	42x60	21	43x54	92	8350
27-3	3	126	6	188	11	251	17	180	48x60	27	49x64	86	10400
27-4	4	126	3	188	5	251	8	180	48x60	27	49x66	86	10500
34-3	3	159	8	239	15	318	22	240	54x60	34	55x70	87	12800
34-4	4	159	4	239	6	318	10	240	54x60	34	55x72	87	12900
43-3	3	197	10	295	20	393	31	300	60x60	43	61x76	89	15800
43-4	4	197	5	295	9	393	13	300	60x60	43	61x78	89	15900

NOTES:

1. Filter media consists of various size, distinctly layered sand.
2. All pressure drop data based on new filter media and 60 °F water temperature
3. Backwash when pressure drop increases by 12-15 psig over pressure drop of a clean filter.
4. Consult Cleaver-Brooks for larger diameter tanks.
5. Allow a minimum of 24" above filter for access into top of tank.

Table H8-3. Model SF Sand Filter

MODEL NUMBER	PIPE SIZE	WATER QUALITY						BACK-WASH RATE	TANK SIZE DIA x SIDE SHELL	FILTER MEDIA LOAD	FLOOR SPACE REQ'D	HEIGHT	OPER WT
		SUPERIOR		HIGH		UTILITY							
		FLOW RATE	PRESS. LOSS	FLOW RATE	PRESS. LOSS	FLOW RATE	PRESS. LOSS						
SFB-	IN.	GPM	PSIG	GPM	PSIG	GPM	PSIG	GPM	IN.	CU-FT	IN.	IN.	LBS
2-1	1	3	2	4	3	5	5	10	12x54	2	13x21	60	490
3-1	1	3	2	5	4	6	5	13.5	14x60	3	15x23	66	650
4-1	1	4	2	6	4	8	6	15	16x60	4	17x25	66	850
6-1	1	7	2	10	3	13	5	25	20x54	6	21x29	72	1700
9-1-1/4	1-1/4	9	2	14	4	19	6	35	24x54	9	25x33	74	2250
14-1-1/2	1-1/2	15	3	22	5	29	7	60	30x54	14	31x40	79	3500
20-2	2	21	2	32	5	42	7	85	36x60	20	37x46	90	5300
28-2	2	29	3	43	6	58	9	115	42x60	28	43x53	92	7900
28-2-1/2	2-1/2	29	2	43	4	58	6	115	42x60	28	43x54	92	8000
34-3	3	38	2	57	4	75	5	150	48x60	34	49x64	86	9900
44-3	3	48	2	72	4	95	6	190	54x60	44	55x70	87	12200
54-3	3	59	3	88	5	118	7	230	60x60	54	61x76	89	15100
78-4	4 BWA	85	3	127	6	170	9	330	72x60	78	73x88	93	21700

NOTES:

1. Filter media consists of silica sand.
2. 4BWA - minimum 4" water supply required. Filter manifold connections are 3" inlet/outlet and 3" backwash assist.
3. All pressure drop data based on new filter media and 60 °F water temperature.
4. Backwash when pressure drop increases by 12-15 psig over pressure drop of a clean filter.
5. Consult Cleaver-Brooks for larger diameter tanks.
6. Allow a minimum of 24" above filter for access into top of tank.

Table H8-4. Model IF Iron Filter

MODEL NUMBER	PIPE SIZE	WATER QUALITY						BACK-WASH RATE	TANK SIZE DIA x SIDE SHELL	FILTER MEDIA LOAD	FLOOR SPACE REQ'D	HEIGHT	OPER WT
		SUPERIOR		HIGH		UTILITY							
		FLOW RATE	PRESS. LOSS	FLOW RATE	PRESS. LOSS	FLOW RATE	PRESS. LOSS						
IFB-	IN.	GPM	PSIG	GPM	PSIG	GPM	PSIG	GPM	IN.	CU-FT	IN.	IN.	LBS
2-1	1	3	3	5	5	6	7	8.3	12x54	2	13x21	60	490
3-1	1	4	3	6	5	9	8	10	14x60	3	15x23	66	660
4-1	1	6	3	8	6	11	8	13.5	16x60	4	17x25	66	850
6-1	1	9	3	13	6	17	8	20	20x54	6	21x29	72	1550
9-1-1/4	1-1/4	13	5	19	7	25	10	30	24x54	9	25x33	74	2200
13-1-1/2	1-1/2	20	3	29	6	39	9	46	30x54	13	31x40	79	3600
18-2	2	28	2	42	4	57	6	69	36x60	18	37x46	90	5200
28-2	2	38	5	58	9	77	13	90	42x60	28	43x53	92	7500
28-2-1/2	2-1/2	38	3	58	5	77	8	90	42x60	28	43x54	92	7600
34-3	3	50	3	75	5	100	7	115	48x60	34	49x64	86	9800
44-3	3	64	4	95	6	127	9	150	54x60	44	55x70	87	10800
54-3	3	79	4	118	7	157	10	190	60x60	54	61x76	89	13900
78-3	3	113	5	170	9	226	15	270	72x60	78	73x88	93	20400
78-4	4	113	3	170	6	226	9	270	72x60	78	73x90	93	20500

Note: Filter media consists of manganese greensand. It must periodically be regenerated with potassium permanganate (KMnO₄).

Table H8-5. Engineering Data (Filters) (Page 1 of 2)

MODEL NUMBER	TANK SIZE (DIA x HT)	PIPE SIZE (IN.)	MEDIA (CU-FT)	FREE BOARD (IN.)	SUPPT BED (LBS)	NO. OF DIST	SERV FLOW (GPM)	PRESS. LOSS (PSIG)	PEAK FLOW (GPM)	PRESS. LOSS (PSIG)	BACK WASH (GPM)	DRAIN PIPE SIZE (IN.)	SHIP WT (LBS)	OP WT (LBS)
ACC-MFB	MULTI-LAYERED													
2-1	12x54	1	2	19	40	1	8	5	16	12	11.5	3/4	377	500
2-1/2-1	14x60	1	2.5	24-1/2	60	1	11	6	21	17	15	3/4	483	690
4-1-1/4	16x60	1-1/4	4	25	85	1	14	7	28	18	20	1	621	850
5-1-1/4	20x54	1-1/4	5	19	200	4	22	6	44	19	30	1-1/4	955	1800
5-1-1/2	20x54	1-1/2	5	19	200	6	22	3	44	10	30	1-1/4	982	1850
7-1-1/4	24x54	1-1/4	7	23-1/2	200	4	31	9	63	29	45	1/1/4	1283	2350
7-1-1/2	24x54	1-1/2	7	23-1/2	200	6	31	5	63	16	45	1-1/4	1314	2400
10-1-1/2	30x54	1-1/2	10	23	400	6	49	10	98	26	75	2	2046	3675
10-2	30x54	2	10	23	400	8	49	6	98	20	75	2	2066	3700
15-2	36x60	2	15	30-1/2	500	8	71	9	141	27	105	2	3180	5550
15-2-1/2	36x60	2-1/2	15	30-1/2	500	12	71	5	141	15	105	2	3391	5650
21-2-1/2	42x60	2-1/2	21	31	700	12	96	7	192	20	150	2-1/2	3741	8295
21-3	42x60	3	21	31	700	16	96	6	192	16	150	2-1/2	3761	8350
27-3	48x60	3	27	31	1000	26	126	6	251	17	180	3	5370	10400
27-4	48x60	4	27	31	1000	26	126	3	251	8	240	3	5888	10500
34-3	54x60	3	34	31	1300	36	159	8	318	22	240	3	6566	12800
34-4	54x60	4	34	31	1300	36	159	4	318	10	240	3	7087	12900
43-3	60x60	3	43	31	1800	36	197	10	393	31	300	4	8999	15800
43-4	60x60	4	43	31	1800	36	197	5	393	13	300	4	9213	15900
ACC-SFB	SAND													
2-1	12x54	1	2	16	40	1	3	2	5	5	10	3/4	386	490
3-1	14x60	1	3	18	60	1	3	2	6	5	13.5	3/4	534	650
4-1	16x60	1	4	17-1/2	85	1	4	2	8	6	15	1	701	850
6-1	20x54	1	6	13	200	4	7	2	13	5	25	1-1/4	1073	1700
9-1-1/4	24x54	1-1/4	9	15	200	4	9	2	19	6	35	1-1/4	1545	2250
14-1-1/2	30x54	1-1/2	14	15	400	6	15	3	29	7	60	2	2532	3500
20-2	36x60	2	20	22-1/2	500	8	21	2	42	7	85	2	3630	5300
28-2	42x60	2	28	22	700	12	29	3	58	9	115	2-1/2	4781	7900
28-2-1/2	42x60	2-1/2	28	22	700	16	29	2	58	6	115	2-1/2	5385	8000
34-3	48x60	3	34	24	1000	10	38	2	75	5	150	3	6045	9900
44-3	54x60	3	44	24	1300	16	48	2	95	6	190	3	7566	12200
54-3	60x60	3	54	24	1800	16	59	3	118	7	230	4	9623	15100
78-4	72x60	4	78	24	2600	26	85	3	170	9	330	6	14727	21700

Table H8-5. Engineering Data (Filters) (Page 2 of 2)

MODEL NUMBER	TANK SIZE (DIA x HT)	PIPE SIZE (IN.)	MEDIA (CU-FT)	FREE BOARD (IN.)	SUPPT BED (LBS)	NO. OF DIST	SERV FLOW (GPM)	PRESS LOSS (PSIG)	PEAK FLOW (GPM)	PRESS LOSS (PSIG)	BACK WASH GPM	DRAIN PIPE SIZE (IN.)	SHIP WT (LBS)	OP WT (LBS)
ACC-CFB	ACTIVATED CARBON													
2-1	12x54	1	2	16	40	1	3	1	6	3	8.3	3/4	206	450
3-1	14x60	1	3	18	60	1	4	1	9	4	10	3/4	324	550
4-1	16x60	1	4	17-1/2	85	1	6	1	11	4	13.5	1	421	700
5-1/2-1	20x54	1	5-1/2	16	200	4	9	1	17	3	20	1-1/4	633	1200
7-1-1/4	24x54	1-1/4	7	22-1/2	200	4	13	2	25	6	30	1-1/4	855	1650
12-1/2-1-1/2	30x54	1-1/2	12-1/2	18-1/2	400	6	20	3	39	7	46	2	1407	2700
18-2	36x60	2	18	26	500	8	28	2	57	7	70	2	2170	4200
25-2	42x60	2	25	25-1/2	700	8	38	3	77	9	95	2-1/2	2731	5800
25-2-1/2	42x60	2-1/2	25	25-1/2	700	12	38	2	77	5	95	2-1/2	3335	5900
34-3	48x60	3	34	24	1000	16	50	1	100	3	115	3	3652	7100
44-3	54x60	3	44	24	1300	16	64	2	127	5	150	3	4462	9100
54-3	60x60	3	54	24	1800	26	79	2	157	7	190	4	5856	11400
78-3	72x60	3	78	24	2600	26	113	3	226	11	270	6	8662	15700
78-4	72x60	4	78	24	2600	26	113	2	226	5	270	6	9113	15800
ACC-IFB	IRON													
2-1	12x54	1	2	16	40	1	3	3	6	7	8.3	3/4	356	490
3-1	14x60	1	3	18	60	1	4	3	9	8	10	3/4	489	660
4-1	16x60	1	4	17-1/2	85	1	6	3	11	8	13.5	1	633	850
6-1	20x54	1	6	13	200	4	9	3	17	8	20	1-1/4	983	1550
9-1-1/4	24x54	1-1/4	9	15-1/2	200	4	13	5	25	10	30	1-1/4	1380	2200
13-1-1/2	30x54	1-1/2	13	17-1/2	400	6	20	3	39	9	46	2	2232	3600
18-2	36x60	2	18	26	500	8	28	2	57	6	69	2	3160	5200
28-2	42x60	2	28	22	700	8	38	5	77	13	90	2-1/2	4361	7500
28-2-1/2	42x60	2-1/2	28	22	700	12	38	3	77	8	90	2-1/2	4965	7600
34-3	48x60	3	34	24	1000	16	50	3	100	7	115	3	5522	9800
44-3	54x60	3	44	24	1300	16	64	4	127	9	150	3	6882	10800
54-3	60x60	3	54	24	1800	26	79	4	157	10	190	4	8813	13900
78-3	72x60	3	78	24	2600	26	113	5	226	15	270	6	12952	20400
78-4	72x60	4	78	24	2600	26	113	3	226	9	270	6	13403	20500

NOTES

Section H8

Filters Sample Specifications

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The following sample specifications are provided by Cleaver-Brooks to assist you in meeting your customer's requirements.

PART 1 GENERAL

11 GENERAL

Furnish, install, and place in service an assembled vertical, pressure type, water filtration system of an approved design fabricated by a manufacturer regularly engaged in the production of water conditioning equipment. It shall be a Cleaver-Brooks Model ___ having ___ cubic feet of filter media in each filter tank. Service flow rate through each filter tank shall be ___ gpm at pressure loss not to exceed ___ psig.

PART 2 PRODUCTS

21 HARDWARE

A. Mineral Tank

1. The mineral tank(s) shall be of welded construction of tank quality carbon steel. It shall be _____ " diameter with a _____ " straight shell with reinforced openings for pipe connections and an 11" x 15" manhole in the top head (for tank 30" diameter and smaller; two (2) 4" spin off handholes are provided in the top head and lower sideshell). The mineral tank shall be rated for 100 psig working pressure and hydrotested to 150 psig. Support legs shall be strap type - permanently welded to the lower tank head. Mineral tank(s) shall have both the exterior and interior protected with a hot dipped galvanized application prior to fabrication and shipment.
2. Option. ASME Code 100 psig working pressure, 150 psig test pressure stamped and certified. Cold set epoxy polyamide internal lining 8-10 mils DFT, with external rust resistance prime coat, 2-3 mils DFT. (For activated carbon and multilayer filters, cold set epoxy lining must be used due to highly corrosive effects of activated carbon.)
3. A minimum freeboard of 50% shall be provided for backwash expansion above the normal filter media bed level.

B. Upper Distributor

- a. The upper distributor system shall be of the single point baffle type. Constructed of Schedule-40 galvanized steel and fittings.

C. Lower Distributor

1. The lower radial distribution system shall be the hub and radial type of Schedule-80 PVC construction with a sub-fill of 1/8" x 1/16" gravel covering the distributor system laterals with slotted full flow non-clogging replaceable polypropylene strainers.

D. Main Operating Valve

1. The main operating valve on the filter shall be of the automatic multiport type, consisting of five (5) individual diaphragm valves housed in a compact casting. These valves are to be pressure actuated by an external pilot valve, automatically or manually. The valve shall be manufactured by the same manufacturer as the entire filtering system. The valve guides, seats, and diaphragm shall be constructed of Noryl plastic.

2. Pressure gauges and sample cocks to be provided on the inlet and outlet of the filter system.
 3. An automatic backwash control shall be provided to maintain a proper backwash and flush flows over wide variations of operating pressure. Controller shall contain no moving parts and require no field adjustment.
 4. The regeneration sequence shall be the accepted standard, which is backwash, fast flush, and return to service.
 5. An external PVC constructed eductor is to be provided to draw regenerant solution and rinse water to regenerate the filter media mineral. (On iron removal filters only.)
 6. The pipings shall be galvanized Schedule-40 galvanized steel with galvanized fittings.
 7. All face piping shall be preassembled to the tank in a professional manner.
- E. Filter Media
1. The filter media shall be S (No. 26 sand) for removal of sand and heavy sediment from water.
 2. The filter media shall be ML (Multi-Media) consisting of reverse grading of fine gravel, coarse gravel, red flint sand, and activated carbon.
 3. The filter media shall be M (Manganese Greensand) that will be periodically regenerated with potassium permanganate (KMnO₄).
 4. The filter media shall be AC (Granular Activated Carbon).
- F. Controls
1. Regeneration shall be controlled by a fully automatic time clock control (TCC) which is fully adjustable or a remote manual controller. For fully automatic operation, the regeneration shall be initiated by a calendar clock. A pointer shall indicate the cycle of operation at all times.
 2. When two (2) filters, or more, are required, a lockout shall be provided to allow only one (1) unit to regenerate at any one time.
 3. In the event of a power failure, a complete regeneration can be performed by manual operation of the external pilot valve.
 4. Control Options: Regeneration to be initiated by head loss across the filter(s). A delay timer is to be provided to prevent false backwashing due to pressure surges in the system.

PART 3 EXECUTION 31 INSTRUCTIONS

A complete set of installation and operating instructions shall be included.

3.2 GUARANTEES

- A. Attrition loss of mineral is guaranteed not to exceed 3% per year for a period of three (3) years.
- B. All mechanical equipment is guaranteed for one (1) year against any defects in workmanship or materials. Any part proving defective will be replaced or repaired within this period.

- C. The manufacturer guarantees that under actual operating conditions, the mineral shall not be washed out of the system during the service run or backwashing period; that the turbidity and color of the effluent, by reason of passing through the filter system, shall not be less than the incoming water; and that the under-drain system, gravel, and mineral shall not become fouled, either with turbidity or by dirt, while operating as noted on manufacturers instructions.