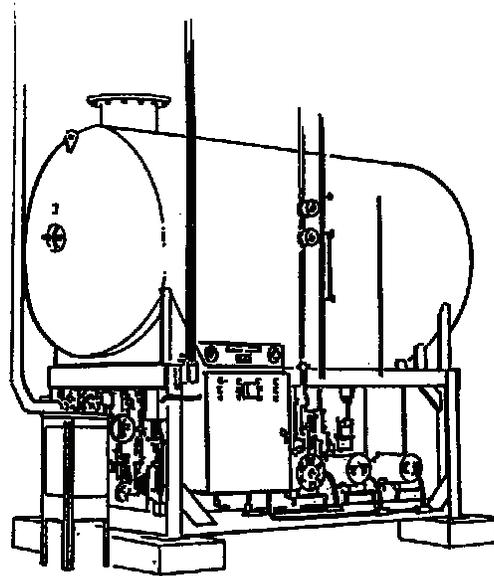


# SPRAYMASTER DEAERATORS (DUO-TANK)



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The Duo Tank product combines a surge tank with a Spraymaster deaerator into a single combined vessel, providing a complete engineered and packaged system.

The Cleaver-Brooks designed deaerator assures high purity effluent by removing oxygen and other dissolved gases in boiler feed. Thus, it is the answer to long-lasting boiler equipment for industrial and commercial boiler users. Built of corrosion-resistant alloys for lifetime service, the deaerator employs those basic principles of gas removal proven most effective and economical to every boiler owner. Contact your local Cleaver-Brooks authorized representative for component sizing information.

## FEATURES AND BENEFITS

The Duo Tank product combines a surge tank with a Spraymaster deaerator in to a single combined vessel, providing the following features and benefits in addition to the benefits of the deaerator and surge tank independently.

### Double Inner Head Separates the Deaerator Pressure Vessel From Surge Tank:

- Ensures the deaerator and surge tank are two separate vessels while structurally attached for space considerations. This also limits heat transfer from the deaerator pressure vessel to the surge atmospheric vessel, preventing energy loss due to surge tank water boiling.

### Vented and Insulated Gap Between the Deaerator and Surge Tank:

- Insulation is placed between the double inner head to further limit heat transfer from the deaerator pressure vessel to the surge atmospheric vessel. A vent is placed between the double inner head to allow moisture evaporation eliminating corrosion potential.

### Low Profile Design:

- Low head room allows for installation in space restricted areas.

### Two-Stage Deaeration in a Common Vessel:

- Recycle pumps are not required.
- Packaged for easy maintenance.

### Packaged Units for Cost Effective Installation:

- Complete packages are pre-fabricated in the Cleaver-Brooks manufacturing facility to ensure piping alignment and control wiring function. The unit is disassembled, match marked for efficient field re-assembly.

## PRODUCT OFFERING

Information in this section applies directly to Cleaver-Brooks packaged Spraymaster Deaerators in duo-tank arrangement ranging from 7000 to 280,000 lbs/hr.

The product offering for Duo-Tank packaging is a combination of the product offering for the Spraymaster Deaerator and the Surge Tank. The combined package product offering for Duo-Tank products is shown in Table H2-1

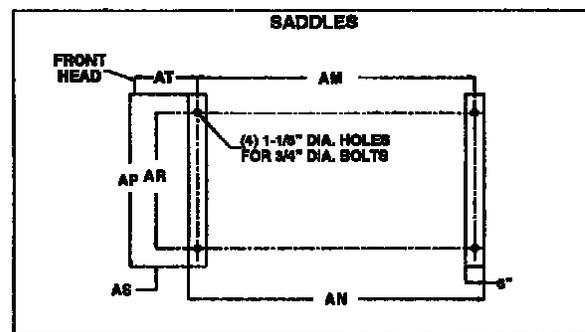
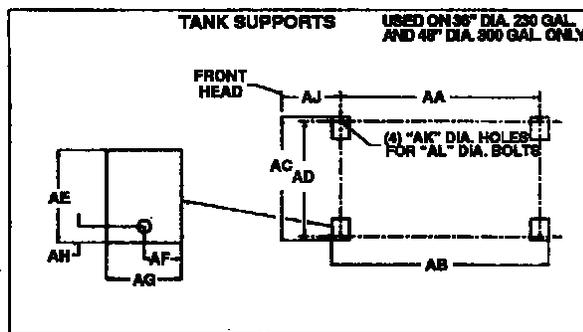
## DIMENSIONS AND RATINGS

Dimensions and ratings are shown in Figure H2-1 and Figure H2-2

Table H2-1. Spraymaster Deaerator Duo-Tank Offering

MODEL NO.	SD-7	SD-15	SD-30	SD-45	SD-70	SD-100	SD-40	SD-200	SD-280
Rating (lbs/hr)	7000	15000	30000	45000	70000	100000	140000	200000	280000
Deaerator Gallons to Overflow	230	300	600	900	1400	2000	2800	4000	5600
Deaerator Storage Capacity (min)	16	10	10	10	10	10	10	10	10
Surge Gallons to Flooded	160	300	600	900	1400	2000	2800	4000	5600
Surge Storage Capacity (Min)	11.5	10	10	10	10	10	10	10	10

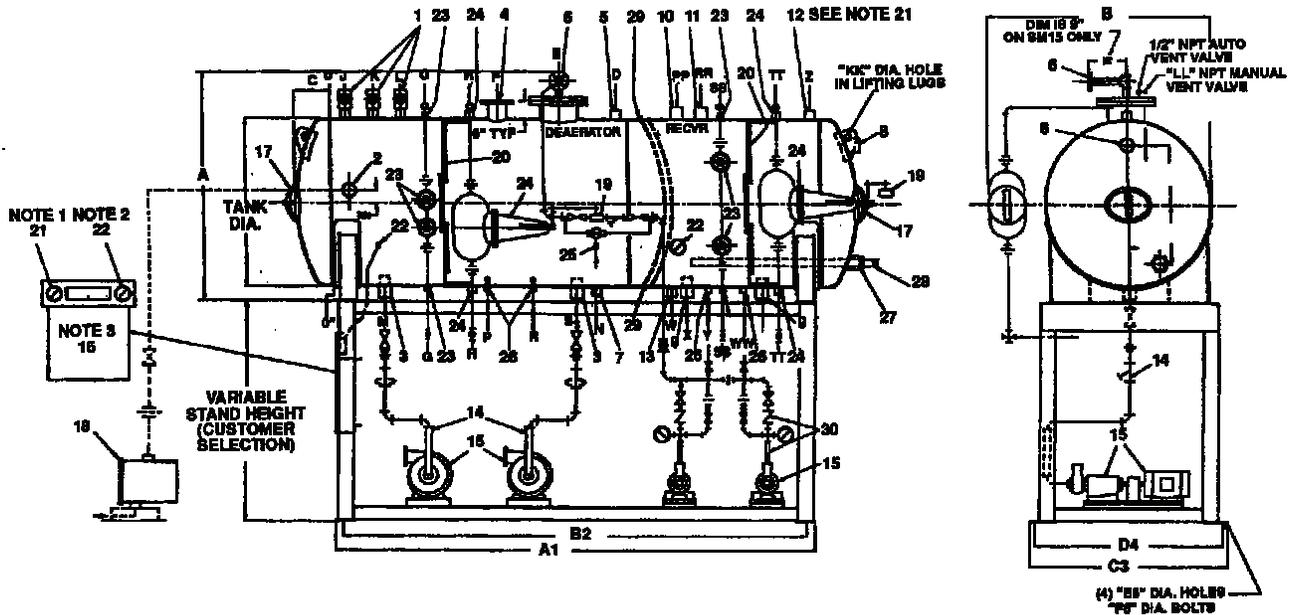
NOTE: Model designation (example SD-7) is: S = Spraymaster Deaerator, D = Duo-tank, 7 = 7,000 lbs/h rating, combined deaerator and surge tank package.



TANK CAPACITY (GALLONS)

	230	300	600	900	1400	2000	2800	4000	5600
AA	81-1/2	108-1/2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AB	875-1/2	114-1/2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AC	31-3/4	40-1/4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AD	29-1/2	38	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AE	6-1/8	7-3/8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AF	2	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AG	4	6	N/A	N/A	N/A	N/A	N/A <td N/A	N/A	
AH	1-1/8	1-1/4	M/A	N/A	N/A	N/A	N/A	N/A	N/A
AJ	12-1/2	16-1/2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AK	7/8	7/8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AL	3/4	3/4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AM	N/A	N/A	148	169-1/2	231-1/2	270	257	245-1/2	281
AN	N/A	N/A	154	175-1/2	237-1/2	276	263	251-1/2	287
AP	N/A	N/A	51-1/2	57	62	67	77-1/2	88	98-3/4
AR	N/A	N/A	44-3/4	44-3/4	50	52	62	72	83
AS	N/A	N/A	3-3/8	6-18	6	7-1/2	7-3/4	8	7-7/8
AT	N/A	N/A	16-1/2	18-3/4	20	25	22-1/2	31-5/8	34

Figure H2-1. Spraymaster Duo-Tank Supports and Saddles, Details and Dimensions



NOTES:

1. Mounted at dim. "H" (top of tank) on non-packaged units.
2. Tank mounted on non-packaged unit.
3. Packaged units only. Mounted on left end, right side of stand on 48" dia. 450 gal, 66" dia. 1400 gal & 72" dia. 2000 gal units as shown.
4. Suction piping includes strainer, gate valve and flexible connector.
5. Discharge piping includes gate valve, check valve, control valve, by-pass orifice, and pressure gauge.
6. All couplings are 3000# F.S.
7. All flanges are 150# F.F. except as noted.
8. Two water and steam inlets used, one shown.
9. Customer to plug all fittings not being used.
10. Mount tank above pump at elevation necessary for static head including safe allowance for piping friction as approved by pump manufacturer.
11. Deaerator section of tank is built to ASME Code.
12. Accompanying dimensions, while sufficiently accurate for layout purposes, must be confirmed for construction by certified dimension prints.
13. Add suffix "P" to Model no. for packaged units (SDP-45).
14. Optional tanks available for 5 minutes storage (except SDP-7 & SDP-15), other combinations of capacities as required - contact your local Cleaver-Brooks authorized representative.
15. Using Warren #377 float cage (except SM7 which uses MCD-M #51), dimension "B" may change with other controls - contact your local Cleaver-Brooks authorized representative.
16. No interconnecting piping or wiring furnished on non-packaged units unless specified, contact your local Cleaver-Brooks authorized representative for specific piping or wiring furnished on packaged assemblies.
17. Weights shown are without controls or packaging - contact your local Cleaver-Brooks authorized representative for additions.
18. Capacities other than shown as standard available by proper selection of controls - contact your local Cleaver-Brooks authorized representative.
19. Optional tank sizes and ratings available - contact your local Cleaver-Brooks authorized representative.
20. Lifting lugs are for lifting empty tank only.
21. Raw water make-up should first pass through a water softener if hardness is present.
22. All dimensions, while sufficiently accurate for layout purposes, must be confirmed for construction by certified dimensional prints.

Figure H2-2. Spraymaster Deaerator (Duo-Tank) Dimensions and Ratings – Sheet 1 of 3

STORAGE TANK DETAIL AND DIMENSIONS										
SPRAYMASTER MODEL NO.	SM-7D	SM-15D	SM-30D	SM-45D	SM-70D	SM-100D	SM-140D	SM-200D <sup>B</sup>	SM-280D <sup>B</sup>	
Ratings (lb/h)	7000	15000	30000	45000	70000	100000	140000	200000	280000	
Tank Weight (lbs)	1530	2500	3650	4500	6770	8810	10760	12975	18735	
Tank Weight Flooded (lbs)	5165	10835	17720	24440	38450	52310	68045	80290	106475	
Tank Cap-Deaerator (Gal to Overflow)	230	300	600	900	1400	2000	2800	4000	5600	
Storage Cap (Min)	16	10	10	10	10	10	10	10	10	
Tank Cap-Rec Section (Gal to Flooded)	160	300	600	900	1400	2000	2800	4000	5600	
Storage Cap (Min)	11.5	10	10	10	10	10	10	10	10	
Tank Size (Dia x Length)	36 x 106-1/2	48 x 141-1/2	54 x 181	60 x 207	66 x 270-1/2	72 x 302	84 x 302-1/4	96 x 308-3/4	108 x 349	
A Overall Height	58	66-1/2	74-1/2	80-1/2	88	96-1/2	109	120-1/2	133	
B Overall Width	51	62	68	75	80	87	99	111	123	
C	8-1/2	10-1/2	11-1/2	12-1/2	13-1/2	14-1/2	16-1/2	18-5/8	20-3/4	
D	28-1/2	72-1/2	92-1/2	101	146	164	146	4 136	4 153	
E	43	54-1/2	74	83	124	142	124	24 116	24 133	
F	48-1/2	34-1/2	54	63	104	122	104	44 96	48 109	
G	11	16	31	42	68	68	73	60	59	
H	21	26	45	54	80	104	86	82	98	
J	Contact Your Local Cleaver-Brooks Authorized Representative									
K	Contact Your Local Cleaver-Brooks Authorized Representative									
L	Contact Your Local Cleaver-Brooks Authorized Representative									
M	Contact Your Local Cleaver-Brooks Authorized Representative									
N	52	56	90	102	144	164	147	130	144	
P	N/A	31	50	32	35	36	28	35	28	
R	N/A	47	65	74	115	132	126	106	123	
S	Consult Your Local Cleaver-Brooks Authorized Representative									
T	38	60	90	27	27	32	27	36	27	
W	64	90	109	126	169	224	205	160	186	
X	Consult Your Local Cleaver-Brooks Authorized Representative									
Y	69	95	120	145	198	192	177	196	196	
z	85	115	155	171	230	266	258	258	249	
KK	2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-3/4	2-3/4	
LL	1/2	3/4	3/4	3/4	1	1-1/2	2	2 @ 1-1/2	2 @ 2	
MM	3	6	6	10	6	6	8	12	12	
NN	10	C <sub>L</sub>	4	7	6-1/2	8	14-1/2	26-1/2	27-1/2	
PP	68	94	112	127	180	197	173	175	191	
RR	74	101	120	133	200	227	205	201-1/2	211	
SS	72	95	126	138	188	214	183	190	229	
TT	82	109	144	160	218	243	232	213	249	
WW	75	108	132	153	208	267	249	206	279	
XX	Consult Your Local Cleaver-Brooks Authorized Representative									
YY	12	16	19	22	24	27	31	36	40	
ZZ	10	12-1/2	16	19-1/2	22	25	30	34-1/2	40	

Figure H2-2. Spraymaster Deaerator (Duo-Tank) Dimensions and Ratings – Sheet 2 of 3



STAND BASE DIMENSIONS										
	TANK CAPACITY (GAL)	230	300	600	900	1400	2000	2800	4000	5600
A1	Outside Length	87	115	154	175-1/2	237-1/2	276	268	144	297
B2	C <sub>L</sub> to C <sub>L</sub> Anchor Bolt Holes	82	110	148	169-1/2	230-1/2	269	265	137	294
C3	Outside Width	49	62	66	71	76	81	86-1/2	102	112
D4	C <sub>L</sub> to C <sub>L</sub> Anchor Bolt Holes	46	59	63	68	73	78	79-1/2	99	101
E5		3/4	1	1	1	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8
F6		5/6	7/8	7/8	7/8	1	1	1	1	1
TANK CONNECTION SIZES										
1	Relief-Valve(s)	Contact Your Local Cleaver-Brooks Authorized Representative								
2	Overflow (Dea)	1-1/4 NPT	3 NPT	3 NPT	3 NPT	4 FLG	4 FLG	4 FLG	6 FLG	6 FLG
3	Pump Suction (Optional)	Contact Your Local Cleaver-Brooks Authorized Representative								
4	Steam Inlet (Dea Flg)	3	6	6	6	6	6	8	2 @ 6	2 @ 8
5	High Temp Return	1-1/4 NPT	1-1/2 NPT	2 NPT	2 NPT	3 NPT	3 NPT	3 NPT	2 @ 3 NPT	2 @ 3 NPT
6	Water Inlet (150# RF Flg)	1 NPT	1-1/2	2	2	2-1/2	3	4	2 @ 3	2 @ 4
7	Drain (Dea)	1-1/4 NPT	2 NPT	2 NPT	2 NPT	2 NPT	2 NPT	2 NPT	2 NPT	2 NPT
8	Overflow (Rec)	2 NPT	2 NPT	2 NPT	3 NPT	3 NP	3 NPT	4 NPT	4 NPT	6 NPT
9	Pump Suction (Optional)	Contact Your Local Cleaver-Brooks Authorized Representative								
10	Vent (Rec)	3 NPT	3 NPT	3 NPT	3 NPT	4 NPT	4 NPT	4 NPT	4 NPT	6 NPT
11	Low Pressure Return (Rec)	2 NPT	2 NPT	3 NPT	3 NPT	3 NPT	3 NPT	4NPT	4 NPT	6 NPT
12	Cold Water Inlet (Rec)	2 NPT	2 NPT	2 NPT	2 NPT	2 NPT	2 NPT	2 NPT	2 NPT	3 NPT
13	Drain (Rec)	1-1/4 NPT	2 NPT	2 NPT	2 NPT	2 NPT	2 NPT	2 NPT	2 NPT	2 NPT
ITEM LIST										
14	Suction Pump, (optional) (For each pump) (Note 4)									
15	Pump/Motor, (optional)									
16	Control Panel, (optional)									
17	Manway 11 x 15									
18	Overflow Drainer, (optional)									
19	Make-Up Valve, (optional)									
20	Gauge Glass Assembly									
21	Pressure Gauge									
22	Thermometer (3/4 NPT)									
23	Level Alarms (1 NPT), (optional)									
24	Level Control (1-1/2 NPT), (optional)									
25	Sample Connection (1/2 NPT)									
26	Recirculation Connection (1 NPT), (optional) (For each pump)									
27	High Temp Return Connection-Rec (3 NPT)									
28	Diffuser Tube (2-1/2 NPT, (optional)									
29	Breather Connection (1/2 NPT -Do Not Plug)									
30	Discharge Piping, (optional) (For each pump) (NOTE 5)									
										Sizes listed for items 22 thru 29 are for tank connections only.

Figure H2-2. Spraymaster Deaerator (Duo-Tank) Dimensions and Ratings – Sheet 3 of 3



**SAMPLE SPECIFICATIONS**

PART 1 GENERAL.....H2-9

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PART 2 PRODUCTS.....H2-11

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B. Steam Pressure Reducing Station .....H2-11

C. Boiler Feedwater Pump and Motor Set .....H2-12

D. Make Up Valve and Controller.....H2-13

E. Control Panel .....H2-14

F. Standard .....H2-14

The following sample specifications are provided by Cleaver-Brooks to assist you in specifying your customer’s specific needs and application.

## PART 1 GENERAL

The following sample specifications are provided by Cleaver-Brooks to assist you in specifying your customer's specific needs and application.

### 1.1 DEAERATOR AND SURGE TANK

- A. Cleaver-Brooks Model \_\_\_\_\_ spray type, pressurized, horizontal deaerator is rated at \_\_\_\_\_ pounds per hour. The system shall be guarantee oxygen removal to not more than 0.005 CCS/liter in the effluent throughout all load conditions between 5 and 100 percent. The deaerator shall be designed for operation at 5 psig, but shall be suitable for use from 2 to 15 psig.
- B. The surge tank shall receive returning condensate and supplement make up water to maintain the desired operating level. Condensate and make up water mix into a blended temperature, as determined by the percentage of each. The surge tank shall be vented to atmosphere. The collected water is then transferred to the deaerator.
- C. The collected water shall be admitted to the deaerator through a single spring-loaded, self-cleaning, adjustable stainless steel spray valve, which shall provide proper internal vent condensing and water distribution at any load between 5 and 100 percent of rated capacity. The water temperature in the primary heating and vent concentrating section is to be raised within 2 or 3 °F of steam temperature and most of the gases released. The water is then to be collected in a conical water collector. From there, it is to flow to an atomizing valve where high velocity steam strikes it, breaks it down into a fine mist, and heats it to a full steam saturation temperature. The mixture is to strike a deflecting baffle, which separates water and steam. Hot, gas-free water is to then drop to the storage compartment to complete the cycle. The steam and non-condensables are to flow upward, through the primary heating spray, into the internal vent concentrating section, where they contact the cold influent water. Here, the steam is to be condensed to continue the cycle. Released gasses are discharged to atmosphere through the vent outlet. All internal surfaces, which come in contact with un-deaerated water, shall be constructed of Type 316 stainless steel.
- D. Automatic vent valve shall be thermostatically controlled to provide a fast means of venting when a sudden buildup of gases occurs, such as seen at start up. The manual vent valve shall have an orifice for continuous minimum venting. Venting rate shall not exceed 0.1 of 1% of the rated deaerator capacity at 5 psig.
- E. The duo tank shall be divided into two separate sections. The deaerator water storage and condensate surge section shall be divided by a double inner head. The dead air space between the two inner heads shall be packed with a fiberglass insulation and have a breather and drain connection. The duo tank shall be \_\_\_\_\_" diameter and \_\_\_\_\_" long.
- F. The deaerated water storage tank section shall have \_\_\_\_\_ minutes of storage and have a capacity of \_\_\_\_\_ gallons measured to overflow. An \_\_\_\_\_ manhole shall be provided for access. All nozzles 3" and under shall be 3000 lbs forged steel couplings and over 3" shall be 150 lbs flat face flanges. Heads to be ASME torispherical type constructed of ASTM A516 GR 70 carbon steel with a minimum thickness of 0.25 inches. Shell plate to be fabricated of ASTM A36 carbon steel with a minimum thickness of 0.25 inches. The tank shall be designed in accordance with ASME, Section VIII of the Pressure Vessel Code for 50 psig at 650 delta-F and stamped accordingly. Certification shall be required. Joint efficiencies to be 70% circumferential per Table UW-12, which does not require stress relieving or nondestructive examination.

- G. The surge tank section shall have \_\_\_\_\_ minutes of storage and have a capacity of \_\_\_\_\_ gallons flooded. An \_\_\_\_\_ manhole shall be provided for access. All nozzles shall be 3000 lbs forged steel couplings. Heads to be ASME torispherical type (flat heads are not acceptable) constructed of ASTM A516 GR 70 carbon steel with a minimum thickness of 0.25 inches. Shell plate to be fabricated of ASTM A36 carbon steel with a minimum thickness of 0.25 inches.
- H. The loads shall be as specified in the table above. Low temperature returns are defined as condensate with a temperature below that of the deaerator operating temperature. High temperature returns are defined as condensate with a temperature above that of the deaerator operating temperature.
- I. Optional - The surge tank section shall be designed in accordance with Section VIII of the ASME Pressure Vessel Code for \_\_\_\_\_ psig, and stamped accordingly. Certification shall be required. Joint efficiencies to be 70% circumferential per Table UW-12, which does not require stress relieving or nondestructive examination.
- J. Optional - The duo tank shall be factory-insulated and lagged with blanket insulation, pins, clips, and a durable steel jacket. Block-type insulation is not acceptable. The blanket insulation is to be fiberglass, 2" thick, 1 lb/cu-ft, and have a rating of R3.85. Pins are to be located on 18" centers and holding clips attached. The steel jacket or lagging shall have a shell thickness of 18 gauge (0.0478") minimum and head thickness of 18 gauge (0.0478") minimum.
- K. Optional - The magnesium or sacrificial anode shall provide cathodic protection against galvanic corrosion. This rod shall be 1-5/16" diameter with a 1/4" steel core to assure a good electrical contact and added strength. The design shall have a small weep hole to signal it has been consumed. Linings shall not be acceptable in this application.
- L. Optional - The high temperature diffuser or sparge tube shall be located beneath the normal tank water level. The tube shall be constructed of 2 inch pipe. This tube shall provide even distribution and blending of high-temperature condensate returns.
- M. Optional - The chemical feed quill shall be located beneath the normal tank water level. The quill material shall be constructed of stainless steel. The tube shall provide even distribution and blending of chemical.
- N. Optional - The basic deaerator section shall be equipped with the following trim and accessories. Piping on packaged units shall comply with ASME Power Piping Code B31.1.

## PART 2 PRODUCTS

### 2.1 HARDWARE

#### A. Make Up Valve and Controller

1. Option (Mechanical) - \_\_\_\_\_ " inlet water regulating lever valve with \_\_\_\_\_ body and \_\_\_\_\_ connections. The valve Cv shall not exceed \_\_\_\_\_ and be rated for \_\_\_\_\_ gpm at \_\_\_\_\_ psi inlet pressure. The pressure drop across the valve shall not exceed a delta-P of 10 psig. This valve shall be suitable for temperatures up to 300 °F. The valve manufacture shall be \_\_\_\_\_, Model \_\_\_\_\_. This valve shall be mechanically controlled by an external float cage with cast iron body and 8" stainless steel float. The float cage manufacturer shall be \_\_\_\_\_ Model \_\_\_\_\_.
2. Option (Electronic) - \_\_\_\_\_ " inlet water motorized regulating valve with steel body and threaded NPT connections. Motor shall be 110V bi-directional type with a permanently lubricated gear train, and be directly coupled to the valve stem. The valve Cv shall not exceed \_\_\_\_\_ and be rated for \_\_\_\_\_ gpm at \_\_\_\_\_ psig inlet pressure. Valve shall not exceed a delta-P of 10 psig. This valve shall have teflon seats and be suitable for temperatures up to 300 °F. The motorized valve manufacturer shall be \_\_\_\_\_. This valve shall be electronically controlled by a solid state control with internally mounted capacitance probes. The electronic solid state control shall be able to set desired level point and acceptable deviation. The electronic solid state control shall include a selection for automatic and manual operating mode. The internals shall include two additional probes for high and low water alarm. The controller manufacturer shall be Cleaver-Brooks Model TW82. A solenoid valve and float switch are not acceptable. (Available only in the U.S.)
3. Option (Pneumatic) - \_\_\_\_\_ " inlet water diaphragm actuated regulating valve with cast iron body and \_\_\_\_\_ connections. The valve shall be globe type with proportional control and a spring opposed diaphragm actuator arranged for 3 - 15 psig operating signal. The valve shall be normally open on loss of air. The valve Cv shall not exceed \_\_\_\_\_ and be rated for \_\_\_\_\_ gpm at \_\_\_\_\_ psig inlet pressure. Valve shall not exceed a delta-P of 10 psig. This valve shall have stainless steel trim with TFE packing and be suitable for temperature up to 410 °F. The diaphragm actuated valve manufacturer shall be \_\_\_\_\_, Model \_\_\_\_\_. This valve shall be pneumatically controlled by an external proportional type sensor. The sensor shall be a 14" displacer that produces a pneumatic output signal. The controller manufacturer shall be \_\_\_\_\_, Model \_\_\_\_\_. A filter regulator is to be provided to reduce 50 psig instrument air supply to 3 - 15 psig for proper operation.
4. Optional - The make up valve shall include an ANSI Class 125 lb three-valve bypass with inlet Y-type cast iron strainer. Strainer screen to be removable and of stainless steel construction.

#### B. Steam Pressure Reducing Station

1. Option (Mechanical) - \_\_\_\_\_ " steam pressure reducing valve with cast iron body and \_\_\_\_\_ connections. The valve shall be a self-contained unit capable of reducing \_\_\_\_\_ psig saturated steam to the operating pressure of the deaerator at a flow rate of \_\_\_\_\_ lbs/hr. The valve shall be 250 lb class with stainless steel trim and an adjustable pilot. The valve manufacturer shall be \_\_\_\_\_, Model \_\_\_\_\_.
2. Option (Pneumatic) - \_\_\_\_\_ " diaphragm actuated steam pressure reducing valve with cast iron body and \_\_\_\_\_ connections. The valve shall be globe type with proportional control and a spring opposed diaphragm actuator arranged for

- \_\_\_\_\_ psig operating signal. The valve shall be normally closed on loss of air. The valve shall be capable of reducing \_\_\_\_\_ psig saturated steam to the operating pressure of the deaerator at a flow rate of \_\_\_\_\_ lbs/hr. This valve shall be 250 lb class and have stainless steel trim. The diaphragm actuated valve manufacturer shall be \_\_\_\_\_, Model \_\_\_\_\_. This valve shall be pneumatically controlled by an external transmitter. The transmitter set pressure shall be adjustable. The transmitter manufacturer shall be \_\_\_\_\_, Model \_\_\_\_\_.
3. Optional - The steam pressure reducing valve shall include a three valve bypass with Y-type cast iron strainer. Strainer screen to be removable and of stainless steel construction.
  4. Optional - Quantity \_\_\_\_\_, \_\_\_\_\_" relief valves sized to relieve full capacity of the pressure reducing valve in the event of its failure. Valves to meet Paragraph UG-125 of ASME Unfired Pressure Vessel Code, Section VIII. Valve body to be of bronze construction. Relieving set pressure to be 50 psig. Relief valve manufacturer to be \_\_\_\_\_, Model \_\_\_\_\_.
  5. Optional - High level alarm switch. This shall be an externally mounted float type switch. The switch shall make contact on rise and break on fall. The float cage construction shall be cast iron. (Not required with electronic make up controller.)
  6. Optional - Low level alarm switch. This shall be an externally mounted float type switch. The switch shall make contact on fall and break on rise. The float cage construction shall be cast iron. (Not required with electronic make up controller.)
  7. Optional - \_\_\_\_\_" overflow drainer sized to relieve full capacity at the operating pressure of the deaerator. The overflow drainer shall be a float type trap. The construction is to be a steel housing with stainless steel float ball. The overflow drainer manufacturer shall be \_\_\_\_\_, Model \_\_\_\_\_.
  8. Optional - Suction piping for pumps shall consist of a gate valve, cast iron Y-type strainer with replaceable stainless steel screen and flexible connector or hose. This piping assembly shall be 125 lb class construction. The vortex breaker shall be located in the tank nozzle. Manifold suction lines are not acceptable.
- C. Boiler Feedwater Pump and Motor Set
1. Option - Intermittent - Quantity \_\_\_\_\_, turbine type boiler feedwater pump and motor set. Centrifugal type pumps are not acceptable in this application. Pump to be rated for \_\_\_\_\_ gpm at \_\_\_\_\_ feet TDH with \_\_\_\_\_ feet NPSH required. Pump to be \_\_\_\_\_ materials of construction and have \_\_\_\_\_ seals for a maximum water temperature of 250 °F. Pump impeller to be hydraulically balanced. The pump shall be mounted on a steel baseplate and flexibly coupled with an OSHA type coupling guard to a \_\_\_\_\_ hp, \_\_\_\_\_ phase, \_\_\_\_\_ Hz, \_\_\_\_\_ Volt, \_\_\_\_\_ rpm, \_\_\_\_\_ enclosure motor. Motor to be non-overloading at the rated condition without using any portion of the service factor. Pump and motor set to be factory aligned prior to shipment. Pump manufacturer to be \_\_\_\_\_, Model \_\_\_\_\_, size \_\_\_\_\_" x \_\_\_\_\_".
  2. Option (Continuous) - Quantity \_\_\_\_\_, centrifugal type boiler feedwater pump and motor set. Turbine type pumps are not acceptable in this application. Pump to be rated for \_\_\_\_\_ gpm at \_\_\_\_\_ feet TDH with \_\_\_\_\_ feet NPSH required. Pump to be \_\_\_\_\_ materials of construction as defined by the Hydraulic Institute and have \_\_\_\_\_ seals for a maximum water temperature of 250 °F. Pump impeller to be hydraulically balanced. The pump shall be mounted on a steel baseplate and flexibly coupled with an OSHA type coupling guard to a \_\_\_\_\_ hp, \_\_\_\_\_ phase, \_\_\_\_\_ Hz, \_\_\_\_\_ Volt, \_\_\_\_\_ rpm, \_\_\_\_\_ enclosure motor. Motor to be non-overloading at the rated condition without using any portion of the service factor. Pump and motor set to be factory aligned prior to shipment. Pump

manufacturer to be \_\_\_\_\_, Model \_\_\_\_\_, size \_\_\_\_\_ " x \_\_\_\_\_ ". A stainless steel recirculation orifice is to be supplied with the pump and shipped loose for field installation to provide minimum bypass flow.

3. Optional - The basic surge tank shall be equipped with the following trim and accessories. Piping on packaged units shall comply with ASME Power Piping Code B31.1.

D. Make Up Valve and Controller

1. Option (Mechanical) - \_\_\_\_\_ " inlet water regulating lever valve with \_\_\_\_\_ body and \_\_\_\_\_ connections. The valve Cv shall not exceed \_\_\_\_\_, and shall be rated for \_\_\_\_\_ gpm at \_\_\_\_\_ psi inlet pressure. The pressure drop across the valve shall not exceed a delta-P of 10 psig. This valve shall be suitable for temperatures up to 300 °F. The valve manufacture shall be \_\_\_\_\_, Model \_\_\_\_\_. This valve shall be mechanically controlled by an external float cage with cast iron body and 8" stainless steel float. The float cage manufacturer shall be \_\_\_\_\_, Model \_\_\_\_\_.
  - 1) Option (Electronic) - \_\_\_\_\_ " inlet water motorized regulating valve with steel body and threaded NPT connections. Motor shall be 110V bi-directional type, with a permanently lubricated gear train, and directly coupled to the valve stem. The valve Cv shall not exceed \_\_\_\_\_ and be rated for \_\_\_\_\_ gpm at \_\_\_\_\_ psi inlet pressure. Valve shall not exceed a delta-P of 10 psig. This valve shall have teflon seats and be suitable for temperatures up to 300 °F. The motorized valve manufacturer shall be \_\_\_\_\_. This valve shall be electronically controlled by a solid state control with internally mounted capacitance probes. The electronic solid state control shall be able to set desired level point and acceptable deviation. The electronic solid state control shall include a selection for automatic and manual operating mode. The internals shall include two additional probes for high and low water alarm. The controller manufacturer shall be Cleaver-Brooks, Model TW82. A solenoid valve and float switch are not acceptable. (Available only in the U.S.)
  - 2) Option (Pneumatic) - \_\_\_\_\_ " inlet water diaphragm actuated regulating valve with cast iron body and \_\_\_\_\_ connections. The valve shall be globe-type with proportional control and a spring-opposed diaphragm actuator arranged for 3 - 15 psig operating signal. The valve shall be normally open on loss of air. The valve Cv shall not exceed \_\_\_\_\_ and be rated for \_\_\_\_\_ gpm at \_\_\_\_\_ psi inlet pressure. Valve shall not exceed a delta-P of 10 psig. This valve shall have stainless steel trim with TFE packing and be suitable for temperature up to 410 °F. The diaphragm actuated valve manufacturer shall be \_\_\_\_\_, Model \_\_\_\_\_. This valve shall be pneumatically controlled by an external proportional type sensor. The sensor shall be a 14" displacer that produces a pneumatic output signal. The controller manufacturer shall be \_\_\_\_\_, Model \_\_\_\_\_. A filter regulator is to be provided to reduce 50 psig instrument air supply to 3 - 15 psig for proper operation.
2. Optional - The make up valve shall include a ANSI Class 125 lb three-valve bypass with inlet Y-type cast iron strainer. Strainer screen to be removable and of stainless steel construction.
3. Optional - High-level alarm switch. This shall be an externally mounted float-type switch. The switch shall make contact on rise and break on fall. The float cage construction shall be cast iron. (Not required with electronic make up controller.)
4. Optional - Low-level alarm switch. This shall be an externally mounted float-type switch. The switch shall make contact on fall and break on rise. The float cage construction shall be cast iron. (Not required with electronic make up controller.)

5. Optional - Suction piping for pumps shall consist of a gate valve, cast iron Y-type strainer with replaceable stainless steel screen and flexible connector or hose. This piping assembly shall be 125 lb class construction. The vortex breaker shall be located in the tank nozzle. Manifold suction lines are not acceptable.
  6. Transfer Pump and Motor Set - Quantity \_\_\_\_\_, centrifugal type transfer pump and motor set. Turbine type pumps are not acceptable in this application. Pump to be rated for \_\_\_\_\_ gpm at \_\_\_\_\_ feet TDH with \_\_\_\_\_ feet NPSH required. Pump to be \_\_\_\_\_ materials of construction as defined by the Hydraulic Institute, and have \_\_\_\_\_ seals for a maximum water temperature of 212 °F. Pump impeller to be hydraulically balanced. The pump shall be mounted on a steel baseplate and flexibly coupled with an OSHA type coupling guard to a \_\_\_\_\_ hp, \_\_\_\_\_ phase, \_\_\_\_\_ Hz, \_\_\_\_\_ Volt, \_\_\_\_\_ rpm, \_\_\_\_\_ enclosure motor. Motor to be non-overloading at the rated condition without using any portion of the service factor. Pump and motor set to be factory aligned prior to shipment. Pump manufacturer to be \_\_\_\_\_, Model \_\_\_\_\_, size \_\_\_\_\_" x \_\_\_\_\_". A stainless steel recirculation orifice is to be supplied with the pump and shipped loose for field installation to provide minimum bypass flow.
  7. Optional - The duo stand shall elevate the deaerator and surge tank sections to provide the net positive suction head required by the pump at the rated condition to prevent cavitation. The stand shall be constructed of heavy square steel tubing for the legs and 1/4" steel plate covering the floor.
- E. Control Panel
1. Optional (Base) - Control panel shall be in a NEMA 1 enclosure and wired to the National Electric Code. The wire shall be black number coded. The assembly is to contain individual motor starters with 120 Volt holding coil and fuse protection. Individual green oil-tight pump run lights shall be provided. All switches and lights to have nameplate identification. The assembled panel shall be given a factory continuity test prior to shipment.
  2. Optional (Electric Components) - Audible and visual high and low water alarm function shall be provided by a bell or horn with silence switch and individual red oil-tight lights.
    - a. Control circuit transformer to supply 110-120 Volts, single-phase power supply. The transformer shall be mounted, wired and fused.
    - b. Auxiliary contacts shall be furnished for chemical feed pump initiation. Contacts shall be normally open.
- F. Standard
1. The deaerator and surge section shall have a gauge glass assembly that covers the entire tank diameter. The gauge glass shall be quartz 0.625 inch diameter by 24 inch maximum length. Each length of glass shall be furnished with a bronzegauge cock set and protector rods.
    - a. The deaerator section shall be supplied with a pressure gauge that has a 4-1/2 inch dial with a 0-60 psig range and a thermometer with a 50 to 300 °F range. Packaged units are required to have both gauges bracket-mounted at eye level.
    - b. The surge tank section shall be supplied with a thermometer with a 50 to 300 °F range.
    - c. The duo tank is to be hand cleaned with a solvent to SSPC- SP-1 standards prior to painting. Prime coated to not less than 1 mil thick and finish coated with an enamel paint to not less than 1 mil thick prior to shipment.

- d. Unit is to be knocked down for shipment. Piping is to be matched marked. Three, bound, Operating and Maintenance manuals to be provided. Warranty period to be twelve months after start-up or eighteen months after shipment, whichever comes first.

**Load Specifications**

LOAD	PERCENTAGE	LBS/HR	TEMP	PRESSURE
Make up to Deaerator		GPM		25 psig Min.
Make up to Surge Tank		GPM		
Pumped Low Temp Returns				
Gravity Feed Low Temp Returns				
High Temp Returns				