ARCADIS

Appendix E

Groundwater Extraction and
Treatment System Design Information

NOTE:

Catalogue and product data sheets represent an example of the equipment proposed for this project. Actual equipment make and model will be approved during construction.

APPENDIX E

Calculations

No.	Description
1	RAP Estimated Influent Concentration Calculation
2	pH Adjustment Design Calculations
3	Extraction Pump Design Calculations Summary
4	Extraction Well Pump (EW-2008; Trench 1) Design Calculations
5	Extraction Well Pump (EW-2007; Trench 2) Design Calculations
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7	Extraction Well Pump (EW-2013; Trench 4) Design Calculations
8	Extraction Well Pump (EW-2101 (T-1); Trench 2) Design Calculations
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10	Summary of Pump Design Calculations
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12	P-200A/B/C Filter Feed Pump Design Calculations
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16	P-300C AOP Feed Pump Design Calculations
17	P-310A/B/C AOP Discharge Pump Design Calculations
18	P-400A/B GAC Backwash Pump Design Calculations
19	P-500A/B Discharge Pump Design Calculations
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21	P-600A/B Water Softener Feed Pump Design Calculations
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23	P-640 RO Feed Pump Design Calculations
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25	P-800A/B Surge Transfer Pump Design Calculations
26	P-1000A/B Process Water Pump Design Calculations
27	P-1200 Sump Pump Design Calculations

APPENDIX E

Calculations

No.	Description
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30	Tank Size Calculations Solids Contact Tank (T-120)
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Calculation 1

RAP Estimated Influent Concentration Calculation
Total Dynamic Head Calculation Summary
Lockheed Martin Tallevast Site
Tallevast, Florida

The estimated RAP concentrations were calculated utilizing analytical data collected from 16 monitoring wells sampled during the March 2009 sampling event. In addition to the typical VOC, SVOC and metals included in the 6 site COCs and the current Manatee County Industrial User Discharge Permit (IW#0025S), an extensive list of other constituents were sampled from these wells. The expanded list of constituents covered potential discharge criteria for POTW, groundwater recharge/injection and surface water recharge/discharge.

The overall number of wells selected from the individual aquifer zones (USAS, LSAS, AF Gravels and S&P Sands) were chosen on the basis of flow as described in the Table below.

Aquifer Zone	Expected Flow Rate (gpm)	Percentage of Total Flow Rate = QT(%)	Calculated Number of Monitoring Wells from Aquifer Zone (based on 16MWs Total)	Actual Number of Monitoring Wells Sampled from each Aquifer Zone
USAS	144.5	71.7%	11.5	10
LSAS	33.5	16.6%	2.7	4
AF Gravels	19.5	9.7%	1.5	1
S&P Sands	4	2.0%	0.3	1
Total	201.5	100.0%	16.0	16

The actual monitoring wells were chosen on the basis of their proximity to the proposed extraction wells and trenches locations and are shown on Figure XX (attached).

The calculation of estimated RAP treatment system influent concentrations are based on a flow weighted average. The monitoring wells are weighted based on their proximity to the proposed extraction wells and trenches locations. The Table below describes the above mentioned flow weighting.

Monitoring Well	Aquifer	Number Of Wells in Vicinity	Number of Trenches in Vicinity	Estimated Flow from MW Vicinity (gpm)	Percentage of Total Flow from Aquifer	Percentage of Total Flow for RAP System
MW-128	S&P	2	NA	4.0	100.0%	2.0%
MW-127	AFG	11	NA	19.5	100.0%	9.7%
MW-37	LSAS	8	NA	12.8	38.1%	6.3%
MW-77	LSAS	1	NA	1.6	4.8%	0.8%
MW-81	LSAS	3	NA	4.8	14.3%	2.4%
MW-82	LSAS	9	NA	14.4	42.9%	7.1%
MW-35	USAS	3.5	1	27.5	19.1%	13.7%
MW-36	USAS	7.33	0	11.4	7.9%	5.7%
MW-40	USAS	7.33	0	11.4	7.9%	5.7%
MW-42	USAS	7.33	0	11.4	7.9%	5.7%
MW-74	USAS	3.5	1	27.5	19.1%	13.7%
MW-95	USAS	0	1	20.3	14.0%	10.0%
MW-104	USAS	0	1	20.3	14.0%	10.0%
MW-108	USAS	3	0	6.3	4.3%	3.1%

MW-110	USAS	3	0	6.3	4.3%	3.1%
MW-111	USAS	1	0	2.1	1.4%	1.0%

A sample calculation for estimated RAP treatment system influent concentration of 1,4-Dioxane is presented below:

The Table below is a summary of 1,4-Dioxane concentrations and the calculated percentage of flow from the monitoring wells:

Monitoring Well	Aquifer	1,4-Dioxane Concentration (ug/L) = C_{MW}	Percentage of Total Flow from Aquifer = QA(%)
MW-128	S&P	4	100.0%
MW-127	AFG	330	100.0%
MW-37	LSAS	220	38.1%
MW-77	LSAS	160	4.8%
MW-81	LSAS	99	14.3%
MW-82	LSAS	700	42.9%
MW-35	USAS	0.54 U	19.1%
MW-36	USAS	9.6	7.9%
MW-40	USAS	8.1 I	7.9%
MW-42	USAS	28	7.9%
MW-74	USAS	110	19.1%
MW-95	USAS	5.8	14.0%
MW-104	USAS	180	14.0%
MW-108	USAS	6.6	4.3%
MW-110	USAS	46	4.3%
MW-111	USAS	2.8	1.4%

S&P Sands

Estimated 1,4-Dioxane concentration for the S&P Sands = 1,4-Dioxane concentration in MW-128 x MW-128 flow percentage for S&P Sands aquifer

Or

$C_{S\&P} = C_{MW128} \times QA(\%)_{MW128}$

$C_{S\&P} = 4ug/L \times 100\% = 4ug/L$

AF Gravels

$C_{AFG} = C_{MW127} \times QA(\%)_{MW127}$

$C_{AFG} = 330ug/L \times 100\% = 330ug/L$

LSAS

RAP Estimated Influent Concentration Calculation
Total Dynamic Head Calculation Summary
Lockheed Martin Tallevast Site
Tallevast, Florida

$C_{LSAS} = (C_{MW37} \times QA(\%)_{MW37}) + (C_{MW77} \times QA(\%)_{MW77}) + (C_{MW81} \times QA(\%)_{MW81}) + (C_{MW82} \times QA(\%)_{MW82})$

$C_{LSAS} = (220ug/L \times 38.1\%) + (160ug/L \times 4.8\%) + (99ug/L \times 14.3\%) + (700ug/L \times 42.9\%)$

$C_{LSAS} = 406ug/L$

USAS

$C_{usas} = (C_{MW35} \times QA(\%)_{MW35}) + (C_{MW36} \times QA(\%)_{MW36}) + (C_{MW40} \times QA(\%)_{MW40}) + (C_{MW42} \times QA(\%)_{MW42}) + (C_{MW74} \times QA(\%)_{MW74}) + (C_{MW95} \times QA(\%)_{MW95}) + (C_{MW104} \times QA(\%)_{MW104}) + (C_{MW108} \times QA(\%)_{MW108}) + C_{MW110} \times QA(\%)_{MW110}) + (C_{MW111} \times QA(\%)_{MW111})$

$C_{usas} = (0.54ug/L \times 19.1\%) + (9.9ug/L \times 7.9\%) + (8.1ug/L \times 7.9\%) + (28ug/L \times 7.9\%) + (110ug/L \times 19.1\%) + (5.8ug/L \times 14.0\%) + (180ug/L \times 14.0\%) + (6.6ug/L \times 4.3\%) + (46ug/L \times 4.3\%) + (2.8ug/L \times 1.4\%)$

$C_{usas} = 53ug/L$

Treatment System Influent

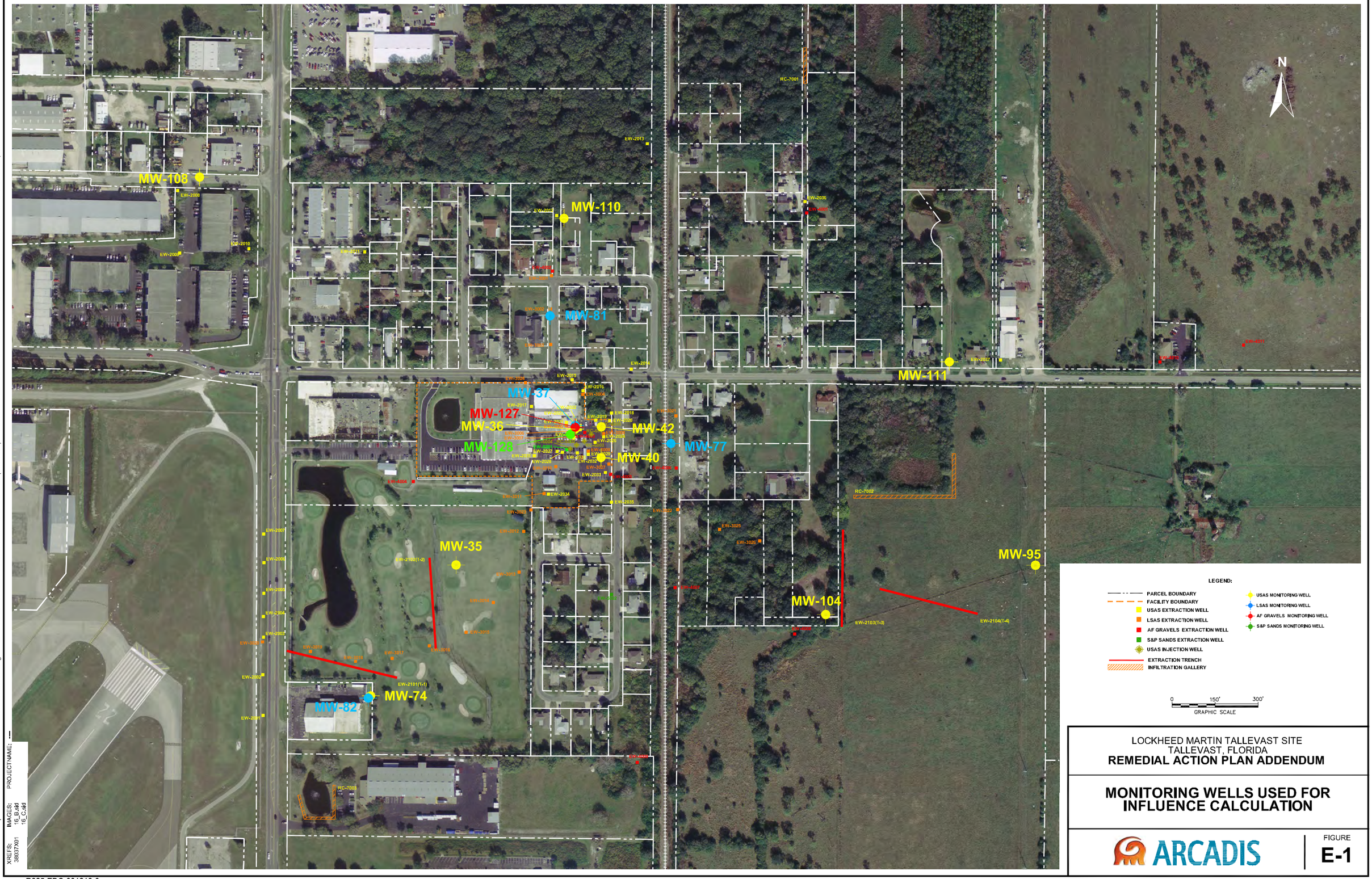
Estimated 1,4-Dioxane concentration for RAP treatment system influent = Estimated 1,4-Dioxane concentration from respective aquifer zones x estimated flow percentage for respective aquifer zones

Or

$C_{TS} = (C_{S\&P} \times QT(\%)_{S\&P}) + (C_{AFG} \times QT(\%)_{AFG}) + (C_{LSAS} \times QT(\%)_{LSAS}) + (C_{USAS} \times QT(\%)_{USAS})$

$C_{TS} = (4ug/L \times 2.0\%) + (330ug/L \times 9.7\%) + (406ug/L \times 16.6\%) + (53ug/L \times 71.7\%)$

$C_{TS} = 138ug/L$



LOCKHEED MARTIN TALLEVAST SITE
TALLEVAST, FLORIDA
REMEDIAL ACTION PLAN ADDENDUM

MONITORING WELLS USED FOR INFLUENCE CALCULATION

ARCADIS

FIGURE
E-1

R625-EDC-001213-0

CITY:TAMPA DIV/GROUP:85 DB:JAR LD:(Opt) PIC:(Opt) PM:(Regd) TM:(Opt) LYR:(Opt)ON=*OFF=*REF*
G:\ENVCAD\Tampa-BACT\B0038055\0013\0000024\AP 2009\B0038055001.dwg LAYOUT: E-1 SAVED: 7/7/2009 2:16 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: --- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 7/7/2009 3:35 PM BY: RICHARDS, JIM
XREFS: 38037X01
IMAGES: 16_B.sid 16_C.sid
PROJECTNAME: --

RAP Estimated Influent Concentration Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Method	Analyte	MCUO IUD Permit Limits	FDEP GCTL	FDEP SWCTL	Result Units	Monitoring Well Aquifer % of Total Flow	MW-128 S&P 1.99%	MW-127 AFG 9.68%	MW-37 LSAS 38.10%	MW-77 LSAS 4.76%	MW-81 LSAS 14.29%	MW-82 LSAS 42.86%	Weighted Average LSAS WELLS 16.63%	Average LSAS WELLS 16.63%	Median LSAS WELLS	Standard D /Median LSAS WELLS	MW-35 USAS 19.06%	MW-36 USAS 7.92%	MW-40 USAS 7.92%	MW-42 USAS 7.92%
8081A - Organochlorine Pesticides																				
8081A	4,4'-DDD	- -	0.1	0.0003	ug/L		0.0039 U	0.0042 U	0.0039 U	0.0039 U	0.0039 U	0.0039 U	0.0039	0.0039	0.0039	0.0000	0.0043 U	0.0038 U	0.0039 U	0.0039 U
8081A	4,4'-DDE	- -	0.1	0.0002	ug/L		0.0052 U	0.0057 U	0.0052 U	0.0052 U	0.0053 U	0.0052 U	0.0052	0.0052	0.0052	0.0096	0.0058 U	0.0051 U	0.0053 U	0.0053 U
8081A	4,4'-DDT	- -	0.1	0.00059 avg; 0.001 max	ug/L		0.003 U	0.0033 U	0.003 U	0.003 U	0.003 U	0.003 U	0.0030	0.0030	0.0030	0.0000	0.0033 U	0.003 U	0.003 U	0.003 U
8081A	Aldrin	- -	0.002	0.00014 avg; 3.0 max	ug/L		0.0017 U	0.0019 U	0.0017 U	0.0017 U	0.0018 U	0.0017 U	0.0017	0.0017	0.0017	0.0294	0.0019 U	0.0017 U	0.0018 U	0.0018 U
8081A	alpha-BHC	- -	0.006	0.005	ug/L		0.0026 U	**0.014**	0.0026 U	0.0027 U	0.0027 U	0.0027 U	0.0027	0.0027	0.0027	0.0185	0.0029 U	0.0026 U	0.0027 U	0.0027 U
8081A	beta-BHC	- -	0.02	0.046 avg	ug/L		0.0025 U	0.0049 I	0.0025 U	0.0025 U	0.0026 U	0.0025 U	0.0025	0.0025	0.0025	0.0200	0.0028 U	0.0025 U	0.0026 U	0.0026 U
8081A	Chlordane (technical)	- -	2	0.00059 avg; 0.0043 max	ug/L		0.054 U	0.059 U	0.054 U	0.054 U	0.055 U	0.054 U	0.0541	0.0543	0.0540	0.0093	0.06 U	0.054 U	0.055 U	0.055 U
8081A	delta-BHC	- -	2.1	- -	ug/L		0.0026 U	0.029	0.0026 U	0.0026 U	0.0027 U	0.0026 U	0.0026	0.0026	0.0026	0.0192	0.0029 U	0.0026 U	0.0027 U	0.0027 U
8081A	Dieldrin	- -	0.002	0.00014 avg; 0.0019 max	ug/L		**0.025**	0.0014 U	**0.0083** I	0.0013 U	0.0013 U	0.0013 U	**0.0040**	**0.0031**	0.0013	2.6923	0.0015 U	0.0013 U	0.0013 U	0.0013 U
8081A	Endosulfan I	- -	- -	- -	ug/L		0.0032 U	0.0035 U	0.0032 U	0.0033 U	0.0033 U	0.0033 U	0.0033	0.0033	0.0033	0.0152	0.0036 U	0.0032 U	0.0033 U	0.0033 U
8081A	Endosulfan II	- -	- -	- -	ug/L		0.0031 U	0.0034 U	0.0031 U	0.0031 U	0.0032 U	0.0031 U	0.0031	0.0031	0.0031	0.0161	0.0035 U	0.0031 U	0.0032 U	0.0032 U
8081A	Endosulfan sulfate	- -	- -	- -	ug/L		0.0028 U	0.003 U	0.0028 U	0.0028 U	0.0028 U	0.0028 U	0.0028	0.0028	0.0028	0.0000	0.0031 U	0.0028 U	0.0028 U	0.0028 U
8081A	Total Endosulfan[7]	- -	42	0.056			0.0032	0.0035	0.0032	0.0033	0.0033	0.0033	0.0033	0.0092			0.0102	0.0091	0.0093	0.0093
8081A	Endrin	- -	2	0.0023	ug/L		0.0029 U	0.0032 U	0.0029 U	0.003 U	0.003 U	0.003 U	0.0030	0.0030	0.0030	0.0167	0.0033 U	0.0029 U	0.003 U	0.003 U
8081A	Endrin aldehyde	- -	- -	- -	ug/L		0.003 U	0.0033 U	0.003 U	0.003 U	0.0031 U	0.003 U	0.0030	0.0030	0.0030	0.0167	0.0034 U	0.003 U	0.0031 U	0.0031 U
8081A	Endrin ketone	- -	- -	- -	ug/L		0.0051 U	0.0056 U	0.0051 U	0.0051 U	0.0062 I	0.0051 U	0.0053	0.0054	0.0051	0.1078	0.0057 U	0.0051 U	0.0052 U	0.0052 U
8081A	gamma-BHC (Lindane)	- -	0.2	0.063 avg; 0.08 max	ug/L		0.0025 U	0.016	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025	0.0025	0.0025	0.0000	0.0027 U	0.0024 U	0.0025 U	0.0025 U
8081A	Heptachlor	- -	0.4	0.00021 avg; 0.0038 max	ug/L		0.0029 U	0.0032 U	0.0029 U	0.0029 U	0.003 U	0.0029 U	0.0029	0.0029	0.0029	0.0172	0.0032 U	0.0029 U	0.003 U	0.003 U
8081A	Heptachlor epoxide	- -	0.2	0.00004	ug/L		0.003 U	0.0032 U	0.003 U	0.003 U	0.003 U	0.003 U	0.0030	0.0030	0.0030	0.0000	0.0033 U	0.003 U	0.003 U	0.003 U
8081A	Methoxychlor	- -	40	0.03	ug/L		0.0048 U	0.0052 U	0.0048 U	0.0048 U	0.0049 U	0.0048 U	0.0048	0.0048	0.0048	0.0104	0.0053 U	0.0048 U	0.0049 U	0.0049 U
8081A	Toxaphene	- -	3	0.0002	ug/L		0.68 U	0.74 U	0.68 U	0.69 U	0.69 U	0.69 U	0.6862	0.6875	0.6900	0.0072	0.76 U	0.68 U	0.69 U	0.69 U
8082 - Polychlorinated Biphenyls																				
8082	PCB-1016	- -			ug/L		0.25 U	0.27 U	0.25 U	0.25 U	0.25 U	0.25 U	0.2500	0.2500	0.2500	0.0000	0.27 U	0.24 U	0.25 U	0.25 U
8082	PCB-1221	- -			ug/L		0.14 U	0.15 U	0.14 U	0.14 U	0.14 U	0.14 U	0.1400	0.1400	0.1400	0.0000	0.16 U	0.14 U	0.14 U	0.14 U
8082	PCB-1232	- -		0.000045 avg;	ug/L		0.36 U	0.39 U	0.36 U	0.36 U	0.37 U	0.36 U	0.3614	0.3625	0.3600	0.0139	0.4 U	0.36 U	0.37 U	0.37 U
8082	PCB-1242	- -	0.5 (Total PCBs)	0.014 max	ug/L		0.073 U	0.079 U	0.073 U	0.073 U	0.074 U	0.073 U	0.0731	0.0733	0.0730	0.0068	0.081 U	0.072 U	0.074 U	0.074 U
8082	PCB-1248	- -		(Total PCBs)	ug/L		0.066 U	0.072 U	0.066 U	0.067 U	0.067 U	0.067 U	0.0666	0.0668	0.0670	0.0075	0.074 U	0.066 U	0.067 U	0.067 U
8082	PCB-1254	- -			ug/L		0.11 U	0.12 U	0.11 U	0.11 U	0.12 U	0.11 U	0.1114	0.1125	0.1100	0.0455	0.13 U	0.11 U	0.12 U	0.12 U
8082	PCB-1260	- -			ug/L		0.094 U	0.1 U	0.094 U	0.095 U	0.096 U	0.095 U	0.0948	0.0950	0.0950	0.0086	0.11 U	0.094 U	0.096 U	0.096 U
8082	Total PCBs[5]	- -	0.5	0.000045	ug/L		0.36	0.39	0.36	0.36	0.37	0.36	0.3614	0.3625			0.4	0.36	0.37	0.37
8141A - Organophoso Pesticides																				
8141A	Guthion	- -	11	0.01	ug/L		0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	0.32 U	0.3162	0.3175	0.3200	0.0156	0.32 U	0.31 U	0.32 U	0.32 U
8141A	Bolstar	- -	- -	- -	ug/L		0.09 U	0.093 U	0.09 U	0.093 U	0.093 U	0.093 U	0.0919	0.0923	0.0930	0.0161	0.091 U	0.09 U	0.091 U	0.091 U
8141A	Chlorpyrifos	- -	21	0.002	ug/L		0.1 U	0.11 U	0.1 U	0.11 U	0.11 U	0.11 U	0.1062	0.1075	0.1100	0.0455	0.11 U	0.1 U	0.11 U	0.11 U
8141A	Coumaphos	- -	1.8	0.004	ug/L		0.076 U	0.079 U	0.077 U	0.079 U	0.079 U	0.079 U	0.0782	0.0785	0.0790	0.0127	0.078 U	0.076 U	0.078 U	0.078 U
8141A	Demeton-O	- -	- -	- -	ug/L		0.1 U	0.11 U	0.1 U	0.11 U	0.11 U	0.11 U	0.1062	0.1075	0.1100	0.0455	0.11 U	0.1 U	0.11 U	0.11 U
8141A	Diazinon	- -	6.3	0.002	ug/L		0.1 U	0.11 U	0.1 U	0.11 U	0.11 U	0.11 U	0.1062	0.1075	0.1100	0.0455	0.11 U	0.1 U	0.11 U	0.11 U
8141A	Dichlorvos	- -	0.1	0.005	ug/L		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.2500	0.2500	0.2500	0.0000	0.25 U	0.25 U	0.25 U	0.25 U
8141A	Dimethoate	- -	1.4	0.1	ug/L		0.3 U	0.31 U	0.3 U	0.31 U	0.31 U	0.31 U	0.3062	0.3075	0.3100	0.0161	0.31 U	0.3 U	0.31 U	0.31 U
8141A	Disulfoton	- -	0.3	0.3	ug/L		0.11 U	0.12 U	0.11 U	0.12 U	0.12 U	0.12 U	0.1162	0.1175	0.1200	0.0417	0.12 U	0.11 U	0.12 U	0.12 U
8141A	EPN	- -	0.07	0.02	ug/L		0.067 U	0.07 U	0.068 U	0.07 U	0.07 U	0.07 U	0.0692	0.0695	0.0700	0.0143	0.068 U	0.067 U	0.068 U	0.068 U
8141A	Ethion	- -	3.5	0.007	ug/L		0.1 U	0.11 U	0.1 U	0.11 U	0.11 U	0.11 U	0.1062	0.1075	0.1100	0.0455	0.11 U	0.1 U	0.11 U	0.11 U
8141A	Ethoprop	- -	0.7	0.3	ug/L		0.39 U	0.4 U	0.39 U	0.4 U	0.4 U	0.4 U	0.3962	0.3975	0.4000	0.0125	0.39 U	0.39 U	0.39 U	0.39 U
8141A	Ethyl Parathion	- -	4.2	0.04	ug/L		0.075 U	0.078 U	0.076 U	0.078 U	0.078 U	0.078 U	0.0772	0.0775	0.0780	0.0128	0.077 U	0.075 U	0.077 U	0.077 U
8141A	Fensulfothion	- -	1.8	0.5	ug/L		0.16 U	0.17 U	0.16 U	0.17 U	0.17 U	0.17 U	0.1662	0.1675	0.1700	0.0294	0.16 U	0.16 U	0.16 U	0.16 U
8141A	Malathion	- -	140	0.1	ug/L		0.087 U	0.09 U	0.088 U	0.09 U	0.09 U	0.09 U	0.0892	0.0895	0.0900	0.0111	0.088 U	0.087 U	0.088 U	0.088 U
8141A	Merphos	- -	0.2	- -	ug/L		0.12 U	0.13 U	0.12 U	0.13 U	0.13 U	0.13 U	0.1262	0.1275	0.1300	0.0385	0.12 U	0.12 U	0.12 U	0.12 U
8141A	Methyl parathion	- -	1.8	0.01	ug/L		0.11 U	0.12 U	0.11 U	0.12 U	0.12 U	0.12 U	0.1162	0.1175	0.1200	0.0417	0.12 U	0.11 U	0.12 U	0.12 U
8141A	Mevinphos	- -	1.8	0.05	ug/L		0.14 U	0.15 U	0.14 U	0.15 U	0.15 U	0.15 U	0.1462	0.1475	0.1500	0.0333	0.14 U	0.14 U	0.14 U	0.14 U
8141A	Monochrotophos	- -	- -	- -	ug/L		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5000	2.5000	2.5000	0.0000	2.5 U	2.5 U	2.5 U	2.5 U
8141A	Naled	- -	14	0.02	ug/L		0.34 U	0.35 U	0.34 U	0.35 U	0.35 U	0.35 U	0.3462	0.3475	0.3500	0.0143	0.35 U	0.34 U	0.35 U	0.35 U
8141A	Phorate	- -	1.4	0.005	ug/L		0.15 U	0.16 U	0.15 U	0.16 U	0.16 U	0.16 U	0.1562	0.1575	0.1600	0.0313	0.15 U	0.15 U	0.15 U	0.15 U
8141A	Ronnel	- -	350	0.06	ug/L		0.12 U	0.13 U	0.12 U	0.13 U	0.13 U	0.13 U	0.1262	0.1275	0.1300	0.0385	0.12 U	0.12 U	0.12 U	0.12 U
8141A	Stirophos	- -	- -	- -	ug/L		0.079 U	0.082 U	0.08 U	0.082 U	0.082 U	0.082 U	0.0812	0.0815	0.0820	0.0122	0.081 U	0.079 U	0.081 U	0.081 U
8141A	Sulfotepp	- -	3.5	0.01	ug/L		0.052 U	0.054 U	0.052 U	0.054 U	0.054 U	0.054 U	0.0532	0.0535	0.0540	0.0185	0.053 U	0.052 U	0.053 U	0.053 U
8141A	Tokuthion	- -	- -	- -	ug/L		0.082 U	0.085 U	0.083 U	0.085 U	0.085 U	0.085 U	0.0842	0.0845	0.0850	0.0118	0.084 U	0.082 U	0.084 U	0.084 U
8141A	Trichloronate	- -	- -	- -	ug/L		0.1 U	0.11 U	0.1 U	0.11 U	0.11 U	0.11 U	0.1062	0.1075	0.1100	0.0455	0.11 U	0.1 U	0.11 U	0.11 U
8151A - Chlorinated Herbicides																				
8151A	2,4-D	- -	70	- -	ug/L		0.95 U	1.1 U	0.94 U	0.95 U	1 U	0.94 U	0.9490	0.9575	0.9450	0.0304	0.22 U	0.94 U	0.96 U	1.1 U
8151A	2,4-DB	- -	56	- -	ug/L		0.95 U	1.1 U	0.94 U	0.95 U	1 U	0.94 U	0.9490	0.9575	0.9450	0.0304	0.22 U	0.94 U	0.96 U	1.1 U
8151A	Dalapon	- -	200	5000	ug/L		24 U	26 U	23 U	24 U	25 U	24 U	23.7619	24.0000	24.0000	0.0340	5.4 U	23 U	24 U	26 U
8151A	Dicamba	- -	210	200	ug/L		0.24 U	0.26 U	0.23 U	0.24 U	0.25 U	0.24 U	0.2376	0.2400	0.2400	0.0340	0.054 U	0.23 U	0.24 U	0.26 U
8151A	Dichlorprop	- -	35	42	ug/L		0.95 U	1.1 U	0.94 U	0.95 U	1 U	0.94 U	0.9490	0.9575	0.9450	0.0304	0.22 U	0.94 U	0.96 U	1.1 U
8151A	Dinoseb	- -	7	5.9	ug/L		0.95 U	1.1 U	0.94 U	0.95 U	1 U	0.94 U	0.9490	0.9575	0.9450	0.0304	0.22 U	0.94 U	0.96 U	1.1 U
8151A	MCPA	- -	3.5	72	ug/L		32 U	36 U	32 U	32 U	34 U	32 U	32.2857	32.5000	32.0000	0.0313	7.4 U	32 U	33 U	36 U
8151A	MCPP	- -	7	- -	ug/L		33 U	37 U	33 U	33 U	35 U	33 U	33.2857	33.5000	33.0000	0.0303	7.6 U	33 U	34 U	37 U
8151A	Pentachlorophenol	- -	1	8.3 avg; 30 max; e^(1.005[pH]-	ug/L		0.081 U	0.089 U	0.08 U	0.081 U	0.085 U	0.08 U	0.0808	0.0815	0.0805	0.0296	0.018 U	0.08 U	0.082 U	0.089 U
8151A	Picloram	- -	500	70	ug/L		0.95 U	1.1 U	0.94 U	0.95 U	1 U	0.94 U	0.9490	0.9575	0.9450	0.0304	0.22 U	0.94 U	0.96 U	1.1 U
8151A	Silvex (2,4,5-TP)	- -	50	- -	ug/L		0.95 U	1.1 U	0.94 U	0.95 U	1 U	0.94 U	0.9490	0.9575	0.9450	0.0304	0.22 U	0.94 U	0.96 U	1.1 U

RAP Estimated Influent Concentration Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Method	Analyte	MCUO IUD Permit Limits	FDEP GCTL	FDEP SWCTL	Result Units	Monitoring Well	MW-128	MW-127	MW-37	MW-77	MW-81	MW-82	Weighted Average	Average	Median	Standard D /Median	MW-35	MW-36	MW-40	MW-42
						Aquifer	S&P	AFG	LSAS	LSAS	LSAS	LSAS	LSAS WELLS	LSAS WELLS	LSAS WELLS	LSAS WELLS	USAS	USAS	USAS	USAS
						% of Total Flow	1.99%	9.68%	38.10%	4.76%	14.29%	42.86%	16.63%	16.63%			19.06%	7.92%	7.92%	7.92%
	8260B - VOCs																			
8260B	1,1,1,2-Tetrachloroethane	- -	1.3	- -	ug/L		1.3 U	32 U	32 U	2.5 U	2.5 U	6.3 U	15.366667	10.825000	4.400000	3.234061	0.63 U	3.2 U	6.3 U	6.3 U
8260B	1,1,1-Trichloroethane	- -	200	270	ug/L		0.92 U	23 U	23 U	1.8 U	1.8 U	4.6 U	11.076190	7.800000	3.200000	3.193418	0.46 U	2.3 U	4.6 U	4.6 U
8260B	1,1,2,2-Tetrachloroethane	- -	0.2	10.8 avg	ug/L		0.3 U	7.5 U	7.5 U	0.6 U	0.6 U	1.5 U	3.614286	2.550000	1.050000	3.168725	0.15 U	0.75 U	1.5 U	1.5 U
8260B	1,1,2-Trichloroethane	- -	5	16	ug/L		0.94 U	24 U	24 U	1.9 U	1.9 U	4.7 U	11.519048	8.125000	3.300000	3.231917	0.47 U	2.4 U	4.7 U	4.7 U
8260B	1,1-Dichloroethane	70	70	- -	ug/L		29	**76**	49 I	23	6.8	**120**	**72.161905**	49.700000	36.000000	1.388507	2.4	59	11	37
8260B	1,1-Dichloroethene	7	7	3.2 avg	ug/L		**83**	**400**	**160**	**21**	**73**	**75**	**104.523810**	**82.250000**	**74.000000**	0.777653	**10**	**220**	**11**	**66**
8260B	1,1-Dichloropropene	- -	- -	- -	ug/L		0.62 U	16 U	16 U	1.2 U	1.2 U	3.1 U	7.652381	5.375000	2.150000	3.320808	0.31 U	1.6 U	3.1 U	3.1 U
8260B	1,2,3-Trichlorobenzene	- -	70	85	ug/L		1.5 U	38 U	38 U	3.1 U	3.1 U	7.7 U	18.366667	12.975000	5.400000	3.115494	0.77 U	3.8 U	7.7 U	7.7 U
8260B	1,2,3-Trichloropropane	- -	0.02	0.2	ug/L		0.36 U	9 U	9 U	0.72 U	0.72 U	1.8 U	4.337143	3.060000	1.260000	3.168725	0.18 U	0.9 U	1.8 U	1.8 U
8260B	1,2,4-Trichlorobenzene	- -	70	23	ug/L		1.2 U	29 U	29 U	2.3 U	2.3 U	5.8 U	13.971429	9.850000	4.050000	3.178479	0.58 U	2.9 U	5.8 U	5.8 U
8260B	1,2,4-Trimethylbenzene	- -	10	220	ug/L		1.7 U	43 U	43 U	3.4 U	3.4 U	8.6 U	20.714286	14.600000	6.000000	3.181893	0.86 U	4.3 U	8.6 U	8.6 U
8260B	1,2-Dibromo-3-Chloropropane	- -	0.2	- -	ug/L		5 U	120 U	120 U	10 U	10 U	25 U	58.333333	41.250000	17.500000	3.027089	2.5 U	12 U	25 U	25 U
8260B	1,2-Dibromoethane	- -	0.02	13	ug/L		1 U	25 U	25 U	2 U	2 U	5 U	12.047619	8.500000	3.500000	3.168725	0.5 U	2.5 U	5 U	5 U
8260B	1,2-Dichlorobenzene	- -	600	99	ug/L		0.88 U	22 U	22 U	1.8 U	1.8 U	4.4 U	10.609524	7.500000	3.100000	3.143245	0.44 U	2.2 U	4.4 U	4.4 U
8260B	1,2-Dichloroethane	- -	3	37	ug/L		1.1 U	28 U	28 U	2.3 U	2.3 U	5.7 U	13.547619	9.575000	4.000000	3.096865	0.57 U	2.8 U	5.7 U	5.7 U
8260B	1,2-Dichloropropane	- -	5	14	ug/L		1 U	26 U	26 U	2.1 U	2.1 U	5.2 U	12.533333	8.850000	3.650000	3.157903	0.52 U	2.6 U	5.2 U	5.2 U
8260B	1,3,5-Trimethylbenzene	- -	10	220	ug/L		1.1 U	27 U	27 U	2.2 U	2.2 U	5.4 U	13.019048	9.200000	3.800000	3.147938	0.54 U	2.7 U	5.4 U	5.4 U
8260B	1,3-Dichlorobenzene	- -	210	85	ug/L		1.3 U	32 U	32 U	2.6 U	2.6 U	6.4 U	15.428571	10.900000	4.500000	3.151171	0.64 U	3.2 U	6.4 U	6.4 U
8260B	1,3-Dichloropropane	- -	- -	- -	ug/L		0.78 U	20 U	20 U	1.6 U	1.6 U	3.9 U	9.595238	6.775000	2.750000	3.230212	0.39 U	2 U	3.9 U	3.9 U
8260B	1,4-Dichlorobenzene	- -	75	3	ug/L		1 U	26 U	26 U	2.1 U	2.1 U	5.2 U	12.533333	8.850000	3.650000	3.157903	0.52 U	2.6 U	5.2 U	5.2 U
8260B	2,2-Dichloropropane	- -	- -	- -	ug/L		0.72 U	18 U	18 U	1.4 U	1.4 U	3.6 U	8.666667	6.100000	2.500000	3.200333	0.36 U	1.8 U	3.6 U	3.6 U
8260B	2-Butanone	- -	4,200	120000	ug/L		17 U	420 U	420 U	34 U	34 U	84 U	202.476190	143.000000	59.000000	3.155336	8.4 U	42 U	84 U	84 U
8260B	2-Chlorotoluene	- -	140	390	ug/L		1.3 U	32 U	32 U	2.6 U	2.6 U	6.5 U	15.471429	10.925000	4.550000	3.114236	0.65 U	3.2 U	6.5 U	6.5 U
8260B	2-Hexanone	- -	280	- -	ug/L		8.8 U	220 U	220 U	18 U	18 U	44 U	106.095238	75.000000	31.000000	3.143245	4.4 U	22 U	44 U	44 U
8260B	4-Chlorotoluene	- -	140	- -	ug/L		1 U	26 U	26 U	2.1 U	2.1 U	5.2 U	12.533333	8.850000	3.650000	3.157903	0.52 U	2.6 U	5.2 U	5.2 U
8260B	4-Isopropyl Toluene	- -	- -	- -	ug/L		1.4 U	34 U	34 U	2.8 U	2.8 U	6.9 U	16.442857	11.625000	4.850000	3.101311	0.69 U	3.4 U	6.9 U	6.9 U
8260B	4-Methyl-2-Pentanone	- -	560	23000	ug/L		7.6 U	190 U	190 U	15 U	15 U	38 U	91.523810	64.500000	26.500000	3.183633	3.8 U	19 U	38 U	38 U
8260B	Acetone	- -	6,300	1700	ug/L		1000	500 U	500 U	40 U	40 U	99 U	240.523810	169.750000	69.500000	3.193043	9.9 U	50 U	99 U	99 U
8260B	Benzene	- -	1	71.28 avg	ug/L		1 U	25 U	25 U	2 U	2 U	5 U	12.047619	8.500000	3.500000	3.168725	0.5 U	2.5 U	5 U	5 U
8260B	Bromobenzene	- -	- -	- -	ug/L		1.2 U	29 U	29 U	2.3 U	2.3 U	5.8 U	13.971429	9.850000	4.050000	3.178479	0.58 U	2.9 U	5.8 U	5.8 U
8260B	Bromochloromethane	- -	91	- -	ug/L		1.2 U	29 U	29 U	2.3 U	2.3 U	5.8 U	13.971429	9.850000	4.050000	3.178479	0.58 U	2.9 U	5.8 U	5.8 U
8260B	Bromodichloromethane	- -	0.6	22 avg	ug/L		0.7 U	18 U	18 U	1.4 U	1.4 U	3.5 U	8.623810	6.075000	2.450000	3.269958	0.35 U	1.8 U	3.5 U	3.5 U
8260B	Bromoform	- -	4.4	360 avg	ug/L		1.2 U	29 U	29 U	2.3 U	2.3 U	5.8 U	13.971429	9.850000	4.050000	3.178479	0.58 U	2.9 U	5.8 U	5.8 U
8260B	Bromomethane	- -	9.8	35	ug/L		5 U	120 U	120 U	10 U	10 U	25 U	58.333333	41.250000	17.500000	3.027089	2.5 U	12 U	25 U	25 U
8260B	Carbon Disulfide	- -	700	110	ug/L		1.7 U	42 U	42 U	3.4 U	3.4 U	8.5 U	20.290476	14.325000	5.950000	3.127055	0.85 U	4.2 U	8.5 U	8.5 U
8260B	Carbon Tetrachloride	- -	3	4.42 avg	ug/L		0.84 U	21 U	21 U	1.7 U	1.7 U	4.2 U	10.123810	7.150000	2.950000	3.155336	0.42 U	2.1 U	4.2 U	4.2 U
8260B	Chlorobenzene	- -	100	17	ug/L		1.3 U	32 U	32 U	2.5 U	2.5 U	6.3 U	15.366667	10.825000	4.400000	3.234061	0.63 U	3.2 U	6.3 U	6.3 U
8260B	Chloroethane	- -	12	- -	ug/L		5 U	120 U	120 U	10 U	10 U	25 U	58.333333	41.250000	17.500000	3.027089	2.5 U	12 U	25 U	25 U
8260B	Chloroform	- -	70	470.8	ug/L		1.8 U	45 U	45 U	3.6 U	3.6 U	9 U	21.685714	15.300000	6.300000	3.168725	0.9 U	4.5 U	9 U	9 U
8260B	Chloromethane	- -	2.7	470.8	ug/L		2 U	50 U	50 U	4 U	4 U	10 U	24.095238	17.000000	7.000000	3.168725	1 U	5 U	10 U	10 U
8260B	cis-1,2-Dichloroethene	70	70	- -	ug/L		3.6	**120**	**210**	2.6 U	55	6.5 U	**90.766667**	68.525000	30.750000	3.163639	0.65 U	14	6.5 U	35
8260B	cis-1,3-Dichloropropene	- -	- -	- -	ug/L		0.28 U	7 U	7 U	0.56 U	0.56 U	1.4 U	3.373333	2.380000	0.980000	3.168725	0.14 U	0.7 U	1.4 U	1.4 U
8260B	Dibromochloromethane	- -	0.4	34	ug/L		0.68 U	17 U	17 U	1.4 U	1.4 U	3.4 U	8.200000	5.800000	2.400000	3.135815	0.34 U	1.7 U	3.4 U	3.4 U
8260B	Dibromomethane	- -	70	13	ug/L		0.82 U	20 U	20 U	1.6 U	1.6 U	4.1 U	9.680952	6.825000	2.850000	3.109489	0.41 U	2 U	4.1 U	4.1 U
8260B	Dichlorodifluoromethane	- -	1,400	- -	ug/L		5 U	120 U	120 U	10 U	10 U	25 U	58.333333	41.250000	17.500000	3.027089	2.5 U	12 U	25 U	25 U
8260B	Ethylbenzene	- -	700	610	ug/L		0.88 U	22 U	22 U	1.8 U	1.8 U	4.4 U	10.609524	7.500000	3.100000	3.143245	0.44 U	2.2 U	4.4 U	4.4 U
8260B	Hexachlorobutadiene	- -	0.4	49.7	ug/L		0.8 U	20 U	20 U	1.6 U	1.6 U	4 U	9.638095	6.800000	2.800000	3.168725	0.4 U	2 U	4 U	4 U
8260B	Isopropyl Benzene	- -	0.8	260	ug/L		0.38 U	9.5 U	9.5 U	0.76 U	0.76 U	1.9 U	4.578095	3.230000	1.330000	3.168725	0.19 U	0.95 U	1.9 U	1.9 U
8260B	Methyl Tert Butyl Ether	- -	20	34000	ug/L		0.88 U	22 U	22 U	1.8 U	1.8 U	4.4 U	10.609524	7.500000	3.100000	3.143245	0.44 U	2.2 U	4.4 U	4.4 U
8260B	Methylene Chloride	- -	5	1580 avg	ug/L		8 U	200 U	200 U	16 U	16 U	40 U	96.380952	68.000000	28.000000	3.168725	4 U	20 U	40 U	40 U
8260B	m-Xylene & p-Xylene	- -	- -	- -	ug/L		1.2 U	30 U	30 U	2.4 U	2.4 U	6 U	14.457143	10.200000	4.200000	3.168725	0.6 U	3 U	6 U	6 U
8260B	O-Xylene	- -	- -	- -	ug/L		1 U	25 U	25 U	2 U	2 U	5 U	12.047619	8.500000	3.500000	3.168725	0.5 U	2.5 U	5 U	5 U
8260 B	Total Xylenes	- -	10000	370			2.2	55	55	4.4	4.4	11	26.5047619	18.7			1.1	5.5	11	11
8260B	Naphthalene	- -	14	26	ug/L		5 U	120 U	120 U	10 U	10 U	25 U	58.333333	41.250000	17.500000	3.027089	2.5 U	12 U	25 U	25 U
8260B	n-Butylbenzene	- -	- -	- -	ug/L		1.3 U	34 U	34 U	2.7 U	2.7 U	6.7 U	16.338095	11.525000	4.700000	3.213089	0.67 U	3.4 U	6.7 U	6.7 U
8260B	n-Propylbenzene	- -	- -	- -	ug/L		1.2 U	30 U	30 U	2.4 U	2.4 U	5.9 U	14.414286	10.175000	4.150000	3.209459	0.59 U	3 U	5.9 U	5.9 U
8260B	sec-Butylbenzene	- -	- -	- -	ug/L		1.3 U	32 U	32 U	2.5 U	2.5 U	6.3 U	15.366667	10.825000	4.400000	3.234061	0.63 U	3.2 U	6.3 U	6.3 U
8260B	Styrene	- -	100	460	ug/L		2 U	49 U	49 U	3.9 U	3.9 U	9.8 U	23.609524	16.650000	6.850000	3.174492	0.98 U	4.9 U	9.8 U	9.8 U
8260B	tert-Butylbenzene	- -	- -	- -	ug/L		1.7 U	42 U	42 U	3.4 U	3.4 U	8.4 U	20.247619	14.300000	5.900000	3.155336	0.84 U	4.2 U	8.4 U	8.4 U
8260B	Tetrachloroethene	3	3	8.85 avg	ug/L		1.3 I	**170**	**160**	2 U	2 U	5 U	**63.476190**	**42.250000**	**3.500000**	22.432211	**33**	**3.4** I	**180**	**15**
8260B	Toluene	- -	1,000	480	ug/L		1 U	26 U	26 U	2 U	2 U	5.1 U	12.471429	8.775000	3.550000	3.260830	0.51 U	2.6 U	5.1 U	5.1 U
8260B	Trans-1,2-Dichloroethene	- -	100	11000	ug/L		0.88 U	22 U	22 U	1.8 U	1.8 U	4.4 U	10.609524	7.500000	3.100000	3.143245	0.44 U	2.2 U	4.4 U	4.4 U
8260B	Trans-1,3-Dichloropropene	- -	- -	- -	ug/L		0.28 U	7 U	7 U	0.56 U	0.56 U	1.4 U	3.373333	2.380000	0.980000	3.168725	0.14 U	0.7 U	1.4 U	1.4 U
8260B	Trichloroethene	3	3	80.7 avg	ug/L		**49**	**3000**	**3400**	**13**	**230**	5 U	**1330.857143**	**912.000000**	**121.500000**	13.678506	**25**	**400**	**650**	**920**
8260B	Trichlorofluoromethane	- -	2,100	- -	ug/L		5 U	120 U	120 U	10 U	10 U	25 U	58.333333	41.250000	17.500000	3.027089	2.5 U	12 U	25 U	25 U
8260B	Vinyl Chloride	1	1	2.4	ug/L		1 U	25 U	25 U	2 U	2 U	5 U	12.047619	8.500000	3.500000	3.168725	0.5 U	2.5 U	5 U	5 U
	8260C SIM/ID - 1,4-Dioxane																			
8260C SIM/ID	1,4-Dioxane	Report	3.2	120	ug/L		**4**	**330**	**220**	**160**	**99**	**700**	**405.571429**	**294.750000**	**190.000000**	1.445504	0.54 U	**9.9**	**8.1** I	**28**

R625-EDC-001213-0

RAP Estimated Influent Concentration Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Method	Analyte	MCUO IUD Permit Limits	FDEP GCTL	FDEP SWCTL	Result Units	Monitoring Well Aquifer % of Total Flow	MW-128 S&P 1.99%	MW-127 AFG 9.68%	MW-37 LSAS 38.10%	MW-77 LSAS 4.76%	MW-81 LSAS 14.29%	MW-82 LSAS 42.86%	Weighted Average LSAS WELLS 16.63%	Average LSAS WELLS 16.63%	Median LSAS WELLS	Standard D /Median LSAS WELLS	MW-35 USAS 19.06%	MW-36 USAS 7.92%	MW-40 USAS 7.92%	MW-42 USAS 7.92%
8270C - Phenols and Phthalates																				
8270C	Phenol	- -	10	6.5	ug/L		2.3 U	2.4 U	2.3 U	2.3 U	2.4 U	2.5 U	2.4000	2.3750	2.3500	0.0407	2.4 U	2.3 U	2.3 U	2.3 U
8270C	Dimethyl phthalate	- -	70,000	1400	ug/L		2.4 U	2.5 U	2.4 U	2.4 U	2.5 U	2.6 U	2.5000	2.4750	2.4500	0.0391	2.5 U	2.3 U	2.4 U	2.4 U
8270C	Diethyl phthalate	- -	5,600	380	ug/L		2.4 U	2.5 U	2.4 U	2.4 U	2.5 U	2.6 U	2.5000	2.4750	2.4500	0.0391	2.5 U	2.3 U	2.4 U	2.4 U
8270C	Di-n-butyl phthalate	- -	700	23	ug/L		2.4 U	2.5 U	2.4 U	2.4 U	2.5 U	2.6 U	2.5000	2.4750	2.4500	0.0391	2.5 U	2.3 U	2.4 U	2.4 U
8270C	Butyl benzyl phthalate	- -	140	26	ug/L		1.1 U	1.2 U	1.1 U	1.1 U	1.2 U	1.2 U	1.1571	1.1500	1.1500	0.0502	1.2 U	1.1 U	1.1 U	1.2 U
8270C	Bis(2-ethylhexyl) phthalate	- -	6	2.2	ug/L		1.2 U	1.3 U	2 I J3	1.2 U	1.3 U	1.4 U	1.6048	1.4750	1.3500	0.2662	1.3 U	1.2 U	1.2 U	1.2 U
8270C	Di-n-octyl phthalate	- -	140	- -	ug/L		2.4 U	2.5 U	2.4 U	2.4 U	2.5 U	2.6 U	2.5000	2.4750	2.4500	0.0391	2.5 U	2.3 U	2.4 U	2.4 U
8270C	2-Chlorophenol	- -	35	130	ug/L		2 U	2.1 U	2 U	2 U	2.1 U	2.2 U	2.1000	2.0750	2.0500	0.0467	2.1 U	2 U	2 U	2 U
8270C	2-Nitrophenol	- -	- -	- -	ug/L		1.1 U	1.2 U	1.1 U	1.1 U	1.2 U	1.2 U	1.1571	1.1500	1.1500	0.0502	1.2 U	1.1 U	1.1 U	1.2 U
8270C	2,4-Dimethylphenol	- -	140	160	ug/L		1.7 U	1.8 U	1.7 U	1.7 U	1.8 U	1.9 U	1.8000	1.7750	1.7500	0.0547	1.8 U	1.7 U	1.7 U	1.7 U
8270C	2,4-Dichlorophenol	- -	0.3	13	ug/L		1.7 U	1.8 U	1.7 U	1.7 U	1.8 U	1.9 U	1.8000	1.7750	1.7500	0.0547	1.8 U	1.7 U	1.7 U	1.7 U
8270C	2,4,6-Trichlorophenol	- -	3.2	6.5 avg	ug/L		1.8 U	1.9 U	1.8 U	1.8 U	1.9 U	2 U	1.9000	1.8750	1.8500	0.0518	1.9 U	1.8 U	1.8 U	1.8 U
8270C	4-Chloro-3-methylphenol	- -	63	100	ug/L		1.6 U	1.7 U	1.6 U	1.6 U	1.7 U	1.8 U	1.7000	1.6750	1.6500	0.0580	1.7 U	1.6 U	1.6 U	1.6 U
8270C	2,4-Dinitrophenol	- -	14	3	ug/L		5.9 U	6.1 U	5.9 U	5.9 U	6.1 U	6.5 U	6.1857	6.1000	6.0000	0.0471	6.3 U	5.8 U	5.9 U	6 U
8270C	4,6-Dinitro-2-methylphenol	- -	- -	- -	ug/L		1.4 U	1.5 U	1.4 U	1.4 U	1.5 U	1.6 U	1.5000	1.4750	1.4500	0.0660	1.5 U	1.4 U	1.4 U	1.4 U
8270C	Pentachlorophenol	- -	1	8.3 avg; 30 max; e^(1.005[pH]-5.29)	ug/L		1.4 U	1.5 U	1.4 U	1.4 U	1.5 U	1.6 U	1.5000	1.4750	1.4500	0.0660	1.5 U	1.4 U	1.4 U	1.4 U
8270C	4-Nitrophenol	- -	56	55	ug/L		5.9 U	6.1 U	5.9 U	5.9 U	6.1 U	6.5 U	6.1857	6.1000	6.0000	0.0471	6.3 U	5.8 U	5.9 U	6 U
8270C	2,4,5-Trichlorophenol	- -	1	23	ug/L		2 U	2.1 U	2 U	2 U	2.1 U	2.2 U	2.1000	2.0750	2.0500	0.0467	2.1 U	2 U	2 U	2 U
8270C	2-Methylphenol	- -	35	250	ug/L		2.2 U	2.3 U	2.2 U	2.2 U	2.3 U	2.4 U	2.3000	2.2750	2.2500	0.0426	2.3 U	2.2 U	2.2 U	2.2 U
8270C	3 & 4 Methylphenol[3]	- -	3.5	70	ug/L		2.3 U	2.4 U	2.3 U	2.3 U	2.4 U	2.5 U	2.4000	2.3750	2.3500	0.0407	2.4 U	2.3 U	2.3 U	2.3 U
8270C LL - Low Level PAH Compounds																				
8270C LL	Naphthalene	- -	14	26	ug/L		0.23 U	0.25 U	0.24 U	0.25 U	0.25 U	0.26 U	0.2505	0.2500	0.2500	0.0327	0.27 U	0.23 U	0.24 U	0.25 U
8270C LL	2-Methylnaphthalene	- -	28	30	ug/L		0.47 U	0.51 U	0.47 U	0.5 U	0.5 U	0.51 U	0.4929	0.4950	0.5000	0.0346	0.55 U	0.47 U	0.48 U	0.5 U
8270C LL	1-Methylnaphthalene	- -	28	95	ug/L		0.47 U	0.51 U	0.47 U	0.5 U	0.5 U	0.51 U	0.4929	0.4950	0.5000	0.0346	0.55 U	0.47 U	0.48 U	0.5 U
8270C LL	Acenaphthene	- -	20	3	ug/L		0.47 U	0.51 U	0.47 U	0.5 U	0.5 U	0.51 U	0.4929	0.4950	0.5000	0.0346	0.55 U	0.47 U	0.48 U	0.5 U
8270C LL	Fluorene	- -	280	30	ug/L		0.47 U	0.51 U	0.47 U	0.5 U	0.5 U	0.51 U	0.4929	0.4950	0.5000	0.0346	0.55 U	0.47 U	0.48 U	0.5 U
8270C LL	Anthracene	- -	2,100	0.3	ug/L		0.071 U	0.077 U	0.072 U	0.075 U	0.075 U	0.078 U	0.0751	0.0750	0.0750	0.0327	0.084 U	0.071 U	0.073 U	0.075 U
8270C LL	Fluoranthene	- -	280	0.3	ug/L		0.85	0.055 U	0.16 I J3	0.053 U	0.053 U	0.056 I	0.0950	0.0805	0.0545	0.9728	0.059 U	0.051 U	0.052 U	0.053 U
8270C LL	Pyrene	- -	210	0.3	ug/L		0.71	0.09 U	0.13 I	0.088 U	0.088 U	0.091 U	0.1053	0.0993	0.0895	0.2296	0.098 U	0.084 U	0.086 U	0.088 U
8270C LL	Acenaphthylene	- -	210		ug/L		0.23 U	0.25 U	0.24 U	0.25 U	0.25 U	0.26 U	0.2505	0.2500	0.2500	0.0327	0.27 U	0.23 U	0.24 U	0.25 U
8270C LL	Phenanthrene	- -	210		ug/L		0.25 I	0.2 U	0.19 U	0.2 U	0.2 U	0.2 U	0.1962	0.1975	0.2000	0.0250	0.22 U	0.19 U	0.19 U	0.2 U
8270C LL	Benzo[a]anthracene	- -	0.05		ug/L		**0.19** I	0.051 U	**0.056** I	0.05 U	0.05 U	0.051 U	**0.0527**	**0.0518**	**0.0505**	0.0569	0.055 U	0.047 U	0.048 U	0.05 U
8270C LL	Chrysene	- -	4.8		ug/L		0.66	0.07 U	0.11 I	0.068 U	0.068 U	0.07 U	0.0849	0.0790	0.0690	0.2998	0.076 U	0.065 U	0.066 U	0.068 U
8270C LL	Benzo[b]fluoranthene	- -	0.05	0.031	ug/L		**0.61**	0.051 U	**0.088** I	0.05 U	0.05 U	0.051 U	**0.0649**	**0.0598**	**0.0505**	0.3731	0.055 U	0.047 U	0.048 U	0.05 U
8270C LL	Benzo[k]fluoranthene	- -	0.5	(Total PAH[1])	ug/L		0.2	0.058 U	0.054 U	0.056 U	0.056 U	0.058 U	0.0561	0.0560	0.0560	0.0292	0.063 U	0.054 U	0.055 U	0.056 U
8270C LL	Benzo[a]pyrene	- -	0.2		ug/L		**0.31**	0.058 U	0.057 I	0.056 U	0.056 U	0.058 U	0.0572	0.0568	0.0565	0.0169	0.063 U	0.054 U	0.055 U	0.056 U
8270C LL	Indeno[1,2,3-cd]pyrene	- -	0.05		ug/L		**0.29**	0.051 U	0.047 U	0.05 U	0.05 U	0.051 U	0.0493	0.0495	0.0500	0.0346	0.055 U	0.047 U	0.048 U	0.05 U
8270C LL	Dibenz(a,h)anthracene	- -	0.005		ug/L		**0.054** I	0.051 U	0.047 U	0.05 U	0.05 U	0.051 U	0.0493	0.0495	0.0500	0.0346	0.055 U	0.047 U	0.048 U	0.05 U
8270C LL	Benzo[g,h,i]perylene	- -	210		ug/L		0.29 I	0.1 U	0.095 U	0.099 U	0.099 U	0.1 U	0.0979	0.0983	0.0990	0.0224	0.11 U	0.094 U	0.096 U	0.099 U
8270C LL	Total PAH[1]	- -		0.031			**2.854**	0.25	**0.311**	0.25	0.25	0.26	**0.2597**	**0.2473**			0.27	0.23	0.24	0.25
524.2 - TTHMs and Benzene																				
524.2	Benzene	- -	1	71.28 avg	ug/L		0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.1900	0.1900	0.1900	0.0000	0.19 U	0.19 U	0.19 U	0.19 U
524.2	Bromoform	- -	4.4	360 avg	ug/L		0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.1700	0.1700	0.1700	0.0000	0.17 U	0.17 U	0.17 U	0.17 U
524.2	Chloroform	- -	70	470.8 avg	ug/L		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2000	0.2000	0.2000	0.0000	0.2 U	0.26 I	0.2 U	0.9
524.2	Dichlorobromomethane	- -	0.6	22 avg	ug/L		0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.1900	0.1900	0.1900	0.0000	0.19 U	0.19 U	0.19 U	0.19 U
524.2	Chlorodibromomethane	- -	0.4	34 avg	ug/L		0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.1600	0.1600	0.1600	0.0000	0.16 U	0.16 U	0.16 U	0.16 U
524.2	Trihalomethanes, Total	- -	80	- -	ug/L		0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.1600	0.1600	0.1600	0.0000	0.16 U	0.26 I	0.16 U	0.9
120.1 - Specific Conductance																				
120.1	Specific Conductance	- -	- -	- -	umhos/cm		670	1100	1000	950	750	670	820.4762	842.5000	850.0000	0.1856	1200	570	580	750
1664A - Oil and Grease																				
1664A	HEM (Oil and Grease)	- -	- -	- -	mg/L		0.94 U	1 U	0.95 U	0.96 U	0.98 U	1 U	0.9762	0.9725	0.9700	0.0229	1 U	0.95 U	1.5 I	0.98 U
300 - Anions																				
300	Fluoride	- -	4	10	mg/L		0.81	0.62	0.49	0.4	0.55	0.4	0.4557	0.4600	0.4450	0.1651	0.78	0.68	0.44	0.36
300	Chloride	- -	250[4]	- -	mg/L		33	73	61	75	58	38	51.3810	58.0000	59.5000	0.2564	110	45	32	37
300	Sulfate	- -	250[4]	- -	mg/L		43	**250**	**260**	180	110	77	156.3333	156.7500	145.0000	0.5595	**380**	180	190	**290**
300	Bromide	- -	- -	- -	mg/L		0.027 U	5.3	5.4	0.16	0.19		2.0919	1.9167	0.1900	15.8773	0.26	0.13	0.33	0.027 U
335.4 - Cyanide																				
335.4	Cyanide	- -	0.2	0.0052	mg/L		0.0082 I J3	0.0062 U	0.0062 U	0.0062 U	**0.025**	**0.056**	**0.0302**	**0.0234**	**0.0156**	1.5065	**0.0062 I**	0.0062 U	0.0062 U	0.0062 U
350.1 - Ammonia																				
350.1	Ammonia (as N)	- -	2.8	0.02[6]	mg/L		**0.77**	**0.43**	**0.75**	**0.34**	**0.44**	**0.16**	**0.4333**	**0.4225**	**0.3900**	0.6338	**1.1**	**1.8**	**3.4**	**2.8**
353.2 - Nitrate / Nitrite																				
353.2	Nitrate Nitrite as N	- -	10	- -	mg/L		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1000	0.1000	0.1000	0.0000	0.1 U	0.1 U	0.13 I	0.1 U
353.2	Nitrite as N	- -	1	- -	mg/L		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1000	0.1000	0.1000	0.0000	0.1 U	0.1 U	0.1 U	0.1 U J
SM 2320B - Alkalinity																				
SM 2320B	Alkalinity	- -	- -	> 20.0	mg/L		110	220	180	190	210	230	206.1905	202.5000	200.0000	0.1109	**13**	**1 U**	**11**	**1.1**
SM 2320B	Bicarbonate Alkalinity as CaCO3	- -	- -	- -	mg/L		1 U	220	180	190	210	230	206.1905	202.5000	200.0000	0.1109	13	1 U	11	1.1
SM 2320B	Carbonate Alkalinity as CaCO3	- -	- -	- -	mg/L		32	1 U	1 U	1 U	1 U	1 U	1.0000	1.0000	1.0000	0.0000	1 U	1 U	1 U	1 U
SM 2340B - Hardness																				
SM 2340B	Hardness as CaCO3	- -	- -	- -	mg/L		96	540	460	340	420	370	410.0000	397.5000	395.0000	0.1346	450	190	110	260
SM 2340B	Calcium hardness as CaCO3	- -	- -	- -	mg/L		88	300	270	190	230	210	234.7619	225.0000	220.0000	0.1553	250	110	65	170
SM 2340B	Magnesium hardness as CaCO3	- -	- -	- -	mg/L		10 U	240	200	150	180	170	181.9048	175.0000	175.0000	0.1190	200	80	42	91

RAP Estimated Influent Concentration Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Method	Analyte	MCUO IUD Permit Limits	FDEP GCTL	FDEP SWCTL	Result Units	Monitoring Well / Aquifer / % of Total Flow	MW-128 S&P 1.99%	MW-127 AFG 9.68%	MW-37 LSAS 38.10%	MW-77 LSAS 4.76%	MW-81 LSAS 14.29%	MW-82 LSAS 42.86%	Weighted Average LSAS WELLS 16.63%	Average LSAS WELLS 16.63%	Median LSAS WELLS	Standard D /Median LSAS WELLS	MW-35 USAS 19.06%	MW-36 USAS 7.92%	MW-40 USAS 7.92%	MW-42 USAS 7.92%
SM 2540C/D - TDS / TSS																				
SM 2540C	Total Dissolved Solids	- -	500[4]	- -	mg/L		180	**760**	**700**	**570**	470	410	**536.6667**	**537.5000**	**520.0000**	0.2439	**800**	360	350	480
SM 2540D	Total Suspended Solids	- -	- -	- -	mg/L		4.6	0.7 I	23	14	1.5	0.6 I	9.9000	9.7750	7.7500	1.3845	3.4	10	13	0.8 I
SM 3500 CR B - Chromium																				
SM 3500 CR B	Chromium (hexavalent)	- -	0.1	11	mg/L		0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014	0.0014	0.0014	0.0000	0.0014 U	0.0014 U	0.0014 U J:	0.0014 U
SM 4500 H+ B - pH																				
SM 4500 H+ B	pH	5.0 - 11.5	6.5 - 8.5	Note 2	SU		**11.7 Q**	7.08 Q	6.85 Q	6.68 Q	7.98 Q	8.07 Q	7.5262	7.3950	7.4150	0.0987	**5.54 Q**	**5.63 Q**	**5.65 Q**	**5.75 Q**
SM 4500 S2 F - Sulfide																				
SM 4500 S2 F	Sulfide	- -	- -	- -	mg/L		1.6	1 U	1 U	1 U	1 U	1 U	1.0000	1.0000	1.0000	0.0000	1 U	1 U	1 U	1 U
SM 5210B - BOD																				
SM 5210B	Biochemical Oxygen Demand	- -	- -	Note 3	mg/L		8.7	2 U	2 U	2 U	7.8	8.5	5.6143	5.0750	4.9000	0.7270	2.4	2 U	2.4	7.9
SM 5310C - TOC																				
SM 5310C	Total Organic Carbon	- -	- -	- -	mg/L		4.1	4.4	5.1	5.2	5.5	4	4.6905	4.9500	5.1500	0.1273	8.7	2.2	3.4	3.1
SM 5540 C - Methylene Blue Active Substances (Surfactants)																				
SM 5540C	MBAS	- -	0.5[4]	0.5	mg/l LAS MW 340		0.1	0.05 U	0.05 U	0.081 I	0.063 I	0.075 I	0.0640	0.0673	0.0690	0.1988	0.07 I	0.052 I	0.05 U	0.13
200.7 - Silica (Dissolved)																				
200.7 Rev 4.4	SiO2, Silica	- -	- -	- -	ug/L		22000	38000	23000	23000	24000	24000	23571.4286	23500.0000	23500.0000	0.0246	6100	7600	9100	7900
6020 - Metals (Total)																				
6020	Silver	- -	100[4]	0.07	ug/L		0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.0900	0.0900	0.0900	0.0000	0.09 U	0.09 U	0.09 U	0.09 U
6020	Aluminum	200	200[4]	13	ug/L		**350**	15 U	15 U	15 U	**20 I**	**24 I**	**19.5714**	**18.5000**	**17.5000**	0.2491	**640**	**330**	**210**	**180**
6020	Arsenic	2510	10	50	ug/L		0.9 I	0.85 I V	4 V	0.52 I V	0.28 U	0.28 U	1.7086	1.2700	0.4000	4.5588	0.85 I	20 V	4.6 V	**14**
6020	Beryllium	4	4	0.13 avg	ug/L		**0.38 I**	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.0650	0.0650	0.0650	0.0000	0.065 U	0.065 U	0.065 U	0.065 U
6020	Calcium	- -	- -	- -	ug/L		35000	120000	110000	76000	94000	82000	94095.2381	90500.0000	88000.0000	0.1705	100000	46000	26000	67000
6020	Cadmium	730	5	1.2[8]	ug/L		0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.1200	0.1200	0.1200	0.0000	0.12 U	0.34 I	0.12 U	0.12 U
6020	Chromium	9900	100	11	ug/L		0.69 I	1.5 I V	1.4 I V	1.5 I V	1 I	0.87 I	1.1205	1.1925	1.2000	0.2540	0.6 U	1.1 I V	1 I V	0.6 U
6020	Copper	28480	1000[4]	10.12[9]	ug/L		1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2000	1.2000	1.2000	0.0000	1.2 U	16	1.2 U	1.2 U
6020	Iron	- -	300[4]	1000	ug/L		32 I	26 I	**4900**	**4900**	86 I	45 I	**2131.5714**	**2482.7500**	**2493.0000**	1.1196	**27000** V	**9000**	**27000**	**6200**
6020	Magnesium	- -	- -	- -	ug/L		2000	58000	47000	37000	44000	41000	43523.8095	42250.0000	42500.0000	0.1005	48000	19000	10000	22000
6020	Manganese	- -	50	- -	ug/L		0.95 U	1.2 I	**86**	**87**	18	21	48.4762	**53.0000**	**53.5000**	0.7234	**70**	15	12	15
6020	Sodium	- -	160,000	- -	ug/L		13000	36000	45000	66000	21000	15000	29714.2857	36750.0000	33000.0000	0.7095	60000	24000	43000	39000
6020	Lead	1870	15	3.59[10]	ug/L		0.21 I	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.1500	0.1500	0.1500	0.0000	0.15 U	0.15 U	0.15 U	0.15 U
6020	Antimony	- -	6	4300	ug/L		0.36 U	0.36 U	0.54 IV	0.36 U	0.36 U	0.36 U	0.4286	0.4050	0.3600	0.2500	0.46 IV	2.4 IV	0.36 U	**12**
6020	Selenium	- -	50	5	ug/L		0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6000	0.6000	0.6000	0.0000	0.6 U	0.6 U	0.6 U	0.72 I
6020	Thallium	- -	2	6.3	ug/L		0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.5500	0.5500	0.5500	0.0000	0.55 U	1.1	0.55 U	**2.6**
6020	Potassium	- -	- -	- -	ug/L		4700	2400	3000	2100	1600	1700	2200.0000	2100.0000	1900.0000	0.3356	8300	4600	5100	5900
6020	Nickel	11080	100	56.54[11]	ug/L		2.4	2.1 V	4.2 V	0.77 I V	0.32 U	0.32 U	1.8195	1.4025	0.5450	3.4441	0.45 I V	8.9 V	1.4 V	6
6020	Zinc	4780	5000*	129.89[12]	ug/L		6.5 U	6.5 U	6.5 U	6.5 U	6.5 U	6.5 U	6.5000	6.5000	6.5000	0.0000	6.5 U	6.7 I	6.5 U	58
6020 - Metals (Dissolved)																				
6020	Silver, Dissolved	- -	100[4]	0.07	ug/L		0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.0900	0.0900	0.0900	0.0000	0.09 U	0.09 U	0.09 U	0.09 U
6020	Aluminum, Dissolved	200	200[4]	13	ug/L		**320**	15 U	15 U	15 U	17 I	15 U	15.2857	15.5000	15.0000	0.0667	**660**	**340**	**200**	**170**
6020	Arsenic, Dissolved	2510	10	50	ug/L		0.77 I	0.39 I	4.2	0.55 I	0.28 U	0.28 U	1.7862	1.3275	0.4150	4.6246	0.9 I	**22**	4.8	**14**
6020	Beryllium, Dissolved	4	4	0.13 avg	ug/L		0.08 I	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.0650	0.0650	0.0650	0.0000	0.065 U	0.065 U	0.065 U	0.065 U
6020	Calcium, Dissolved	- -	- -	- -	ug/L		33000	130000 V	110000 V	85000 V	76000	75000	88952.3810	86500.0000	80500.0000	0.2025	110000	49000 V	29000 V	66000
6020	Cadmium, Dissolved	730	5	1.2[8]	ug/L		0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.1200	0.1200	0.1200	0.0000	0.12 U	0.2 I	0.12 U	0.12 U
6020	Chromium, Dissolved	9900	100	11	ug/L		0.6 U	1 I V	1.3 I V	1.4 I V	0.76 I	0.8 I	1.0133	1.0650	1.0500	0.3162	0.6 U	1.2 I V	1.1 I V	1.2 I
6020	Copper, Dissolved	28480	1000[4]	10.12[9]	ug/L		1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2000	1.2000	1.2000	0.0000	1.2 U	1.2 U	1.2 U	1.2 U
6020	Iron, Dissolved	- -	300[4]	1000	ug/L		12 U	19 I	**5000**	**4700**	67 I	28 I	**2150.1429**	**2448.7500**	**2383.5000**	1.1645	**29000** V	**9500**	**30000**	**5900**
6020	Magnesium, Dissolved	- -	- -	- -	ug/L		1400	60000	48000	41000	37000	37000	41380.9524	40750.0000	39000.0000	0.1330	51000	21000	11000	22000
6020	Manganese, Dissolved	- -	50	- -	ug/L		0.95 U	1.1 I	**87**	**95**	15	19	47.9524	**54.0000**	**53.0000**	0.8091	**76**	16	13	15
6020	Sodium, Dissolved	- -	160,000	- -	ug/L		12000	38000	46000	70000	17000	13000	28857.1429	36500.0000	31500.0000	0.8489	64000	25000	47000	38000
6020	Lead, Dissolved	1870	15	3.59[10]	ug/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.1500	0.1500	0.1500	0.0000	0.15 U	0.15 U	0.15 U	0.15 U
6020	Antimony, Dissolved	- -	6	4300	ug/L		0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.3600	0.3600	0.3600	0.0000	0.41 IV	2.3 IV	0.36 U	**12**
6020	Selenium, Dissolved	- -	50	5	ug/L		0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6000	0.6000	0.6000	0.0000	0.6 U	0.6 U	0.6 U	0.63 I
6020	Thallium, Dissolved	- -	2	6.3	ug/L		0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.5500	0.5500	0.5500	0.0000	0.55 U	1.1	0.55 U	**2.6**
6020	Potassium, Dissolved	- -	- -	- -	ug/L		5000	2300	3000	2100	1500	1700	2185.7143	2075.0000	1900.0000	0.3501	9000	4800	5600	6000
6020	Nickel, Dissolved	11080	100	56.54[11]	ug/L		1.9	1.5 V	4.3 V	0.7 I V	0.32 U	0.32 U	1.8543	1.4100	0.5100	3.7941	0.77 I V	9.7 V	1.6 V	6.5
6020	Zinc, Dissolved	4780	5000[4]	129.89[12]	ug/L		6.5 U	6.5 U	6.5 U	6.5 U	6.5 U	6.5 U	6.5000	6.5000	6.5000	0.0000	6.5 U	6.5 U	6.5 U	6.5 U
7470A - Mercury (Total)																				
7470A	Mercury	- -	2	0.012	mg/L		0.000072 U	0.000072 U	0.000072 U	0.000072 U	0.000072 U	0.00012 I	0.000093	0.000084	0.000072	0.333333	0.000072 U	0.000072 U	0.000072 U	0.000072 U
7470A - Mercury (Dissolved)																				
7470A	Mercury, Dissolved	- -	2	0.012	mg/L		0.000098 I	0.000072 U	0.000072 U	0.000072 U	0.000072 U	0.00012 I	0.000093	0.000084	0.000072	0.333333	0.000072 U	0.000072 U	0.000072 U	0.000074 I
DPD HACH KIT - Chlorine																				
DPD	Chlorine	- -	700	0.01	mg/L		**2.4**	**0.5**	**0.9**	**0.9**	**2.4**	**0.3**	**0.857143**	**1.125000**	**0.900000**	0.995360	**0.9**	**0.9**	**0.9**	**2.1**
Field Parameters																				
	pH				SU		11.39	6.95	6.58	6.61	10.02	6.88	7.2014	7.5225	6.7450	0.2477	5.26	5.14	5.33	5.07
	Conductivity				uS/cm		1155	1235	1182	925	838	605	873.3333	887.5000	881.5000	0.2704	1273	684	702	791
	Dissolved Oxygen				mg/L		1.34	0.28	0.24	0.5	7.19	0.34	1.2881	2.0675	0.4200	8.1349	0.37	0.26	0.34	0.21
	Turbidity				NTU		26.9	0.42	0.54	0.97	2.2	0.8	0.9090	1.1275	0.8850	0.8322	1.69	12.8	4.39	0.28
	ORP				mV		na	-133.1	na	-88.4	-192.3	-84.6	-87.9187	-121.7667	-88.4000	-0.6913	-62.3	na	-334.4	85.5

R625-EDC-001213-0

RAP Estimated Influent Concentration Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Method	Analyte	MCUO IUD Permit Limits	FDEP GCTL	FDEP SWCTL	Result Units	Monitoring Well Aquifer % of Total Flow	MW-74 USAS 19.06%	MW-95 USAS 14.01%	MW-104 USAS 14.01%	MW-108 USAS 4.33%	MW-110 USAS 4.33%	MW-111 USAS 1.44%	Weighted Average USAS WELLS 71.71%	Average USAS WELLS 71.71%	Median USAS WELLS	Standard D /Median USAS WELLS	Weighted Average ALL WELLS 100.00%	Average ALL WELLS 100.00%	Median ALL WELLS	Standard D /Median All Wells
8081A - Organochlorine Pesticides																				
8081A	4,4'-DDD	- -	0.1	0.0003	ug/L		0.004 U	0.0039 U	0.0039 U	0.004 U	0.0041 U	0.0039 U	0.0040	0.0040	0.0039	0.0364	0.0040	0.0040	0.0039	0.0336
8081A	4,4'-DDE	- -	0.1	0.0002	ug/L		0.0054 U	0.0053 U	0.0053 U	0.0053 U	0.0055 U	0.0052 U	0.0054	0.0054	0.0053	0.0359	0.0054	0.0054	0.0053	0.0356
8081A	4,4'-DDT	- -	0.1	0.00059 avg; 0.001 max	ug/L		0.0031 U	0.003 U	0.003 U	0.0031 U	0.0032 U	0.003 U	0.0031	0.0031	0.0030	0.0353	0.0031	0.0031	0.0030	0.0363
8081A	Aldrin	- -	0.002	0.00014 avg; 3.0 max	ug/L		0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0017 U	0.0018	0.0018	0.0018	0.0315	**0.0018**	0.0018	0.0018	0.0380
8081A	alpha-BHC	- -	0.006	0.005	ug/L		0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0028 U	0.0027 U	0.0027	0.0027	0.0027	0.0292	0.0038	0.0055	0.0027	1.0466
8081A	beta-BHC	- -	0.02	0.046 avg	ug/L		0.0026 U	0.0026 U	0.0026 U	0.0026 U	0.0027 U	0.0025 U	0.0026	0.0026	0.0026	0.0337	0.0028	0.0031	0.0026	0.2254
8081A	Chlordane (technical)	- -	2	0.00059 avg; 0.0043 max	ug/L		0.056 U	0.055 U	0.055 U	0.055 U	0.057 U	0.054 U	0.0561	0.0556	0.0550	0.0323	0.0560	0.0557	0.0550	0.0331
8081A	delta-BHC	- -	2.1	- -	ug/L		0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0028 U	0.0026 U	0.0027	0.0027	0.0027	0.0324	0.0053	0.0092	0.0027	2.4372
8081A	Dieldrin	- -	0.002	0.00014 avg; 0.0019 max	ug/L		0.0014 U	0.0013 U	0.0013 U	0.0014 U	0.0014 U	0.0013 U	0.0014	0.0014	0.0013	0.0544	**0.0023**	**0.0077**	0.0013	4.6560
8081A	Endosulfan I	- -	- -	- -	ug/L		0.0034 U	0.0033 U	0.0033 U	0.0033 U	0.0034 U	0.0032 U	0.0034	0.0033	0.0033	0.0351	0.0034	0.0033	0.0033	0.0336
8081A	Endosulfan II	- -	- -	- -	ug/L		0.0032 U	0.0032 U	0.0032 U	0.0032 U	0.0033 U	0.0031 U	0.0033	0.0032	0.0032	0.0355	0.0032	0.0032	0.0032	0.0361
8081A	Endosulfan sulfate	- -	- -	- -	ug/L		0.0029 U	0.0028 U	0.0028 U	0.0029 U	0.003 U	0.0028 U	0.0029	0.0029	0.0028	0.0378	0.0029	0.0029	0.0028	0.0344
8081A	Total Endosulfan[7]	- -	42	0.056			0.0095	0.0093	0.0093	0.0094	0.0097	0.0091	0.0095	0.0094	0.0093	0.0350	0.0095	0.0094	0.0092	0.3338
8081A	Endrin	- -	2	0.0023	ug/L		0.0031 U	0.003 U	0.003 U	0.003 U	0.0031 U	0.003 U	0.0031	0.0030	0.0030	0.0358	0.0031	0.0030	0.0030	0.0355
8081A	Endrin aldehyde	- -	- -	- -	ug/L		0.0031 U	0.0031 U	0.0031 U	0.0031 U	0.0032 U	0.003 U	0.0032	0.0031	0.0031	0.0366	0.0031	0.0031	0.0031	0.0372
8081A	Endrin ketone	- -	- -	- -	ug/L		0.0053 U	0.0052 U	0.0052 U	0.0052 U	0.0054 U	0.0051 U	0.0053	0.0053	0.0052	0.0342	0.0053	0.0053	0.0052	0.0579
8081A	gamma-BHC (Lindane)	- -	0.2	0.063 avg; 0.08 max	ug/L		0.0026 U	0.0025 U	0.0025 U	0.0025 U	0.0026 U	0.0025 U	0.0026	0.0025	0.0025	0.0329	0.0038	0.0059	0.0025	1.3483
8081A	Heptachlor	- -	0.4	0.00021 avg; 0.0038 max	ug/L		0.003 U	0.003 U	0.003 U	0.003 U	0.0031 U	0.0029 U	0.0030	0.0030	0.0030	0.0292	0.0030	0.0030	0.0030	0.0333
8081A	Heptachlor epoxide	- -	0.2	0.00004	ug/L		0.0031 U	0.003 U	0.003 U	0.0031 U	0.0031 U	0.003 U	0.0031	0.0031	0.0030	0.0322	0.0031	0.0031	0.0030	0.0298
8081A	Methoxychlor	- -	40	0.03	ug/L		0.005 U	0.0049 U	0.0049 U	0.0049 U	0.0051 U	0.0048 U	0.0050	0.0050	0.0049	0.0308	0.0050	0.0049	0.0049	0.0312
8081A	Toxaphene	- -	3	0.0002	ug/L		0.71 U	0.69 U	0.69 U	0.7 U	0.72 U	0.68 U	0.7078	0.7010	0.6900	0.0351	0.7068	0.7021	0.6900	0.0334
8082 - Polychlorinated Biphenyls																				
8082	PCB-1016	- -			ug/L		0.25 U	0.25 U	0.25 U	0.25 U	0.26 U	0.25 U	0.2534	0.2520	0.2500	0.0316	0.2544	0.2555	0.2500	0.0310
8082	PCB-1221	- -			ug/L		0.15 U	0.14 U	0.14 U	0.15 U	0.15 U	0.14 U	0.1466	0.1450	0.1400	0.0505	0.1457	0.1438	0.1400	0.0442
8082	PCB-1232	- -		0.000045 avg;	ug/L		0.37 U	0.37 U	0.37 U	0.37 U	0.38 U	0.36 U	0.3752	0.3720	0.3700	0.0307	0.3740	0.3711	0.3700	0.0312
8082	PCB-1242	- -	0.5 (Total PCBs)	0.014 max	ug/L		0.075 U	0.074 U	0.074 U	0.075 U	0.077 U	0.073 U	0.0755	0.0749	0.0740	0.0340	0.0754	0.0750	0.0740	0.0327
8082	PCB-1248	- -		(Total PCBs)	ug/L		0.069 U	0.067 U	0.067 U	0.068 U	0.07 U	0.066 U	0.0688	0.0681	0.0670	0.0362	0.0687	0.0682	0.0670	0.0344
8082	PCB-1254	- -			ug/L		0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.11 U	0.1210	0.1190	0.1200	0.0473	0.1191	0.1154	0.1200	0.0502
8082	PCB-1260	- -			ug/L		0.098 U	0.096 U	0.096 U	0.097 U	0.1 U	0.095 U	0.0991	0.0978	0.0960	0.0478	0.0983	0.0967	0.0960	0.0410
8082	Total PCBs[5]	- -	0.5	0.000045	ug/L		0.37	0.37	0.37	0.37	0.38	0.36	0.3752	0.3720			0.3740	0.3711		
8141A - Organophoso Pesticides																				
8141A	Guthion	- -	11	0.01	ug/L		0.31 U	0.32 U	0.32 U	0.32 U	0.32 U	0.33 U	0.3174	0.3190	0.3200	0.0177	0.3173	0.3166	0.3200	0.0170
8141A	Bolstar	- -	- -	- -	ug/L		0.09 U	0.091 U	0.091 U	0.091 U	0.091 U	0.095 U	0.0908	0.0912	0.0910	0.0154	0.0912	0.0916	0.0910	0.0161
8141A	Chlorpyrifos	- -	21	0.002	ug/L		0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.1073	0.1080	0.1100	0.0383	0.1072	0.1064	0.1100	0.0407
8141A	Coumaphos	- -	1.8	0.004	ug/L		0.077 U	0.078 U	0.078 U	0.078 U	0.078 U	0.081 U	0.0777	0.0780	0.0780	0.0160	0.0779	0.0779	0.0780	0.0159
8141A	Demeton-O	- -	- -	- -	ug/L		0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.1073	0.1080	0.1100	0.0383	0.1072	0.1064	0.1100	0.0407
8141A	Diazinon	- -	6.3	0.002	ug/L		0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U J3	0.1073	0.1080	0.1100	0.0383	0.1072	0.1064	0.1100	0.0407
8141A	Dichlorvos	- -	0.1	0.005	ug/L		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.26 U	0.2501	0.2510	0.2500	0.0126	0.2501	0.2503	0.2500	0.0100
8141A	Dimethoate	- -	1.4	0.1	ug/L		0.3 U	0.31 U	0.31 U	0.31 U	0.31 U	0.32 U	0.3074	0.3090	0.3100	0.0183	0.3073	0.3066	0.3100	0.0175
8141A	Disulfoton	- -	0.3	0.3	ug/L		0.11 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.1173	0.1180	0.1200	0.0351	0.1172	0.1164	0.1200	0.0373
8141A	EPN	- -	0.07	0.02	ug/L		0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	0.071 U	0.0680	0.0682	0.0680	0.0152	0.0683	0.0687	0.0680	0.0178
8141A	Ethion	- -	3.5	0.007	ug/L		0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.1073	0.1080	0.1100	0.0383	0.1072	0.1064	0.1100	0.0407
8141A	Ethoprop	- -	0.7	0.3	ug/L		0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.41 U	0.3902	0.3920	0.3900	0.0162	0.3922	0.3949	0.3900	0.0159
8141A	Ethyl Parathion	- -	4.2	0.04	ug/L		0.076 U	0.077 U	0.077 U	0.077 U	0.077 U	0.08 U	0.0767	0.0770	0.0770	0.0162	0.0769	0.0769	0.0770	0.0161
8141A	Fensulfothion	- -	1.8	0.5	ug/L		0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.17 U	0.1601	0.1610	0.1600	0.0198	0.1621	0.1646	0.1600	0.0299
8141A	Malathion	- -	140	0.1	ug/L		0.088 U	0.088 U	0.088 U	0.088 U	0.088 U	0.092 U	0.0880	0.0883	0.0880	0.0152	0.0884	0.0887	0.0880	0.0155
8141A	Merphos	- -	0.2	- -	ug/L		0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.13 U	0.1201	0.1210	0.1200	0.0264	0.1221	0.1246	0.1200	0.0399
8141A	Methyl parathion	- -	1.8	0.01	ug/L		0.11 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.1173	0.1180	0.1200	0.0351	0.1172	0.1164	0.1200	0.0373
8141A	Mevinphos	- -	1.8	0.05	ug/L		0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.15 U	0.1401	0.1410	0.1400	0.0226	0.1421	0.1446	0.1400	0.0342
8141A	Monochrotophos	- -	- -	- -	ug/L		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.6 U	2.5011	2.5100	2.5000	0.0126	2.5008	2.5025	2.5000	0.0100
8141A	Naled	- -	14	0.02	ug/L		0.34 U	0.35 U	0.35 U	0.35 U	0.35 U	0.36 U	0.3474	0.3490	0.3500	0.0162	0.3473	0.3466	0.3500	0.0155
8141A	Phorate	- -	1.4	0.005	ug/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.16 U	0.1501	0.1510	0.1500	0.0211	0.1521	0.1546	0.1500	0.0319
8141A	Ronnel	- -	350	0.06	ug/L		0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.13 U	0.1201	0.1210	0.1200	0.0264	0.1221	0.1246	0.1200	0.0399
8141A	Stirophos	- -	- -	- -	ug/L		0.08 U	0.081 U	0.081 U	0.081 U	0.081 U	0.084 U	0.0807	0.0810	0.0810	0.0154	0.0809	0.0809	0.0810	0.0153
8141A	Sulfotepp	- -	3.5	0.01	ug/L		0.052 U	0.053 U	0.053 U	0.053 U	0.053 U	0.055 U	0.0528	0.0530	0.0530	0.0154	0.0529	0.0531	0.0530	0.0167
8141A	Tokuthion	- -	- -	- -	ug/L		0.083 U	0.084 U	0.084 U	0.084 U	0.084 U	0.087 U	0.0837	0.0840	0.0840	0.0148	0.0839	0.0839	0.0840	0.0147
8141A	Trichloronate	- -	- -	- -	ug/L		0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.1073	0.1080	0.1100	0.0383	0.1072	0.1064	0.1100	0.0407
8151A - Chlorinated Herbicides																				
8151A	2,4-D	- -	70	- -	ug/L		0.96 U	0.19 U	0.98 U	1 U	1 U	0.94 U	0.7264	0.8290	0.9600	0.3460	0.8040	0.9591	0.9550	0.2833
8151A	2,4-DB	- -	56	- -	ug/L		0.96 U	0.19 U	0.98 U	1 U	1 U	0.94 U	0.7264	0.8290	0.9600	0.3460	0.8040	0.9591	0.9550	0.2833
8151A	Dalapon	- -	200	5000	ug/L		24 U	4.8 U	25 U	25 U	26 U	24 U	18.1098	20.7200	24.0000	0.3453	19.9300	23.6800	24.0000	0.2790
8151A	Dicamba	- -	210	200	ug/L		0.24 U	0.048 U	0.25 U	0.25 U	0.26 U	0.24 U	0.1811	0.2072	0.2400	0.3453	0.1993	0.2368	0.2400	0.2790
8151A	Dichlorprop	- -	35	42	ug/L		0.96 U	0.19 U	0.98 U	1 U	1 U	0.94 U	0.7264	0.8290	0.9600	0.3460	0.8040	0.9591	0.9550	0.2833
8151A	Dinoseb	- -	7	5.9	ug/L		0.96 U	0.19 U	0.98 U	1 U	1 U	0.94 U	0.7264	0.8290	0.9600	0.3460	0.8040	0.9591	0.9550	0.2833
8151A	MCPA	- -	3.5	72	ug/L		33 U	6.5 U	33 U	34 U	35 U	32 U	24.6759	28.1900	33.0000	0.3414	27.1823	32.1725	32.5000	0.2801
8151A	MCPP	- -	7	- -	ug/L		34 U	6.7 U	34 U	35 U	36 U	33 U	25.4111	29.0300	34.0000	0.3412	27.9925	33.1325	33.5000	0.2798
8151A	Pentachlorophenol	- -	1	8.3 avg; 30 max; e^(1.005[pH]-	ug/L		0.082 U	0.016 U	0.083 U	0.085 U	0.089 U	0.08 U	0.0615	0.0704	0.0820	0.3455	0.0677	0.0805	0.0815	0.2807
8151A	Picloram	- -	500	70	ug/L		0.96 U	0.19 U	0.98 U	1 U	1 U	0.94 U	0.7264	0.8290	0.9600	0.3460	0.8040	0.9591	0.9550	0.2833
8151A	Silvex (2,4,5-TP)	- -	50	- -	ug/L		0.96 U	0.19 U	0.98 U	1 U	1 U	0.94 U	0.7264	0.8290	0.9600	0.3460	0.8040	0.9591	0.9550	0.2833

RAP Estimated Influent Concentration Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Method	Analyte	MCUO IUD Permit Limits	FDEP GCTL	FDEP SWCTL	Result Units	Monitoring Well Aquifer % of Total Flow	MW-74 USAS 19.06%	MW-95 USAS 14.01%	MW-104 USAS 14.01%	MW-108 USAS 4.33%	MW-110 USAS 4.33%	MW-111 USAS 1.44%	Weighted Average USAS WELLS 71.71%	Average USAS WELLS 71.71%	Median USAS WELLS	Standard D /Median USAS WELLS	Weighted Average ALL WELLS 100.00%	Average ALL WELLS 100.00%	Median ALL WELLS	Standard D /Median All Wells
	8260B - VOCs																			
8260B	1,1,1,2-Tetrachloroethane	- -	1.3	- -	ug/L		1.3 U	0.63 U	1.3 U	0.63 U	0.63 U	0.63 U	1.952512	2.155000	0.965000	2.4067	7.077525	11.570000	1.900000	5.4269
8260B	1,1,1-Trichloroethane	- -	200	270	ug/L		0.92 U	0.46 U	0.92 U	0.46 U	0.46 U	0.46 U	1.413094	1.564000	0.690000	2.4585	5.098881	8.321000	1.360000	5.4495
8260B	1,1,2,2-Tetrachloroethane	- -	0.2	10.8 avg	ug/L		0.3 U	0.15 U	0.3 U	0.15 U	0.15 U	0.15 U	0.460792	0.510000	0.225000	2.4585	1.663092	2.715000	0.450000	5.3692
8260B	1,1,2-Trichloroethane	- -	5	16	ug/L		0.94 U	0.47 U	0.94 U	0.47 U	0.47 U	0.47 U	1.447771	1.603000	0.705000	2.4621	5.294546	8.667000	1.420000	5.4478
8260B	1,1-Dichloroethane	70	70	- -	ug/L		72	0.52 U	25	1.1	14	0.52 U	26.886857	22.254000	12.500000	2.0709	39.208807	44.238500	24.000000	1.4298
8260B	1,1-Dichloroethene	7	7	3.2 avg	ug/L		49	0.45 U	32	0.45 U	17	0.45 U	40.062341	40.635000	14.000000	4.7726	86.464298	151.471250	40.500000	2.6115
8260B	1,1-Dichloropropene	- -	- -	- -	ug/L		0.62 U	0.31 U	0.62 U	0.31 U	0.31 U	0.31 U	0.956260	1.059000	0.465000	2.4640	3.518682	5.763500	0.910000	5.6719
8260B	1,2,3-Trichlorobenzene	- -	70	85	ug/L		1.5 U	0.77 U	1.5 U	0.77 U	0.77 U	0.77 U	2.348209	2.605000	1.135000	2.5028	8.444663	13.770000	2.300000	5.3215
8260B	1,2,3-Trichloropropane	- -	0.02	0.2	ug/L		0.36 U	0.18 U	0.36 U	0.18 U	0.18 U	0.18 U	0.552950	0.612000	0.270000	2.4585	1.995710	3.258000	0.540000	5.3692
8260B	1,2,4-Trichlorobenzene	- -	70	23	ug/L		1.2 U	0.58 U	1.2 U	0.58 U	0.58 U	0.58 U	1.794957	1.980000	0.890000	2.3996	6.440269	10.507500	1.750000	5.3368
8260B	1,2,4-Trimethylbenzene	- -	10	220	ug/L		1.7 U	0.86 U	1.7 U	0.86 U	0.86 U	0.86 U	2.635257	2.920000	1.280000	2.4791	9.528651	15.555000	2.550000	5.4338
8260B	1,2-Dibromo-3-Chloropropane	- -	0.2	- -	ug/L		5 U	2.5 U	5 U	2.5 U	2.5 U	2.5 U	7.640283	8.450000	3.750000	2.4525	26.889268	43.675000	7.500000	5.1478
8260B	1,2-Dibromoethane	- -	0.02	13	ug/L		1 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	1.535972	1.700000	0.750000	2.4585	5.543638	9.050000	1.500000	5.3692
8260B	1,2-Dichlorobenzene	- -	600	99	ug/L		0.88 U	0.44 U	0.88 U	0.44 U	0.44 U	0.44 U	1.351655	1.496000	0.660000	2.4585	4.879669	7.969000	1.340000	5.2876
8260B	1,2-Dichloroethane	- -	3	37	ug/L		1.1 U	0.57 U	1.1 U	0.57 U	0.57 U	0.57 U	1.733821	1.925000	0.835000	2.5187	6.227208	10.150000	1.700000	5.3047
8260B	1,2-Dichloropropane	- -	5	14	ug/L		1 U	0.52 U	1 U	0.52 U	0.52 U	0.52 U	1.584181	1.760000	0.760000	2.5278	5.755736	9.402500	1.550000	5.4056
8260B	1,3,5-Trimethylbenzene	- -	10	220	ug/L		1.1 U	0.54 U	1.1 U	0.54 U	0.54 U	0.54 U	1.665464	1.840000	0.820000	2.4265	5.993537	9.785000	1.650000	5.2693
8260B	1,3-Dichlorobenzene	- -	210	85	ug/L		1.3 U	0.64 U	1.3 U	0.64 U	0.64 U	0.64 U	1.972659	2.180000	0.970000	2.4315	7.102265	11.595000	1.950000	5.2846
8260B	1,3-Dichloropropane	- -	- -	- -	ug/L		0.78 U	0.39 U	0.78 U	0.39 U	0.39 U	0.39 U	1.202016	1.331000	0.585000	2.4628	4.408197	7.221500	1.190000	5.4171
8260B	1,4-Dichlorobenzene	- -	75	3	ug/L		1 U	0.52 U	1 U	0.52 U	0.52 U	0.52 U	1.584181	1.760000	0.760000	2.5278	5.755736	9.402500	1.550000	5.4056
8260B	2,2-Dichloropropane	- -	- -	- -	ug/L		0.72 U	0.36 U	0.72 U	0.36 U	0.36 U	0.36 U	1.105900	1.224000	0.540000	2.4585	3.990153	6.511000	1.060000	5.4722
8260B	2-Butanone	- -	4,200	120000	ug/L		17 U	8.4 U	17 U	8.4 U	8.4 U	8.4 U	25.870473	28.600000	12.700000	2.4379	93.197200	152.150000	25.500000	5.3045
8260B	2-Chlorotoluene	- -	140	390	ug/L		1.3 U	0.65 U	1.3 U	0.65 U	0.65 U	0.65 U	1.992806	2.205000	0.975000	2.4561	7.123838	11.607500	1.950000	5.2840
8260B	2-Hexanone	- -	280	- -	ug/L		8.8 U	4.4 U	8.8 U	4.4 U	4.4 U	4.4 U	13.516551	14.960000	6.600000	2.4585	48.796686	79.690000	13.400000	5.2876
8260B	4-Chlorotoluene	- -	140	- -	ug/L		1 U	0.52 U	1 U	0.52 U	0.52 U	0.52 U	1.584181	1.760000	0.760000	2.5278	5.755736	9.402500	1.550000	5.4056
8260B	4-Isopropyl Toluene	- -	- -	- -	ug/L		1.4 U	0.69 U	1.4 U	0.69 U	0.69 U	0.69 U	2.122298	2.345000	1.045000	2.4312	7.573736	12.342500	2.100000	5.2116
8260B	4-Methyl-2-Pentanone	- -	560	23000	ug/L		7.6 U	3.8 U	7.6 U	3.8 U	3.8 U	3.8 U	11.673385	12.920000	5.700000	2.4585	42.125319	68.755000	11.300000	5.4175
8260B	Acetone	- -	6,300	1700	ug/L		20 U	9.9 U	20 U	9.9 U	9.9 U	9.9 U	30.517964	33.750000	14.950000	2.4426	130.111134	425.875000	40.000000	6.8938
8260B	Benzene	- -	1	71.28 avg	ug/L		1 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	1.535972	1.700000	0.750000	2.4585	5.543638	9.050000	1.500000	5.3692
8260B	Bromobenzene	- -	- -	- -	ug/L		1.2 U	0.58 U	1.2 U	0.58 U	0.58 U	0.58 U	1.794957	1.980000	0.890000	2.3996	6.440269	10.507500	1.750000	5.3368
8260B	Bromochloromethane	- -	91	- -	ug/L		1.2 U	0.58 U	1.2 U	0.58 U	0.58 U	0.58 U	1.794957	1.980000	0.890000	2.3996	6.440269	10.507500	1.750000	5.3368
8260B	Bromodichloromethane	- -	0.6	22 avg	ug/L		0.7 U	0.35 U	0.7 U	0.35 U	0.35 U	0.35 U	1.079138	1.195000	0.525000	2.4633	3.963439	6.492500	1.050000	5.5275
8260B	Bromoform	- -	4.4	360 avg	ug/L		1.2 U	0.58 U	1.2 U	0.58 U	0.58 U	0.58 U	1.794957	1.980000	0.890000	2.3996	6.440269	10.507500	1.750000	5.3368
8260B	Bromomethane	- -	9.8	35	ug/L		5 U	2.5 U	5 U	2.5 U	2.5 U	2.5 U	7.640283	8.450000	3.750000	2.4525	26.889268	43.675000	7.500000	5.1478
8260B	Carbon Disulfide	- -	700	110	ug/L		1.7 U	0.85 U	1.7 U	0.85 U	0.85 U	0.85 U	2.607194	2.885000	1.275000	2.4567	9.341293	15.227500	2.550000	5.3040
8260B	Carbon Tetrachloride	- -	3	4.42 avg	ug/L		0.84 U	0.42 U	0.84 U	0.42 U	0.42 U	0.42 U	1.290216	1.428000	0.630000	2.4585	4.657290	7.604500	1.270000	5.3261
8260B	Chlorobenzene	- -	100	17	ug/L		1.3 U	0.63 U	1.3 U	0.63 U	0.63 U	0.63 U	1.952512	2.155000	0.965000	2.4067	7.077525	11.570000	1.900000	5.4269
8260B	Chloroethane	- -	12	- -	ug/L		5 U	2.5 U	5 U	2.5 U	2.5 U	2.5 U	7.640283	8.450000	3.750000	2.4525	26.889268	43.675000	7.500000	5.1478
8260B	Chloroform	- -	70	470.8	ug/L		1.8 U	0.9 U	1.8 U	0.9 U	0.9 U	0.9 U	2.764749	3.060000	1.350000	2.4585	9.978549	16.290000	2.700000	5.3692
8260B	Chloromethane	- -	2.7	470.8	ug/L		2 U	1 U	2 U	1 U	1 U	1 U	3.071943	3.400000	1.500000	2.4585	11.087277	18.100000	3.000000	5.3692
8260B	cis-1,2-Dichloroethene	70	70	- -	ug/L		2.2	0.65 U	1.3 U	0.65 U	0.65 U	0.65 U	5.275029	6.225000	0.975000	11.2581	30.557444	49.587500	3.100000	18.5938
8260B	cis-1,3-Dichloropropene	- -	- -	- -	ug/L		0.28 U	0.14 U	0.28 U	0.14 U	0.14 U	0.14 U	0.430072	0.476000	0.210000	2.4585	1.552219	2.534000	0.420000	5.3692
8260B	Dibromochloromethane	- -	0.4	34	ug/L		0.68 U	0.34 U	0.68 U	0.34 U	0.34 U	0.34 U	1.044461	1.156000	0.510000	2.4585	3.770941	6.159000	1.040000	5.2641
8260B	Dibromomethane	- -	70	13	ug/L		0.82 U	0.41 U	0.82 U	0.41 U	0.41 U	0.41 U	1.255539	1.389000	0.615000	2.4548	4.461624	7.258500	1.210000	5.3222
8260B	Dichlorodifluoromethane	- -	1,400	- -	ug/L		5 U	2.5 U	5 U	2.5 U	2.5 U	2.5 U	7.640283	8.450000	3.750000	2.4525	26.889268	43.675000	7.500000	5.1478
8260B	Ethylbenzene	- -	700	610	ug/L		0.88 U	0.44 U	0.88 U	0.44 U	0.44 U	0.44 U	1.351655	1.496000	0.660000	2.4585	4.879669	7.969000	1.340000	5.2876
8260B	Hexachlorobutadiene	- -	0.4	49.7	ug/L		0.8 U	0.4 U	0.8 U	0.4 U	0.4 U	0.4 U	1.228777	1.360000	0.600000	2.4585	4.434911	7.240000	1.200000	5.3692
8260B	Isopropyl Benzene	- -	0.8	260	ug/L		0.38 U	0.19 U	0.38 U	0.19 U	0.19 U	0.19 U	0.583669	0.646000	0.285000	2.4585	2.106583	3.439000	0.570000	5.3692
8260B	Methyl Tert Butyl Ether	- -	20	34000	ug/L		0.88 U	0.44 U	0.88 U	0.44 U	0.44 U	0.44 U	1.351655	1.496000	0.660000	2.4585	4.879669	7.969000	1.340000	5.2876
8260B	Methylene Chloride	- -	5	1580 avg	ug/L		8 U	4 U	8 U	4 U	4 U	4 U	12.287774	13.600000	6.000000	2.4585	44.349108	72.400000	12.000000	5.3692
8260B	m-Xylene & p-Xylene	- -	- -	- -	ug/L		1.2 U	0.6 U	1.2 U	0.6 U	0.6 U	0.6 U	1.843166	2.040000	0.900000	2.4585	6.652366	10.860000	1.800000	5.3692
8260B	O-Xylene	- -	- -	- -	ug/L		1 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	1.535972	1.700000	0.750000	2.4585	5.543638	9.050000	1.500000	5.3692
8260 B	Total Xylenes	- -	10000	370			2.2	1.1	2.2	1.1	1.1	1.1	3.379138	3.740000			12.196005	19.910000		
8260B	Naphthalene	- -	14	26	ug/L		5 U	2.5 U	5 U	2.5 U	2.5 U	2.5 U	7.640283	8.450000	3.750000	2.4525	26.889268	43.675000	7.500000	5.1478
8260B	n-Butylbenzene	- -	- -	- -	ug/L		1.3 U	0.67 U	1.3 U	0.67 U	0.67 U	0.67 U	2.048930	2.275000	0.985000	2.5145	7.501720	12.275000	2.000000	5.4805
8260B	n-Propylbenzene	- -	- -	- -	ug/L		1.2 U	0.59 U	1.2 U	0.59 U	0.59 U	0.59 U	1.823019	2.015000	0.895000	2.4320	6.630793	10.847500	1.800000	5.3699
8260B	sec-Butylbenzene	- -	- -	- -	ug/L		1.3 U	0.63 U	1.3 U	0.63 U	0.63 U	0.63 U	1.952512	2.155000	0.965000	2.4067	7.077525	11.570000	1.900000	5.4269
8260B	Styrene	- -	100	460	ug/L		2 U	0.98 U	2 U	0.98 U	0.98 U	0.98 U	3.023734	3.340000	1.490000	2.4233	10.875179	17.747500	2.950000	5.3500
8260B	tert-Butylbenzene	- -	- -	- -	ug/L		1.7 U	0.84 U	1.7 U	0.84 U	0.84 U	0.84 U	2.587047	2.860000	1.270000	2.4379	9.319720	15.215000	2.550000	5.3045
8260B	Tetrachloroethene	3	3	8.85 avg	ug/L		1 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	22.444867	23.540000	1.000000	55.9635	43.126232	59.272500	2.000000	33.5532
8260B	Toluene	- -	1,000	480	ug/L		1 U	0.51 U	1 U	0.51 U	0.51 U	0.51 U	1.564034	1.735000	0.755000	2.4967	5.730996	9.377500	1.500000	5.5899
8260B	Trans-1,2-Dichloroethene	- -	100	11000	ug/L		0.88 U	0.44 U	0.88 U	0.44 U	0.44 U	0.44 U	1.351655	1.496000	0.660000	2.4585	4.879669	7.969000	1.340000	5.2876
8260B	Trans-1,3-Dichloropropene	- -	- -	- -	ug/L		0.28 U	0.14 U	0.28 U	0.14 U	0.14 U	0.14 U	0.430072	0.476000	0.210000	2.4585	1.552219	2.534000	0.420000	5.3692
8260B	Trichloroethene	3	3	80.7 avg	ug/L		3.9	0.5 U	1.6 I	0.5 U	0.5 U	0.5 U	161.783016	200.250000	2.750000	122.9298	628.572507	1040.312500	19.000000	56.5472
8260B	Trichlorofluoromethane	- -	2,100	- -	ug/L		5 U	2.5 U	5 U	2.5 U	2.5 U	2.5 U	7.640283	8.450000	3.750000	2.4525	26.889268	43.675000	7.500000	5.1478
8260B	Vinyl Chloride	1	1	2.4	ug/L		1 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	1.535972	1.700000	0.750000	2.4585	5.543638	9.050000	1.500000	5.3692
	8260C SIM/ID - 1,4-Dioxane																			
8260C SIM/ID	1,4-Dioxane	Report	3.2	120	ug/L		110	5.8	180	6.6	46 J3	2.8	53.063074	39.774000	9.000000	6.6077	137.495072	167.131000	37.000000	4.9452

R625-EDC-001213-0

RAP Estimated Influent Concentration Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Method	Analyte	MCUO IUD Permit Limits	FDEP GCTL	FDEP SWCTL	Monitoring Well / Aquifer / % of Total Flow / Result Units	MW-74 USAS 19.06%	MW-95 USAS 14.01%	MW-104 USAS 14.01%	MW-108 USAS 4.33%	MW-110 USAS 4.33%	MW-111 USAS 1.44%	Weighted Average USAS WELLS 71.71%	Average USAS WELLS 71.71%	Median USAS WELLS	Standard D /Median USAS WELLS	Weighted Average ALL WELLS 100.00%	Average ALL WELLS 100.00%	Median ALL WELLS	Standard D /Median All Wells
8270C - Phenols and Phthalates																			
8270C	Phenol	- -	10	6.5	ug/L	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3187	2.3100	2.3000	0.0137	2.3397	2.3463	2.3000	0.0262
8270C	Dimethyl phthalate	- -	70,000	1400	ug/L	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4108	2.4000	2.4000	0.0196	2.4340	2.4438	2.4000	0.0285
8270C	Diethyl phthalate	- -	5,600	380	ug/L	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4108	2.4000	2.4000	0.0196	2.4340	2.4438	2.4000	0.0285
8270C	Di-n-butyl phthalate	- -	700	23	ug/L	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4108	2.4000	2.4000	0.0196	2.4340	2.4438	2.4000	0.0285
8270C	Butyl benzyl phthalate	- -	140	26	ug/L	1.2 U	1.1 U	1.2 U	1.2 U	1.1 U	1.1 U	1.1642	1.1500	1.1500	0.0458	1.1652	1.1500	1.1500	0.0449
8270C	Bis(2-ethylhexyl) phthalate	- -	6	2.2	ug/L	1.3 U	1.2 U	1.3 U	1.3 U	1.2 U	1.2 U	1.2563	1.2400	1.2000	0.0430	1.3173	1.3038	1.2500	0.1573
8270C	Di-n-octyl phthalate	- -	140	- -	ug/L	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4108	2.4000	2.4000	0.0196	2.4340	2.4438	2.4000	0.0285
8270C	2-Chlorophenol	- -	35	130	ug/L	2 U	2 U	2 U	2 U	2 U	2 U	2.0188	2.0100	2.0000	0.0158	2.0398	2.0463	2.0000	0.0301
8270C	2-Nitrophenol	- -	- -	- -	ug/L	1.2 U	1.1 U	1.2 U	1.2 U	1.1 U	1.1 U	1.1642	1.1500	1.1500	0.0458	1.1652	1.1500	1.1500	0.0449
8270C	2,4-Dimethylphenol	- -	140	160	ug/L	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7188	1.7100	1.7000	0.0186	1.7398	1.7463	1.7000	0.0354
8270C	2,4-Dichlorophenol	- -	0.3	13	ug/L	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7188	1.7100	1.7000	0.0186	1.7398	1.7463	1.7000	0.0354
8270C	2,4,6-Trichlorophenol	- -	3.2	6.5 avg	ug/L	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8188	1.8100	1.8000	0.0176	1.8398	1.8463	1.8000	0.0334
8270C	4-Chloro-3-methylphenol	- -	63	100	ug/L	1.7 U	1.6 U	1.7 U	1.7 U	1.6 U	1.6 U	1.6562	1.6400	1.6000	0.0323	1.6666	1.6538	1.6000	0.0395
8270C	2,4-Dinitrophenol	- -	14	3	ug/L	6 U	5.9 U	6 U	6 U	5.9 U	5.9 U	6.0128	5.9700	5.9500	0.0225	6.0477	6.0175	5.9500	0.0297
8270C	4,6-Dinitro-2-methylphenol	- -	- -	- -	ug/L	1.5 U	1.4 U	1.5 U	1.5 U	1.4 U	1.4 U	1.4563	1.4400	1.4000	0.0369	1.4666	1.4538	1.4000	0.0452
8270C	Pentachlorophenol	- -	1	8.3 avg; 30 max; e^(1.005[pH]-5.29)	ug/L	1.5 U	1.4 U	1.5 U	1.5 U	1.4 U	1.4 U	1.4563	1.4400	1.4000	0.0369	1.4666	1.4538	1.4000	0.0452
8270C	4-Nitrophenol	- -	56	55	ug/L	6 U	5.9 U	6 U	6 U	5.9 U	5.9 U	6.0128	5.9700	5.9500	0.0225	6.0477	6.0175	5.9500	0.0297
8270C	2,4,5-Trichlorophenol	- -	1	23	ug/L	2 U	2 U	2 U	2 U	2 U	2 U	2.0188	2.0100	2.0000	0.0158	2.0398	2.0463	2.0000	0.0301
8270C	2-Methylphenol	- -	35	250	ug/L	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2187	2.2100	2.2000	0.0144	2.2397	2.2463	2.2000	0.0274
8270C	3 & 4 Methylphenol[3]	- -	3.5	70	ug/L	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3187	2.3100	2.3000	0.0137	2.3397	2.3463	2.3000	0.0262
8270C LL - Low Level PAH Compounds																			
8270C LL	Naphthalene	- -	14	26	ug/L	0.24 U	0.24 U	0.24 U	0.25 U	0.26 U	0.24 U	0.2470	0.2460	0.2400	0.0489	0.2475	0.2440	0.2450	0.0444
8270C LL	2-Methylnaphthalene	- -	28	30	ug/L	0.49 U	0.48 U	0.48 U	0.49 U	0.51 U	0.48 U	0.4977	0.4930	0.4850	0.0477	0.4975	0.4920	0.4900	0.0426
8270C LL	1-Methylnaphthalene	- -	28	95	ug/L	0.49 U	0.48 U	0.48 U	0.49 U	0.51 U	0.48 U	0.4977	0.4930	0.4850	0.0477	0.4975	0.4920	0.4900	0.0426
8270C LL	Acenaphthene	- -	20	3	ug/L	0.49 U	0.48 U	0.48 U	0.49 U	0.51 U	0.48 U	0.4977	0.4930	0.4850	0.0477	0.4975	0.4920	0.4900	0.0426
8270C LL	Fluorene	- -	280	30	ug/L	0.49 U	0.48 U	0.48 U	0.49 U	0.51 U	0.48 U	0.4977	0.4930	0.4850	0.0477	0.4975	0.4920	0.4900	0.0426
8270C LL	Anthracene	- -	2,100	0.3	ug/L	0.074 U	0.073 U	0.072 U	0.075 U	0.078 U	0.072 U	0.0754	0.0747	0.0735	0.0521	0.0754	0.0744	0.0745	0.0451
8270C LL	Fluoranthene	- -	280	0.3	ug/L	0.052 U	0.052 U	0.051 U	0.053 U	0.055 U	0.051 U	0.0533	0.0529	0.0520	0.0475	0.0763	0.2596	0.0530	3.7585
8270C LL	Pyrene	- -	210	0.3	ug/L	0.086 U	0.086 U	0.085 U	0.087 U	0.091 U	0.085 U	0.0884	0.0876	0.0860	0.0482	0.1037	0.2467	0.0880	1.7633
8270C LL	Acenaphthylene	- -	210		ug/L	0.24 U	0.24 U	0.24 U	0.25 U	0.26 U	0.24 U	0.2470	0.2460	0.2400	0.0489	0.2475	0.2440	0.2450	0.0444
8270C LL	Phenanthrene	- -	210		ug/L	0.19 U	0.19 U	0.19 U	0.2 U	0.2 U	0.19 U	0.1973	0.1960	0.1900	0.0508	0.1985	0.2109	0.2000	0.0775
8270C LL	Benzo[a]anthracene	- -	0.05		ug/L	0.049 U	0.048 U	0.048 U	0.049 U	0.051 U	0.048 U	0.0498	0.0493	0.0485	0.0477	**0.0532**	**0.0855**	**0.0500**	0.7014
8270C LL	Chrysene	- -	4.8		ug/L	0.067 U	0.066 U	0.066 U	0.068 U	0.07 U	0.066 U	0.0684	0.0678	0.0665	0.0485	0.0831	0.2192	0.0680	2.1715
8270C LL	Benzo[b]fluoranthene	- -	0.05	0.031	ug/L	0.049 U	0.048 U	0.048 U	0.049 U	0.051 U	0.048 U	0.0498	0.0493	0.0485	0.0477	**0.0635**	**0.1925**	**0.0500**	2.7958
8270C LL	Benzo[k]fluoranthene	- -	0.5	(Total PAH[1])	ug/L	0.055 U	0.055 U	0.054 U	0.056 U	0.058 U	0.054 U	0.0565	0.0560	0.0550	0.0500	0.0595	0.0925	0.0560	0.6436
8270C LL	Benzo[a]pyrene	- -	0.2		ug/L	0.055 U	0.055 U	0.054 U	0.056 U	0.058 U	0.054 U	0.0565	0.0560	0.0550	0.0500	0.0618	0.1202	0.0560	1.1331
8270C LL	Indeno[1,2,3-cd]pyrene	- -	0.05		ug/L	0.049 U	0.048 U	0.048 U	0.049 U	0.051 U	0.048 U	0.0498	0.0493	0.0485	0.0477	**0.0546**	**0.1100**	0.0495	1.2155
8270C LL	Dibenz(a,h)anthracene	- -	0.005		ug/L	0.049 U	0.048 U	0.048 U	0.049 U	0.051 U	0.048 U	0.0498	0.0493	0.0485	0.0477	**0.0499**	**0.0510**	**0.0495**	0.0464
8270C LL	Benzo[g,h,i]perylene	- -	210		ug/L	0.097 U	0.096 U	0.095 U	0.098 U	0.1 U	0.095 U	0.0990	0.0980	0.0965	0.0479	0.1027	0.1466	0.0985	0.4883
8270C LL	Total PAH[1]	- -		0.031		0.24	0.24	0.24	0.25	0.26	0.24	0.2470	0.2460			**0.9742**	**1.4723**		
524.2 - TTHMs and Benzene																			
524.2	Benzene	- -	1	71.28 avg	ug/L	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.1900	0.1900	0.1900	0.0000	0.1900	0.1900	0.1900	0.0000
524.2	Bromoform	- -	4.4	360 avg	ug/L	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.1700	0.1700	0.1700	0.0000	0.1700	0.1700	0.1700	0.0000
524.2	Chloroform	- -	70	470.8 avg	ug/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2601	0.2760	0.2000	1.1003	0.2431	0.2190	0.2000	0.8732
524.2	Dichlorobromomethane	- -	0.6	22 avg	ug/L	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.1900	0.1900	0.1900	0.0000	0.1900	0.1900	0.1900	0.0000
524.2	Chlorodibromomethane	- -	0.4	34 avg	ug/L	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.1600	0.1600	0.1600	0.0000	0.1600	0.1600	0.1600	0.0000
524.2	Trihalomethanes, Total	- -	80	- -	ug/L	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.2265	0.2440	0.1600	1.4539	0.2077	0.1810	0.1600	1.1564
120.1 - Specific Conductance																			
120.1	Specific Conductance	- -	- -	- -	umhos/cm	600	450	440	520	730	620	681.1967	646.0000	590.0000	0.3724	744.6594	814.6250	670.0000	0.3382
1664A - Oil and Grease																			
1664A	HEM (Oil and Grease)	- -	- -	- -	mg/L	0.96 U	1 U	0.94 U	0.94 U	0.97 U	0.94 U	1.0131	1.0180	0.9650	0.1771	1.0042	0.9826	0.9650	0.1401
300 - Anions																			
300	Fluoride	- -	4	10	mg/L	0.42	0.29	0.56	0.31 J3	0.43	0.44	0.5033	0.4710	0.4350	0.3629	0.5128	0.5903	0.4400	0.3549
300	Chloride	- -	250[4]	- -	mg/L	59	36	46	51	85	59	59.4591	56.0000	48.5000	0.5031	58.9012	55.0000	54.5000	0.3932
300	Sulfate	- -	250[4]	- -	mg/L	140	51	130	79	72	40	183.8253	155.2000	135.0000	0.8124	182.8631	151.2375	135.0000	0.7397
300	Bromide	- -	- -	- -	mg/L				0.24			0.0985	0.1974	0.2400	0.4969	0.9318	1.8603	0.2150	10.1678
335.4 - Cyanide																			
335.4	Cyanide	- -	0.2	0.0052	mg/L	0.0062 U	**0.0083 I J3**	**0.044**	**0.0088 I**	0.0062 U	**0.023**	**0.0121**	**0.0121**	**0.0062**	1.9904	**0.0145**	**0.0125**	**0.0062**	2.4655
350.1 - Ammonia																			
350.1	Ammonia (as N)	- -	2.8	0.02[6]	mg/L	**0.11**	**0.36**	**0.11**	**0.24**	**0.29**	**0.24 J3**	**0.9561**	**1.0450**	**0.3250**	3.7380	**0.8146**	**0.6669**	**0.3950**	2.5110
353.2 - Nitrate / Nitrite																			
353.2	Nitrate Nitrite as N	- -	10	- -	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1024	0.1030	0.1000	0.0949	0.1017	0.1008	0.1000	0.0750
353.2	Nitrite as N	- -	1	- -	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1000	0.1000	0.1000	0.0000	0.1000	0.1000	0.1000	0.0000
SM 2320B - Alkalinity																			
SM 2320B	Alkalinity	- -	- -	> 20.0	mg/L	69	100	**4.3**	98	160	200	45.3252	65.7400	41.0000	1.7637	90.2574	149.5600	105.0000	0.8316
SM 2320B	Bicarbonate Alkalinity as CaCO3	- -	- -	- -	mg/L	69	100	4.3	98	160	200	45.3252	65.7400	41.0000	1.7637	88.0937	122.3100	99.0000	0.9258
SM 2320B	Carbonate Alkalinity as CaCO3	- -	- -	- -	mg/L	1 U	1 U	1 U	1 U	1 U	1 U	0.9999	1.0000	1.0000	0.0000	1.6153	8.7500	1.0000	7.7500
SM 2340B - Hardness																			
SM 2340B	Hardness as CaCO3	- -	- -	- -	mg/L	290	190	130	190	270	270	254.0023	235.0000	225.0000	0.4320	304.4781	317.1250	270.0000	0.4968
SM 2340B	Calcium hardness as CaCO3	- -	- -	- -	mg/L	200	110	91	110	160	150	155.0861	141.6000	130.0000	0.4275	181.0246	188.6500	165.0000	0.4288
SM 2340B	Magnesium hardness as CaCO3	- -	- -	- -	mg/L	94	81	41	84	110	120	100.1138	94.3000	87.5000	0.5133	125.4603	129.8250	102.0000	0.6435

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RAP Estimated Influent Concentration Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Method	Analyte	MCUO IUD Permit Limits	FDEP GCTL	FDEP SWCTL	Result Units	Monitoring Well	MW-74	MW-95	MW-104	MW-108	MW-110	MW-111	Weighted Average	Average	Median	Standard D /Median	Weighted Average	Average	Median	Standard D /Median
						Aquifer	USAS	USAS	USAS	USAS	USAS	USAS	USAS WELLS	USAS WELLS	USAS WELLS	USAS WELLS	ALL WELLS	ALL WELLS	ALL WELLS	All Wells
						% of Total Flow	19.06%	14.01%	14.01%	4.33%	4.33%	1.44%	71.71%	71.71%			100.00%	100.00%		
SM 2540C/D - TDS / TSS																				
SM 2540C	Total Dissolved Solids	- -	500[4]	- -	mg/L		350	260	280	310	430	360	426.2529	398.0000	355.0000	0.4380	472.0192	468.8750	385.0000	0.4701
SM 2540D	Total Suspended Solids	- -	- -	- -	mg/L		16	4.8	5.4	1.8	14	8.4	7.8154	7.7600	6.9000	0.7745	7.4095	5.7088	5.1000	1.3185
SM 3500 CR B - Chromium																				
SM 3500 CR B	Chromium (hexavalent)	- -	0.1	11	mg/L		0.0014 U	0.0014 U J:	0.0014 U	0.0014 U	0.0014 U	0.0014 U J3	0.0014	0.0014	0.0014	0.0000	0.0014	0.0014	0.0014	0.0000
SM 4500 H+ B - pH																				
SM 4500 H+ B	pH	5.0 - 11.5	6.5 - 8.5	Note 2	SU		6.67 Q	**6.47 Q**	**6 Q**	6.55 Q	6.65 Q	6.89 Q	**6.0930**	**6.1800**	**6.2350**	0.0828	6.5381	8.0888	6.6600	0.2235
SM 4500 S2 F - Sulfide																				
SM 4500 S2 F	Sulfide	- -	- -	- -	mg/L		1 U	1 U	1 U	1 U	1 U	1 U	0.9999	1.0000	1.0000	0.0000	1.0118	1.1500	1.0000	0.1500
SM 5210B - BOD																				
SM 5210B	Biochemical Oxygen Demand	- -	- -	Note 3	mg/L		2 U	2 U	11	2 U	2 U	2 U	3.8359	3.5700	2.0000	1.5941	4.0504	4.8363	2.0000	1.6414
SM 5310C - TOC																				
SM 5310C	Total Organic Carbon	- -	- -	- -	mg/L		2.4	12	3.3	9.2	4.2	12	5.7010	6.0500	3.8000	1.0475	5.3753	4.8750	4.3000	0.7385
SM 5540 C - Methylene Blue Active Substances (Surfactants)																				
SM 5540C	MBAS	- -	0.5[4]	0.5	mg/l LAS MW 340		0.052 I	0.088 I	0.075 I	0.86	0.13	0.11	0.1089	0.1617	0.0815	3.0338	0.0955	0.0947	0.0750	2.6303
200.7 - Silica (Dissolved)																				
200.7 Rev 4.4	SiO2, Silica	- -	- -	- -	ug/L		20000	14000	11000	18000	17000	14000	12140.9458	12470.0000	12500.0000	0.3875	16739.5014	23992.5000	17500.0000	0.4780
6020 - Metals (Total)																				
6020	Silver	- -	100[4]	0.07	ug/L		0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.0900	0.0900	0.0900	0.0000	0.0900	0.0900	0.0900	0.0000
6020	Aluminum	200	200[4]	13	ug/L		**22 I**	**25 I**	**280**	**61**	**22 I**	**24 I**	**229.8449**	**179.4000**	**120.5000**	1.6539	**176.4800**	**140.7250**	**24.5000**	7.3906
6020	Arsenic	2510	10	50	ug/L		0.28 U	0.28 U	0.28 U	0.28 U	1.3 I V	0.28 U	3.4215	4.2150	0.5650	12.4077	2.8378	1.8088	0.6850	8.3266
6020	Beryllium	4	4	0.13 avg	ug/L		0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.0650	0.0650	0.0650	0.0000	0.0712	**0.1438**	0.0650	1.2115
6020	Calcium	- -	- -	- -	ug/L		79000	43000	36000	43000	64000	60000	61683.5352	56400.0000	53000.0000	0.4173	72185.9122	75475.0000	65500.0000	0.4361
6020	Cadmium	730	5	1.2[8]	ug/L		0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.1374	0.1420	0.1200	0.5798	0.1325	0.1255	0.1200	0.4583
6020	Chromium	9900	100	11	ug/L		0.63 I	0.6 U	0.6 U	1 I	1.3 I V	0.85 I	0.7281	0.8280	0.7400	0.3500	0.8672	1.0526	0.9350	0.3532
6020	Copper	28480	1000[4]	10.12[9]	ug/L		1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	2.3713	2.6800	1.2000	3.9001	2.0400	1.5700	1.2000	3.0833
6020	Iron	- -	300[4]	1000	ug/L		**10000**	**2100 V**	**8600**	**970**	**5500**	**2800**	**12212.1107**	**9917.0000**	**7400.0000**	1.2831	**9115.1000**	**3114.4375**	**4900.0000**	1.7462
6020	Magnesium	- -	- -	- -	ug/L		23000	20000	9900	20000	27000	29000	24210.4671	22790.0000	21000.0000	0.5149	30250.4224	31260.0000	25000.0000	0.6334
6020	Manganese	- -	50	- -	ug/L		**94**	24	44	24	**52**	34	47.8896	38.4000	29.0000	0.9290	42.5369	23.3875	24.0000	1.3021
6020	Sodium	- -	160,000	- -	ug/L		20000	20000	42000	36000	33000	30000	35743.6563	34700.0000	34500.0000	0.3555	34314.5752	30112.5000	34500.0000	0.4414
6020	Lead	1870	15	3.59[10]	ug/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.1500	0.1500	0.1500	0.0000	0.1512	0.1650	0.1500	0.1000
6020	Antimony	- -	6	4300	ug/L		0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	1.4618	1.7380	0.3600	10.1714	1.1615	0.7158	0.3600	8.0990
6020	Selenium	- -	50	5	ug/L		0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6094	0.6120	0.6000	0.0632	0.6067	0.6030	0.6000	0.0500
6020	Thallium	- -	2	6.3	ug/L		0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.7557	0.8100	0.5500	1.1859	0.6975	0.6150	0.5500	0.9485
6020	Potassium	- -	- -	- -	ug/L		1800	1200	1400	1400	1100	1400	3652.5087	3220.0000	1600.0000	1.5996	3310.6079	3105.0000	1950.0000	1.0850
6020	Nickel	11080	100	56.54[11]	ug/L		0.32 U	0.48 I V	0.68 I	0.32 U	0.68 I V	0.32 U	1.6474	1.9550	0.5800	5.1601	1.7347	1.9644	0.6800	3.6511
6020	Zinc	4780	5000*	129.89[12]	ug/L		6.5 U	6.5 U	10 I	6.5 U	6.5 U	6.5 U	11.0817	12.0200	6.5000	2.4912	9.7856	7.8800	6.5000	1.9758
6020 - Metals (Dissolved)																				
6020	Silver, Dissolved	- -	100[4]	0.07	ug/L		0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.0900	0.0900	0.0900	0.0000	0.0900	0.0900	0.0900	0.0000
6020	Aluminum, Dissolved	200	200[4]	13	ug/L		15 U	**17 I**	**240**	**27 I**	**17 I**	**20 I**	**223.0600**	**170.6000**	**98.5000**	2.1095	**170.3064**	**130.2750**	**18.5000**	9.9358
6020	Arsenic, Dissolved	2510	10	50	ug/L		0.28 U	0.28 U	0.31 I	0.28 U	1.3 I	0.28 U	3.6094	4.4430	0.6050	12.4248	2.9383	1.7326	0.4700	13.0335
6020	Beryllium, Dissolved	4	4	0.13 avg	ug/L		0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.0650	0.0650	0.0650	0.0000	0.0653	0.0688	0.0650	0.0577
6020	Calcium, Dissolved	- -	- -	- -	ug/L		74000	44000	32000	40000	72000 V	59000	62813.7255	57500.0000	54000.0000	0.4509	73069.4198	76750.0000	69000.0000	0.4376
6020	Cadmium, Dissolved	730	5	1.2[8]	ug/L		0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.1263	0.1280	0.1200	0.2108	0.1245	0.1220	0.1200	0.1667
6020	Chromium, Dissolved	9900	100	11	ug/L		0.68 I	0.6 U	0.6 U	0.92 I	1.3 I V	0.79 I	0.7966	0.8990	0.8550	0.3287	0.8484	0.8910	0.8600	0.3340
6020	Copper, Dissolved	28480	1000[4]	10.12[9]	ug/L		1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.1998	1.2000	1.2000	0.0000	1.1999	1.2000	1.2000	0.0000
6020	Iron, Dissolved	- -	300[4]	1000	ug/L		**9000**	**1600 V**	**7800**	**710**	**5400**	**2700**	**12456.8051**	**10161.0000**	**6850.0000**	1.5503	**9292.5887**	**3160.1875**	**4850.0000**	1.9330
6020	Magnesium, Dissolved	- -	- -	- -	ug/L		21000	21000	8700	19000	31000	28000	24725.8362	23370.0000	21000.0000	0.5610	30445.3858	31380.0000	25000.0000	0.6466
6020	Manganese, Dissolved	- -	50	- -	ug/L		**88**	24	41	23	**56**	34	47.7572	38.6000	29.0000	0.9158	42.3453	23.6625	23.5000	1.3734
6020	Sodium, Dissolved	- -	160,000	- -	ug/L		19000	19000	39000	33000	38000	30000	36158.0161	35200.0000	35500.0000	0.3825	34642.9162	30425.0000	35500.0000	0.4793
6020	Lead, Dissolved	1870	15	3.59[10]	ug/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.1500	0.1500	0.1500	0.0000	0.1500	0.1500	0.1500	0.0000
6020	Antimony, Dissolved	- -	6	4300	ug/L		0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	1.4444	1.7230	0.3600	10.1716	1.1376	0.7008	0.3600	8.1031
6020	Selenium, Dissolved	- -	50	5	ug/L		0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6023	0.6030	0.6000	0.0158	0.6016	0.6008	0.6000	0.0125
6020	Thallium, Dissolved	- -	2	6.3	ug/L		0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.7557	0.8100	0.5500	1.1859	0.6975	0.6150	0.5500	0.9485
6020	Potassium, Dissolved	- -	- -	- -	ug/L		1900	1300	1500	1400	1200	1500	3902.1050	3420.0000	1700.0000	1.6126	3483.5017	3198.7500	2000.0000	1.1434
6020	Nickel, Dissolved	11080	100	56.54[11]	ug/L		0.38 I	0.47 I V	0.56 I	0.32 U	0.69 I V	0.34 I	1.8210	2.1330	0.6250	5.2084	1.7971	1.7358	0.6950	3.8656
6020	Zinc, Dissolved	4780	5000*	129.89[12]	ug/L		6.5 U	6.5 U	8.2 I	6.5 U	6.5 U	6.5 U	6.7373	6.6700	6.5000	0.0827	6.6702	6.5425	6.5000	0.0654
7470A - Mercury (Total)																				
7470A	Mercury	- -	2	0.012	mg/L		0.000072 U	0.000072 U	0.00012 I	0.00008 I	0.000072 U	0.0001 I	0.000079	0.000080	0.000072	0.2290	0.000081	0.000077	0.000072	0.2370
7470A - Mercury (Dissolved)																				
7470A	Mercury, Dissolved	- -	2	0.012	mg/L		0.000072 U	0.000072 U	0.000072 U	0.000072 U	0.000072 U	0.000072 U	0.000072	0.000072	0.000072	0.0088	0.000076	0.000082	0.000072	0.1837
DPD HACH KIT - Chlorine																				
DPD	Chlorine	- -	700	0.01	mg/L		0	**1.4**	**0.2**	**2.4**	**0.8**	**0.2**	**0.845747**	**0.980000**	**0.900000**	0.8824	**0.845036**	**1.251250**	**0.900000**	0.9194
Field Parameters																				
	pH				SU		6.34	5.39	5.94	6.09	6.38	6.31	5.6591	5.7250	5.6650	0.0946	6.1542	7.8969	6.3250	0.2741
	Conductivity				uS/cm		682	487	435	568	822	646	743.5794	709.0000	683.0000	0.3407	820.8754	996.6250	746.5000	0.3599
	Dissolved Oxygen				mg/L		0.64	0.41	0.06	0.36	0.23	0.36	0.3532	0.3240	0.3500	0.4342	0.5211	1.0029	0.3500	4.9198
	Turbidity				NTU		1.75	7.09	2.65	2.49	13.4	2.98	4.1336	4.9520	2.8150	1.6570	3.6901	8.3499	2.3450	3.0313
	ORP				mV		-40.3	-34.6	72.8	-27.9	-319.6	na	-53.8269	-82.6000	-37.4500	-4.2757	-67.4859	-112.4889	-73.4500	-1.7975

R625-EDC-001213-0

Footnotes:

text	non-detect reported is above surface water cleanup target level
text	detected concentration is above surface water cleanup target level
text	non-detect reported is above groundwater cleanup target level
text	detected concentration is above groundwater cleanup target level
text	non-detect reported is above surface water and groundwater cleanup target level
text	detected concentration is above surface water and groundwater cleanup target level
1	Total PAH concentration is a sum of the following PAHs: Acenaphthylene, Phenanthrene, Benzo(a)anthracene, Chrysene, Benzo(b)flouranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene and Benzo(g,h,i)perylene. However is not detections are noted Total PAHs are the maximum non-detect value
2	pH shall not vary more than one unit above or below the natural background of perdominately fresh waters and coastal waters as defined in Section 62-302.520(3)(b). F.A.C. or more than two-tenths unit above or below natural background of open waters as defined in Section 62-302.520(3)(f), F.A.C., provided that the pH is not lowered to less than 6 units in perdomanently fresh waters, or less than 6.5 units in predominately marine waters, or raised above 8.5 units.
3	BOD value shall not exceed values which would cause dissolved oxygen to be depressed below 5mg/L and, in no case, shall it be great enough to produce nuisance conditions
4	Secondary drinking water standard
5	Total PCBs are the sumation of a PCB detected, however if no detections are noted total PCBs are the maximum non-detect value
6	Surface water quality cirteria for ammoni is for un-ionized
7	Total Endosulfan is the sumation of Endosulfan I, Endosulfan II and Endosulfan sulfate. However, if no detections are noted Total Endosulfan is the maximum non-detect value.
8	Cd < e^(0.782[lnH]-3.49), where H = Hardness and is designated as 110mg/L as CaCo3 which is the hardness value for MW-40, the lowest of all USAS wells
9	Cu < e^(0.8545[lnH]-1.702), where H = Hardness and is designated as 110mg/L as CaCo3 which is the hardness value for MW-40, the lowest of all USAS wells
10	Pb < e^(1.273[lnH]-4.705), where H = Hardness and is designated as 110mg/L as CaCo3 which is the hardness value for MW-40, the lowest of all USAS wells
11	Ni < e^(0.846[lnH]+ 0.0584), where H = Hardness and is designated as 110mg/L as CaCo3 which is the hardness value for MW-40, the lowest of all USAS wells
12	Zn < e^(0.8473[lnH]+ 0.884), where H = Hardness and is designated as 110mg/L as CaCo3 which is the hardness value for MW-40, the lowest of all USAS wells
I	The reported value is between the laboratory method detection limit and the laboratory practical quatitation limit
J1	Estimated value; value may not be accurate. Surrogate recovery outside of criteria
J3	Estimated value; value may not be accurate. Spike recovery or RPD outside of criteria
Q	Sample held beyond the accepted holding time
U	Indicates that the compound was analyzed for but not detected
V	Indicates the analyte was detected in both the sample and the associated method blank

Calculation 2

pH ADJUSTMENT DESIGN CALCULATIONS

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: D. Carpenter
Calc checked by: J. Bedessem
Date: 7/7/09

Assumptions:

pH adjustment calculations were completed using the PHREEQC model (PH REdox Equilibrium EQuation in C language).
The model was completed based on the estimated influent concentrations for the RAP treatment system.
Treated water will be aerated to saturated oxygen conditions.
Aeration will not result in pH changes.
pH will be increased in two steps for metals removal; then will be decreased in one step for advanced oxidation treatment.

Input Parameters:

Influent flow rate =	200	Gallons per Minute (gpm)
Influent pH =	6.48	

PHREEQC Model Results:

		Units	Comments
Concentration of O_2 in Atmosphere =	300	Grams per Cubic Meter	
Concentration of O_2 in Atmosphere =	9.38	Moles per Cubic Meter	
Required O_2 =	3.10E-04	Moles per Liter of Solution	Saturate Water with Oxygen
Required Aeration Rate =	3.30E-05	Cubic Meters per Liter of Water Treated	
Required Ventilation Rate =	0.878	Cubic Feet per Minute	For 200 gpm of water treated

Sodium Hydroxide Required to Increase pH:

Concentration of NaOH Reagent =	50%	Percent
Concentration of NaOH Reagent =	12.5	Moles per Liter

Increase pH from 6.48 to 7:

Required NaOH =	8.00E-04	Moles per Liter of Solution
Required NaOH Addition =	0.06	Milliliters per Liter of Water Treated
Required NaOH Addition =	0.013	gpm

Increase pH from 7 to 8.5:

Required NaOH =	2.00E-03	Moles per Liter of Solution
Required NaOH Addition =	0.16	Milliliters per Liter of Water Treated
Required NaOH Addition =	0.032	gpm

Total sodium hydroxide use:

Required NaOH Addition =	0.22	Milliliters per Liter of Water Treated
Required NaOH Addition =	0.045	gpm

Sulfuric Acid Required to Decrease pH:

Concentration of H_2SO_4 Reagent =	98%	Percent
Concentration of H_2SO_4 Reagent =	10	Moles per Liter

Decrease pH from 8.5 to 7:

Required H_2SO_4 =	9.50E-05	Moles per Liter of Solution
Required H_2SO_4 =	0.0095	Milliliters per Liter of Water Treated
Required H_2SO_4 Addition =	0.002	gpm

Calculation 3

PUMP DESIGN CALCULATIONS
Total Dynamic Head Calculation Summary
Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Perella
Date: 6/15/09

Pump	Flow (gpm)	Total Dynamic Head (ft)
EW-2008	2.1	171
EW-2007	2.1	174
EW-4011	1.8	205
EW-2013	2.1	138
EW-2101 (T-1)	20.3	183
EW-2104 (T-4)	20.3	187

Calculation 4

EXTRACTION WELL PUMP (EW-2008; TRENCH 1) DESIGN CALCULATIONS

Total Dynamic Head Calculation

Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Perella
Date: 6/15/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	60	feet
	Head loss, h_e =	60	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

$f = .2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness
(100 for new stainless steel pipe, 150 for hdpe pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
1	1.049	0.924
1.25	1.380	1.255
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94

NOTES: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Pipe Section	Nominal Pipe Diameter (in)	Inside Pipe Diameter (in)	Flow (gpm)	C	f (ft/100 ft water)
Well Extraction	1	0.924	2.08	100	1.2
EW-2008 to EW-2009	1.25	1.255	2.08	150	0.1
EW-2009 to EW-2010	1.25	1.255	4.17	150	0.5
EW-2010 to Point A	1.25	1.255	6.25	150	1.0
Point A TO EW-4004	1.25	1.255	8.33	150	1.7
EW-4004 TO BLDG	1.25	1.255	10.11	150	2.4
INSIDE BLDG	6	5.94	201.5	100	0.7

EXTRACTION WELL PUMP (EW-2008; TRENCH 1) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each section

	Equivalent Length per Fitting (ft)						
Nominal Fitting size	1 in	1.25 in	1.5 in	2 in	3 in	4 in	6 in
90 Elbows	2.7	3.2	3.4	3.6	4.0	4.6	10.4
Standard Tee (thru flow)	3.2	4.6	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	8.7	9.9	12.0	17.0	21.0	47.3
Ball valve (full open)	1.6	2.0	2.3	2.9	4.3	5.5	12.3
Butterfly valve (full open)	3.9	5.3					26.0
Check Valve - Spring and Swing	11.0	13.0	15.0	19.0	27.0	38.0	85.5
Union	0.3	0.4	0.4	0.5	0.5	0.7	1.5
Expansion (1"/1.25")	1.0	1.3	1.5	1.5	3.0	4.0	9.0
Expansion (1.25"/1.5")	1.5	2.0	2.5	3.0	4.0	6.0	13.5
Expansion (1.5"/2")	1.5	2.0	2.5	3.0	4.0	6.0	13.5
Expansion (2"/6")	1.5	2.0	2.5	3.0	4.0	6.0	13.5

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

EW-2008 (Extraction Well and Wellhead)

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_l)	1	40	40
90 Elbows	1	2.7	2.7
Check Valve - Spring and Swing	1	11	11
Standard Tee (thru flow)	2	3.2	6.4
Butterfly valve (full open)	1	3.9	3.9
Expansion (1" x 1.25")	1	1	1
Union	1	0.29	0.29
		Equivalent Length:	**66**

EW-2008 to EW-2009

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_l)	1	220	220
		Equivalent Length:	**220**

EW-2009 to EW-2010

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_l)	1	245	245
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**250**

EW-2010 to Point A

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_l)	1	60	60
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**65**

EXTRACTION WELL PUMP (EW-2008; TRENCH 1) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Point A to EW-4004

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_l)	1	1,320	1,320
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**1,325**

EW-4004 to Building

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_l)	1	630	630
Standard Tee (thru flow)	1	4.6	4.6
90 Elbows	1	3.2	3.2
		Equivalent Length:	**638**

Inside Building (6" Piping)

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_l)	1	100	100
Butterfly valve (full open)	5	26	130
Reducer (6" to 2")	1	13	13
Reducer (2" to 6")	1	13	13
Standard Tee (thru flow)	4	4.6	18.4
90 Elbows	3	85.5	256.5
		Equivalent Length:	**531**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Total Pipe Friction - EW-2008 (Extraction Well and Wellhead)
total equivalent length = 66 feet
friction factor = 1.2 feet water / 100 feet of pipe

Total Pipe Friction = 0.8 feet

Total Pipe Friction - EW-2008 to EW-2009
total equivalent length = 220 feet
friction factor = 0.1 feet water / 100 feet of pipe

Total Pipe Friction = 0.3 feet

Total Pipe Friction - EW-2009 to EW-2010
total equivalent length = 250 feet
friction factor = 0.5 feet water / 100 feet of pipe

Total Pipe Friction = 1.1 feet

Total Pipe Friction - EW-2010 to Point A
total equivalent length = 65 feet
friction factor = 1.0 feet water / 100 feet of pipe

Total Pipe Friction = 0.6 feet

EXTRACTION WELL PUMP (EW-2008; TRENCH 1) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total Pipe Friction - Point A to EW-4004

total equivalent length =	1,325	feet
friction factor =	1.7	feet water / 100 feet of pipe
Total Pipe Friction =	21.9	feet

Total Pipe Friction - EW-4004 to Building

total equivalent length =	638	feet
friction factor =	2.4	feet water / 100 feet of pipe
Total Pipe Friction =	15.1	feet

Total Pipe Friction - Inside Building (6" Piping)

total equivalent length =	531	feet
friction factor =	0.7	feet water / 100 feet of pipe
Total Pipe Friction =	3.5	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections = 43.3

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	60	ft	
Headloss due to pipe friction	43	ft	
Headloss Across Misc. Process Components			
Well Vault Flow Meter	5	ft	1 psi = 2.31 ft
Wye-Strainer	12	ft	
In-Building Flow Meter	5	ft	
Static Mixer	12	ft	
Required Discharge Pressure (0 psi)	0	ft	
Total Dynamic Head Required - Calculated	**136**	ft	
Design Safety Factor	**25%**		
Total Dynamic Head Required - Design	**171**	**feet**	

Pump Design Requirements:

Flow	**2.1**	gpm
Total Dynamic Head	**171**	feet

Inputs
Formulas or Constant

Calculation 5

EXTRACTION WELL PUMP (EW-2007; TRENCH 2) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Perella
Date: 6/15/09

Calculate head loss (h_e) due to elevation change:

assume: Height from pump to discharge point = 60 feet
Head loss, h_e = 60 feet

Calculate headloss due to pipe friction losses

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

$$f = .2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$$

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness
(100 for new stainless steel pipe, 150 for hdpe pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
1	1.049	0.924
1.25	1.380	1.255
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94

NOTES: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Pipe Section	Nominal Pipe Diameter (in)	Inside Pipe Diameter (in)	Flow (gpm)	C	f (ft/100 ft water)
Well Extraction	1	0.924	2.08	100	1.2
EW-2007 to EW-2006	1.25	1.255	2.08	150	0.1
EW-2006 to EW-2005	1.25	1.255	4.17	150	0.5
EW-2005 to EW-2004	1.25	1.255	6.25	150	1.0
EW-2004 to EW-2003	1.25	1.255	8.33	150	1.7
EW-2003 to EW-3020	1.25	1.255	10.42	150	2.5
EW-3020 to Point E	1.25	1.255	12.01	150	3.3
Point E to EW-3019	1.5	1.485	16.18	150	2.5
EW-3019 to EW-3018	1.5	1.485	17.77	150	3.0
EW-3018 to EW-3017+EW-2038	1.5	1.485	19.37	150	3.5
EW-3017+EW-2101 to EW-3016+EW-2102	2	1.942	41.21	150	3.8
EW-3016+EW-2102 to EW-3015	3	2.943	63.06	150	1.1
EW-3015 to EW-3014	3	2.943	64.65	150	1.2
EW-3014 to EW-3013	3	2.943	66.25	150	1.2
EW-3013 to EW-3012	3	2.943	67.84	150	1.3
EW-3012 to BLDG	3	2.943	69.44	150	1.3
INSIDE BLDG	6	5.94	201.50	100	0.7

EXTRACTION WELL PUMP (EW-2007; TRENCH 2) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each sectior

	Equivalent Length per Fitting (ft)						
Nominal Fitting size	1 in	1.25 in	1.5 in	2 in	3 in	4 in	6 in
90 Elbows	2.7	3.2	3.4	3.6	4.0	4.6	10.4
Standard Tee (thru flow)	3.2	4.6	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	8.7	9.9	12.0	17.0	21.0	47.3
Ball valve (full open)	1.6	2.0	2.3	2.9	4.3	5.5	12.3
Butterfly valve (full open)	3.9	5.3					26.0
Check Valve - Spring and Swing	11.0	13.0	15.0	19.0	27.0	38.0	85.5
Union	0.3	0.4	0.4	0.5	0.5	0.7	1.5
Expansion (1"/1.25")	1.0	1.3	1.5	1.5	3.0	4.0	9.0
Expansion (1.25"/1.5")	1.5	2.0	2.5	3.0	4.0	6.0	13.5
Expansion (1.5"/2")	1.5	2.0	2.5	3.0	4.0	6.0	13.5
Expansion (2"/6")	1.5	2.0	2.5	3.0	4.0	6.0	13.5

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

EW-2007 (Extraction Well and Wellhead)

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	40	40
90 Elbows	1	2.7	2.7
Check Valve - Spring and Swing	1	11	11
Standard Tee (thru flow)	2	3.2	6.4
Butterfly valve (full open)	1	3.9	3.9
Expansion (1" x 1.25")	1	1	1
Union	1	0.29	0.29
		Equivalent Length:	**66**

EW-2007 to EW-2006

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	100	100
		Equivalent Length:	**100**

EW-2006 to EW-2005

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	110	110
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**115**

EW-2005 to EW-2004

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	85	85
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**90**

EW-2004 to EW-2003

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	75	75
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**80**

EW-2003 to EW-3020

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	20	20
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**25**

EXTRACTION WELL PUMP (EW-2007; TRENCH 2) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

EW-3020 to Point E

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	25	25
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**30**

Point E to EW-3019

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	165	165
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**170**

EW-3019 to EW-3018

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	175	175
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**180**

EW-3018 to EW-3017+EW-2101

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	150	150
Expander (1.25" to 1.5")	1	2	2
Standard Tee (thru flow)	1	5.6	5.6
		Equivalent Length:	**158**

EW-3017+EW-2101 to EW-3016+EW-2102

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	230	230
Standard Tee (thru flow)	1	5.6	5.6
		Equivalent Length:	**236**

EW-3016+EW-2102 to EW-3015

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	150	150
Standard Tee (thru flow)	1	5.6	5.6
		Equivalent Length:	**156**

EW-3015 to EW-3014

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	140	140
Standard Tee (thru flow)	1	5.6	5.6
		Equivalent Length:	**146**

EW-3014 to EW-3013

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	145	145
Expander (1.5" to 2")	1	3	3
Standard Tee (thru flow)	1	7.7	7.7
		Equivalent Length:	**156**

EW-3013 to EW-3012

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	170	170
Standard Tee (thru flow)	1	7.7	7.7
		Equivalent Length:	**178**

EXTRACTION WELL PUMP (EW-2007; TRENCH 2) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

EW-3012 to Building

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	405	405
Standard Tee (thru flow)	1	7.7	7.7
90 Elbows	1	3.6	3.6
		Equivalent Length:	**417**

Inside Building (6" Piping)

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	100	100
Butterfly valve (full open)	5	26	130
Reducer (6" to 2")	1	3	3
Expander (2" to 6")	1	13.5	13.5
Standard Tee (thru flow)	4	4.6	18.4
90 Elbows	3	85.5	256.5
		Equivalent Length:	**522**

Step 4. Determine pipe friction for each pipe section

total pipe friction = total equivalent length x friction factor

Total Pipe Friction - EW-2007 (Extraction Well and Wellhead)
total equivalent length = 66 feet
friction factor = 1.2 feet water / 100 feet of pipe

Total Pipe Friction = 0.8 feet

Total Pipe Friction - EW-2007 to EW-2006
total equivalent length = 100 feet
friction factor = 0.1 feet water / 100 feet of pipe

Total Pipe Friction = 0.1 feet

Total Pipe Friction - EW-2006 to EW-2005
total equivalent length = 115 feet
friction factor = 0.5 feet water / 100 feet of pipe

Total Pipe Friction = 0.5 feet

Total Pipe Friction - EW-2005 to EW-2004
total equivalent length = 90 feet
friction factor = 1.0 feet water / 100 feet of pipe

Total Pipe Friction = 0.9 feet

Total Pipe Friction - EW-2004 to EW-2003
total equivalent length = 80 feet
friction factor = 1.7 feet water / 100 feet of pipe

Total Pipe Friction = 1.3 feet

Total Pipe Friction - EW-2003 to EW-3020
total equivalent length = 25 feet
friction factor = 2.5 feet water / 100 feet of pipe

Total Pipe Friction = 0.6 feet

Total Pipe Friction - EW-3020 to Point E
total equivalent length = 30 feet
friction factor = 3.3 feet water / 100 feet of pipe

Total Pipe Friction = 1.0 feet

EXTRACTION WELL PUMP (EW-2007; TRENCH 2) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total Pipe Friction - Point E to EW-3019

total equivalent length =	170	feet
friction factor =	2.5	feet water / 100 feet of pipe
Total Pipe Friction =	4.2	feet

Total Pipe Friction - EW-3019 to EW-3018

total equivalent length =	180	feet
friction factor =	3.0	feet water / 100 feet of pipe
Total Pipe Friction =	5.3	feet

Total Pipe Friction - EW-3018 to EW3017+EW-2038

total equivalent length =	158	feet
friction factor =	3.5	feet water / 100 feet of pipe
Total Pipe Friction =	5.5	feet

Total Pipe Friction - EW-3017+EW-2038 to EW-3016+EW-2039

total equivalent length =	236	feet
friction factor =	3.8	feet water / 100 feet of pipe
Total Pipe Friction =	9.0	feet

Total Pipe Friction - EW-3016+EW-2039 to EW-3015

total equivalent length =	156	feet
friction factor =	1.1	feet water / 100 feet of pipe
Total Pipe Friction =	1.7	feet

Total Pipe Friction - EW-3015 to EW-3014

total equivalent length =	146	feet
friction factor =	1.2	feet water / 100 feet of pipe
Total Pipe Friction =	1.7	feet

Total Pipe Friction - EW-3014 to EW-3013

total equivalent length =	156	feet
friction factor =	1.2	feet water / 100 feet of pipe
Total Pipe Friction =	1.9	feet

Total Pipe Friction - EW-3013 to EW-3012

total equivalent length =	178	feet
friction factor =	1.3	feet water / 100 feet of pipe
Total Pipe Friction =	2.3	feet

Total Pipe Friction - EW-3012 to Building

total equivalent length =	417	feet
friction factor =	1.3	feet water / 100 feet of pipe
Total Pipe Friction =	5.5	feet

Total Pipe Friction - Inside Building (6" Piping)

total equivalent length =	522	feet
friction factor =	0.7	feet water / 100 feet of pipe
Total Pipe Friction =	3.5	feet

EXTRACTION WELL PUMP (EW-2007; TRENCH 2) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 5. Determine total pipe friction (all sections

Total Pipe Friction - All Sections =	45.8	

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	60	ft	
Headloss due to pipe friction	46	ft	
Headloss Across Misc. Process Components			
Well Vault Flow Meter	5	ft	1 psi = 2.31 ft
Wye-Strainer	12	ft	
In-Building Flow Meter	5	ft	
Static Mixer	12	ft	
Required Discharge Pressure (0 psi)	0	ft	
Total Dynamic Head Required - Calculated	**139**	ft	
Design Safety Factor	**25%**		
Total Dynamic Head Required - Design	**174**	**feet**	

Pump Design Requirements:

Flow	**2.1**	gpm
Total Dynamic Head	**174**	feet

Inputs
Formulas or Constant

Calculation 6

EXTRACTION WELL PUMP (EW-4011; TRENCH 3) DESIGN CALCULATIONS

Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =
- headloss due to elevation change
- headloss due to pipe friction
- headloss across misc. process components
- required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Perella
Date: 6/15/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	90	feet
	Head loss, h_e =	90	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

$$f = .2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$$

- f = Friction in head in feet of water per 100 ft of pipe
- C = Constant for inside roughness (100 for new stainless steel pipe, 150 for hdpe pipe)
- q = Flow rate (gal/min)
- D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
1	1.049	0.924
1.25	1.380	1.255
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94

NOTES: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Pipe Section	Nominal Pipe Diameter (in)	Inside Pipe Diameter (in)	Flow (gpm)	C	f (ft/100 ft water)
Well Extraction	1	0.924	1.77	100	0.9
EW-4011 to EW-4010	1.25	1.255	1.77	100	0.2
EW-4010 to EW-2037	1.25	1.255	3.55	150	0.3
EW-2037 to Point B	1.25	1.255	5.63	150	0.8
Point B to EW-2104	2	1.942	9.49	150	0.3
EW-2104 to EW-2103	2	1.942	29.74	150	2.1
EW-2103 TO EW-4008	3	2.943	49.99	150	0.7
EW-4008 TO Point D	3	2.943	51.76	150	0.8
Point D TO EW-4009	3	2.943	56.90	150	0.9
EW-4009 TO BLDG	3	2.943	58.67	150	1.0
INSIDE BLDG	6	5.94	201.50	100	0.7

EXTRACTION WELL PUMP (EW-4011; TRENCH 3) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each section

Nominal Fitting size	Equivalent Length per Fitting (ft)						
	1 in	1.25 in	1.5 in	2 in	3 in	4 in	6 in
90 Elbows	2.7	3.2	3.4	3.6	4.0	4.6	10.4
Standard Tee (thru flow)	3.2	4.6	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	8.7	9.9	12.0	17.0	21.0	47.3
Ball valve (full open)	1.6	2.0	2.3	2.9	4.3	5.5	12.3
Butterfly valve (full open)	3.9	5.3					26.0
Check Valve - Spring and Swing	11.0	13.0	15.0	19.0	27.0	38.0	85.5
Union	0.3	0.4	0.4	0.5	0.5	0.7	1.5
Expansion (1"/1.25")	1.0	1.3	1.5	1.5	3.0	4.0	9.0
Expansion (1.25"/1.5")	1.5	2.0	2.5	3.0	4.0	6.0	13.5
Expansion (1.5"/2")	1.5	2.0	2.5	3.0	4.0	6.0	13.5
Expansion (2"/6")	1.5	2.0	2.5	3.0	4.0	6.0	13.5

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

EW-4011 (Extraction Well and Wellhead)

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	110	110
90 Elbows	1	2.7	2.7
Check Valve - Spring and Swing	1	11	11
Standard Tee (thru flow)	2	3.2	6.4
Butterfly valve (full open)	1	3.9	3.9
Expansion (1" x 1.25")	1	1	1
Union	1	0.29	0.29
		Equivalent Length:	**136**

EW-4011 to EW-4010

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	470	470
		Equivalent Length:	**470**

EW-4010 to EW-2037

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	560	560
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**565**

EW-2037 to Point B

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	135	135
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**140**

Point B to EW-2104

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	1,035	1,035
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**1,040**

EXTRACTION WELL PUMP (EW-4011; TRENCH 3) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

EW-2104 to EW-2103

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	200	200
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**205**

EW-2103 to EW-4008

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	200	200
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**205**

EW-4008 to Point D

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	425	425
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**430**

Point D to EW-4009

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	580	580
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**585**

EW-4009 to Building

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	1,585	1,585
Standard Tee (thru flow)	1	4.6	4.6
90 Elbows	1	3.2	3.2
		Equivalent Length:	**1,593**

Inside Building (6" Piping)

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	100	100
Butterfly valve (full open)	5	26	130
Reducer (6" to 2")	1	13	13
Reducer (2" to 6")	1	13	13
Standard Tee (thru flow)	4	4.6	18.4
90 Elbows	3	85.5	256.5
		Equivalent Length:	**531**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Total Pipe Friction - EW-4011 (Extraction Well and Wellhead)

total equivalent length =	136	feet
friction factor =	0.9	feet water / 100 feet of pipe
Total Pipe Friction =	1.2	feet

EXTRACTION WELL PUMP (EW-4011; TRENCH 3) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total Pipe Friction - EW-4011 to EW-4010

total equivalent length =	470	feet
friction factor =	0.2	feet water / 100 feet of pipe
Total Pipe Friction =	0.9	feet

Total Pipe Friction - EW-4010 to EW-2037

total equivalent length =	565	feet
friction factor =	0.3	feet water / 100 feet of pipe
Total Pipe Friction =	1.9	feet

Total Pipe Friction - EW-2037 to Point B

total equivalent length =	140	feet
friction factor =	0.8	feet water / 100 feet of pipe
Total Pipe Friction =	1.1	feet

Total Pipe Friction - Point B to EW-2104

total equivalent length =	1,040	feet
friction factor =	0.3	feet water / 100 feet of pipe
Total Pipe Friction =	2.6	feet

Total Pipe Friction - EW-2104 to EW-2103

total equivalent length =	205	feet
friction factor =	2.1	feet water / 100 feet of pipe
Total Pipe Friction =	4.3	feet

Total Pipe Friction - EW-2103 to EW-4008

total equivalent length =	205	feet
friction factor =	0.7	feet water / 100 feet of pipe
Total Pipe Friction =	1.5	feet

Total Pipe Friction - EW-4008 to Point D

total equivalent length =	430	feet
friction factor =	0.8	feet water / 100 feet of pipe
Total Pipe Friction =	3.3	feet

Total Pipe Friction - Point D to EW-4009

total equivalent length =	585	feet
friction factor =	0.9	feet water / 100 feet of pipe
Total Pipe Friction =	5.4	feet

Total Pipe Friction - EW-4009 to BLDG

total equivalent length =	1,593	feet
friction factor =	1.0	feet water / 100 feet of pipe
Total Pipe Friction =	15.5	feet

Total Pipe Friction - Inside Building (6" Piping)

total equivalent length =	531	feet
friction factor =	0.7	feet water / 100 feet of pipe
Total Pipe Friction =	3.5	feet

EXTRACTION WELL PUMP (EW-4011; TRENCH 3) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	41.2	

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	90	ft	
Headloss due to pipe friction	41	ft	
Headloss Across Misc. Process Components			
Well Vault Flow Meter	5	ft	1 psi = 2.31 ft
Wye-Strainer	12	ft	
In-Building Flow Meter	5	ft	
Static Mixer	12	ft	
Required Discharge Pressure (0 psi)	0	ft	
Total Dynamic Head Required - Calculated	**164**	ft	
Design Safety Factor	**25%**		
Total Dynamic Head Required - Design	**205**	**feet**	

Pump Design Requirements:

Flow	**1.8**	gpm
Total Dynamic Head	**205**	feet

Inputs
Formulas or Constant

Calculation 7

EXTRACTION WELL PUMP (EW-2013; TRENCH 4) DESIGN CALCULATIONS

Total Dynamic Head Calculation

Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =
- headloss due to elevation change
- headloss due to pipe friction
- headloss across misc. process components
- required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Perella
Date: 6/15/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	60	feet
	Head loss, h_e =	60	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

f = .2083 * (100/C)$^{1.852}$ * (q$^{1.852}$) / (D$^{4.8655}$)

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (100 for new stainless steel pipe, 150 for hdpe pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
1	1.049	0.924
1.25	1.380	1.255
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94

NOTES: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Pipe Section	Nominal Pipe Diameter (in)	Inside Pipe Diameter (in)	Flow (gpm)	C	f (ft/100 ft water)
Well Extraction	1	0.924	2.08	100	1.2
EW-2013 to EW-2012	1.25	1.255	2.08	150	0.1
EW-2012 to EW-4002	1.25	1.255	4.17	150	0.5
EW-4002 to EW-3001	1.25	1.255	5.94	150	0.9
EW-3001 to EW-3002	1.25	1.255	7.53	150	1.4
EW-3002 to EW-3003	1.25	1.255	9.13	150	2.0
EW-3003 to BLDG	1.25	1.255	10.72	150	2.6
INSIDE BLDG	6	5.94	201.50	100	0.7

EXTRACTION WELL PUMP (EW-2013; TRENCH 4) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each section

	Equivalent Length per Fitting (ft)						
Nominal Fitting size	1 in	1.25 in	1.5 in	2 in	3 in	4 in	6 in
90 Elbows	2.7	3.2	3.4	3.6	4.0	4.6	10.4
Standard Tee (thru flow)	3.2	4.6	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	8.7	9.9	12.0	17.0	21.0	47.3
Ball valve (full open)	1.6	2.0	2.3	2.9	4.3	5.5	12.3
Butterfly valve (full open)	3.9	5.3					26.0
Check Valve - Spring and Swing	11.0	13.0	15.0	19.0	27.0	38.0	85.5
Union	0.3	0.4	0.4	0.5	0.5	0.7	1.5
Expansion (1"/1.25")	1.0	1.3	1.5	1.5	3.0	4.0	9.0
Expansion (1.25"/1.5")	1.5	2.0	2.5	3.0	4.0	6.0	13.5
Expansion (1.5"/2")	1.5	2.0	2.5	3.0	4.0	6.0	13.5
Expansion (2"/6")	1.5	2.0	2.5	3.0	4.0	6.0	13.5

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

EW-2013 (Extraction Well and Wellhead)

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	40	40
90 Elbows	1	2.7	2.7
Check Valve - Spring and Swing	1	11	11
Standard Tee (thru flow)	2	3.2	6.4
Butterfly valve (full open)	1	3.9	3.9
Expansion (1" x 1.25")	1	1	1
Union	1	0.29	0.29
		Equivalent Length:	**66**

EW-2013 to EW-2012

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	565	565
		Equivalent Length:	**565**

EW-2012 to EW-4002

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	190	190
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**195**

EW-4002 to EW-3001

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	30	30
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**35**

EW-3001 to EW-3002

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	120	120
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**125**

EXTRACTION WELL PUMP (EW-2013; TRENCH 4) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

EW-3002 to EW-3003

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	120	120
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**125**

EW-3003 to Building

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	265	265
Standard Tee (thru flow)	1	4.6	4.6
90 Elbows	1	3.2	3.2
		Equivalent Length:	**273**

Inside Building (6" Piping)

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	100	100
Butterfly valve (full open)	5	26	130
Reducer (6" to 2")	1	13	13
Reducer (2" to 6")	1	13	13
Standard Tee (thru flow)	4	4.6	18.4
90 Elbows	3	85.5	256.5
		Equivalent Length:	**531**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Total Pipe Friction - EW-2013 (Extraction Well and Wellhead)
total equivalent length = 66 feet
friction factor = 1.2 feet water / 100 feet of pipe

Total Pipe Friction = 0.8 feet

Total Pipe Friction - EW-2013 to EW-2012
total equivalent length = 565 feet
friction factor = 0.1 feet water / 100 feet of pipe

Total Pipe Friction = 0.7 feet

Total Pipe Friction - EW-2012 to EW-4002
total equivalent length = 195 feet
friction factor = 0.5 feet water / 100 feet of pipe

Total Pipe Friction = 0.9 feet

Total Pipe Friction - EW-4002 to EW-3001
total equivalent length = 35 feet
friction factor = 0.9 feet water / 100 feet of pipe

Total Pipe Friction = 0.3 feet

EXTRACTION WELL PUMP (EW-2013; TRENCH 4) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total Pipe Friction - EW-3001 to EW-3002

total equivalent length =	125	feet
friction factor =	1.4	feet water / 100 feet of pipe
Total Pipe Friction =	1.7	feet

Total Pipe Friction - EW-3002 to EW-3003

total equivalent length =	125	feet
friction factor =	2.0	feet water / 100 feet of pipe
Total Pipe Friction =	2.4	feet

Total Pipe Friction - EW-3003 to Building

total equivalent length =	273	feet
friction factor =	2.6	feet water / 100 feet of pipe
Total Pipe Friction =	7.2	feet

Total Pipe Friction - Inside Building (6" Piping)

total equivalent length =	531	feet
friction factor =	0.7	feet water / 100 feet of pipe
Total Pipe Friction =	3.5	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	17.6

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	60	ft	
Headloss due to pipe friction	18	ft	
Headloss Across Misc. Process Components			
Well Vault Flow Meter	5	ft	1 psi = 2.31 ft
Wye-Strainer	12	ft	
In-Building Flow Meter	5	ft	
Static Mixer	12	ft	
Required Discharge Pressure (0 psi)	0	ft	
Total Dynamic Head Required - Calculated	**111**	ft	
Design Safety Factor	**25%**		
Total Dynamic Head Required - Design	**138**	**feet**	

Pump Design Requirements:

Flow	**2.1**	gpm
Total Dynamic Head	**138**	feet

Inputs
Formulas or Constant

Calculation 8

EXTRACTION WELL PUMP (EW-2101 (T-1); TRENCH 2) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Perella
Date: 6/15/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	60	feet
	Head loss, h_e =	60	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

f = .2083 * (100/C)$^{1.852}$ * (q$^{1.852}$) / (D$^{4.8655}$)

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness
(100 for new stainless steel pipe, 150 for hdpe pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
1	1.049	0.924
1.25	1.380	1.255
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94

NOTES: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Pipe Section	Nominal Pipe Diameter (in)	Inside Pipe Diameter (in)	Flow (gpm)	C	f (ft/100 ft water)
Well Extraction	1.25	1.255	20.25	100	18.1
EW-2101 to EW-3017	1.5	1.485	20.25	150	3.8
EW-3017+EW-2101 to EW-3016+EW-2102	2	1.942	41.21	150	3.8
EW-3016+EW-2102 to EW-3015	3	2.943	63.06	150	1.1
EW-3015 to EW-3014	3	2.943	64.65	150	1.2
EW-3014 to EW-3013	3	2.943	66.25	150	1.2
EW-3013 to EW-3012	3	2.943	67.84	150	1.3
EW-3012 to BLDG	3	2.943	69.44	150	1.3
INSIDE BLDG	6	5.94	201.50	100	0.7

EXTRACTION WELL PUMP (EW-2101 (T-1); TRENCH 2) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each section

	Equivalent Length per Fitting (ft)					
Nominal Fitting size	1 in	1.25 in	1.5 in	2 in	3 in	4 in
90 Elbows	2.7	3.2	3.4	3.6	4.0	4.6
Standard Tee (thru flow)	3.2	4.6	5.6	7.7	12.0	17.0
Standard Tee (branch flow)	6.6	8.7	9.9	12.0	17.0	21.0
Ball valve (full open)	1.6	2.0	2.3	2.9	4.3	5.5
Butterfly valve (full open)	3.9	5.3				
Check Valve - Spring and Swing	11.0	13.0	15.0	19.0	27.0	38.0
Union	0.3	0.4	0.4	0.5	0.5	0.7
Expansion (1"/1.25")	1.0	1.3	1.5	1.5	3.0	4.0
Expansion (1.25"/1.5")	1.5	2.0	2.5	3.0	4.0	6.0
Expansion (1.5"/2")	1.5	2.0	2.5	3.0	4.0	6.0
Expansion (2"/6")	1.5	2.0	2.5	3.0	4.0	6.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

EW-2101 (Extraction Well and Wellhead)

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	40	40
90 Elbows	1	3.2	3.2
Check Valve - Spring and Swing	1	13	13
Standard Tee (thru flow)	2	4.6	9.2
Ball Valve (full open)	1	2	2
Expansion (1" x 1.25")	0	1.25	0
Union	1	0.36	0.36
		Equivalent Length:	**68**

EW-2101 to EW-3017

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	400	400
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**405**

EW-3017+EW-2101 to EW-3016+EW-2102

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	230	230
Standard Tee (thru flow)	1	5.6	5.6
		Equivalent Length:	**236**

EW-3016+EW-2102 to EW-3015

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	150	150
Standard Tee (thru flow)	1	5.6	5.6
		Equivalent Length:	**156**

EW-3015 to EW-3014

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	140	140
Standard Tee (thru flow)	1	5.6	5.6
		Equivalent Length:	**146**

EW-3014 to EW-3013

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	145	145
Expander (1.5" to 2")	1	3	3
Standard Tee (thru flow)	1	7.7	7.7
		Equivalent Length:	**156**

EXTRACTION WELL PUMP (EW-2101 (T-1); TRENCH 2) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

EW-3013 to EW-3012

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	170	170
Standard Tee (thru flow)	1	7.7	7.7
		Equivalent Length:	**178**

EW-3012 to Building

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	405	405
Standard Tee (thru flow)	1	7.7	7.7
90 Elbows	1	3.6	3.6
		Equivalent Length:	**417**

Inside Building (6" Piping)

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	100	100
Butterfly valve (full open)	5	26	130
Reducer (6" to 2")	1	3	3
Expander (2" to 6")	1	13.5	13.5
Standard Tee (thru flow)	4	4.6	18.4
90 Elbows	3	85.5	256.5
		Equivalent Length:	**522**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Total Pipe Friction - EW-2101 (Extraction Well and Wellhead)
total equivalent length = 68 feet
friction factor = 18.1 feet water / 100 feet of pipe

Total Pipe Friction = 12.3 feet

Total Pipe Friction - EW-2101 to EW-3017
total equivalent length = 405 feet
friction factor = 3.8 feet water / 100 feet of pipe

Total Pipe Friction = 15.3 feet

Total Pipe Friction - EW-3017+EW-2101 to EW-3016+EW-2102
total equivalent length = 236 feet
friction factor = 3.8 feet water / 100 feet of pipe

Total Pipe Friction = 9.0 feet

Total Pipe Friction - EW-3016+EW-2102 to EW-3015
total equivalent length = 156 feet
friction factor = 1.1 feet water / 100 feet of pipe

Total Pipe Friction = 1.7 feet

Total Pipe Friction - EW-3015 to EW-3014
total equivalent length = 146 feet
friction factor = 1.2 feet water / 100 feet of pipe

Total Pipe Friction = 1.7 feet

Total Pipe Friction - EW-3014 to EW-3013
total equivalent length = 156 feet
friction factor = 1.2 feet water / 100 feet of pipe

Total Pipe Friction = 1.9 feet

Total Pipe Friction - EW-3013 to EW-3012
total equivalent length = 178 feet
friction factor = 1.3 feet water / 100 feet of pipe

Total Pipe Friction = 2.3 feet

EXTRACTION WELL PUMP (EW-2101 (T-1); TRENCH 2) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total Pipe Friction - EW-3012 to Building			
total equivalent length =	417	feet	
friction factor =	1.3	feet water / 100 feet of pipe	
Total Pipe Friction =	5.5	feet	
Total Pipe Friction - Inside Building (6" Piping)			
total equivalent length =	522	feet	
friction factor =	0.7	feet water / 100 feet of pipe	
Total Pipe Friction =	3.5	feet	

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	53.2		

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	60	ft	
Headloss due to pipe friction	53	ft	
Headloss Across Misc. Process Components			
Well Vault Flow Meter	5	ft	1 psi = 2.31 ft
Wye-Strainer	12	ft	
In-Building Flow Meter	5	ft	
Static Mixer	12	ft	
Required Discharge Pressure (0 psi)	0	ft	
Total Dynamic Head Required - Calculated	**146**	ft	
Design Safety Factor	**25%**		
Total Dynamic Head Required - Design	**183**	**feet**	

Pump Design Requirements:

Flow	**20.3**	gpm
Total Dynamic Head	**183**	feet

Inputs
Formulas or Constant

Calculation 9

EXTRACTION WELL PUMP (EW-2104 (T-4); TRENCH 3) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =
- headloss due to elevation change
- headloss due to pipe friction
- headloss across misc. process components
- required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Perella
Date: 6/15/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	60	feet
	Head loss, h_e =	60	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

f = $.2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (100 for new stainless steel pipe, 150 for hdpe pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
1	1.049	0.924
1.25	1.380	1.255
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94

NOTES: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Pipe Section	Nominal Pipe Diameter (in)	Inside Pipe Diameter (in)	Flow (gpm)	C	f (ft/100 ft water)
Well Extraction	1.25	1.255	20.25	100	18.1
EW-2104 to Point G	1.5	1.485	20.25	150	3.8
EW-2104 to EW-2103	2	1.942	29.74	150	2.1
EW-2103 TO EW-4008	3	2.943	49.99	150	0.7
EW-4008 TO Point D	3	2.943	51.76	150	0.8
Point D TO EW-4009	3	2.943	61.68	150	1.1
EW-4009 TO BLDG	3	2.943	65.05	150	1.2
INSIDE BLDG	6	5.94	201.50	100	0.7

EXTRACTION WELL PUMP (EW-2104 (T-4); TRENCH 3) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each section

	Equivalent Length per Fitting (ft)						
Nominal Fitting size	1 in	1.25 in	1.5 in	2 in	3 in	4 in	6 in
90 Elbows	2.7	3.2	3.4	3.6	4.0	4.6	10.4
Standard Tee (thru flow)	3.2	4.6	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	8.7	9.9	12.0	17.0	21.0	47.3
Ball valve (full open)	1.6	2.0	2.3	2.9	4.3	5.5	12.3
Butterfly valve (full open)	3.9	5.3					26.0
Check Valve - Spring and Swing	11.0	13.0	15.0	19.0	27.0	38.0	85.5
Union	0.3	0.4	0.4	0.5	0.5	0.7	1.5
Expansion (1"/1.25")	1.0	1.3	1.5	1.5	3.0	4.0	9.0
Expansion (1.25"/1.5")	1.5	2.0	2.5	3.0	4.0	6.0	13.5
Expansion (1.5"/2")	1.5	2.0	2.5	3.0	4.0	6.0	13.5
Expansion (2"/6")	1.5	2.0	2.5	3.0	4.0	6.0	13.5

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

EW-2104 (Extraction Well and Wellhead)

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	40	40
90 Elbows	1	3.2	3.2
Check Valve - Spring and Swing	1	13	13
Standard Tee (thru flow)	2	4.6	9.2
Butterfly valve (full open)	1	5.3	5.3
Expansion (1" x 1.25")	1	1.25	1.25
Union	1	0.36	0.36
		Equivalent Length:	**73**

EW-2104 to Point G

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	150	150
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**155**

EW-2104 to EW-2103

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	200	200
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**205**

EW-2103 to EW-4008

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	200	200
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**205**

EW-4008 to Point D

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	425	425
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**430**

Point D to EW-4009

		Equivalent Length	
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	580	580
Standard Tee (thru flow)	1	4.6	4.6
		Equivalent Length:	**585**

EXTRACTION WELL PUMP (EW-2104 (T-4); TRENCH 3) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

EW-4009 to Building

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	1,585	1,585
Standard Tee (thru flow)	1	4.6	4.6
90 Elbows	1	3.2	3.2
		Equivalent Length:	**1,593**

Inside Building (6" Piping)

Item	Qty.	Equivalent Length L (ft)	Qty * L
Linear Pipe (L_1)	1	100	100
Butterfly valve (full open)	5	26	130
Reducer (6" to 2")	1	13	13
Reducer (2" to 6")	1	13	13
Standard Tee (thru flow)	4	4.6	18.4
90 Elbows	3	85.5	256.5
		Equivalent Length:	**531**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Total Pipe Friction - EW-2104 (Extraction Well and Wellhead)
total equivalent length = 73 feet
friction factor = 18.1 feet water / 100 feet of pipe

Total Pipe Friction = 13.2 feet

Total Pipe Friction - EW-2104 to Point G
total equivalent length = 155 feet
friction factor = 3.8 feet water / 100 feet of pipe

Total Pipe Friction = 5.8 feet

Total Pipe Friction - EW-2104 to EW-2103
total equivalent length = 205 feet
friction factor = 2.1 feet water / 100 feet of pipe

Total Pipe Friction = 4.3 feet

Total Pipe Friction - EW-2103 to EW-4008
total equivalent length = 205 feet
friction factor = 0.7 feet water / 100 feet of pipe

Total Pipe Friction = 1.5 feet

Total Pipe Friction - EW-4008 to Point D
total equivalent length = 430 feet
friction factor = 0.8 feet water / 100 feet of pipe

Total Pipe Friction = 3.3 feet

Total Pipe Friction - Point D to EW-4009
total equivalent length = 585 feet
friction factor = 1.1 feet water / 100 feet of pipe

Total Pipe Friction = 6.2 feet

Total Pipe Friction - EW-4009 to BLDG
total equivalent length = 1,593 feet
friction factor = 1.2 feet water / 100 feet of pipe

Total Pipe Friction = 18.7 feet

EXTRACTION WELL PUMP (EW-2104 (T-4); TRENCH 3) DESIGN CALCULATIONS
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total Pipe Friction - Inside Building (6" Piping)			
total equivalent length =	531	feet	
friction factor =	0.7	feet water / 100 feet of pipe	
Total Pipe Friction =	3.5	feet	

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	56.6	

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	60	ft	
Headloss due to pipe friction	57	ft	
Headloss Across Misc. Process Components			
Well Vault Flow Meter	5	ft	1 psi = 2.31 ft
Wye-Strainer	12	ft	
In-Building Flow Meter	5	ft	
Static Mixer	12	ft	
Required Discharge Pressure (0 psi)	0	ft	
Total Dynamic Head Required - Calculated	**150**	ft	
Design Safety Factor	**25%**		
Total Dynamic Head Required - Design	**187**	**feet**	

Pump Design Requirements:

Flow	**20.3**	gpm
Total Dynamic Head	**187**	feet

Inputs
Formulas or Constant

Calculation 10

SUMMARY of PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Pump	Flow (gpm)	Total Dynamic Head (ft)
P-150A/B	30	108
P-200A/B/C	100	169
P-210A/B	400	117
P-230A/B	400	138
P-300A/B	300	189
P-300C	150	122
P-310A/B/C	125	152
P-400A/B	280	113
P-500A/B	300	92
P-510	10	109
P-600A/B	100	125
P-620	45	106
P-640	100	330
P-660	70	174
P-800A/B	30	51
P-1000A/B	10	260
P-1200	30	40
P-1300	30	41

Calculation 11

P-150A/B AERATOR RECIRCULATION PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	25	feet
	Head loss, h_e =	25	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	1.5	inch
(P-150A/B to T-110A/B)	Flow (q_1) =	30	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

f = .2083 * (100/C)$^{1.852}$ * (q$^{1.852}$) / (D$^{4.8655}$)

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1 - (P-150A/B to T-110A/B)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	30	gal/min
D_1 = Inner pipe diameter (inches)	1.485	inches (see NOTE)
Pipe Section 1 friction factor	10.2	ft water / 100 feet of pipe

Step 3. Calculate the equivalent length of pipe for each section

	Equivalent Length per Fitting (ft)					
Nominal Fitting size	1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

P-150A/B AERATOR RECIRCULATION PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Pipe Section 1 - (P-150A/B to T-110A/B) - 1.5" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	85	85
Standard Tee (thru flow)	1	5.6	6
Standard Tee (branch flow)	3	9.9	30
Expansion	0	2.5	0
90 Elbows	4	3.4	13.6
Check Valve - Spring	1	15	15
Ball valve (full open)	6	2.3	13.8
		Equivalent Length:	**163**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-150A/B to T-110A/B)

total equivalent length =	163	feet
friction factor =	10.2	feet water / 100 feet of pipe
Total Pipe Friction =	16.6	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	16.6

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation		25	ft
Headloss due to pipe friction		17	ft
Headloss Across Misc. Process Components			1 psi = 2.31 ft
	A-150A/B Aerator	40	ft
	Flow meter	5	ft
Required Discharge Pressure (0 psi)		0	ft
Total Dynamic Head Required - Calculated		**87**	ft
Design Safety Factor		**25%**	
Total Dynamic Head Required - Design		**108**	**feet**

Pump Design Requirements:

Flow	**30**	gpm
Total Dynamic Head	**108**	feet

Inputs
Formulas or Constant

Calculation 12

P-200A/B/C FILTER FEED PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	15	feet
	Head loss, h_e =	15	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	3	inch
(P-200A/B/C to F-210A/B/C)	Flow (q_1) =	100	gpm
Pipe Section 2	Nominal pipe diameter $_2$ =	3	inch
(F-210A/B/C to F-230A/B/C)	Flow (q_2) =	100	gpm
Pipe Section 3	Nominal pipe diameter $_3$ =	4	inch
(F-230A/B/C to T-300)	Flow (q_3) =	100	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

$$f = .2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$$

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1 - (P-200A/B/C to F-210A/B/C)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	100	gal/min
D_1 = Inner pipe diameter (inches)	2.943	inches (see NOTE)
Pipe Section 1 friction factor	3.4	ft water / 100 feet of pipe

P-200A/B/C FILTER FEED PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Friction factor for Pipe Section 2 - (F-210A/B/C to F-230A/B/C)		
C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	100	gal/min
D_2 = Inner pipe diameter (inches)	2.943	inches (see NOTE)
Pipe Section 2 friction factor	3.4	ft water / 100 feet of pipe

Friction factor for Pipe Section 3 - (F-230A/B/C to T-300)		
C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	100	gal/min
D_3 = Inner pipe diameter (inches)	3.901	inches (see NOTE)
Pipe Section 3 friction factor	0.9	ft water / 100 feet of pipe

Step 3. Calculate the equivalent length of pipe for each section

	Equivalent Length per Fitting (ft)					
Nominal Fitting size	1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 - (P-200A/B/C to F-210A/B/C) - 3" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	55	55
Standard Tee (thru flow)	0	12	0
Standard Tee (branch flow)	0	17	0
Expansion	0	4	0
90 Elbows	4	4	16
Check Valve - Spring	1	27	27
Ball valve (full open)	2	4.3	8.5
		Equivalent Length:	**107**

Pipe Section 2 - (F-210A/B/C to F-230A/B/C) - 3" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	45	45
Standard Tee (thru flow)	2	12	24
Standard Tee (branch flow)	0	17	0
Expansion	1	4	4
90 Elbows	4	4	16
Check Valve - Spring	0	27	0
Ball valve (full open)	8	4.3	34.1
		Equivalent Length:	**124**

Pipe Section 3 - (F-230A/B/C to T-300) - 4" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	42	42
Standard Tee (thru flow)	0	17	0
Standard Tee (branch flow)	0	21	0
Expansion	0	6	0
90 Elbows	4	4.6	18.4
Check Valve - Spring	0	38	0
Ball valve (full open)	1	5.47	5.47
		Equivalent Length:	**66**

P-200A/B/C FILTER FEED PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-200A/B/C to F-210A/B/C)

total equivalent length =	107	feet
friction factor =	3.4	feet water / 100 feet of pipe
Total Pipe Friction =	3.6	feet

Pipe Section 2 - (F-210A/B/C to F-230A/B/C)

total equivalent length =	124	feet
friction factor =	3.4	feet water / 100 feet of pipe
Total Pipe Friction =	4.2	feet

Pipe Section 3 - (F-230A/B/C to T-300)

total equivalent length =	66	feet
friction factor =	0.9	feet water / 100 feet of pipe
Total Pipe Friction =	0.6	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	8.4	

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	15	ft
Headloss due to pipe friction	8	ft
Headloss Across Misc. Process Components		
F-201A/B/C Media Filter	45	ft
F-220A /B/C Wye Strainer	12	ft
F-230A/B/C Ultrafilter	50	ft
Flow meter	5	ft
Required Discharge Pressure (0 psi)	0	ft
Total Dynamic Head Required - Calculated	**135**	ft
Design Safety Factor	**25%**	
Total Dynamic Head Required - Design	**169**	**feet**

1 psi = 2.31 ft

Pump Design Requirements:

Flow	**100**	gpm
Total Dynamic Head	**169**	feet

Inputs
Formulas or Constant

Calculation 13

P-210A/B MEDIA FILTER BACKWASH PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	18	feet
	Head loss, h_e =	18	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	6	inch
(P-210A/B to F-210A/B/C)	Flow (q_1) =	400	gpm
Pipe Section 2	Nominal pipe diameter $_2$ =	6	inch
(F-210A/B/C to T-800)	Flow (q_2) =	400	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

f = .2083 * (100/C)$^{1.852}$ * (q$^{1.852}$) / (D$^{4.8655}$)

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1 - (P-210A/B to F-210A/B/C)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	400	gal/min
D_1 = Inner pipe diameter (inches)	5.94	inches (see NOTE)
Pipe Section 1 friction factor	1.5	ft water / 100 feet of pipe

Friction factor for Pipe Section 2 - (F-210A/B/C to T-800)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	400	gal/min
D_2 = Inner pipe diameter (inches)	5.94	inches (see NOTE)
Pipe Section 2 friction factor	1.5	ft water / 100 feet of pipe

P-210A/B MEDIA FILTER BACKWASH PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each section

Nominal Fitting size	Equivalent Length per Fitting (ft) 1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 - (P-210A/B to F-210A/B/C) - 6" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	65	65
Standard Tee (thru flow)	2	38.3	76.5
Standard Tee (branch flow)	0	47.3	0.0
Expansion	0	13.5	0.0
90 Elbows	4	10.4	41.4
Check Valve - Spring	1	85.5	85.5
Ball valve (full open)	4	12.3	49.2
		Equivalent Length:	**318**

Pipe Section 2 - (F-210A/B/C to T-800) - 6" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	55	55
Standard Tee (thru flow)	3	38.3	114.8
Standard Tee (branch flow)	0	47.3	0.0
Expansion	0	13.5	0.0
90 Elbows	4	10.4	41.4
Check Valve - Spring	0	85.5	0.0
Ball valve (full open)	4	12.3	49.2
		Equivalent Length:	**261**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-210A/B to F-210A/B/C)

total equivalent length =	318	feet
friction factor =	1.5	feet water / 100 feet of pipe
Total Pipe Friction =	4.6	feet

Pipe Section 2 - (F-210A/B/C to T-800)

total equivalent length =	261	feet
friction factor =	1.5	feet water / 100 feet of pipe
Total Pipe Friction =	3.8	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections = 8.4

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	18	ft
Headloss due to pipe friction	8	ft
Headloss Across Misc. Process Components		1 psi = 2.31 ft
F-210A/B/C Media Filter	50	ft
Flow meter	5	ft
Wye Strainer	12	ft
Required Discharge Pressure (0 psi)	0	
Total Dynamic Head Required - Calculated	**93**	ft
Design Safety Factor	**25%**	
Total Dynamic Head Required - Design	**117**	**feet**

Pump Design Requirements:

Flow	**400**	gpm
Total Dynamic Head	**117**	feet

Inputs
Formulas or Constant

Calculation 14

P-230A/B ULTRAFILTER BACKWASH PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	18	feet
	Head loss, h_e =	18	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	6	inch
(P-230A/B/C to F-230A/B/C)	Flow (q_1) =	400	gpm
Pipe Section 2	Nominal pipe diameter $_2$ =	6	inch
(F-230A/B/C to T-800)	Flow (q_2) =	400	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

$$f = .2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$$

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1 - (P-230A/B/C to F-230A/B/C)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	400	gal/min
D_1 = Inner pipe diameter (inches)	5.94	inches (see NOTE)
Pipe Section 1 friction factor	1.5	ft water / 100 feet of pipe

Friction factor for Pipe Section 2 - (F-230A/B/C to T-800)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	400	gal/min
D_2 = Inner pipe diameter (inches)	5.94	inches (see NOTE)
Pipe Section 2 friction factor	1.5	ft water / 100 feet of pipe

P-230A/B ULTRAFILTER BACKWASH PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each section

Nominal Fitting size	Equivalent Length per Fitting (ft) 1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 - (P-230A/B/C to F-230A/B/C) - 6" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	40	40
Standard Tee (thru flow)	3	38.3	114.8
Standard Tee (branch flow)	1	47.3	47.3
Expansion	0	13.5	0.0
90 Elbows	6	10.4	62.1
Check Valve - Spring	1	85.5	85.5
Ball valve (full open)	8	12.3	98.5
		Equivalent Length:	**449**

Pipe Section 2 - (F-230A/B/C to T-800) - 6" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	70	70
Standard Tee (thru flow)	3	38.3	114.8
Standard Tee (branch flow)	0	47.3	0.0
Expansion	0	13.5	0.0
90 Elbows	4	10.4	41.4
Check Valve - Spring	0	85.5	0.0
Ball valve (full open)	4	12.3	49.2
		Equivalent Length:	**276**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-230A/B/C to F-230A/B/C)

total equivalent length =	449	feet
friction factor =	1.5	feet water / 100 feet of pipe
Total Pipe Friction =	6.5	feet

Pipe Section 2 - (F-230A/B/C to T-800)

total equivalent length =	276	feet
friction factor =	1.5	feet water / 100 feet of pipe
Total Pipe Friction =	4.0	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections = 10.5

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	18	ft
Headloss due to pipe friction	11	ft
Headloss Across Misc. Process Components		1 psi = 2.31 ft
F-230A/B/C Ultrafilter	65	ft
Flow meter	5	ft
Wye Strainer	12	ft
Required Discharge Pressure (0 psi)	0	ft
Total Dynamic Head Required - Calculated	**111**	ft
Design Safety Factor	**25%**	
Total Dynamic Head Required - Design	**138**	**feet**

Pump Design Requirements:

Flow	**400**	gpm
Total Dynamic Head	**138**	feet

Inputs
Formulas or Constant

Calculation 15

P-300A/B AOP FEED PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calculate head loss (h_e) due to elevation change:

assume: Height from pump to discharge point = 13 feet
Head loss, h_e = 13 feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

$$f = .2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$$

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Pipe Section	Nominal Pipe Diameter (in)	Inside Pipe Diameter (in)	Flow (gpm)	C	f (ft/100 ft water)
Pipe Section 1 - P-300A/B Discharge Line	3	2.943	101	130	3.5
Pipe Section 2 - P-300A/B to Photo Cat PC-310A/B	4	3.901	300	130	6.6
Pipe Section 3 - Photo Cat inlet/outlet piping	3	2.943	101	130	3.5
Pipe Section 4 - Photo Cat to F-400A	4	3.901	101	130	0.9

Step 3. Calculate the equivalent length of pipe for each section

Nominal Fitting size	Equivalent Length per Fitting (ft) 1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

P-300A/B AOP FEED PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Pipe Section 1 - (P-300A/B Discharge Line) - 3" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	5	5
Standard Tee (thru flow)	0	12	0
Standard Tee (branch flow)	0	17	0
Expansion (3"x4")	1	4	4
90 Elbows	4	4	16
Check Valve - Spring	1	27	27
Ball valve (full open)	1	4.3	4.3
		Equivalent Length:	**57**

Pipe Section 2 - (P-300A/B to Photo Cat PC-310A/B) - 4" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	55	55
Standard Tee (thru flow)	2	17	34
Standard Tee (branch flow)	2	21	42
Reducer (4"x3")	1	4	4
90 Elbows	4	4.6	18.4
Check Valve - Spring	0	38	0
Ball valve (full open)	2	5.47	10.94
		Equivalent Length:	**165**

Pipe Section 3 - (Photo Cat inlet/outlet piping) - 3" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	10	10
Standard Tee (thru flow)	0	12	0
Standard Tee (branch flow)	0	17	0
Expansion (3"x4")	1	4	4
90 Elbows	4	4	16
Check Valve - Spring	1	27	27
Ball valve (full open)	3	4.26	12.78
		Equivalent Length:	**70**

Pipe Section 4 - (Photo Cat to F-400A) - 4" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	48	48
Standard Tee (thru flow)	0	17	0
Standard Tee (branch flow)	1	21	21
Reducer (4"x3")	1	4	4
90 Elbows	4	4.6	18.4
Check Valve - Spring	0	38	0
Ball valve (full open)	0	5.47	0
		Equivalent Length:	**92**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-300A/B Discharge Line)
total equivalent length = 57 feet
friction factor = 3.5 feet water / 100 feet of pipe

Total Pipe Friction = 2.0 feet

Pipe Section 2 - (P-300A/B to Photo Cat PC-310A/B)
total equivalent length = 165 feet
friction factor = 6.6 feet water / 100 feet of pipe

Total Pipe Friction = 10.9 feet

Pipe Section 3 - (Photo Cat inlet/outlet piping)
total equivalent length = 70 feet
friction factor = 3.5 feet water / 100 feet of pipe

Total Pipe Friction = 2.4 feet

Pipe Section 4 - (Photo Cat to F-400A)
total equivalent length = 92 feet
friction factor = 0.9 feet water / 100 feet of pipe

Total Pipe Friction = 0.8 feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections = 16.1

P-300A/B AOP FEED PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation		13	ft
Headloss due to pipe friction		16	ft
Headloss Across Misc. Process Components			
	Static Mixer (SM-300)	12	ft
	Photo-Cat PC-310A/B	105	ft
	Flow meter	5	ft
Required Discharge Pressure (0 psi)		0	ft
Total Dynamic Head Required - Calculated		**151**	ft
Design Safety Factor		**25%**	
Total Dynamic Head Required - Design		**189**	**feet**

1 psi = 2.31 ft

Pump Design Requirements:

Flow	**300**	gpm
Total Dynamic Head	**189**	feet

Inputs
Formulas or Constant

Calculation 16

P-300C AOP FEED PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	13	feet
	Head loss, h_e =	13	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

$$f = .2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$$

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Pipe Section	Nominal Pipe Diameter (in)	Inside Pipe Diameter (in)	Flow (gpm)	C	f (ft/100 ft water)
Pipe Section 1 - P-300C Discharge Line	3	2.943	101	130	3.5
Pipe Section 2 - P-300C to Photo Cat PC-310C	4	3.901	150	130	1.8
Pipe Section 3 - Photo Cat inlet/outlet piping	3	2.943	101	130	3.5
Pipe Section 4 - Photo Cat to F-400A	4	3.901	101	130	0.9

Step 3. Calculate the equivalent length of pipe for each section

Nominal Fitting size	Equivalent Length per Fitting (ft) 1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90• Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 - (P-300C Discharge Line) - 3" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	5	5
Standard Tee (thru flow)	0	12	0
Standard Tee (branch flow)	0	17	0
Expansion (3"x4")	1	4	4
90• Elbows	4	4	16
Check Valve - Spring	1	27	27
Ball valve (full open)	1	4.3	4.3
		Equivalent Length:	**57**

Pipe Section 2 - (P-300C to Photo Cat PC-310C) - 4" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	55	55
Standard Tee (thru flow)	2	17	34
Standard Tee (branch flow)	2	21	42
Reducer (4"x3")	1	4	4
90• Elbows	4	4.6	18.4
Check Valve - Spring	0	38	0
Ball valve (full open)	2	5.47	10.94
		Equivalent Length:	**165**

Pipe Section 3 - (Photo Cat inlet/outlet piping) - 3" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	10	10
Standard Tee (thru flow)	0	12	0
Standard Tee (branch flow)	0	17	0
Expansion (3"x4")	1	4	4
90• Elbows	4	4	16
Check Valve - Spring	1	27	27
Ball valve (full open)	3	4.26	12.78
		Equivalent Length:	**70**

Pipe Section 4 - (Photo Cat to F-400A) - 4" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	48	48
Standard Tee (thru flow)	0	17	0
Standard Tee (branch flow)	1	21	21
Reducer (4"x3")	1	4	4
90• Elbows	4	4.6	18.4
Check Valve - Spring	0	38	0
Ball valve (full open)	0	5.47	0
		Equivalent Length:	**92**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-300A/B/C Discharge Line)

total equivalent length =	57	feet
friction factor =	3.5	feet water / 100 feet of pipe
Total Pipe Friction =	2.0	feet

Pipe Section 2 - (P-300A/B/C to Photo Cat PC-310A/B/C)

total equivalent length =	165	feet
friction factor =	1.8	feet water / 100 feet of pipe
Total Pipe Friction =	3.0	feet

Pipe Section 3 - (Photo Cat inlet/outlet piping)

total equivalent length =	70	feet
friction factor =	3.5	feet water / 100 feet of pipe
Total Pipe Friction =	2.4	feet

Pipe Section 4 - (Photo Cat to F-400A)

total equivalent length =	92	feet
friction factor =	0.9	feet water / 100 feet of pipe
Total Pipe Friction =	0.8	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections = 8.2

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation		13	ft
Headloss due to pipe friction		8	ft
Headloss Across Misc. Process Components			
	Static Mixer (SM-300)	6	ft
	Photo-Cat PC-310C	65	ft
	Flow meter	5	ft
Required Discharge Pressure (0 psi)		0	ft
Total Dynamic Head Required - Calculated		**97**	ft
Design Safety Factor		**25%**	
Total Dynamic Head Required - Design		**122**	**feet**

1 psi = 2.31 ft

Pump Design Requirements:

	Flow	**150**	gpm
	Total Dynamic Head	**122**	feet

Inputs
Formulas or Constant

Calculation 17

P-310A/B/C AOP DISCHARGE PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date:

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	15	feet
	Head loss, h_e =	15	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	3	inch
(F-400A to F-400B)	Flow (q_1) =	125	gpm
Pipe Section 2	Nominal pipe diameter $_2$ =	3	inch
(F-400B to F-400C)	Flow (q_2) =	125	gpm
Pipe Section 3	Nominal pipe diameter $_3$ =	3	inch
(F-400C Discharge Piping)	Flow (q_3) =	125	gpm
Pipe Section 4	Nominal pipe diameter $_4$ =	4	inch
(F-400C to T-500)	Flow (q_4) =	125	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

$$f = .2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$$

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1 - (F-400A to F-400B)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	125	gal/min
D_1 = Inner pipe diameter (inches)	2.943	inches (see NOTE)
Pipe Section 1 friction factor	5.1	ft water / 100 feet of pipe

P-310A/B/C AOP DISCHARGE PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Friction factor for Pipe Section 2 - (F-400B to F-400C)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	125	gal/min
D_2 = Inner pipe diameter (inches)	2.943	inches (see NOTE)
Pipe Section 2 friction factor	5.1	ft water / 100 feet of pipe

Friction factor for Pipe Section 3 - (F-400C Discharge Piping)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	125	gal/min
D_3 = Inner pipe diameter (inches)	2.943	inches (see NOTE)
Pipe Section 3 friction factor	5.1	ft water / 100 feet of pipe

Friction factor for Pipe Section 4 - (F-400C to T-500)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	125	gal/min
D_4 = Inner pipe diameter (inches)	3.901	inches (see NOTE)
Pipe Section 4 friction factor	1.3	ft water / 100 feet of pipe

Step 3. Calculate the equivalent length of pipe for each section

	Equivalent Length per Fitting (ft)					
Nominal Fitting size	1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 - (F-400A to F-400B) - 3" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	25	25
Standard Tee (thru flow)	4	12.0	48.0
Standard Tee (branch flow)	1	17.0	17.0
Expansion	0	4.0	0.0
90 Elbows	6	4.0	24.0
Check Valve - Spring	0	27.0	0.0
Ball valve (full open)	3	4.3	12.8
		Equivalent Length:	**127**

Pipe Section 2 - (F-400B to F-400C) - 3" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	25	25
Standard Tee (thru flow)	4	12.0	48.0
Standard Tee (branch flow)	1	17.0	17.0
Expansion	0	4.0	0.0
90 Elbows	6	4.0	24.0
Check Valve - Spring	0	27.0	0.0
Ball valve (full open)	3	4.3	12.8
		Equivalent Length:	**127**

Pipe Section 3 - (F-400C Discharge Piping) - 3" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	5	5
Standard Tee (thru flow)	2	12.0	24.0
Standard Tee (branch flow)	1	17.0	17.0
Expansion	0	4.0	0.0
90 Elbows	6	4.0	24.0
Check Valve - Spring	0	27.0	0.0
Ball valve (full open)	3	4.3	12.8
		Equivalent Length:	**83**

P-310A/B/C AOP DISCHARGE PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Pipe Section 4 - (F-400C to T-500) - 4" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_t)	1	30	30
Standard Tee (thru flow)	2	17.0	34.0
Standard Tee (branch flow)	0	21.0	0.0
Expansion	0	6.0	0.0
90 Elbows	4	4.6	18.4
Check Valve - Spring	0	38.0	0.0
Ball valve (full open)	1	5.5	5.5
		Equivalent Length:	**88**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (F-400A to F-400B)
total equivalent length = 127 feet
friction factor = 5.1 feet water / 100 feet of pipe

Total Pipe Friction = 6.5 feet

Pipe Section 2 - (F-400B to F-400C)
total equivalent length = 127 feet
friction factor = 5.1 feet water / 100 feet of pipe

Total Pipe Friction = 6.5 feet

Pipe Section 3 - (F-400C Discharge Piping)
total equivalent length = 83 feet
friction factor = 5.1 feet water / 100 feet of pipe

Total Pipe Friction = 4.3 feet

Pipe Section 4 - (F-400C to T-500)
total equivalent length = 88 feet
friction factor = 1.3 feet water / 100 feet of pipe

Total Pipe Friction = 1.1 feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections = 17.3

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation		15	ft
Headloss due to pipe friction		17	ft
Headloss Across Misc. Process Components			1 psi = 2.31 ft
	AOP CRU	70	ft
	F-400A GAC Vessel	2	ft
	F-400B GAC Vessel	2	ft
	F-400C GAC Vessel	2	ft
	Wye Strainer	12	ft
Required Discharge Pressure (0 psi)		0	ft
Total Dynamic Head Required - Calculated		**121**	ft
Design Safety Factor		**25%**	
Total Dynamic Head Required - Design		**152**	**feet**

Pump Design Requirements:

Flow	**125**	gpm
Total Dynamic Head	**152**	feet

Inputs
Formulas or Constant

Calculation 18

P-400A/B GAC BACKWASH PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	16	feet
	Head loss, h_e =	16	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	6	inch
(P-400A/B to F-420A/B/C/D)	Flow (q_1) =	280	gpm
Pipe Section 2	Nominal pipe diameter $_2$ =	3	inch
(Cartridge Filter Piping)	Flow (q_2) =	140	gpm
Pipe Section 3	Nominal pipe diameter $_3$ =	6	inch
(F-420A/B/C/D to T-500)	Flow (q_3) =	280	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

f = .2083 * (100/C)$^{1.852}$ * (q$^{1.852}$) / (D$^{4.8655}$)

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1 - (P-400A/B to F-420A/B/C/D)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	280	gal/min
D_1 = Inner pipe diameter (inches)	5.94	inches (see NOTE)
Pipe Section 1 friction factor	0.7	ft water / 100 feet of pipe

Friction factor for Pipe Section 2 - (Cartridge Filter Piping)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	140	gal/min
D_2 = Inner pipe diameter (inches)	2.943	inches (see NOTE)
Pipe Section 2 friction factor	6.3	ft water / 100 feet of pipe

P-400A/B GAC BACKWASH PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Friction factor for Pipe Section 3 - (F-420A/B/C/D to T-500)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	280	gal/min
D_3 = Inner pipe diameter (inches)	5.94	inches (see NOTE)
Pipe Section 3 friction factor	0.7	ft water / 100 feet of pipe

Step 3. Calculate the equivalent length of pipe for each section

	Equivalent Length per Fitting (ft)					
Nominal Fitting size	1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 - (P-400A/B to F-420A/B/C/D) - 6" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	55	55
Standard Tee (thru flow)	3	38.3	114.8
Standard Tee (branch flow)	1	47.3	47.3
Reducer (6"x3")	2	9.0	18.0
90 Elbows	4	10.4	41.4
Check Valve - Spring	1	85.5	85.5
Ball valve (full open)	5	12.3	61.5
		Equivalent Length:	**424**

Pipe Section 2 - (Cartridge Filter Piping) - 3" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	10	10
Standard Tee (thru flow)	1	12.0	12.0
Standard Tee (branch flow)	4	17.0	68.0
Expansion (3"x6")	2	4.0	8.0
90 Elbows	8	4.0	32.0
Check Valve - Spring	0	27.0	0.0
Ball valve (full open)	8	4.3	34.1
		Equivalent Length:	**165**

Pipe Section 3 - (F-420A/B/C/D to T-500) - 6" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	25	25
Standard Tee (thru flow)	0	38.3	0.0
Standard Tee (branch flow)	0	47.3	0.0
Expansion	0	13.5	0.0
90 Elbows	4	10.4	41.4
Check Valve - Spring	0	85.5	0.0
Ball valve (full open)	1	12.3	12.3
		Equivalent Length:	**79**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-400A/B to F-420A/B/C/D)

total equivalent length =	424	feet
friction factor =	0.7	feet water / 100 feet of pipe
Total Pipe Friction =	3.2	feet

Pipe Section 2 - (Cartridge Filter Piping)

total equivalent length =	165	feet
friction factor =	6.3	feet water / 100 feet of pipe
Total Pipe Friction =	10.4	feet

P-400A/B GAC BACKWASH PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
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Tallevast, Florida

Pipe Section 3 - (F-420A/B/C/D to T-500)		
total equivalent length =	79	feet
friction factor =	0.7	feet water / 100 feet of pipe
Total Pipe Friction =	0.6	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	14.2	

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation		16	ft	
Headloss due to pipe friction		14	ft	
Headloss Across Misc. Process Components				1 psi = 2.31 ft
	Liquid GAC Vessel	40	ft	
	F-420A/B/C/D Bag Filter	15	ft	
	Flow meter	5	ft	
Required Discharge Pressure (0 psi)		0	ft	
Total Dynamic Head Required - Calculated		**90**	ft	
Design Safety Factor		**25%**		
Total Dynamic Head Required - Design		**113**	**feet**	

Pump Design Requirements:

Flow	**280**	gpm
Total Dynamic Head	**113**	feet

Inputs
Formulas or Constant

Calculation 19

P-500A/B DISCHARGE PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	13	feet
	Head loss, h_e =	13	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	6	inch
(P-500A/B to POTW Discharge Line)	Flow (q_1) =	300	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

f = .2083 * (100/C)$^{1.852}$ * (q$^{1.852}$) / (D$^{4.8655}$)

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1- (P-500A/B to POTW Discharge Line)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	300	gal/min
D_1 = Inner pipe diameter (inches)	5.94	inches (see NOTE)
Pipe Section 1 friction factor	0.9	ft water / 100 feet of pipe

P-500A/B DISCHARGE PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each section

	Equivalent Length per Fitting (ft)					
Nominal Fitting size	1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 - (P-500A/B to POTW Discharge Line) - 4" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	5,000	5,000
Standard Tee (thru flow)	1	17.0	17.0
Standard Tee (branch flow)	0	21.0	0.0
Expansion	0	6.0	0.0
90 Elbows	12	4.6	55.2
Check Valve - Spring	1	38.0	38.0
Ball valve (full open)	8	5.5	43.8
		Equivalent Length:	**5,154**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-500A/B to POTW Discharge Line)

total equivalent length =	5,154	feet
friction factor =	0.9	feet water / 100 feet of pipe
Total Pipe Friction =	43.9	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	43.9	

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	13	ft
Headloss due to pipe friction	44	ft
Headloss Across Misc. Process Components		
SM-500 Static Mixer	12	ft
Flow meter	5	ft
Required Discharge Pressure (0 psi)	0	ft
Total Dynamic Head Required - Calculated	**74**	ft
Design Safety Factor	**25%**	
Total Dynamic Head Required - Design	**92**	**feet**

1 psi = 2.31 ft

Pump Design Requirements:

Flow	**300**	gpm
Total Dynamic Head	**92**	feet

Inputs
Formulas or Constant

Calculation 20

P-510 ON-FACILITY RECHARGE PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	13	feet
	Head loss, h_e =	13	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	1	inch
(P-510 to On-facility injection well)	Flow (q_1) =	10	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

f = .2083 * (100/C)$^{1.852}$ * (q$^{1.852}$) / (D$^{4.8655}$)

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1- (P-510 to On-facility injection well)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	10	gal/min
D_1 = Inner pipe diameter (inches)	0.924	inches (see NOTE)
Pipe Section 1 friction factor	13.4	ft water / 100 feet of pipe

P-510 ON-FACILITY RECHARGE PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each section

	Equivalent Length per Fitting (ft)					
Nominal Fitting size	1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 - (P-510 to On-facility injection well) - 1" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	360	360
Standard Tee (thru flow)	1	3.2	3.2
Standard Tee (branch flow)	1	6.6	6.6
Expansion	0	1.5	0.0
90 Elbows	10	2.7	27.0
Check Valve - Spring	2	11.0	22.0
Ball valve (full open)	7	1.6	11.1
		Equivalent Length:	**430**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-510 to On-facility injection well)

total equivalent length =	430	feet
friction factor =	13.4	feet water / 100 feet of pipe
Total Pipe Friction =	57.6	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	57.6	

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	13	ft	
Headloss due to pipe friction	58	ft	
Headloss Across Misc. Process Components			1 psi = 2.31 ft
SM-510 Static Mixer	12	ft	
Flow meter	5	ft	
Required Discharge Pressure (0 psi)	0	ft	
Total Dynamic Head Required - Calculated	**88**	ft	
Design Safety Factor	**25%**		
Total Dynamic Head Required - Design	**109**	**feet**	

Pump Design Requirements:

Flow	**10**	gpm
Total Dynamic Head	**109**	feet

Inputs
Formulas or Constant

Calculation 21

P-600A/B WATER SOFTENER FEED PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	13	feet
	Head loss, h_e =	13	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	3	inch
(P-600A/B to F-600A/B)	Flow (q_1) =	100	gpm
Pipe Section 2	Nominal pipe diameter $_2$ =	3	inch
(F-600A/B to P-640)	Flow (q_2) =	100	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

$$f = .2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$$

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1 - (P-600A/B to F-600A/B)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	100	gal/min
D_1 = Inner pipe diameter (inches)	2.943	inches (see NOTE)
Pipe Section 1 friction factor	3.4	ft water / 100 feet of pipe

Friction factor for Pipe Section 2 - (F-600A/B to P-640)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	100	gal/min
D_2 = Inner pipe diameter (inches)	2.943	inches (see NOTE)
Pipe Section 2 friction factor	3.4	ft water / 100 feet of pipe

Step 3. Calculate the equivalent length of pipe for each section

Nominal Fitting size	Equivalent Length per Fitting (ft) 1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90• Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 - (P-600A/B to F-600A/B) - 3" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	20	20
Standard Tee (thru flow)	3	12.0	36.0
Standard Tee (branch flow)	0	17.0	0.0
Expansion	0	4.0	0.0
90• Elbows	4	4.0	16.0
Check Valve - Spring	1	27.0	27.0
Ball valve (full open)	3	4.3	12.8
		Equivalent Length:	**112**

Pipe Section 2 - (F-600A/B to P-640) - 3" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	45	45
Standard Tee (thru flow)	0	12.0	0.0
Standard Tee (branch flow)	0	17.0	0.0
Expansion	0	4.0	0.0
90• Elbows	4	4.0	16.0
Check Valve - Spring	0	27.0	0.0
Ball valve (full open)	5	4.3	21.3
		Equivalent Length:	**83**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-600A/B to F-600A/B)

total equivalent length =	112	feet
friction factor =	3.4	feet water / 100 feet of pipe
Total Pipe Friction =	3.8	feet

Pipe Section 2 - (F-600A/B to P-640)

total equivalent length =	83	feet
friction factor =	3.4	feet water / 100 feet of pipe
Total Pipe Friction =	2.8	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	6.6	

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	13	ft	
Headloss due to pipe friction	7	ft	
Headloss Across Misc. Process Components			1 psi = 2.31 ft
T-600A/B Water Softeners	40	ft	
Bag Filter	5	ft	
Flow meter	5	ft	
Required Discharge Pressure (0 psi)	30	ft	
Total Dynamic Head Required - Calculated	**100**	ft	
Design Safety Factor	**25%**		
Total Dynamic Head Required - Design	**125**	**feet**	

Pump Design Requirements:

Flow	**100**	gpm
Total Dynamic Head	**125**	feet

Inputs
Formulas or Constant

Calculation 22

P-620 POTW WASTE PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	10	feet
	Head loss, h_e =	10	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	2	inch
(P-620 to POTW Discharge Line)	Flow (q_1) =	45	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

f = .2083 * (100/C)$^{1.852}$ * (q$^{1.852}$) / (D$^{4.8655}$)

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1- (P-620 to POTW Discharge Line)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	45	gal/min
D_1 = Inner pipe diameter (inches)	1.942	inches (see NOTE)
Pipe Section 1 friction factor	5.8	ft water / 100 feet of pipe

P-620 POTW WASTE PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each section

	Equivalent Length per Fitting (ft)					
Nominal Fitting size	1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 - (P-620 to POTW Discharge Line) - 2" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	50	50
Standard Tee (thru flow)	0	7.7	0.0
Standard Tee (branch flow)	1	12.0	12.0
Expansion (2"x6")	0	3.0	0.0
90 Elbows	1	3.6	3.6
Check Valve - Spring	1	19.0	19.0
Ball valve (full open)	1	2.9	2.9
		Equivalent Length:	**88**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-620 to POTW Discharge Line)

total equivalent length =	88	feet
friction factor =	5.8	feet water / 100 feet of pipe
Total Pipe Friction =	5.1	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	5.1

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	10	ft
Headloss due to pipe friction	5	ft
Headloss Across Misc. Process Components	0	ft
Required Discharge Pressure (30 psi)	70	ft
Total Dynamic Head Required - Calculated	**85**	ft
Design Safety Factor	**25%**	
Total Dynamic Head Required - Design	**106**	**feet**

1 psi = 2.31 ft

Pump Design Requirements:

Flow	**45**	gpm
Total Dynamic Head	**106**	feet

Inputs
Formulas or Constant

Calculation 23

P-640 RO FEED PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	14	feet
	Head loss, h_e =	14	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	3	inch
(P-640 to RO-640A/B/C)	Flow (q_1) =	100	gpm
Pipe Section 2	Nominal pipe diameter $_2$ =	3	inch
(RO-640A/B/C to T-660)	Flow (q_2) =	75	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

$f = .2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1 - (P-640 to RO-640A/B/C)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	100	gal/min
D_1 = Inner pipe diameter (inches)	2.943	inches (see NOTE)
Pipe Section 1 friction factor	3.4	ft water / 100 feet of pipe

Friction factor for Pipe Section 2 - (RO-640A/B/C to T-660)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	75	gal/min
D_2 = Inner pipe diameter (inches)	2.943	inches (see NOTE)
Pipe Section 2 friction factor	2.0	ft water / 100 feet of pipe

P-640 RO FEED PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each section

Nominal Fitting size	Equivalent Length per Fitting (ft) 1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 - (P-640 to RO-640A/B/C) - 3" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	20	20
Standard Tee (thru flow)	2	12.0	24.0
Standard Tee (branch flow)	0	17.0	0.0
Expansion	0	4.0	0.0
90 Elbows	4	4.0	16.0
Check Valve - Spring	1	27.0	27.0
Ball valve (full open)	2	4.3	8.5
		Equivalent Length:	**96**

Pipe Section 2 - (RO-640A/B/C to T-660) - 3" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	15	15
Standard Tee (thru flow)	2	12.0	24.0
Standard Tee (branch flow)	0	17.0	0.0
Expansion	0	4.0	0.0
90 Elbows	4	4.0	16.0
Check Valve - Spring	0	27.0	0.0
Ball valve (full open)	5	4.3	21.3
		Equivalent Length:	**77**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-640 to RO-640A/B/C)

total equivalent length =	96	feet
friction factor =	3.4	feet water / 100 feet of pipe
Total Pipe Friction =	3.3	feet

Pipe Section 2 - (RO-640A/B/C to T-660)

total equivalent length =	77	feet
friction factor =	2.0	feet water / 100 feet of pipe
Total Pipe Friction =	1.5	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections = 4.8

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	14	ft
Headloss due to pipe friction	5	ft
Headloss Across Misc. Process Components		
Flow meter	5	ft
Reverse Osmosis Unit	240	ft
Required Discharge Pressure (0 psi)	0	ft
Total Dynamic Head Required - Calculated	**264**	ft
Design Safety Factor	**25%**	
Total Dynamic Head Required - Design	**330**	**feet**

1 psi = 2.31 ft

Pump Design Requirements:

Flow	**100**	gpm
Total Dynamic Head	**330**	feet

Inputs
Formulas or Constant

Calculation 24

P-660 WETLANDS RECHARGE PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	15	feet
	Head loss, h_e =	15	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	3	inch
(P-660 to end of GC)	Flow (q_1) =	70	gpm
Pipe Section 2	Nominal pipe diameter $_2$ =	3	inch
(end of GC to INF2)	Flow (q_2) =	70	gpm
Pipe Section 3	Nominal pipe diameter $_3$ =	3	inch
(INF2 to INF3)	Flow (q_3) =	70	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

$$f = .2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$$

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1- (P-660 to end of GC)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	70	gal/min
D_1 = Inner pipe diameter (inches)	2.943	inches (see NOTE)
Pipe Section 1 friction factor	1.8	ft water / 100 feet of pipe

Friction factor for Pipe Section 2- (end of GC to INF2)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	50	gal/min
D_2 = Inner pipe diameter (inches)	2.943	inches (see NOTE)
Pipe Section 2 friction factor	0.9	ft water / 100 feet of pipe

P-660 WETLANDS RECHARGE PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Friction factor for Pipe Section 3- (INF2 to INF3)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	25	gal/min
D_3 = Inner pipe diameter (inches)	1.942	inches (see NOTE)
Pipe Section 3 friction factor	2.0	ft water / 100 feet of pipe

Step 3. Calculate the equivalent length of pipe for each section

	Equivalent Length per Fitting (ft)					
Nominal Fitting size	1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 (P-660 to End of GC) - 3" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	1,300	1,300
Standard Tee (thru flow)	0	12.0	0.0
Standard Tee (branch flow)	1	17.0	17.0
Expansion	0	4.0	0.0
90 Elbows	6	4.0	24.0
Check Valve - Spring	1	27.0	27.0
Ball valve (full open)	1	4.3	4.3
		Equivalent Length:	**1,373**

Pipe Section 2 (End of GC to INF2) - 3" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	2,000	2,000
Standard Tee (thru flow)	1	12.0	12.0
Standard Tee (branch flow)	0	17.0	0.0
Expansion	0	4.0	0.0
90 Elbows	12	4.0	48.0
Check Valve - Spring	0	27.0	0.0
Ball valve (full open)	0	4.3	0.0
		Equivalent Length:	**2,060**

Pipe Section 3 (INF 2 to INF3) - 3" diameter

	Equivalent Length		
Item	Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	2,000	2,000
Standard Tee (thru flow)	0	12.0	0.0
Standard Tee (branch flow)	0	17.0	0.0
Expansion	0	4.0	0.0
90 Elbows	12	4.0	48.0
Check Valve - Spring	0	27.0	0.0
Ball valve (full open)	2	4.3	8.5
		Equivalent Length:	**2,057**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-660A Wetland Injection Pump to Discharge)

total equivalent length =	1,373	feet
friction factor =	1.8	feet water / 100 feet of pipe
Total Pipe Friction =	24.1	feet

Pipe Section 2 - (P-660A Wetland Injection Pump to Discharge)

total equivalent length =	2,060	feet
friction factor =	0.9	feet water / 100 feet of pipe
Total Pipe Friction =	19.4	feet

P-660 WETLANDS RECHARGE PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Pipe Section 3 - (P-660A Wetland Injection Pump to Discharge)

total equivalent length =	2,057	feet
friction factor =	2.0	feet water / 100 feet of pipe
Total Pipe Friction =	40.5	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	83.9	

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	15	ft	
Headloss due to pipe friction	84	ft	
Headloss Across Misc. Process Components			1 psi = 2.31 ft
Vault Flow Meters	5	ft	
Required Discharge Pressure (0 psi)	35	ft	
Total Dynamic Head Required - Calculated	**139**	ft	
Design Safety Factor	**25%**		
Total Dynamic Head Required - Design	**174**	**feet**	

Pump Design Requirements:

Flow	**70**	gpm
Total Dynamic Head	**174**	feet

Inputs
Formulas or Constant

Calculation 25

P-800A/B SURGE TRANSFER PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	20	feet
	Head loss, h_e =	20	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	2	inch
(P-800A/B to T-810)	Flow (q_1) =	30	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

f = .2083 * (100/C)$^{1.852}$ * (q$^{1.852}$) / (D$^{4.8655}$)

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness
(140 for new galvanized steel pipe, 150 for hdpe pipe) ** See H-W "C" spreadsheet
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1 - (P-800A/B to T-810)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	30	gal/min
D_1 = Inner pipe diameter (inches)	1.942	inches (see NOTE)
Pipe Section 1 friction factor	2.8	ft water / 100 feet of pipe

Step 3. Calculate the equivalent length of pipe for each section

Nominal Fitting size	Equivalent Length per Fitting (ft) 1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

P-800A/B SURGE TRANSFER PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Pipe Section 1 - (P-800A/B to T-810) - 2" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	45	45
Standard Tee (thru flow)	2	7.7	15.4
Standard Tee (branch flow)	1	12.0	12.0
Expansion	1	3.0	3.0
90 Elbows	4	3.6	14.4
Check Valve - Spring	1	19.0	19.0
Ball valve (full open)	6	2.9	17.3
		Equivalent Length:	**127**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-800A to T-810)

total equivalent length =	127	feet
friction factor =	2.8	feet water / 100 feet of pipe
Total Pipe Friction =	3.5	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	3.5

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation		20	ft
Headloss due to pipe friction		4	ft
Headloss Across Misc. Process Components			1 psi = 2.31 ft
	SM-800 Static Mixer	12	ft
	Flow meter	5	ft
Required Discharge Pressure (0 psi)		0	ft
Total Dynamic Head Required - Calculated		**41**	ft
Design Safety Factor		**25%**	
Total Dynamic Head Required - Design		**51**	**feet**

Pump Design Requirements:

Flow	**30**	gpm
Total Dynamic Head	**51**	feet

Inputs
Formulas or Constant

Calculation 26

P-1000A/B PROCESS WATER PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	5	feet
	Head loss, h_e =	5	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	1	inch
(P-1000A/B to Bladder Tank)	Flow (q_1) =	10	gpm
Pipe Section 2	Nominal pipe diameter $_2$ =	0.75	inch
(Bladder Tank to Trench Drain)	Flow (q_2) =	5	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

$$f = .2083 * (100/C)^{1.852} * (q^{1.852}) / (D^{4.8655})$$

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness (130 for Sch. 40 Stainless Steel Pipe)
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1 - (P-1000A/B to Bladder Tank)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	10	gal/min
D_1 = Inner pipe diameter (inches)	0.924	inches (see NOTE)
Pipe Section 1 friction factor	13.4	ft water / 100 feet of pipe

Friction factor for Pipe Section 2 - (Bladder Tank to Trench Drain)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	5	gal/min
D_2 = Inner pipe diameter (inches)	0.625	inches (see NOTE)
Pipe Section 2 friction factor	24.8	ft water / 100 feet of pipe

P-1000A/B PROCESS WATER PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Step 3. Calculate the equivalent length of pipe for each section

Nominal Fitting size	Equivalent Length per Fitting (ft) 1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

Pipe Section 1 - (P-1000A/B to Bladder Tank) - 1" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	45	45
Standard Tee (thru flow)	1	3.2	3.2
Standard Tee (branch flow)	1	6.6	6.6
Reducer (1" x 3/4")	1	1.0	1.0
90 Elbows	4	2.7	10.8
Check Valve - Spring	1	11.0	11.0
Ball valve (full open)	2	1.6	3.2
		Equivalent Length:	**81**

Pipe Section 2 - (Bladder Tank to Trench Drain) - 3/4" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	120	120
Standard Tee (thru flow)	2	3.2	6.4
Standard Tee (branch flow)	1	6.6	6.6
Expansion	0	1.5	0.0
90 Elbows	4	2.7	10.8
Check Valve - Spring	0	11.0	0.0
Ball valve (full open)	3	1.6	4.7
		Equivalent Length:	**149**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-1000A/B to Bladder Tank)

total equivalent length =	81	feet
friction factor =	13.4	feet water / 100 feet of pipe
Total Pipe Friction =	10.8	feet

Pipe Section 2 - (Bladder Tank to Trench Drain)

total equivalent length =	149	feet
friction factor =	24.8	feet water / 100 feet of pipe
Total Pipe Friction =	37.0	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections = 47.9

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	5	ft
Headloss due to pipe friction	48	ft
Headloss Across Misc. Process Components	0	ft
Required Discharge Pressure (0 psi)	155	ft
Total Dynamic Head Required - Calculated	**208**	ft
Design Safety Factor	**25%**	
Total Dynamic Head Required - Design	**260**	**feet**

1 psi = 2.31 ft

Pump Design Requirements:

Flow	**10**	gpm
Total Dynamic Head	**260**	feet

Inputs
Formulas or Constant

Calculation 27

P-1200 SUMP PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	25	feet
	Head loss, h_e =	25	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	2	inch
(P-1200 to T-100)	Flow (q_1) =	30	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

f = .2083 * (100/C)$^{1.852}$ * (q$^{1.852}$) / (D$^{4.8655}$)

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness
(140 for new galvanized steel pipe, 150 for hdpe pipe) ** See H-W "C" spreadsheet
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1 - (P-1200 to T-100)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	30	gal/min
D_1 = Inner pipe diameter (inches)	1.942	inches (see NOTE)
Pipe Section 1 friction factor	2.8	ft water / 100 feet of pipe

Step 3. Calculate the equivalent length of pipe for each section

Nominal Fitting size	Equivalent Length per Fitting (ft) 1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

P-1200 SUMP PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Pipe Section 1 - (P-1200 to T-100) - 2" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	175	175
Standard Tee (thru flow)	0	7.7	0.0
Standard Tee (branch flow)	1	12.0	12.0
Expansion	0	3.0	0.0
90 Elbows	8	3.6	28.8
Check Valve - Spring	1	19.0	19.0
Ball valve (full open)	2	2.9	5.8
		Equivalent Length:	**241**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-1200 to T-100)

total equivalent length =	241	feet
friction factor =	2.8	feet water / 100 feet of pipe
Total Pipe Friction =	6.7	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	6.7

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	25	ft
Headloss due to pipe friction	7	ft
Headloss Across Misc. Process Components	0	ft
Required Discharge Pressure (0 psi)	0	ft
Total Dynamic Head Required - Calculated	**32**	ft
Design Safety Factor	**25%**	
Total Dynamic Head Required - Design	**40**	**feet**

1 psi = 2.31 ft

Pump Design Requirements:

Flow	**30**	gpm
Total Dynamic Head	**40**	feet

Inputs
Formulas or Constant

Calculation 28

P-1300 PROCESS WATER PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Total dynamic head calculation =

headloss due to elevation change
headloss due to pipe friction
headloss across misc. process components
required discharge head

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Calculate head loss (h_e) due to elevation change:

assume:	Height from pump to discharge point =	25	feet
	Head loss, h_e =	25	feet

Calculate headloss due to pipe friction losses:

Step 1. There are multiple pipe sections with flow and pipe diameters shown below

Pipe Section 1	Nominal pipe diameter $_1$ =	1.5	inch
(P-1300 to T-200)	Flow (q_1) =	30	gpm

Step 2. Calculate the friction factor for each pipe section using the Hazen-Williams formula

Hazen-Williams Formula

f = .2083 * (100/C)$^{1.852}$ * (q$^{1.852}$) / (D$^{4.8655}$)

f = Friction in head in feet of water per 100 ft of pipe
C = Constant for inside roughness
(140 for new galvanized steel pipe, 150 for hdpe pipe) ** See H-W "C" spreadsheet
q = Flow rate (gal/min)
D = Inside diameter of pipe (inches)

Nominal Diam (in)	ID (in)	ID w/ deposition (in)
0.75	0.750	0.625
1	1.049	0.924
1.5	1.610	1.485
2	2.067	1.942
3	3.068	2.943
4	4.026	3.901
6	6.065	5.94
8	7.981	7.856
10	10.020	9.895

NOTE: a 0.0625 inch (1/16 inch) deposition on interior pipe wall is included in diameter for calculation - 1.049 - (2 x 0.0625) = 0.924 inch diameter

Friction factor for Pipe Section 1 - (P-1300 to T-200)

C = Pipe roughness factor	130	unitless
q = flow rate (gal/min)	30	gal/min
D_1 = Inner pipe diameter (inches)	1.485	inches (see NOTE)
Pipe Section 1 friction factor	10.2	ft water / 100 feet of pipe

Step 3. Calculate the equivalent length of pipe for each section

Nominal Fitting size	Equivalent Length per Fitting (ft) 1 in	1.5 in	2 in	3 in	4 in	6 in
Standard Tee (thru flow)	3.2	5.6	7.7	12.0	17.0	38.3
Standard Tee (branch flow)	6.6	9.9	12.0	17.0	21.0	47.3
Expansion (1/2)	1.5	2.5	3.0	4.0	6.0	13.5
90 Elbows	2.7	3.4	3.6	4.0	4.6	10.4
Check Valve - Spring and Swing	11.0	15.0	19.0	27.0	38.0	85.5
Ball valve (full open)	1.6	2.3	2.9	4.3	5.5	12.3
Union	0.3	0.4	0.5	0.5	0.7	1.5
Reducer (2/1)	1.0	1.5	1.5	3.0	4.0	9.0

Equivalent lengths from reference: Civil Engineering Reference Manual, 9th Ed, Professional Publications, Inc., 2003; and "Flow of Fluids", Crane Technical Paper No. 410, 1988.

P-1300 PROCESS WATER PUMP DESIGN CALCULATIONS
RAP Groundwater Treatment System
Total Dynamic Head Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Pipe Section 1 - (P-1300 to T-200) - 1.5" diameter

Item	Equivalent Length Qty.	L (ft)	Qty * L
Linear Pipe (L_1)	1	40	40
Standard Tee (thru flow)	1	5.6	5.6
Standard Tee (branch flow)	0	9.9	0.0
Expansion	0	2.5	0.0
90 Elbows	4	3.4	13.6
Check Valve - Spring	1	15.0	15.0
Ball valve (full open)	1	2.3	2.3
		Equivalent Length:	**77**

Step 4. Determine pipe friction for each pipe section.

total pipe friction = total equivalent length x friction factor

Pipe Section 1 - (P-1300 to T-200)

total equivalent length =	77	feet
friction factor =	10.2	feet water / 100 feet of pipe
Total Pipe Friction =	7.8	feet

Step 5. Determine total pipe friction (all sections)

Total Pipe Friction - All Sections =	7.8

Calculate Total Dynamic Head:

Head Loss Due to Change in Elevation	25	ft
Headloss due to pipe friction	8	ft
Headloss Across Misc. Process Components	0	ft
Required Discharge Pressure (0 psi)	0	ft
Total Dynamic Head Required - Calculated	**33**	ft
Design Safety Factor	**25%**	
Total Dynamic Head Required - Design	**41**	**feet**

1 psi = 2.31 ft

Pump Design Requirements:

Flow	**30**	gpm
Total Dynamic Head	**41**	feet

Inputs
Formulas or Constant

Calculation 29

TANK SIZE CALCULATIONS
PRIMARY SETTLING TANKS (T-110A/B)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

Tank Design Assumptions:

Material:	Fiberglass reinforced plastic (FRP)
Type:	Cone Bottom with Dome Top
Overflow rate:	Maintain overflow rate less than 1,500 gpd/ft^2 per tank

Calculate design volume based on design retention time:

Total influent flow rate =	212	gpm
Influent flow rate (per tank) =	106	gpm
Design retention time =	30	min
Design volume =	3,180	gal

Calculate overflow rate:

Design tank diameter =	12	ft
Surface area =	113	ft^2
Total overflow rate =	2,699	gpd/ft^2
Overflow rate per tank (2 tanks) =	1,350	gpd/ft^2

Determine actual tank volume:

**Note: Tank volumes and characteristics are based on vendor capacity charts.
Actual tank volumes shall be greater than design requirements.

Sidewall height =	7	ft
Tank volume =	7,470	gal
Freeboard height =	1.0	ft
Freeboard volume =	846	gal
Operating volume =	6,624	gal
Operating retention time =	62	min

Calculate total tank height:

Sidewall height =	7	ft
Cone height =	70	in
Dome height =	24	in
Stand height =	30	in
Total tank height =	17.3	ft

Tank Design Requirements:

Tank Diameter =	12	ft
Total Height =	17.3	ft
Total Volume =	7,470	gal

Inputs
Formulas or Constant

Calculation 30

TANK SIZE CALCULATIONS
SOLIDS CONTACT TANK (T-120)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

Tank Design Assumptions:

Material:	Fiberglass reinforced plastic (FRP)
Type:	Cone Bottom with Dome Top
Retention time:	Maintain operating retention time greater than design retention time

Calculate design volume and diameter based on design retention time:

Tank influent flow rate =	236	gpm
Design retention time =	10	min
Design volume =	2,360	gal

Determine actual tank volume:

**Note: Tank volumes and characteristics are based on vendor capacity charts.
Actual tank volumes shall be greater than design requirements.

Tank diameter =	8	ft
Sidewall height =	8	ft
Tank volume =	3,390	gal
Freeboard height =	1.0	ft
Freeboard volume =	376	gal
Operating volume =	3,014	gal
Operating retention time =	13	min

Calculate total tank height:

Sidewall height =	8	ft
Cone height =	45	in
Dome height =	16	in
Stand height =	44	in
Total tank height =	16.8	ft

Tank Design Requirements:

Tank Diameter =	8	ft
Total Height =	16.8	ft
Total Volume =	3,390	gal

Inputs
Formulas or Constant

Calculation 31

TANK SIZE CALCULATIONS
SECONDARY SETTLING TANKS (T-140A/B)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

Tank Design Assumptions:

Material:	Fiberglass reinforced plastic (FRP)
Type:	Cone Bottom with Dome Top
Overflow rate:	Maintain overflow rate less than 1,500 gpd/ft^2 per tank

Calculate design volume based on design retention time:

Total influent flow rate =	228	gpm
Influent flow rate (per tank) =	114	gpm
Design retention time =	30	min
Design volume =	3,420	gal

Calculate overflow rate:

Design tank diameter =	12	ft
Surface area =	113	ft^2
Total overflow rate =	2,903	gpd/ft^2
Overflow rate per tank (2 tanks) =	1,451	gpd/ft^2

Determine actual tank volume:

**Note: Tank volumes and characteristics are based on vendor capacity charts.
Actual tank volumes shall be greater than design requirements.

Sidewall height =	7	ft
Tank volume =	7,470	gal
Freeboard height =	1.0	ft
Freeboard volume =	846	gal
Operating volume =	6,624	gal
Operating retention time =	58	min

Calculate total tank height:

Sidewall height =	7	ft
Cone height =	70	in
Dome height =	24	in
Stand height =	18	in
Total tank height =	16.3	ft

Tank Design Requirements:

Tank Diameter =	12	ft
Total Height =	16.3	ft
Total Volume =	7,470	gal

Inputs
Formulas or Constant

Calculation 32

TANK SIZE CALCULATIONS
FILTER FEED TANK (T-200)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

Tank Design Assumptions:

Material:	Fiberglass reinforced plastic (FRP)
Type:	Flat Bottom with Dome Top and Sloped Floor
Floor slope:	Slope of floor shall be 1/2 inch per foot of tank diameter
Operation:	Plan to operate at mid-tank level to account for potential overflow from upgradient tanks.
Aspect Ratio:	Maintain aspect ratio of 1 (or as close as possible)

Calculate design volume based on design retention time:

Tank influent flow rate =	227	gpm
Design retention time =	10	min
Design volume =	2,272	gal

Determine actual tank volume:

**Note: Tank volumes and characteristics are based on vendor capacity charts.
Actual tank volumes shall be greater than design requirements.

Tank diameter =	8	ft	
Tank height =	9	ft	
Aspect ratio (D/H) =	0.89	ft	
Tank volume =	3,340	gal	
Freeboard height =	1.0	ft	
Freeboard volume =	376	gal	
Potential overflow volume =	1,450	gal	**from upgradient tanks
Operating volume =	1,514	gal	

Calculate total tank height:

Sidewall height =	9	ft
Dome height =	16	in
Stand height =	0	in
Total tank height =	10.3	ft
Floor slope =	4.0	in

Tank Design Requirements:

Tank Diameter =	8	ft
Total Height =	10.3	ft
Total Volume =	3,340	gal

Inputs
Formulas or Constant

Calculation 33

TANK SIZE CALCULATIONS
AOP FEED TANK (T-300)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

Tank Design Assumptions:

Material:	Fiberglass reinforced plastic (FRP)
Type:	Flat Bottom with Dome Top and Sloped Floor
Floor slope:	Slope of floor shall be 1/2 inch per foot of tank diameter
Aspect Ratio:	Maintain aspect ratio of 1 (or as close as possible)

Calculate design volume based on required backwash volume:

Tank influent flow rate =	202	gpm
Required backwash volume =	4,000	gal for (1) MF and UF backwash cycle
Emergency capacity (3 backwash volumes) =	12,000	gal

Determine actual tank volume:

**Note: Tank volumes and characteristics are based on vendor capacity charts.
Actual tank volumes shall be greater than design requirements.

Tank diameter =	12	ft
Tank height =	14	ft
Aspect ratio (D/H) =	0.86	ft
Tank volume =	12,050	gal
Freeboard height =	1.0	ft
Freeboard volume =	846	gal
Operating volume =	11,204	gal

Calculate total tank height:

Sidewall height =	14	ft
Dome height =	24	in
Stand height =	0	in
Total tank height =	16.0	ft
Floor slope =	6.0	in

Tank Design Requirements:

Tank Diameter =	12	ft
Total Height =	16.0	ft
Total Volume =	12,050	gal

Inputs
Formulas or Constant

Calculation 34

TANK SIZE CALCULATIONS
EFFLUENT TANK (T-500)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

Tank Design Assumptions:

Material:	Fiberglass reinforced plastic (FRP)
Type:	Flat Bottom with Dome Top
Retention time:	Maintain operating retention time greater than design retention time
Aspect Ratio:	Maintain aspect ratio of 1 (or as close as possible)

Calculate design volume based on design retention time:

Tank influent flow rate =	210	gpm
Design retention time =	30	min
Design volume =	6,300	gal

Determine actual tank volume:

**Note: Tank volumes and characteristics are based on vendor capacity charts.
Actual tank volumes shall be greater than design requirements.

Tank diameter =	11	ft
Tank height =	12	ft
Aspect ratio (D/H) =	0.92	ft
Tank volume =	8,500	gal
Freeboard height =	1.0	ft
Freeboard volume =	711	gal
Operating volume =	7,789	gal
Operating retention time =	37	min

Calculate total tank height:

Sidewall height =	12	ft
Dome height =	22	in
Stand height =	0	in
Total tank height =	13.8	ft

Tank Design Requirements:

Tank Diameter =	11	ft
Total Height =	13.8	ft
Total Volume =	8,500	gal

Inputs
Formulas or Constant

Calculation 35

TANK SIZE CALCULATIONS
POTW WASTE TANK (T-620)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

Tank Design Assumptions:

Material:	Fiberglass reinforced plastic (FRP)
Type:	Flat Bottom with Dome Top
Retention time:	Maintain operating retention time greater than design retention time
Aspect Ratio:	Maintain aspect ratio of 1 (or as close as possible)

Calculate design volume based on design retention time:

Tank influent flow rate =	45	gpm
Design retention time =	15	min
Design volume =	675	gal

Determine actual tank volume:

Tank diameter =	6	ft
Tank height =	5	ft
Aspect ratio (D/H) =	1.20	ft
Tank volume =	1,020	gal
Freeboard height =	1.0	ft
Freeboard volume =	211	gal
Operating volume =	809	gal
Operating retention time =	18	min

Calculate total tank height:

**Note: Tank volumes and characteristics are based on vendor capacity charts.
Actual tank volumes shall be greater than design requirements.

Sidewall height =	5	ft
Dome height =	12	in
Stand height =	0	in
Total tank height =	6.0	ft

Tank Design Requirements:

Tank Diameter =	6	ft
Total Height =	6.0	ft
Total Volume =	1,020	gal

Inputs
Formulas or Constant

Calculation 36

TANK SIZE CALCULATIONS
RECHARGE EQUALIZATION TANK (T-660)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

Tank Design Assumptions:

Material:	Fiberglass reinforced plastic (FRP)
Type:	Flat Bottom with Dome Top and Sloped Floor
Floor slope:	Slope of floor shall be 1/2 inch per foot of tank diameter
Retention time:	Maintain operating retention time greater than design retention time
Aspect Ratio:	Maintain aspect ratio of 1 (or as close as possible)

Calculate design volume based on design retention time:

Tank influent flow rate =	75	gpm
Design retention time =	30	min
Design volume =	2,250	gal

Determine actual tank volume:

**Note: Tank volumes and characteristics are based on vendor capacity charts.
Actual tank volumes shall be greater than design requirements.

Tank diameter =	7	ft
Tank height =	9	ft
Aspect ratio (D/H) =	0.78	ft
Tank volume =	2,570	gal
Freeboard height =	1.0	ft
Freeboard volume =	288	gal
Operating volume =	2,282	gal
Operating retention time =	30	min

Calculate total tank height:

Sidewall height =	11	ft
Dome height =	14	in
Stand height =	0	in
Total tank height =	12.2	ft
Floor slope =	3.5	in

Tank Design Requirements:

Tank Diameter =	7	ft
Total Height =	12.2	ft
Total Volume =	2,570	gal

Inputs
Formulas or Constant

Calculation 37

TANK SIZE CALCULATIONS
BACKWASH SURGE TANK (T-800)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

Tank Design Assumptions:

Material:	Fiberglass reinforced plastic (FRP)
Type:	Flat Bottom with Dome Top and Sloped Floor
Floor slope:	Slope of floor shall be 1/2 inch per foot of tank diameter
Retention time:	Maintain operating retention time greater than design retention time
Aspect Ratio:	Maintain aspect ratio of 1 (or as close as possible)
Backwash Cycle[(1)]:	Based on backwash of two filter beds

Calculate design volume based on instantaneous volume required for one backwash cycle [(1)]:

Tank instantaneous volume from MF backwash =	7,200	gal
Tank instantaneous volume from UF backwash =	800	gal
Total design volume =	8,000	gal

Determine actual tank volume:

**Note: Tank volumes and characteristics are based on vendor capacity charts.
Actual tank volumes shall be greater than design requirements.

Tank diameter =	10	ft
Tank height =	14	ft
Aspect ratio (D/H) =	0.71	ft
Tank volume =	8,240	gal
Freeboard height =	1.0	ft
Freeboard volume =	587	gal
Operating volume =	7,653	gal
Continuous operating flow rate =	25	gpm

Calculate total tank height:

Sidewall height =	14	ft
Dome height =	20	in
Stand height =	0	in
Total tank height =	15.7	ft
Floor slope =	5.0	in

Tank Design Requirements:

Tank Diameter =	10	ft
Total Height =	15.7	ft
Total Volume =	8,240	gal

Inputs
Formulas or Constant

Calculation 38

TANK SIZE CALCULATIONS
SOLIDS THICKENING TANK (T-810)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

Tank Design Assumptions:

Material:	Fiberglass reinforced plastic (FRP)
Type:	Cone Bottom with Dome Top
Overflow rate:	Maintain overflow rate less than 700 gpd/ft^2 per tank

Calculate design tank diameter based on required overflow rate:

Tank influent flow rate =	38	gpm
Tank influent flow rate =	54,720	gpd
Maximum overflow rate =	700	gpd/ft^2
Minimum tank surface area =	78	ft^2
Minimum tank diameter =	10	ft

Determine actual tank volume:

**Note: Tank volumes and characteristics are based on vendor capacity charts.
Actual tank volumes shall be greater than design requirements.

Tank diameter =	12	ft
Sidewall height =	7	ft
Tank volume =	7,470	gal
Freeboard height =	1.0	ft
Freeboard volume =	846	gal
Operating volume =	6,624	gal
Operating overflow rate =	484	gpd/ft^2
Operating retention time =	2.91	hrs

Calculate total tank height:

Sidewall height =	7	ft
Cone height =	70	in
Dome height =	24	in
Stand height =	18	in
Total tank height =	16.3	ft

Tank Design Requirements:

Tank Diameter =	12	ft
Total Height =	16.3	ft
Total Volume =	7,470	gal

Inputs
Formulas or Constant

Calculation 39

REQUIRED CONTAINMENT VOLUME FOR RAP SYSTEM

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

Calculate Volume of Tanks and Process Equipment within Containment:

Equipment Name	Volume (gal)	No. Units	Total Volume (gal)
Primary Clarifier	7,470	2	14,940
Solids Contact Tank	3,390	1	3,390
Secondary Clarifiers	7,470	2	14,940
Filter Feed Tank	3,340	1	3,340
Multi-Media Filters	1,535	3	4,605
Ultra-Filters	1,120	3	3,360
AOP Feed Tank	12,050	1	12,050
Cartridge Filters	10	5	50
AOP	100	3	300
Liquid GAC	1,115	6	6,690
Effluent Tank	8,500	1	8,500
Water Softener	150	2	300
RO System	300	1	300
Infiltration EQ Tank	3,160	1	3,160
Solids Thickening Tank	7,470	1	7,470
Backwash Surge Tank	8,240	1	8,240
Coagulant Aid System	55	1	55
Pre-Coat Tank	300	1	300
Air Compressor System	100	1	100
Filter Press	190	1	190
Seal Flush Bladder Tank	265	1	265
Process Tank	1,020	1	1,020
Brine Storage Tank	360	1	360
POTW Waste Tank	1,020	1	1,020
Sodium Bicarbonate Mix Tank	300	1	300
		Subtotal =	95,245 gallons

Calculate Volume of Required Containment:

Total Volume = Volume of Tanks and Process Equipment + Volume of Piping + 10%

Volume of Tanks and Process Equipment	95,245	gallons
Volume of Piping	1,200	gallons
Subtotal =	96,445	gallons
10%	9,645	gallons
Total =	106,090	gallons

Calculate Equipment Area Not Used for Containment:

Determine Equipment Footprint:

Equipment Name	Footing Length (ft)	Footing Width (ft)	No. Footings	Footprint Area (sq ft)
Primary Clarifier	1	1	8	8
Solids Contact Tank	1	1	4	4
Secondary Clarifiers	1	1	8	8
Splitter Boxes	1	1	8	8
Filter Feed Tank	8	8	1	64
Vapor GAC Vessels	3	3	2	18
Process Tank	6	6	1	36
Multi-Media Filters	6	15	1	90
Ultra-Filters	6.5	24	1	156

REQUIRED CONTAINMENT VOLUME FOR RAP SYSTEM

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

UF Backwash Skid	4	9	1	36
Equipment Name	Footing Length (ft)	Footing Width (ft)	No. Footings	Footprint Area (sq ft)
AOP	6.5	12	3	234
Seal Flush Bladder Tank	5	5	1	25
Solids Thickening Tank	1	1	4	4
AOP Feed Tank	12	12	1	144
Backwash Surge Tank	10	10	1	100
Coagulant Aid System	3	3	1	9
Pre-Coat Tank	3	3	1	9
Filter Press	5	16	1	80
Chemical Storage Area	23	16	1	368
Effluent Tank	11	11	1	121
Water Softener	5.5	10	1	55
Cartridge Filters	2	2	4	16
Brine Storage Tank	4	4	1	16
RO System	5.5	25	1	138
Recharge EQ Tank	7	7	1	49
POTW Waste Tank	6	6	1	36
Sodium Bicarbonate Mix Tank	4	4	1	16
Air Compressor System	3	6	1	18
Single Pump Skid	4	4	4	64
Duplex Pump Skid	5	6	12	360
Triplex Pump Skid	9	9	1	81

Total Equipment Footprint = 2,371 square feet

Calculate Available Containment Volume:

Available Containment Volume = (Building Area - Equipment Footprint) x Containment Depth

	Total Area (sf)	Equipment Footprint (sf)	Available Area (sf)	Depth (ft)	Volume (cf)	Volume (gal)	
Plant Area	10,584	2,371	8,214	1.33	10,951	81,916	16" curb height
Tool Room	300	0	300	1.33	400	2,992	
Storage Room	477	0	477	1.33	636	4,757	
Loading Dock Area	708	0	708	4.0	2,832	21,183	
Total =	12,069	square feet			Subtotal =	110,849	gallons

Containment Volume Available = 110,849 gallons
Containment Volume Required = 106,090 gallons

Volume Available > Volume Required therefore design is acceptable

Calculation 40

REQUIRED CONTAINMENT VOLUME FOR CHEMICAL STORAGE SYSTEM

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 6/12/09

Calculate Volume of Tanks and Process Equipment within Containment:

Equipment Name	Volume (gal)	No. Units	Total Volume (gal)
Caustic Totes	330	4	1,320
Acid Totes	330	2	660

Subtotal = 1,980 gallons

Calculate Volume of Required Containment:

Total Volume = Volume of Tanks and Process Equipment + Volume of Piping + 10%

Volume of Tanks and Process Equipment	1,980	gallons
Subtotal =	1,980	gallons
10%	198	gallons
Total =	2,178	gallons

Calculate Equipment Area Not Used for Containment:

Determine Equipment Footprint:

Equipment Name	Footing Length (ft)	Footing Width (ft)	No. Footings	Footprint Area (sq ft)
Caustic Metering Pump Skid	2	5	1	10
Acid Metering Pump Skid	2	2	1	4

Total Equipment Footprint = 14 square feet

Calculate Available Containment Volume:

Available Containment Volume = (Chemical Storage Area - Equipment Footprint) x Containment Depth

	Total Area (sf)	Equipment Footprint (sf)	Available Area (sf)	Depth (ft)	Volume (cf)	Volume (gal)	
Caustic Storage Area	226	10	216	1.00	216	1,612	12" curb height
Acid Storage Area	113	4	109	1.00	109	813	
Total =	338	square feet			Subtotal =	2,425	gallons

Containment Volume Available = 2,425 gallons
Containment Volume Required = 2,178 gallons

Volume Available > Volume Required therefore design is acceptable

Calculation 41

CONVECTIVE HEAT TRANSFER CALCULATIONS

(Influent Water Temperature = 80 ^{o}F)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc Prepared By:	J. Bedessem
Calc Checked By:	W. May
Date:	6/12/2009

Calculate heat gain of water in building piping from influent manifold to primary settling tanks.

Convective Heat Transfer Inputs:

Fluid:	Groundwater	
Flow Rate =	200	gpm
Kinematic viscosity (ν) =	0.0000093	ft^2/sec at 80^{o}F
Prandtl Number (Pr) =	7	at 20°C

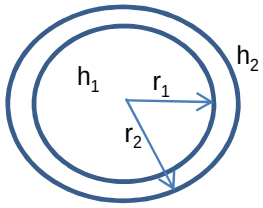
Thermal Conductivity of the fluid:

λ_f (W/m °K) =	0.597	W/m ^{o}K *
λ_f (BTU/ft hr °F) =	0.34495622	BTU/ft hr ^{o}F

*from Engineering Thermodynamics with Applications, Table A.23

Specific heat of water =	1	BTU/lb ^{o}F
Water temperature =	80	F
Air temp =	95	F

Pipe Material:	Sch 40 SS	
Pipe Nominal Diameter =	4	
Pipe Outer Diameter (in) =	4.5	inch
Pipe Outer Diameter (ft) =	0.375	ft
Wall Thickness =	0.237	inch
Pipe Inner Diameter (in) =	4.026	inch
Pipe Inner Diameter (ft) =	0.3355	ft
Linear ft of pipe:	100	ft



Thermal Conductivity of the pipe:

λ_p (W/m °K) =	14	W/m ^{o}K **
λ_p (BTU/ft hr °F) =	8.089	BTU/ft hr °F

**from Engineering Thermodynamics with Applications, Table A.22

Conversion Factors:

1 BTU/ft hr °F =	1.731	W/m °K
1 BTU/ft2 hr °F =	5.678	W/m^2 ^{o}K
1 hr =	60	min
1 gal =	8.34	lb

Calculate Convection Heat Transfer Coefficient for Air:

h_2 =	10	W/m^2 ^{o}K ***
	1.761	BTU/ft hr °F

***from Engineering Thermodynamics with Applications, Table 19.1

CONVECTIVE HEAT TRANSFER CALCULATIONS

(Influent Water Temperature = 80 °F)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc Prepared By:	J. Bedessem
Calc Checked By:	W. May
Date:	6/12/2009

Calculate heat gain of water in building piping from influent manifold to primary settling tanks.

Calculate r_1 and r_2:

Pipe Inner Radius (r_1) =	0.17	ft
Pipe Outer Radius (r_2) =	0.19	ft

Calculate Reynolds Number (Re) of Water Flowing in Pipe:

$$\mathrm{Re} = \frac{VD}{v}$$

Re =	181,849	therefore, flow is turbulent

Calculate Nusselt Number (Nu) for Turbulent Flow:

$$Nu = 0.023(\mathrm{Re})^{0.8}(\mathrm{Pr})^{n}$$

Nu for heating =	808.23	
Nu for cooling =	665.31	
Typical n-values:	0.4	Water in pipe is cooler than surrounding air
	0.3	Water in pipe is hotter than surrounding air

Calculate the Average Unit Convective Coefficient for the Water:

$$Nu = \frac{h_1 * D}{\lambda_f} \rightarrow h_1 = \frac{Nu\lambda_f}{D}$$

h_1 for heating	831.01	BTU/ft^2 hr °F
h_1 for cooling	684.07	BTU/ft^2 hr °F

Calculate the Heat Transfer Per Unit Length of Pipe:

$$R_1 = \frac{1}{2}\pi r_1 h_1 \qquad R_2 = \frac{\ln\left(\frac{r_2}{r_1}\right)}{2\pi r_1 \lambda_p} \qquad q = \frac{\Delta T}{\sum R_i}$$

R_1	0.0011	BTU/ft hr °F
R_2	0.0131	BTU/ft hr °F
q	1056.64	BTU/ft hr

Calculate the Temperature Change in Pipe:

Heat gain/loss	105,664	BTU/hr
Water pumped	100,080	lbs/hr
Temp Change	1.06	°F

Inputs
Formulas or Constant

Calculation 42

CONVECTIVE HEAT TRANSFER CALCULATIONS

(Influent Water Temperature = 80 ^{o}F)

Lockheed Martin Tallevast Site

Tallevast, Florida

Calc Prepared By:	J. Bedessem
Calc Checked By:	W. May
Date:	6/12/2009

Calculate heat gain of water in building piping from primary settling tanks to advanced oxidation process equipment.

Convective Heat Transfer Inputs:

Fluid:	Groundwater	
Flow Rate =	200	gpm
Kinematic viscosity (ν) =	0.0000093	ft^2/sec at 80^{o}F
Prandtl Number (Pr) =	7	at 20°C

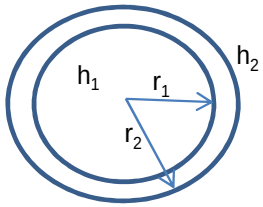
Thermal Conductivity of the fluid:

λ_f (W/m °K) =	0.597	W/m ^{o}K *
λ_f (BTU/ft hr °F) =	0.34495622	BTU/ft hr ^{o}F

*from Engineering Thermodynamics with Applications, Table A.23

Specific heat of water =	1	BTU/lb ^{o}F
Water temperature =	81	F
Air temp =	95	F

Pipe Material:	Sch 40 SS	
Pipe Nominal Diameter =	4	
Pipe Outer Diameter (in) =	4.5	inch
Pipe Outer Diameter (ft) =	0.375	ft
Wall Thickness =	0.237	inch
Pipe Inner Diameter (in) =	4.026	inch
Pipe Inner Diameter (ft) =	0.3355	ft
Linear ft of pipe:	50	ft



Thermal Conductivity of the pipe:

λ_p (W/m °K) =	14	W/m ^{o}K **
λ_p (BTU/ft hr °F) =	8.089	BTU/ft hr °F

**from Engineering Thermodynamics with Applications, Table A.22

Conversion Factors:

1 BTU/ft hr °F =	1.731	W/m °K
1 BTU/ft2 hr °F =	5.678	W/m^2 $^{\circ}$K
1 hr =	60	min
1 gal =	8.34	lb

Calculate Convection Heat Transfer Coefficient for Air:

h_2 =	10	W/m^2 ^{o}K ***
	1.761	BTU/ft hr °F

***from Engineering Thermodynamics with Applications, Table 19.1

CONVECTIVE HEAT TRANSFER CALCULATIONS

(Influent Water Temperature = 80 °F)

Lockheed Martin Tallevast Site

Tallevast, Florida

Calc Prepared By:	J. Bedessem
Calc Checked By:	W. May
Date:	6/12/2009

Calculate heat gain of water in building piping from primary settling tanks to advanced oxidation process equipment.

Calculate r_1 and r_2:

Pipe Inner Radius (r_1) =	0.17	ft
Pipe Outer Radius (r_2) =	0.19	ft

Calculate Reynolds Number (Re) of Water Flowing in Pipe:

$$\mathrm{Re} = \frac{VD}{v}$$

Re =	181,849	therefore, flow is turbulent

Calculate Nusselt Number (Nu) for Turbulent Flow:

$$Nu = 0.023(\mathrm{Re})^{0.8}(\mathrm{Pr})^{n}$$

Nu for heating =	808.23	
Nu for cooling =	665.31	
Typical n-values:	0.4	Water in pipe is cooler than surrounding air
	0.3	Water in pipe is hotter than surrounding air

Calculate the Average Unit Convective Coefficient for the Water:

$$Nu = \frac{h_1 * D}{\lambda_f} \rightarrow h_1 = \frac{Nu\lambda_f}{D}$$

h_1 for heating	831.01	BTU/ft^2 hr °F
h_1 for cooling	684.07	BTU/ft^2 hr °F

Calculate the Heat Transfer Per Unit Length of Pipe:

$$R_1 = \frac{1}{2}\pi r_1 h_1 \qquad R_2 = \frac{\ln\left(\frac{r_2}{r_1}\right)}{2\pi r_1 \lambda_p} \qquad q = \frac{\Delta T}{\sum R_i}$$

R_1	0.0011	BTU/ft hr °F
R_2	0.0131	BTU/ft hr °F
q	986.20	BTU/ft hr

Calculate the Temperature Change in Pipe:

Heat gain/loss	49,310	BTU/hr
Water pumped	100,080	lbs/hr
Temp Change	0.49	°F

Inputs

CONVECTIVE HEAT TRANSFER CALCULATIONS

(Influent Water Temperature = 80 ^{o}F)

Lockheed Martin Tallevast Site

Tallevast, Florida

Calc Prepared By:	J. Bedessem
Calc Checked By:	W. May
Date:	6/12/2009

Calculate heat gain of water in building piping from primary settling tanks to advanced oxidation process equipment.

Formulas or Constant

Calculation 43

CONVECTIVE HEAT TRANSFER CALCULATIONS

(Influent Water Temperature = 97 °F)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc Prepared By:	J. Bedessem
Calc Checked By:	W. May
Date:	6/12/2009

Calculate heat loss of water in building piping following advanced oxidation process equipment, assuming a 15°F temperature rise occurs due to advanced oxidation process.

Convective Heat Transfer Inputs:

Fluid:	Groundwater	
Flow Rate =	200	gpm
Kinematic viscosity (ν) =	0.0000093	ft^2/sec at 80°F
Prandtl Number (Pr) =	7	at 20°C

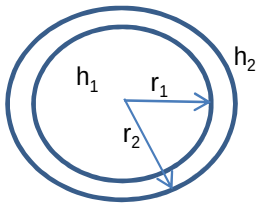
Thermal Conductivity of the fluid:

λ_f (W/m °K) =	0.597	W/m °K *
λ_f (BTU/ft hr °F) =	0.34495622	BTU/ft hr °F

*from Engineering Thermodynamics with Applications, Table A.23

Specific heat of water =	1	BTU/lb °F
Water temperature =	97	F
Air temp =	95	F

Pipe Material:	Sch 40 SS	
Pipe Nominal Diameter =	4	
Pipe Outer Diameter (in) =	4.5	inch
Pipe Outer Diameter (ft) =	0.375	ft
Wall Thickness =	0.237	inch
Pipe Inner Diameter (in) =	4.026	inch
Pipe Inner Diameter (ft) =	0.3355	ft
Linear ft of pipe:	100	ft



Thermal Conductivity of the pipe:

λ_p (W/m °K) =	14	W/m °K **
λ_p (BTU/ft hr °F) =	8.089	BTU/ft hr °F

**from Engineering Thermodynamics with Applications, Table A.22

Conversion Factors:

1 BTU/ft hr °F =	1.731	W/m °K
1 BTU/ft2 hr °F =	5.678	W/m^2 °K
1 hr =	60	min
1 gal =	8.34	lb

Calculate Convection Heat Transfer Coefficient for Air:

h_2 =	10	W/m^2 °K ***
	1.761	BTU/ft hr °F

***from Engineering Thermodynamics with Applications, Table 19.1

CONVECTIVE HEAT TRANSFER CALCULATIONS

(Influent Water Temperature = 97 °F)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc Prepared By:	J. Bedessem
Calc Checked By:	W. May
Date:	6/12/2009

Calculate heat loss of water in building piping following advanced oxidation process equipment, assuming a 15°F temperature rise occurs due to advanced oxidation process.

Calculate r_1 and r_2:

Pipe Inner Radius (r_1) =	0.17	ft
Pipe Outer Radius (r_2) =	0.19	ft

Calculate Reynolds Number (Re) of Water Flowing in Pipe:

$$\mathrm{Re} = \frac{VD}{v}$$

Re =	181,849	therefore, flow is turbulent

Calculate Nusselt Number (Nu) for Turbulent Flow:

$$Nu = 0.023(\mathrm{Re})^{0.8}(\mathrm{Pr})^{n}$$

Nu for heating =	808.23	
Nu for cooling =	665.31	
Typical n-values:	0.4	Water in pipe is cooler than surrounding air
	0.3	Water in pipe is hotter than surrounding air

Calculate the Average Unit Convective Coefficient for the Water:

$$Nu = \frac{h_1 * D}{\lambda_f} \quad \rightarrow \quad h_1 = \frac{Nu\lambda_f}{D}$$

h_1 for heating	831.01	BTU/ft^2 hr °F
h_1 for cooling	684.07	BTU/ft^2 hr °F

Calculate the Heat Transfer Per Unit Length of Pipe:

$$R_1 = \frac{1}{2}\pi r_1 h_1 \qquad R_2 = \frac{\ln\left(\frac{r_2}{r_1}\right)}{2\pi r_1 \lambda_p} \qquad q = \frac{\Delta T}{\sum R_i}$$

R_1	0.0014	BTU/ft hr °F
R_2	0.0131	BTU/ft hr °F
q	-138.49	BTU/ft hr

Calculate the Temperature Change in Pipe:

Heat gain/loss	-13,849	BTU/hr
Water pumped	100,080	lbs/hr
Temp Change	-0.14	°F

Inputs
Formulas or Constant

Calculation 44

CONVECTIVE HEAT TRANSFER CALCULATIONS

(Influent Water Temperature = 105 ^{o}F)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc Prepared By:	J. Bedessem
Calc Checked By:	W. May
Date:	6/12/2009

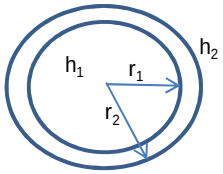
Calculate heat loss of water in building piping following advanced oxidation process equipment, assuming temperature following advanced oxidation process is 105^{o}F.

Convective Heat Transfer Inputs:

Fluid:	Groundwater	
Flow Rate =	200	gpm
Kinematic viscosity (v) =	0.0000093	ft^2/sec at 80^{o}F
Prandtl Number (Pr) =	7	at 20°C
Thermal Conductivity of the fluid:		
λ_f (W/m °K) =	0.597	W/m ^{o}K *
λ_f (BTU/ft hr °F) =	0.34495622	BTU/ft hr ^{o}F
Specific heat of water =	1	BTU/lb ^{o}F
Water temperature =	105	F
Air temp =	95	F
Pipe Material:	Sch 40 SS	
Pipe Nominal Diameter =	4	
Pipe Outer Diameter (in) =	4.5	inch
Pipe Outer Diameter (ft) =	0.375	ft
Wall Thickness =	0.237	inch
Pipe Inner Diameter (in) =	4.026	inch
Pipe Inner Diameter (ft) =	0.3355	ft
Linear ft of pipe:	100	ft
Thermal Conductivity of the pipe:		
λ_p (W/m °K) =	14	W/m ^{o}K **
λ_p (BTU/ft hr °F) =	8.089	BTU/ft hr °F

*from Engineering Thermodynamics with Applications, Table A.23

**from Engineering Thermodynamics with Applications, Table A.22



Conversion Factors:

1 BTU/ft hr °F =	1.731	W/m °K
1 BTU/ft2 hr °F =	5.678	W/m^2 °K
1 hr =	60	min
1 gal =	8.34	lb

Calculate Convection Heat Transfer Coefficient for Air:

h_2 =	10	W/m^2 ^{o}K ***
	1.761	BTU/ft hr °F

***from Engineering Thermodynamics with Applications, Table 19.1

CONVECTIVE HEAT TRANSFER CALCULATIONS

(Influent Water Temperature = 105 °F)

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc Prepared By:	J. Bedessem
Calc Checked By:	W. May
Date:	6/12/2009

Calculate heat loss of water in building piping following advanced oxidation process equipment, assuming temperature following advanced oxidation process is 105°F.

Calculate r_1 and r_2:

Pipe Inner Radius (r_1) =	0.17	ft
Pipe Outer Radius (r_2) =	0.19	ft

Calculate Reynolds Number (Re) of Water Flowing in Pipe:

$$\mathrm{Re} = \frac{VD}{v}$$

Re = 181,849 therefore, flow is turbulent

Calculate Nusselt Number (Nu) for Turbulent Flow:

$$Nu = 0.023(\mathrm{Re})^{0.8}(\mathrm{Pr})^{n}$$

Nu for heating =	808.23
Nu for cooling =	665.31

Typical n-values:	0.4	Water in pipe is cooler than surrounding air
	0.3	Water in pipe is hotter than surrounding air

Calculate the Average Unit Convective Coefficient for the Water:

$$Nu = \frac{h_1 * D}{\lambda_f} \rightarrow h_1 = \frac{Nu\lambda_f}{D}$$

h_1 for heating	831.01	BTU/ft^2 hr °F
h_1 for cooling	684.07	BTU/ft^2 hr °F

Calculate the Heat Transfer Per Unit Length of Pipe:

$$R_1 = \frac{1}{2}\pi r_1 h_1 \qquad R_2 = \frac{\ln\left(\frac{r_2}{r_1}\right)}{2\pi r_1 \lambda_p} \qquad q = \frac{\Delta T}{\sum R_i}$$

R_1	0.0014	BTU/ft hr °F
R_2	0.0131	BTU/ft hr °F
q	-692.46	BTU/ft hr

Calculate the Temperature Change in Pipe:

Heat gain/loss	-69,246	BTU/hr
Water pumped	100,080	lbs/hr
Temp Change	-0.69	°F

Inputs
Formulas or Constant

Calculation 45

ARCADIS

RAP Estimated AOP Performance Calculation
Lockheed Martin Tallevast Site
Tallevast, Florida

Rate Constant Calculation:

The estimated RAP AOP rate constants for specific COCs were calculated utilizing analytical data collected from the IRA treatment system from 2/5/08 through 3/28/08. This period of IRA operations was chosen because influent water quality is similar to that expected during RAP operations, since during this period the IRA iron removal system was operating and bromide concentrations were at background levels. During this period, analytical samples were collected from the AOP influent and effluent, seven times. The table below summarizes AOP influent and effluent average concentrations for TCE, 1,4-Dioxane and 1,1-DCA.

Constituent	Average Influent Concentration (ug/L)	Average Effluent Concentration (ug/L)
TCE	659	0.5
1,4 Dioxane	256	0.6
1,1-DCA	64	19

TCE and 1,4-dioxane are used specifically to size the AOP since TCE concentrations are expected to be the highest experienced at the treatment system and 1,4-dioxane is recalcitrant to other treatment processes. 1,1-DCA is not be used to size the AOP since 1,1-DCA and other chlorinated ethanes have long rates of reaction with most oxidants, including the hydroxyl radicals produced in this AOP. However, calculated 1,1-DCA removal through the AOP is used to determine GAC influent concentrations of 1,1,-DCA.

The rate constant equation for a specific COC is as follows:

*K = ln (C / Co) * (Q / P) – Equation 1*

Where:

K = Rate Constant (Lpm/kW)

C = Influent Concentration (ug/L)

Co = Effluent Concentration (ug/L)

Q = Flow Rate (Lpm) – 25 gpm or 94.6 Lpm during the period of testing

P = Power (kW) – 38.4 kW during the period of testing

Therefore, calculating the rate constant for TCE is performed as follows:

K_{TCE} *= ln (659 ug/L / 0.5 ug/L) * (94.6 Lpm / 38.4 kW)*

K_{TCE} = *17.55 Lpm/kW*

Resulting rate constants for 1,4-Dioxane and 1,1-DCA are as follows:

$K_{1,4\text{-}Dioxane}$ = *14.92 Lpm/kW*

$K_{1,1\text{-}DCA}$ = *3.09 Lpm/kW*

AOP Power Requirement Calculation:

Utilizing the calculated rate constants; the power requirement for the RAP AOP can be calculated. The equation for power is simply derived from Equation 1.

*P = ln (C / Co) * (Q / K) – Equation 2*

The calculated influent concentrations for TCE and 1,4-Dioxane are 629 ug/L and 138 ug/L respectively. Influent concentrations utilized for the AOP power calculation utilize a 33% safety factor which results in concentrations of 837 ug/L and 184 ug/L for TCE and 1,4 Dioxane respectively. Finally, the desired effluent concentration for the constituents are the GCTL which are 3.0 ug/L and 3.2 ug/L for TCE and 1,4-Dioxane respectively.

The maximum design flow rate for the RAP AOP is 300 gpm or 1135.5 Lpm.

Therefore:

P_{TCE} = *ln (837 ug/L / 3.0 ug/L) * (1135.5 Lpm / 17.55 Lpm/kW)*

P_{TCE} = *364.3 kW*

$P_{1,4\text{-}Dioxane}$ = *ln (184 ug/L / 3.2 ug/L) * (1135.5 Lpm / 14.92 Lpm/kW)*

$P_{1,4\text{-}Dioxane}$ = *308.4 kW*

From the calculations above the power requirement for TCE is greater than that for 1,4-Dioxane, therefore the AOP will be sized based on TCE concentrations. An AOP of 365 kW will be sufficient to treat groundwater expected during RAP treatment system operations.

1,4-Dioxane Maximum AOP Influent Calculation:

The maximum RAP AOP influent concentration for 1,4-Dioxane can be calculated from a derivation of Equation 1 as shown below:

$C = Co / e^{-((P * K) / Q)}$ *– Equation 3*

Where:

C = Influent Concentration (ug/L)

Co = Effluent Concentration (ug/L) – 3.2 ug/L required for RAP system

P = AOP Power (kW) – 365 kW determined from calculations above

K = Rate Constant (Lpm/kW) – 14.92 Lpm/kW for 1,4-Dioxane

Q = Maximum Design Flow Rate (Lpm) – 300 gpm or 1135.5 Lpm for RAP system

Therefore:

$C_{1,4\text{-}Dioxane} = 3.2\ ug/L\ /\ e^{-((365\ kW\ *\ 14.92\ Lpm/Kw)\ /\ 1135.5\ Lpm)}$

$C_{1,4\text{-}Dioxane} = 387\ ug/L$

1,1-DCA Expected AOP Effluent Calculation:

The expected RAP AOP effluent concentration for 1,1-DCA can be calculated from a derivation of Equation 1 as shown below:

$Co = C\ /\ e^{((P\ *\ K)\ /\ Q)}$ – *Equation 4*

Where:

Co = Effluent Concentration (ug/L)

C = Influent Concentration (ug/L) – 50 ug/L based on calculated influent concentration (40ug/L) plus 25% safety factor

P = AOP Power (kW) – 365 kW determined from calculations above

K = Rate Constant (Lpm/kW) – 3.09 Lpm/kW for 1,1-DCA

Q = Maximum Design Flow Rate (Lpm) – 300 gpm or 1135.5 Lpm for RAP system

Therefore:

$Co_{1,1\text{-}DCA} = 50\ ug/L\ /\ e^{((365\ kW\ *\ 3.09\ \ Lpm/Kw)\ /\ 1135.5\ Lpm)}$

$Co_{1,1\text{-}DCA} = 18.6\ ug/L$

Calculation 46

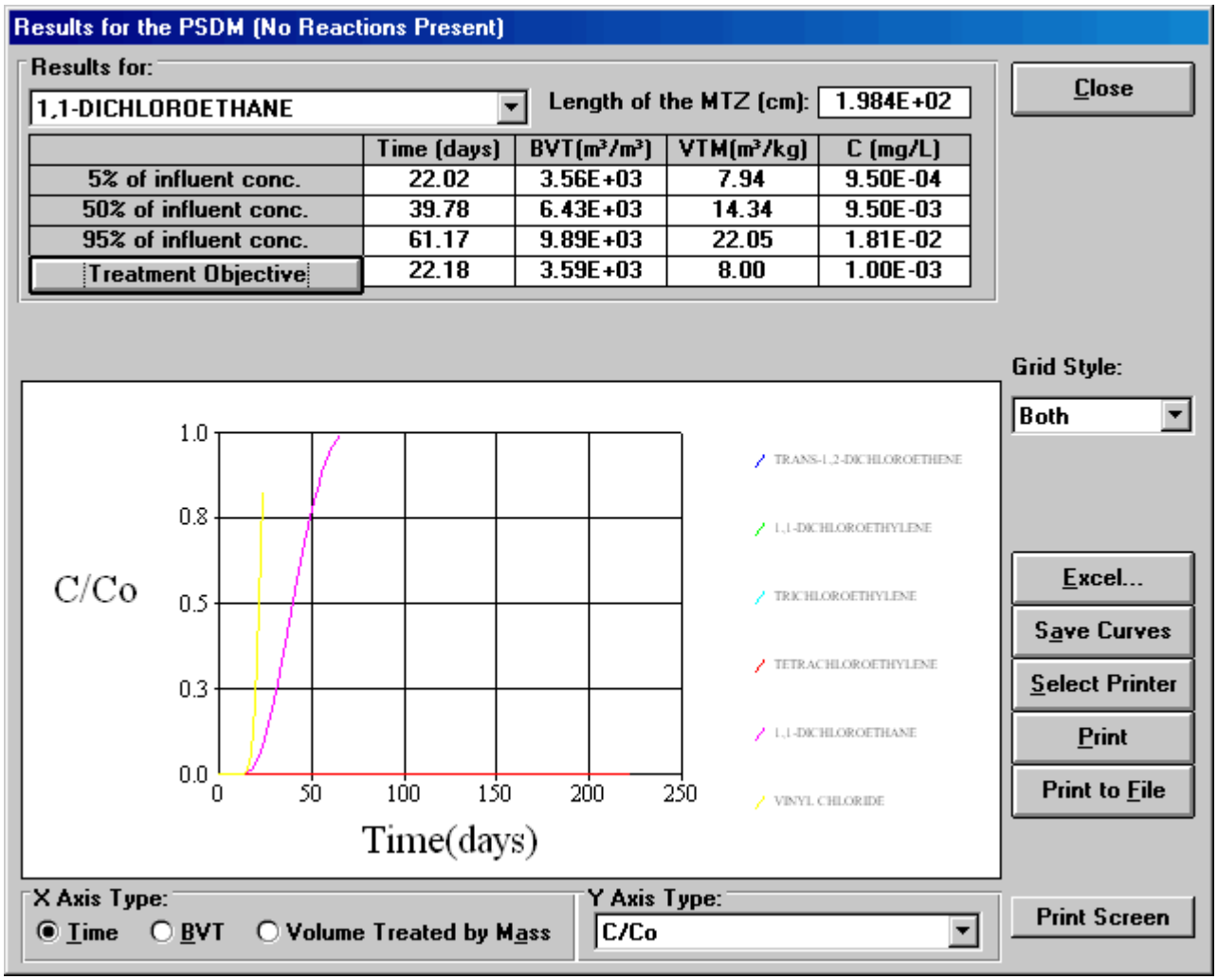
ARCADIS

RAP Carbon Use Calculations
Lockheed Martin Tallevast Site
Tallevast, Florida

Assumptions:

1. Expected 1,1 DCA Concentration at Mid Process point = 0.019 mg/L[1]
2. Expected 1,1 DCE Concentration at Mid Process point = 0.002 mg/L[2]
3. Expected cis-1,2 DCE Concentration at Mid Process point = 0.00065 mg/L[2]
4. Expected PCE Concentration at Mid Process point = 0.0005 mg/L[2]
5. Maximum TCE Concentration at Mid Process point = 0.003 mg/L[2]
6. Maximum Vinyl Chloride Concentration at Mid Process point = 0.00052 mg/L[2]
7. Maximum daily flow rate = 300 gpm
8. Two trains of carbon, each containing 3 vessels in series
9. 5,000 pounds of virgin coconut carbon per vessel
10. Carbon changed out when concentrations in effluent are detectable.

Carbon use calculated by Siemens (liquid phase carbon supplier) - 1,1 DCA controls design



ARCADIS

RAP Carbon Use Calculations
Lockheed Martin Tallevast Site
Tallevast, Florida

Modeling by Siemens predicts breakthrough of lead vessels in 22 days at 300 gpm (150 gpm per train).

At 200 gpm (100 gpm per train), single vessel lifespan will be:

Time = 22 days x (300 gpm / 200 gpm)

Time = 33 days

Carbon Vessel Exchange expected to occur 1 time per month.

Calculation 47

VAPOR GAC USE CALCULATIONS

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Estimate of Chemical Concentrations in Air:

Air Discharge Assumptions:

Passive air discharge occurs as tank levels increase, pushing air out of the tank.
The water levels in T-100, T-110A/B, T-130, T-140A/B, T-200, and T-810 will remain fairly constant.
The water levels in T-300 and T-800 will vary due to backwashing operations and therefore will be the primary contributors to passive air discharge.
During backwashing, the water level in T-300 will be dropping, while T-800 will be rising proportionally.
Following backwashing, the water level in T-800 will be dropping, while T-300 will be rising proportionally.
These tanks will be manifolded together, therefore, air may be moved between tanks and not all air will discharge through the carbon.
Therefore, the air discharge rate has been estimated to equal 1/2 the backwash rate on a daily basis.
The air in the tanks will be in equilibrium with the influent groundwater concentrations.

1/2 Backwash System Flow Rate =	12.5	gpm	average daily flow for backwash waters,
Air Discharge Rate =	0.8	cfm	not instantaneous
Q_{air} =	0.0237	m^3/min	conversion 1 ft^3 = 0.028316 m^3

Convert air concentrations from ppmv to ug/m^3:

$$Conc_2 = \frac{Conc_1 * 1000 * MW}{Temp * R}$$

Where:

$Conc_1$ =	Air concentration in parts per million by volume (ppmv)
$Conc_2$ =	Air concentration in ug/m^3
MW =	Molecular weight of compound
$Temp$ =	Air temperature in degrees Kelvin
R =	Universal gas constant (0.08205 atm*L/mol*K)

Calculate VOC Flow Rate:

$$\text{Mass flow rate (lb/day)} = Conc_2 * 2.2 * \left(\frac{1}{1{,}000{,}000}\right) * Q_{air} * 1{,}440$$

Conversions:

2.2 kg =	1 lb
1,440 min =	1 day
1 kg =	1,000,000 ug

Compound	Influent Concentration (mg/L)	Equilibrium Air Concentration (ppmv)	Equilibrium Air Concentration (ug/m^3)	VOC Flow Rate (lbs/day)
PCE	0.043	0.04	271	0.02
TCE	0.629	0.49	2632	0.20
cis-DCE	0.030	0.01	40	0.00
trans-DCE	<0.005	0.00	0	0.00
VC	<0.005	0.00	0	0.00
1,1 DCE	0.086	0.23	911	0.07
1,1 DCA	0.039	0.02	81	0.01
1,4 Dioxane	0.138	0.00	1	0.00

Total potential lbs of VOCs	0.29	lbs/day
Average GAC Loading Rate	0.1	lb/lb
Potential GAC Use Rate	2.9	lb/day

CHEMICAL PROPERTIES

Lockheed Martin Tallevast Site
Tallevast, Florida

Calc prepared by: M. Seppanen
Calc checked by: J. Bedessem
Date: 7/2/09

Henry's Law Conversion:

$H_A = c_2 \times H \times 10^3\ L/m^3$

where: H_A = henry's law constant in atm
c_2 = molar concentration of water (55.56 mol/L)
H = henry's law constant in atm - m^3/mol

and

$H_{Ax} = H_A / [c_2 \times R \times (T + 273.2)]$

where H_{Ax} = henry's law constant used in Airstrip program (dimensionless)
R = universal gas constant which is 0.082076
T = temperature in degrees Celcius which is 25

Compound	H (atm - m^3/mol)	H_A (atm)	H_{AX} (dimensionless)	MW (g/mol)	Temperature degrees C	Source
PCE	1.47E-02	817.8432	0.6015	165.83	25	(1)
TCE	1.02E-02	566.7120	0.4168	131.39	25	(1)
cis-DCE	4.50E-03	250.0200	0.1839	96.94	25	(2)
trans-DCE	9.45E-03	525.0420	0.3862	96.94	25	(1)
VC	2.65E-02	1472.3400	1.0829	62.50	25	(1)
1,1 DCE	2.59E-02	1439.0040	1.0584	96.94	25	(1)
1,1 DCA	6.25E-03	347.2500	0.2554	98.96	25	(1)
1,4 Dioxane	9.05E-06	0.5028	0.0004	88.11	25	(1)

Notes:
(1) Groundwater Chemicals Desk Reference
(2) CRC Handbook of Chemistry & Physics

Using Henry's Law to Calculate VOC Equilibrium

PCE

Given:

$C_{VOC} := 0.043 \cdot \frac{mg}{L}$

$MW_{VOC} := 165.83 \cdot \frac{gm}{mol}$

$MW_{h2o} := 18 \cdot \frac{gm}{mol}$

$H_{VOC} := 818 \cdot atm$ at 25 degrees C

$\delta_{h2o} := 1 \cdot \frac{gm}{mL}$

$p_T := 1 \cdot atm$

C_{VOC} is the concentration of VOC in water

MW_{VOC} is the molecular weight of VOC compound

MW_{h2o} is the molecular weigth of water

H_{VOC} is the Henry's Law constant for the VOC

δ_{h2o} is the density of water

p_T is atmospheric pressure

Convert concentration of VOC in water to mol fraction:

$x_{VOC} := \frac{C_{VOC}}{MW_{VOC}} \cdot \frac{MW_{h2o}}{\delta_{h2o}}$ x_{VOC} is the concentration of VOC in water (mol fraction)

$x_{VOC} = 4.667 \times 10^{-9}$

Calculate the resulting partial pressure of VOC in air using Henry's Law:

$p_{VOC} := H_{VOC} \cdot x_{VOC}$ p_{VOC} is the partial pressure of VOC in air

$p_{VOC} = 3.818 \times 10^{-6}\ atm$

Now we can calculate the mol fraction of VOC in air using the formula:

$y_{VOC} := \frac{p_{VOC}}{p_T}$ y_{VOC} is the concentration of VOC in air (mol fraction)

$y_{VOC} = 3.818 \times 10^{-6}$

Converting the concentration in air from mol fraction to ppmv:

$C_{VOC} := y_{VOC} \cdot 10000$

$C_{VOC} = 0.04$ ppmv

At equilibrium, the PCE concentration in air above water with a concentration of 0.043 mg/L dissolved PCE would be approximately 0.04 ppmv.

Using Henry's Law to Calculate VOC Equilibrium

TCE

Given:

$C_{VOC} := 0.629 \cdot \frac{mg}{L}$

$MW_{VOC} := 131.39 \cdot \frac{gm}{mol}$

$MW_{h2o} := 18 \cdot \frac{gm}{mol}$

$H_{VOC} := 567 \cdot atm$ at 25 degrees C

$\delta_{h2o} := 1 \cdot \frac{gm}{mL}$

$p_T := 1 \cdot atm$

C_{VOC} is the concentration of VOC in water

MW_{VOC} is the molecular weight of VOC compound

MW_{h2o} is the molecular weigth of water

H_{VOC} is the Henry's Law constant for the VOC

δ_{h2o} is the density of water

p_T is atmospheric pressure

Convert concentration of VOC in water to mol fraction:

$x_{VOC} := \frac{C_{VOC}}{MW_{VOC}} \cdot \frac{MW_{h2o}}{\delta_{h2o}}$ x_{VOC} is the concentration of VOC in water (mol fraction)

$x_{VOC} = 8.617 \times 10^{-8}$

Calculate the resulting partial pressure of VOC in air using Henry's Law:

$p_{VOC} := H_{VOC} \cdot x_{VOC}$ p_{VOC} is the partial pressure of VOC in air

$p_{VOC} = 4.886 \times 10^{-5}\ atm$

Now we can calculate the mol fraction of VOC in air using the formula:

$y_{VOC} := \frac{p_{VOC}}{p_T}$ y_{VOC} is the concentration of VOC in air (mol fraction)

$y_{VOC} = 4.886 \times 10^{-5}$

Converting the concentration in air from mol fraction to ppmv:

$C_{VOC} := y_{VOC} \cdot 10000$

$C_{VOC} = 0.49$ ppmv

At equilibrium, the TCE concentration in air above water with a concentration of 0.629 mg/L dissolved TCE would be approximately 0.49 ppmv.

Using Henry's Law to Calculate VOC Equilibrium cis-DCE

Given:

$C_{VOC} := 0.030 \cdot \frac{mg}{L}$

$MW_{VOC} := 96.94 \cdot \frac{gm}{mol}$

$MW_{h2o} := 18 \cdot \frac{gm}{mol}$

$H_{VOC} := 250 \cdot atm$ at 25 degrees C

$\delta_{h2o} := 1 \cdot \frac{gm}{mL}$

$p_T := 1 \cdot atm$

C_{VOC} is the concentration of VOC in water

MW_{VOC} is the molecular weight of VOC compound

MW_{h2o} is the molecular weigth of water

H_{VOC} is the Henry's Law constant for the VOC

δ_{h2o} is the density of water

p_T is atmospheric pressure

Convert concentration of VOC in water to mol fraction:

$x_{VOC} := \frac{C_{VOC}}{MW_{VOC}} \cdot \frac{MW_{h2o}}{\delta_{h2o}}$ x_{VOC} is the concentration of VOC in water (mol fraction)

$x_{VOC} = 5.57 \times 10^{-9}$

Calculate the resulting partial pressure of VOC in air using Henry's Law:

$p_{VOC} := H_{VOC} \cdot x_{VOC}$ p_{VOC} is the partial pressure of VOC in air

$p_{VOC} = 1.393 \times 10^{-6}\ atm$

Now we can calculate the mol fraction of VOC in air using the formula:

$y_{VOC} := \frac{p_{VOC}}{p_T}$ y_{VOC} is the concentration of VOC in air (mol fraction)

$y_{VOC} = 1.393 \times 10^{-6}$

Converting the concentration in air from mol fraction to ppmv:

$C_{VOC} := y_{VOC} \cdot 10000$

$C_{VOC} = 0.01$ ppmv

At equilibrium, the cis-DCE concentration in air above water with a concentration of 0.030 mg/L dissolved cis-DCE would be approximately 0.01 ppmv.

Using Henry's Law to Calculate VOC Equilibrium

1,1-DCE

Given:

$C_{VOC} := 0.086 \cdot \frac{mg}{L}$

$MW_{VOC} := 96.94 \cdot \frac{gm}{mol}$

$MW_{h2o} := 18 \cdot \frac{gm}{mol}$

$H_{VOC} := 1439 \cdot atm$ at 25 degrees C

$\delta_{h2o} := 1 \cdot \frac{gm}{mL}$

$p_T := 1 \cdot atm$

C_{VOC} is the concentration of VOC in water

MW_{VOC} is the molecular weight of VOC compound

MW_{h2o} is the molecular weigth of water

H_{VOC} is the Henry's Law constant for the VOC

δ_{h2o} is the density of water

p_T is atmospheric pressure

Convert concentration of VOC in water to mol fraction:

$x_{VOC} := \frac{C_{VOC}}{MW_{VOC}} \cdot \frac{MW_{h2o}}{\delta_{h2o}}$ x_{VOC} is the concentration of VOC in water (mol fraction)

$x_{VOC} = 1.597 \times 10^{-8}$

Calculate the resulting partial pressure of VOC in air using Henry's Law:

$p_{VOC} := H_{VOC} \cdot x_{VOC}$ p_{VOC} is the partial pressure of VOC in air

$p_{VOC} = 2.298 \times 10^{-5}\ atm$

Now we can calculate the mol fraction of VOC in air using the formula:

$y_{VOC} := \frac{p_{VOC}}{p_T}$ y_{VOC} is the concentration of VOC in air (mol fraction)

$y_{VOC} = 2.298 \times 10^{-5}$

Converting the concentration in air from mol fraction to ppmv:

$C_{VOC} := y_{VOC} \cdot 10000$

$C_{VOC} = 0.23$ ppmv

At equilibrium, the 1,1-DCE concentration in air above water with a concentration of 0.086 mg/L dissolved 1,1-DCE would be approximately 0.23 ppmv.

Using Henry's Law to Calculate VOC Equilibrium

1,1-DCA

Given:

$C_{VOC} := 0.039 \cdot \frac{mg}{L}$

$MW_{VOC} := 98.96 \cdot \frac{gm}{mol}$

$MW_{h2o} := 18 \cdot \frac{gm}{mol}$

$H_{VOC} := 347 \cdot atm$ at 25 degrees C

$\delta_{h2o} := 1 \cdot \frac{gm}{mL}$

$p_T := 1 \cdot atm$

C_{VOC} is the concentration of VOC in water

MW_{VOC} is the molecular weight of VOC compound

MW_{h2o} is the molecular weigth of water

H_{VOC} is the Henry's Law constant for the VOC

δ_{h2o} is the density of water

p_T is atmospheric pressure

Convert concentration of VOC in water to mol fraction:

$x_{VOC} := \frac{C_{VOC}}{MW_{VOC}} \cdot \frac{MW_{h2o}}{\delta_{h2o}}$ x_{VOC} is the concentration of VOC in water (mol fraction)

$x_{VOC} = 7.094 \times 10^{-9}$

Calculate the resulting partial pressure of VOC in air using Henry's Law:

$p_{VOC} := H_{VOC} \cdot x_{VOC}$ p_{VOC} is the partial pressure of VOC in air

$p_{VOC} = 2.462 \times 10^{-6}\ atm$

Now we can calculate the mol fraction of VOC in air using the formula:

$y_{VOC} := \frac{p_{VOC}}{p_T}$ y_{VOC} is the concentration of VOC in air (mol fraction)

$y_{VOC} = 2.462 \times 10^{-6}$

Converting the concentration in air from mol fraction to ppmv:

$C_{VOC} := y_{VOC} \cdot 10000$

$C_{VOC} = 0.02$ ppmv

At equilibrium, the 1,1-DCA concentration in air above water with a concentration of 0.039 mg/L dissolved 1,1-DCA would be approximately 0.02 ppmv.

Using Henry's Law to Calculate VOC Equilibrium 1,4 Dioxane

Given:

$C_{VOC} := 0.138 \cdot \frac{mg}{L}$

$MW_{VOC} := 88.11 \cdot \frac{gm}{mol}$

$MW_{h2o} := 18 \cdot \frac{gm}{mol}$

$H_{VOC} := 0.5 \cdot atm$ at 25 degrees C

$\delta_{h2o} := 1 \cdot \frac{gm}{mL}$

$p_T := 1 \cdot atm$

C_{VOC} is the concentration of VOC in water

MW_{VOC} is the molecular weight of VOC compound

MW_{h2o} is the molecular weigth of water

H_{VOC} is the Henry's Law constant for the VOC

δ_{h2o} is the density of water

p_T is atmospheric pressure

Convert concentration of VOC in water to mol fraction:

$x_{VOC} := \frac{C_{VOC}}{MW_{VOC}} \cdot \frac{MW_{h2o}}{\delta_{h2o}}$ x_{VOC} is the concentration of VOC in water (mol fraction)

$x_{VOC} = 2.819 \times 10^{-8}$

Calculate the resulting partial pressure of VOC in air using Henry's Law:

$p_{VOC} := H_{VOC} \cdot x_{VOC}$ p_{VOC} is the partial pressure of VOC in air

$p_{VOC} = 1.41 \times 10^{-8}\ atm$

Now we can calculate the mol fraction of VOC in air using the formula:

$y_{VOC} := \frac{p_{VOC}}{p_T}$ y_{VOC} is the concentration of VOC in air (mol fraction)

$y_{VOC} = 1.41 \times 10^{-8}$

Converting the concentration in air from mol fraction to ppmv:

$C_{VOC} := y_{VOC} \cdot 10000$

$C_{VOC} = 1.41 \times 10^{-4}$ ppmv

At equilibrium, the 1,4 Dioxane concentration in air above water with a concentration of 0.138 mg/L dissolved 1,4 Dioxane would be approximately 0.000141 ppmv.

Calculation 48

RECHARGE GALLERY SIZE CALCULATION

Lockheed Martin Tallevast Site
Tallevast, Florida

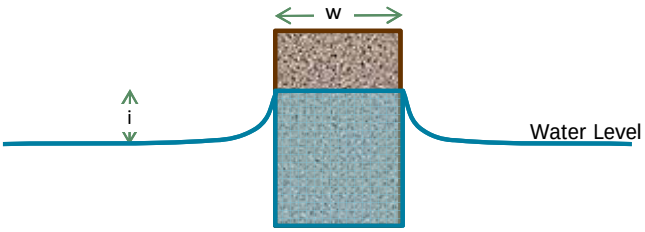
Calc prepared by: J. Bedessem
Calc checked by: J. Perella
Date: 6/12/09

Calculate Size of Treated Water Recharge Gallery:

Recharge Gallery Plan View:



Recharge Gallery Section View:



Recharge gallery size is based on the following parameters:

k =	hydraulic conductivity of soils (ft/day)
A =	plan surface area of recharge gallery (ft^2)
i =	head available in recharge trench (ft/ft)
Q =	Recharge flow rate (GPD)

Where: $Q=k*i*A$ $Q=k*i*w*L$ $L = \frac{Q}{k * i * w}$

Model Data:

The model recharge flow rate (Q) was calculated based on an approximate 200 gpm groundwater extraction rate:

	Trench Location			
	RC-7001	RC-7002	RC-7003	
Model Q =	34	10	4	gpm
Factor of Safety =	1.5	1.5	1.5	
Design Q =	51	15	6	gpm

Recharge Trench Data:

Hydraulic conductivity, k =	0.7	0.7	0.7	ft/day
Available head, h =	2.5	2.5	2.5	ft
Trench width, w =	5	5	5	ft

Conversion Factors:

1 ft^3 =	7.48	gallons
1 day =	1,440	minutes

Calculate the required length of the recharge trench:

Calculated length, L =	1122	330	132	ft

Table E-1
Bill of Materials, RAP Groundwater Treatment System

Lockheed Martin Tallevast Site
Tallevast, Florida

Item	Tag	Qty	Description	System Location	Manufacturer
1	EW-2001 - EW-2037	37	**USAS Extraction Well Submersible Pumps** Type: Submersible Stacked Impeller Centrifugal Model: 5S05-13 Discharge Connection: 1" FNPT Motor: 1/2 HP Submersible 230V 3450RPM Pump Flow Rate: 1.2 gpm @ 360ft TDH - 5gpm @ 240ft TDH Design Flow Rate: 2.1 gpm @ 175ft TDH	Extraction System	Grundfos
2	EW-3001 - EW-3027	27	**LSAS Extraction Well Submersible Pumps** Type: Submersible Stacked Impeller Centrifugal Model: 5S05-13 Discharge Connection: 1" FNPT Motor: 1/2 HP Submersible 230V 3450RPM Pump Flow Rate: 1.2 gpm @ 360ft TDH - 5gpm @ 240ft TDH Design Flow Rate: 1.595 gpm @ 175ft TDH	Extraction System	Grundfos
3	EW-4001 - EW-4011	11	**AFG Extraction Well Submersible Pumps** Type: Submersible Stacked Impeller Centrifugal Model: 5S05-13 Discharge Connection: 1" FNPT Motor: 1/2 HP Submersible 230V 3450RPM Pump Flow Rate: 1.2 gpm @ 360ft TDH - 5gpm @ 240ft TDH Design Flow Rate: 1.8 gpm @ 205ft TDH	Extraction System	Grundfos
4	EW-5001, EW-5002	2	**S&P Extraction Well Submersible Pumps** Type: Submersible Stacked Impeller Centrifugal Model: 5S05-13 Discharge Connection: 1" FNPT Motor: 1/2 HP Submersible 230V 3450RPM Pump Flow Rate: 1.2 gpm @ 360ft TDH - 5gpm @ 240ft TDH Design Flow Rate: 2.0 gpm @ 200ft TDH	Extraction System	Grundfos
5	EW-2101 - EW-2104	4	**USAS Extraction Trench Submersible Pumps** Type: Submersible Stacked Impeller Centrifugal Model: 25S15-9 Discharge Connection: 1 1/2" FNPT Motor: 1.5 HP Submersible 230V 3450RPM Pump Flow Rate: 18 gpm @ 220ft TDH - 25gpm @ 182ft TDH Design Flow Rate: 20.3 gpm @ 185 TDH	Extraction System	Grundfos
6	SM-100	1	**Primary Static Mixer** Type: 4-inch 6 Element Low Pressure Loss Flange Mounted Model: 275 Materials (body): 316L Stainless Steel Materials (mixer): 316L Stainless Steel	Metals Pretreatment System	Koflo
7	T-100	1	**Primary Settling Tank Splitter Box** Model: Dual Weir Total Volume: 270-gallons Materials (basin): Fiberglass Reinforced Plastic Materials (gates): 316L Stainless Steel	Metals Pretreatment System	Plasti-Fab, Inc.
8	T-110A, T-110B	2	**Primary Settling Tanks** Type: Vertical Cone Bottom, Dome Top Model: C-CKV Materials: Fiberglass Reinforced Plastic Total Height: 178-inches Head Height: 24-inches Cone Height: 70-inches Straight Length: 84-inches Diameter: 144-inches Total Volume: 7,470-gallons Cone Volume: 1522-gallons	Metals Pretreatment System	Belding Tank Technologies, Inc.
9	P-110A, P-110B	2	**Primary Solids Transfer Pumps** Type: Progressive Cavity Positive Displacement Model: 1000 BIC Single Stage Suction Connection: 2-inch 150# Flange Discharge Connection: 2-inch 150# Flange Motor: 0.5 HP TEFC 460V 400RPM Pump Flowrate: 5.0 gpm @ 50ft TDH Design Flowrate: 4.6 gpm @ 50ft TDH	Metals Pretreatment System	Moyno

Table E-1
Bill of Materials, RAP Groundwater Treatment System

Lockheed Martin Tallevast Site
Tallevast, Florida

Item	Tag	Qty	Description	System Location	Manufacturer
10	T-120	1	**Solids Contact Tank** Type: Vertical Cone Bottom, Dome Top Model: C-CKV Materials: Fiberglass Reinforced Plastic Total Height: 157-inches Head Height: 16-inches Cone Height: 45-inches Straight Length: 96-inches Diameter: 96-inches Total Volume: 3,390-gallons Cone Volume: 422	Metals Pretreatment System	Belding Tank Technologies, Inc.
11	M-120	1	**Solids Contact Tank Mixer** Type: Dual Impellet Top Mount Model: 14S1 Materials (wetted): 316L Stainless Steel Motor: 1 HP 460V TEFC 1200RPM Impeller Speed: 84RPM Impeller: Dual 28-inch A510E / 32 Degree w/ Stabilizer	Metals Pretreatment System	Lightnin
12	T-130	1	**Secondary Settling Tank Splitter Box** Model: Dual Weir Total Volume: 270-gallons Materials (basin): Fiberglass Reinforced Plastic Materials (gates): 316L Stainless Steel	Metals Pretreatment System	Plasti-Fab, Inc.
13	T-140A, T-140B	2	**Secondary Settling Tanks** Type: Vertical Cone Bottom, Dome Top Model: C-CKV Materials: Fiberglass Reinforced Plastic Total Height: 178-inches Head Height: 24-inches Cone Height: 70-inches Straight Length: 84-inches Diameter: 144-inches Total Volume: 7,470-gallons Cone Volume: 1522-gallons	Metals Pretreatment System	Belding Tank Technologies, Inc.
14	P-140A, P-140B	2	**Secondary Solids Transfer Pumps** Type: Progressive Cavity Positive Displacement Model: 1000 BIC Single Stage Suction Connection: 2-inch 150# Flange Discharge Connection: 2-inch 150# Flange Motor: 0.75 HP TEFC 460V 600RPM Pump Flowrate: 7.8 gpm @ 50ft TDH Design Flowrate: 8.5 gpm @ 50ft TDH	Metals Pretreatment System	Moyno
15	A-150A, A-150B	3	**Aeration Housing** Type: Inline Ceramic Membrane Model: P7A-802 Maximum Air Flowrate: 1.75 cfm Maximum Water Flowrate: 26.4 gpm	Metals Pretreatment System	Purifics ES Inc.
16	P-150A, P-150B	2	**Aeration Recirculation Pumps** Type: End Suction Centrifugal Model: 1ST1G5B4F Seal Flush: John Crane Safe Unit SFD Suction Connection: 1.25-inch FNPT Discharge Connection: 1-inch FNPT Motor: 2 HP TEFC 460V 3500RPM Pump Flowrate: 30 gpm @ 108ft TDH, 20 gpm @ 119ft TDH, Deadhead @ 136ft TDH Design Flowrate: 30gpm @ 108ft TDH	Metals Pretreatment System	Goulds Pump
17	T-200	1	**Filter Feed Tank** Type: Vertical with Sloped Interior, Dome Top Model: C-CFV Materials: Fiberglass Reinforced Plastic Total Height: 124-inches Head Height: 16-inches Straight Length: 108-inches Diameter: 96-inches Total Volume: 3,340-gallons	Metals Filtration System	Belding Tank Technologies, Inc.

Table E-1
Bill of Materials, RAP Groundwater Treatment System

Lockheed Martin Tallevast Site
Tallevast, Florida

Item	Tag	Qty	Description	System Location	Manufacturer
18	P-200A, P-200B, P-200C	3	**Filter Feed Pumps** Type: End Suction Centrifugal w/ Clean Water Seal Flush Model: 10SH2L52B0 Suction Connection: 2-inch 150# Flange Discharge Connection: 1-inch 150# Flange Motor: 10 HP TEFC 460V 3500RPM Pump Flow Rate: 100 gpm @ 164ft TDH, 75 gpm @ 203ft TDH, Deadhead @ 240ft TDH Design Flow Rate: 100 gpm @ 169ft TDH	Metals Filtration System	Goulds Pump
19	F-210A, F-210B, F-210C	3	**Media Filters** Type: 54-inch diameter multi-media filter Model: MM 5460-3A Material: Epoxy Coated Carbon Steel (3M Scotchkote 134) Maximum Flowrate: 150 gpm (each) Required Air Supply: 2 cfm @ 70 psig Connections: Inlet/Outlet 6-inches, Backwash 4-inches Maximum Working Pressure: 80 psi Approx. Weight: 34,250 lbs Electrical Requirements: Controller 120V; Solenoids 24 VAC Media: Layne-Ox	Metals Filtration System	Yardney
20	P-210A, P-210B	2	**Media Filter Backwash Pumps** Type: End Suction Centrifugal Model: 6SH2N52E0 Suction Connection: 3-inch 150# Flange Discharge Connection: 2.5-inch 150# Flange Motor: 20 HP TEFC 460V 3500RPM Pump Flowrate: 400 gpm @ 112ft TDH, 300 gpm @ 136ft TDH, Deadhead @ 160ft TDH Design Flowrate: 400 gpm @ 117ft TDH	Metals Filtration System	Goulds Pump
21	F-230A, F-230B, F-230C	3	**Ultrafiltration System** Model: CUF-3-862-100 X-Flow Backwash Skid: PS-2-360-CEB Maximum Flowrate: 100 gpm (each) Materials (membrane): Polyethersulfone (PES) and Polyvinylpyrrolidone (PVP)	Metals Filtration System	Crown Solutions
22	P-230A, P-230B	2	**Ultra-Filter Backwash Pumps** Type: End Suction Centrifugal Model: 22SH2P52H0 Suction Connection: 3-inch 150# Flange Discharge Connection: 2.5-inch 150# Flange Motor: 25HP TEFC 460V 3500RPM Pump Flowrate: 400 gpm @ 136ft TDH, 300 gpm @ 157ft TDH, Deadhead @ 182ft TDH Design Flowrate: 400 gpm @ 138ft TDH	Metals Filtration System	Goulds Pump
23	T-300	1	**AOP Feed Tank** Type: Diameter Vertical with Sloped Interior, Dome Top Model: C-CFV Materials: Fiberglass Reinforced Plastic Total Height: 192-inches Head Height: 24-inches Straight Length: 168-inches Diameter: 144-inches Total Volume: 12,050-gallons	Advanced Oxidation System	Belding Tank Technologies, Inc.
24	P-300A, P-300B	2	**High Flow AOP Feed Pumps** Type: End Suction Centrifugal Model: 3196 STi 2x3-10 (7.25" IMP) Seal Flush: John Crane Safe Unit SFD Suction Connection: 3-inch 150# Flange Discharge Connection: 2-inch 150# Flange Motor: 30 HP TEFC 460V 3600RPM Pump Flow Rate: 300 gpm @ 190ft TDH, 200 gpm @ 210ft TDH, Deadhead @ 228ft TDH Design Flow Rate: 300 gpm @ 189ft TDH	Advanced Oxidation System	Goulds Pump
25	P-300C	1	**Low Flow AOP Feed Pumps** Type: End Suction Centrifugal Model: 3196 STi 1.5x3-6 (5.625" IMP) Seal Flush: John Crane Safe Unit SFD Suction Connection: 3-inch 150# Flange Discharge Connection: 1.5-inch 150# Flange Motor: 10 HP TEFC 460V 3600RPM Pump Flow Rate: 150 gpm @ 125ft TDH, 100 gpm @ 135ft TDH, Deadhead @ 143ft TDH Design Flow Rate: 150 gpm @ 122ft TDH	Advanced Oxidation System	Goulds Pump

Table E-1
Bill of Materials, RAP Groundwater Treatment System

Lockheed Martin Tallevast Site
Tallevast, Florida

Item	Tag	Qty	Description	System Location	Manufacturer
26	SM-300	1	**AOP Static Mixer** Type: 4-inch 6 Element Low Pressure Loss Flange Mounted Model: 400 Materials (body): PVDF lined 316L Stainless Steel Materials (mixer): PVDF	Advanced Oxidation System	Koflo
27	PC-310A, PC-310B, PC-310C	3	**AOP System** Type: Photo-Cat Model: 10DDL Electrical Requirements: 460 VAC / 200 amp (each) Power Rating: 121.8 Kw (each) Lamps: 640 - 190W Lamps (each) Catalyst: Titanium Dioxide Slurry Air Line Connection: 1/8-inch ID hose Acid Line Connection: 1/2-inch OD FNPT Influent/Effluent Connection: 2.5-inch #150 Flange	Advanced Oxidation System	Purifics ES, Inc.
28	P-310A, P-310B, P-310C	3	**AOP Effluent Pumps** Type: End Suction Centrifugal Model: 7SH2L52D0 Suction Connection: 2.5-inch 150# Flange Discharge Connection: 1.5-inch 150# Flange Motor: 10 HP TEFC 460V 3500RPM Pump Flow Rate: 125 gpm @ 150ft TDH, 100 gpm @ 161ft TDH, Deadhead @ 180ft TDH Design Flow Rate: 125gpm @ 152ft TDH	Advanced Oxidation System	Goulds Pump
29	F-400A, F-400B, F-400C, F-410A, F-410B, F-410C	6	**Liquid Phase Granular Activated Carbon Vessels** Type: Liquid Phase Carbon Adsorber Unit Model: PV5000 Materials: Carbon Steel Epoxy Coated Connections: 4-inch Flange Diameter: 72-inches Total Height: 136 -inches Manway Size (2): 14-inch x 18-inch Carbon: 5000# Virgin Coconut Based	Liquid Phase Granular Activated Carbon	Siemens
30	P-400A, P-400B	2	**GAC Backwash Pumps** Type: End Suction Centrifugal Model: 8SH2M52E0 Suction Connection: 2.5-inch 150# Flange Discharge Connection: 2-inch 150# Flange Motor: 15HP TEFC 460V 3500RPM Pump Flowrate: 280 gpm @ 128 ft TDH, 200 gpm @ 160 ft TDH, Deadhead @ 185 ft TDH Design Flowrate: 280 gpm @ 113 ft TDH	Liquid Phase Granular Activated Carbon	Goulds Pump
31	F-420A, F-420B, F-420C, F-420D	4	**GAC Backwash Effluent Bag Filter Canisters** Type: High Capacity Bag Filter Housing Model: 82-30-3F-1-150-S316-V-S-PB-D-C Diameter: 6.7-inches Bag Filter Model: GDPO 529 2A Bag Filter Performance: 19um @ 98% Bag Filter Size: #2	Liquid Phase Granular Activated Carbon	Rosedale
32	T-500	1	**Effluent Tank** Type: Vertical, Dome Top Model: C-CFV Materials: Fiberglass Reinforced Plastic Total Height: 166-inches Head Height: 22-inches Straight Length: 144-inches Diameter: 132-inches Total Volume: 8500-gallons	Effluent Tank System	Belding Tank Technologies, Inc.
33	P-500A, P-500B	2	**Discharge Pumps** Type: End Suction Centrifugal Model: 27SH2M52A0 Suction Connection: 3-inch 150# Flange Discharge Connection: 2.5-inch 150# Flange Motor: 15 HP TEFC 460V 1750RPM Pump Flow Rate: 300 gpm @ 92ft TDH, 200 gpm @ 105ft TDH, 100 gpm @ 114ft TDH, Deadhead @ 118ft TDH	Effluent Tank System	Goulds Pump

Table E-1
Bill of Materials, RAP Groundwater Treatment System

Lockheed Martin Tallevast Site
Tallevast, Florida

Item	Tag	Qty	Description	System Location	Manufacturer
34	SM-500	1	**Effluent Static Mixer** Type: 4-inch 6 Element Low Pressure Loss Flange Mounted Model: 275 Materials (body): 316L Stainless Steel Materials (mixer): 316L Stainless Steel	Effluent Tank System	Koflo
35	P-510	1	**On-Facility Injection Well Feed Pump** Type: Vertical Multi-Stage Centrifugal Model: 1SVD1E5C0H Suction Connection: 1.25-inch 300# Flange Discharge Connection: 1.25-inch 300# Flange Motor: 1 HP TEFC 460V 3500RPM Pump Flow Rate: 10 gpm @ 120ft TDH, 5 gpm @ 135ft TDH, Deadhead @ 140ft TDH Design Flow Rate: 10 gpm @ 109ft TDH	Effluent Tank System	Goulds Pump
36	F-600A, F-600B	2	**Twin Alternating Water Softening System** Model: TSSZ-1500-3P Maximum Flow Rate: 100 gpm Vessel: 42-inch diameter x 60-inch side Resin: Purolite C100E	Reverse Osmosis System	Crown Solutions
37	P-600A, P-600B	2	**Water Softener Feed Pumps** Type: End Suction Centrifugal Model: 4SH2K52C0 Suction Connection: 2.5-inch 150# Flange Discharge Connection: 1.5-inch 150# Flange Motor: 7.5 HP TEFC 460V 3500RPM Pump Flow Rate: 100 gpm @ 125ft TDH, 75 gpm @ 133ft TDH, Deadhead @ 141ft TDH Design Flow Rate: 100 gpm @ 125ft TDH	Reverse Osmosis System	Goulds Pump
38	P-620	1	**POTW Waste Pump** Type: End Suction Centrifugal Model: 1STH5A4F Suction Connection: 1.25-inch FNPT Discharge Connection: 1-inch FNPT Motor: 3 HP TEFC 460V 3500RPM Pump Flow Rate: 45 gpm @ 106ft TDH, 30 gpm @ 130ft TDH, Deadhead @ 156ft TDH Design Flow Rate: 45 gpm @ 106ft TDH	Reverse Osmosis System	Goulds Pump
39	P-640	1	**RO Feed Pump** Type: Vertical Multi-Stage Centrifugal Model: 4SVD1M560H Suction Connection: 2-inch 300# Flange Discharge Connection: 2-inch 300# Flange Motor: 15 HP TEFC 460V 3500RPM Pump Flow Rate: 100 gpm @ 320ft TDH, 75 gpm @ 390ft TDH, Deadhead @ 460ft TDH Design Flow Rate: 100 gpm @ 330ft TDH	Reverse Osmosis System	Goulds Pump
40	RO-640A/B/C	1	**Reverse Osmosis System** Model: CRO-863-75 Maximum Flowrate: 100 gpm Array: 2x1 Recovery: 60 - 75% Membranes: Hydranautic, CPA5 Rejection Rate: 99% for Heavy Metals	Reverse Osmosis System	Crown Solutions
41	P-660	1	**Wetlands Recharge Pump** Type: End Suction Centrifugal Model: 10SH2K52D0 Suction Connection: 2-inch 150# Flange Discharge Connection: 1-inch 150# Flange Motor: 7.5 HP TEFC 460V 3500RPM Pump Flow Rate: 70 gpm @ 168ft TDH, 50 gpm @ 180ft TDH, Deadhead @ 200ft TDH Design Flow Rate: 70 gpm @ 167ft TDH	Reverse Osmosis System	Goulds Pump
42	T-700A, T-700B, T-700C, T-700D; T-710A, T-710B	6	**Chemical Storage Totes** Type: Forklift Moveable Tote Tank Model: 68445 Material (tank): 1.9 SPGR HDLPE Material (basin and stand): HDLPE Total Height: 70-inches Total Width: 46-inches Tank Capacity: 330 gallons	pH Adjustment System	Snyder Tanks

Table E-1
Bill of Materials, RAP Groundwater Treatment System

Lockheed Martin Tallevast Site
Tallevast, Florida

Item	Tag	Qty	Description	System Location	Manufacturer
43	P-700A, P-700B, P-700C, P-700D, P-700E	5	**Sodium Hydroxide Metering Pumps** Type: Diaphragm Chemical Metering Model: DME-12-6 A-PP/E/C-F-21RRB Suction Connection: 3/8-inch Tubing Discharge Connection: 3/8-inch Tubing Max Working Pressure: 85 psi Material (wetted): PP, EPDM and Viton Flow Range: 0.0032 gph - 3.17 gph	pH Adjustment System	Grundfos
44	P-710A, P-710B	2	**Sulfuric Acid Metering Pumps** Type: Diaphragm Chemical Metering Model: DME-8-10 A-PV/V/C-F-21RRB Suction Connection: 3/8-inch Tubing Discharge Connection: 3/8-inch Tubing Max Working Pressure: 145 psi Material (wetted): PVDF, Viton and Ceramic Flow Range: 0.002 gph - 1.98 gph	pH Adjustment System	Grundfos
45	T-800	1	**Backwash Surge Tank** Type: Vertical with Sloped Interior, Dome Top Model: C-CFV Materials: Fiberglass Reinforced Plastic Total Height: 188-inches Head Height: 20-inches Straight Length: 168-inches Diameter: 120-inches Total Volume: 8,240-gallons	Solids Handling System	Belding Tank Technologies, Inc.
46	P-800A, P-800B	2	**Surge Transfer Pumps** Type: End Suction Centrifugal Model: 1ST1E5E4F Seal Flush: John Crane Safe Unit SFD Suction Connection: 1.25-inch FNPT Discharge Connection: 1-inch FNPT Motor: 1 HP TEFC 460V 3500RPM Pump Flowrate: 30 gpm @ 52ft TDH, 20 gpm @ 64ft TDH, Deadhead @ 76ft TDH Design Flowrate: 30gpm @ 51ft TDH	Solids Handling System	Goulds Pump
47	SM-800	1	**Solids Thickening Tank Static Mixer** Type: 2-inch 6 Element Low Pressure Loss Flange Mounted Model: 365 Materials (body): 316L Stainless Steel Materials (mixer): 316L Stainless Steel	Solids Handling System	Koflo
48	P-810A, P-810B	2	**Filter Press Solids Feed Pumps** Type: Positive Displacement Double Diaphragm (pneumatic) Model: SA1-A-DV-4-SS Suction Connection: 1-inch FNPT Discharge Connection: 1-inch FNPT Pump Air Consumption: 15 scfm @ 100 psi Pump Flow Rate: 10gpm @ 90ft TDH Design Flow Rate: 10gpm @ 90ft TDH	Solids Handling System	Warren Rupp
49	T-810	1	**Solids Thickening Tank** Type: Vertical Cone Bottom, Dome Top Model: C-CKV Materials: Fiberglass Reinforced Plastic Total Height: 178-inches Head Height: 24-inches Cone Height: 70-inches Straight Length: 84-inches Diameter: 144-inches Total Volume: 7,470-gallons Cone Volume: 1522-gallons	Solids Handling System	Belding Tank Technologies, Inc.
50	FP-820	1	**Filter Press** Type: J-Press® Sidebar Filter Press Model: 800 mm Length: 175-inches Height: 58-inches Width: 43.5-inches Pressure: 100 psi (7 bar) Volume: 20 ft^3	Solids Handling System	Siemens

Table E-1
Bill of Materials, RAP Groundwater Treatment System

Lockheed Martin Tallevast Site
Tallevast, Florida

Item	Tag	Qty	Description	System Location	Manufacturer
51	T-830	1	**Coagulant Aid Storage Tank** Type: 55-gallon HDPE Drum	Solids Handling System	
52	P-830A, P-830B	2	**Coagulant Aid Feed Pumps** Type: Diaphragm Chemical Metering Model: DME-8-10 A-PV/V/C-F-21RRB Suction Connection: 3/8-inch Tubing Discharge Connection: 3/8-inch Tubing Max Working Pressure: 145 psi Material (wetted): PVDF, Viton and Ceramic Flow Range: 0.002 gph - 1.98 gph	Solids Handling System	Grundfos
53	T-840	1	**Pre-Coat Storage Tank** Type: Open Top Vertical Total Drain Tank w/ Mixer Tank Model: 5860000N-L Stand Model: 1750001N-L Material: HDPE Tank Height: 64-inches Total Height w/ Stand: 86-inches Tank Diameter: 46-inches Total Volume: 330-gallons	Solids Handling System	Snyder Tanks
54	M-840	1	**Pre-Coat Storage Tank Mixer** Type: Clamp-On Tank Mixer Model: EV5P25 Materials (wetted): 316L Stainless Steel Motor: 1/2 HP TEFC 460V 1725RPM Impeller Speed: 350RPM Impeller: Single 11.2" A310 w/ Stabilizer	Solids Handling System	Lightnin
55	P-840A, P-840B	2	**Filter Press Solids Feed Pumps** Type: Positive Displacement Double Diaphragm (pneumatic) Model: SA1-A-DV-4-SS Suction Connection: 1-inch FNPT Discharge Connection: 1-inch FNPT Pump Air Consumption: 15 scfm @ 100 psi Pump Flow Rate: 10gpm @ 90ft TDH Design Flow Rate: 10gpm @ 90ft TDH	Solids Handling System	Warren Rupp
56	AC-900	1	**Air Compressor** Type: Oil-less Scroll Compressor Model: SF8 HP Motor: 10 HP ODP 460V 3450RPM Max Working Pressure: 145 psi Flow Rate: 24 cfm @ 145 psi, 28 cfm @ 116 psi	Compressed Air System	Atlas Copco
57	AD-900	1	**Air Dryer** Type: Refrigerated Air Dryer Model: Integral to Air Compressor	Compressed Air System	Atlas Copco
58	T-900	1	**Air Receiver Tank** Type: Horizontal Model Integral to Air Compressor Capacity: 120 gallons	Compressed Air System	Atlas Copco
59	T-1000	1	**Seal Water Bladder Tank** Type: Vertical Bottom Outlet Bladder Tank Model: TB-264-R Material (Vessel): Carbon Steel Material (Bladder): Butyl Rubber Total Height: 87-inches Diameter: 36-inches Total Volume: 264-gallons Maximum Working Pressure: 150 psi Design Working Pressure: 115 psi Design Discharge Pressure: 100 psi	Seal Water System	Roy E. Hanson Mfg.
60	P-1000A, P-1000B	2	**Process Water Pumps** Type: Vertical Multi-Stage Centrifugal Model: 1SVD1G5F0H Suction Connection: 1.25-inch 300# Flange Discharge Connection: 1.25-inch 300# Flange Motor: 2 HP TEFC 460V 3500RPM Pump Flowrate: 10 gpm @ 245ft TDH, 5 gpm @ 278ft TDH, Deadhead @ 300ft TDH Design Flowrate: 10gpm @ 260ft TDH	Seal Water System	Goulds Pump

Table E-1
Bill of Materials, RAP Groundwater Treatment System

Lockheed Martin Tallevast Site
Tallevast, Florida

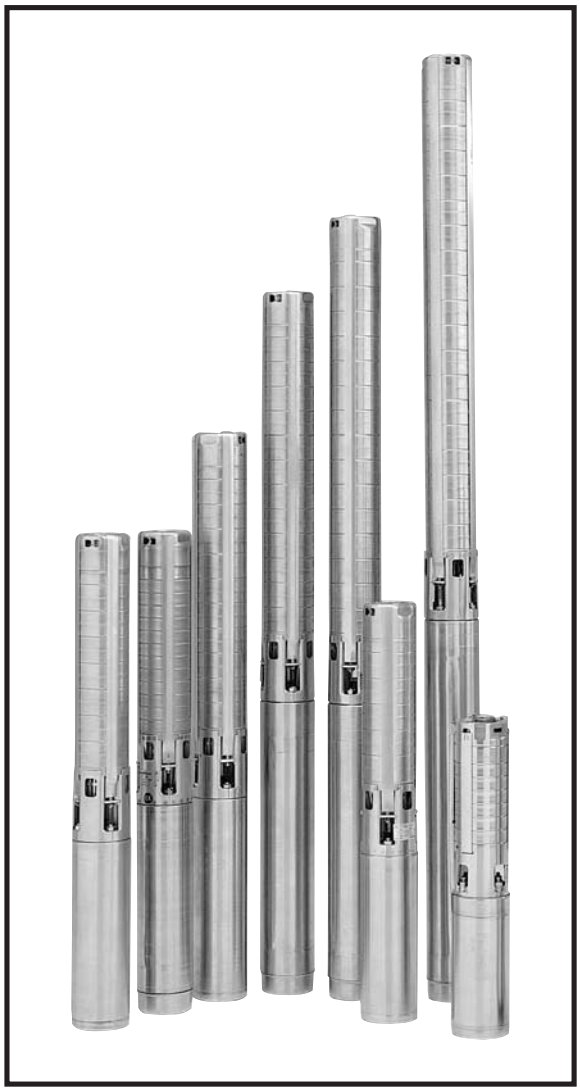
Item	Tag	Qty	Description	System Location	Manufacturer
61	F-1100A, F-1100B	2	**Vapor Phase Granular Activated Carbon Vessels** Type: Vapor Phase Carbon Adsorber Unit Model: GPC-5R Materials: Carbon Steel Epoxy Coated Connections: 4.5-inch Nozzle Diameter: 30-inches Total Height: 67-inches Carbon: 500# Virgin Coal Based (each)	Vapor Phase Granular Activated Carbon	Carbonair
62	P-1200	1	**Sump Pump** Type: Submersible Sewage Model: 2DM51F4NA Discharge Connection: 2-inch FNPT Motor: 1.5 HP Submersible 460V Pump Flowrate: 50 gpm @ 41ft TDH, Deadhead @ 47ft TDH Design Flowrate: 30gpm @ 38ft TDH	Sump	Goulds Pump
63	P-1300	1	**Process Water Discharge Pump** Type: End Suction Submersible Model: 10SH2E53C0 Suction Connection: 2-inch 150# Flange Discharge Connection: 1-inch 150# Flange Motor: 1 HP TEFC 460V 1750RPM Pump Flowrate: 30 gpm @ 47ft TDH, 20 gpm @ 50ft TDH, Deadhead @ 54ft TDH Design Flowrate: 30gpm @ 45ft TDH	Misc.	Goulds Pump

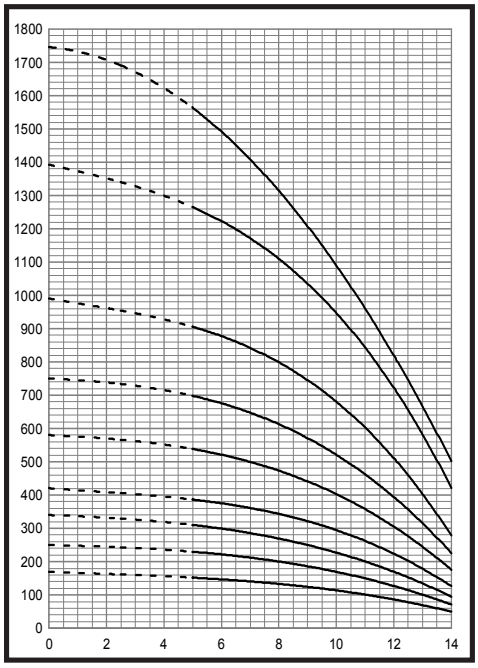
Catalogue and Product Data Sheets

Item	Tag	Description
1	EW-2001, EW-2037	USAS Extraction Well Submersible Pumps
2	EW-3001, EW-3027	LSAS Extraction Well Submersible Pumps
3	EW-4001, EW-4011	AFG Extraction Well Submersible Pumps
4	EW-5001, EW-5002	S&P Extraction Well Submersible Pumps

Easy Selection Chart
Performance Curves and Technical Data

4-Inch Submersible Pumps





Performance Curves



Materials of Construction

Grundfos Stainless Steel Submersible Pumps

4" Submersible
Easy Selection Charts.



R625-EDC-001213-0

5 GPM

SELECTION CHARTS

FLOW RANGE
(1.2 TO 7 GPM)

PUMP OUTLET
1 " NPT

(Ratings are in GALLONS PER MINUTE-GPM)

			DEPTH TO PUMPING WATER LEVEL (LIFT) IN FEET																									
PUMP MODEL	**HP**	**PSI**	**20**	**40**	**60**	**80**	**100**	**120**	**140**	**160**	**180**	**200**	**220**	**240**	**260**	**280**	**300**	**340**	**400**	**460**	**520**	**600**	**700**	**800**	**900**	**1000**	**1100**
5S03-9	**1/3**	0				7.1	6.7	6.2	5.8	5.3	4.8	4.3	3.2	2.1													
		20		7.0	6.6	6.1	5.7	5.2	4.6	4.0	2.8	1.6															
		30		6.5	6.0	5.6	5.1	4.6	3.8	2.9	1.5																
		40	6.7	6.0	5.5	5.1	4.4	3.8	2.4																		
		50	6.2	5.5	4.9	4.4	3.4	2.5	1.3																		
		60	5.6	4.9	4.2	3.5	1.9																				
SHUT-OFF PSI:			102	94	85	76	68	59	50	42	33	24	16	7													
5S05-13	**1/2**	0						7.1	6.8	6.4	6.1	5.8	5.5	5.2	4.8	4.5	3.9	2.3									
		20			7.3	7.0	6.7	6.3	6.0	5.7	5.4	5.1	4.7	4.3	3.7	3.1	2.0										
		30		7.2	6.9	6.6	6.3	6.0	5.7	5.4	5.0	4.7	4.2	3.7	2.8	2.0											
		40	7.2	6.9	6.6	6.3	5.9	5.6	5.3	5.0	4.6	4.2	3.5	2.8	1.6												
		50	6.8	6.5	6.2	5.9	5.6	5.3	4.9	4.6	4.0	3.5	2.6	1.6													
		60	6.5	6.2	5.8	5.5	5.2	4.9	4.5	4.0	3.3	2.6	1.3														
SHUT-OFF PSI:			152	143	134	126	117	108	100	91	82	74	65	56	48	39	30	13									
5S07-18	**3/4**	0								7.1	6.9	6.7	6.4	6.2	6.0	5.8	5.6	5.1	4.2	2.7							
		20						7.1	6.8	6.6	6.4	6.2	5.9	5.7	5.5	5.3	5.0	4.5	3.2								
		30					7.0	6.8	6.6	6.3	6.1	5.9	5.7	5.5	5.2	5.0	4.7	4.0	2.5								
		40			7.2	7.0	6.8	6.5	6.3	6.1	5.9	5.6	5.4	5.2	4.9	4.7	4.4	3.5	1.5								
		50		7.2	7.0	6.7	6.5	6.3	6.1	5.8	5.6	5.4	5.1	4.9	4.6	4.3	3.9	2.9									
		60	7.1	6.9	6.7	6.5	6.2	6.0	5.8	5.6	5.3	5.1	4.9	4.6	4.3	3.9	3.4	2.1									
SHUT-OFF PSI:			213	204	195	187	178	169	161	152	143	135	126	117	109	100	91	74	48	22							
5S10-22	**1**	0										7.1	6.9	6.7	6.6	6.4	6.2	5.8	5.3	4.7	3.8	1.7					
		20								7.1	6.9	6.7	6.5	6.3	6.1	6.0	5.8	5.4	4.8	4.0	2.8						
		30							7.0	6.8	6.7	6.5	6.3	6.1	5.9	5.7	5.6	5.2	4.6	3.6	2.1						
		40						7.0	6.8	6.6	6.5	6.3	6.1	5.9	5.7	5.5	5.4	5.0	4.3	3.1	1.3						
		50				7.2	7.0	6.8	6.6	6.4	6.2	6.1	5.9	5.7	5.5	5.3	5.1	4.7	3.9	2.5							
		60			7.1	6.9	6.8	6.6	6.4	6.2	6.0	6.0	5.7	5.5	5.3	5.1	4.9	4.4	3.5	1.7							
SHUT-OFF PSI:					245	237	228	219	211	202	194	185	176	168	159	150	142	124	98	72	46	12					
5S15-26	**1 1/2**	0												7.1	7.0	6.8	6.7	6.4	5.9	5.4	4.9	4.1	2.1				
		20										7.1	6.9	6.8	6.6	6.5	6.3	6.0	5.5	5.1	4.5	3.4					
		30									7.1	6.9	6.7	6.6	6.4	6.3	6.1	5.8	5.4	4.8	4.2	2.9					
		40								7.0	6.9	6.7	6.6	6.4	6.3	6.1	6.0	5.6	5.2	4.6	5.6	2.4					
		50							7.0	6.9	6.7	6.5	6.4	6.2	6.1	5.9	5.8	5.5	5.0	4.4	3.6	1.7					
		60						7.0	6.8	6.7	6.5	6.4	6.2	6.1	5.9	5.8	5.6	5.3	4.8	4.1	3.1						
SHUT-OFF PSI:								269	260	252	243	234	226	217	208	200	191	174	148	122	96	61	18				
5S15-31	**1 1/2**	0														7.1	7.0	6.7	6.3	5.9	5.5	6.7	4.1	2.6			
		20												7.1	6.9	6.8	6.7	6.4	6.0	5.6	5.2	4.6	3.5	1.6			
		30											7.0	6.9	6.8	6.6	6.5	6.2	5.9	5.5	5.1	4.4	3.2	0.9			
		40										7.0	6.9	6.8	6.6	6.5	6.4	6.1	5.7	5.3	4.9	4.2	2.8				
		50								7.1	7.0	6.9	6.7	6.6	6.5	6.3	6.2	6.0	5.6	5.2	4.7	4.0	2.3				
		60							7.1	7.0	6.8	6.7	6.6	6.5	6.3	6.2	6.1	5.8	5.4	5.0	4.5	3.7	1.7				
SHUT-OFF PSI:									320	311	303	294	285	277	268	259	251	233	207	181	155	121	77	34			

See 5S performance curves for higher head models.
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

DIMENSIONS AND WEIGHTS

MODEL NO.	FIG.	HP	MOTOR SIZE	DISCH. SIZE	DIMENSIONS IN INCHES					APPROX. SHIP WT.
					A	B	C	D	E	
5S03-9	A	1/3	4"	1" NPT	22.3	8.8	13.5	3.8	3.9	27
5S05-13	A	1/2	4"	1" NPT	26.4	9.5	16.9	3.8	3.9	31
5S07-18	A	3/4	4"	1" NPT	31.7	10.7	21.0	3.8	3.9	34
5S10-22	A	1	4"	1" NPT	36.1	11.8	24.3	3.8	3.9	42
5S15-26	A	1 1/2	4"	1" NPT	41.2	13.6	27.6	3.8	3.9	46
5S15-31	A	1 1/2	4"	1" NPT	47.1	13.6	33.5	3.8	3.9	58
5S20-39DS	A	2	4"	1" NPT	55.2	15.1	40.1	3.8	3.9	65
5S30-48DS	A	3	4"	1" NPT	70.0	20.6	45.8	3.8	3.9	90

NOTES: All models suitable for use in 4" wells.
Weights include pump end with motor in lbs.

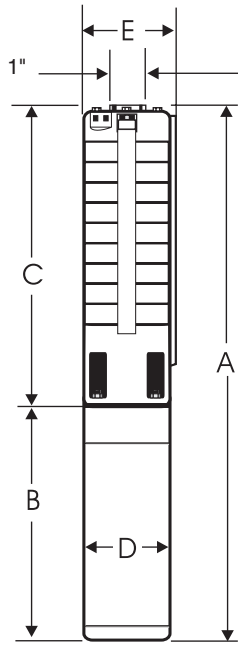


Fig. A

MATERIALS OF CONSTRUCTION

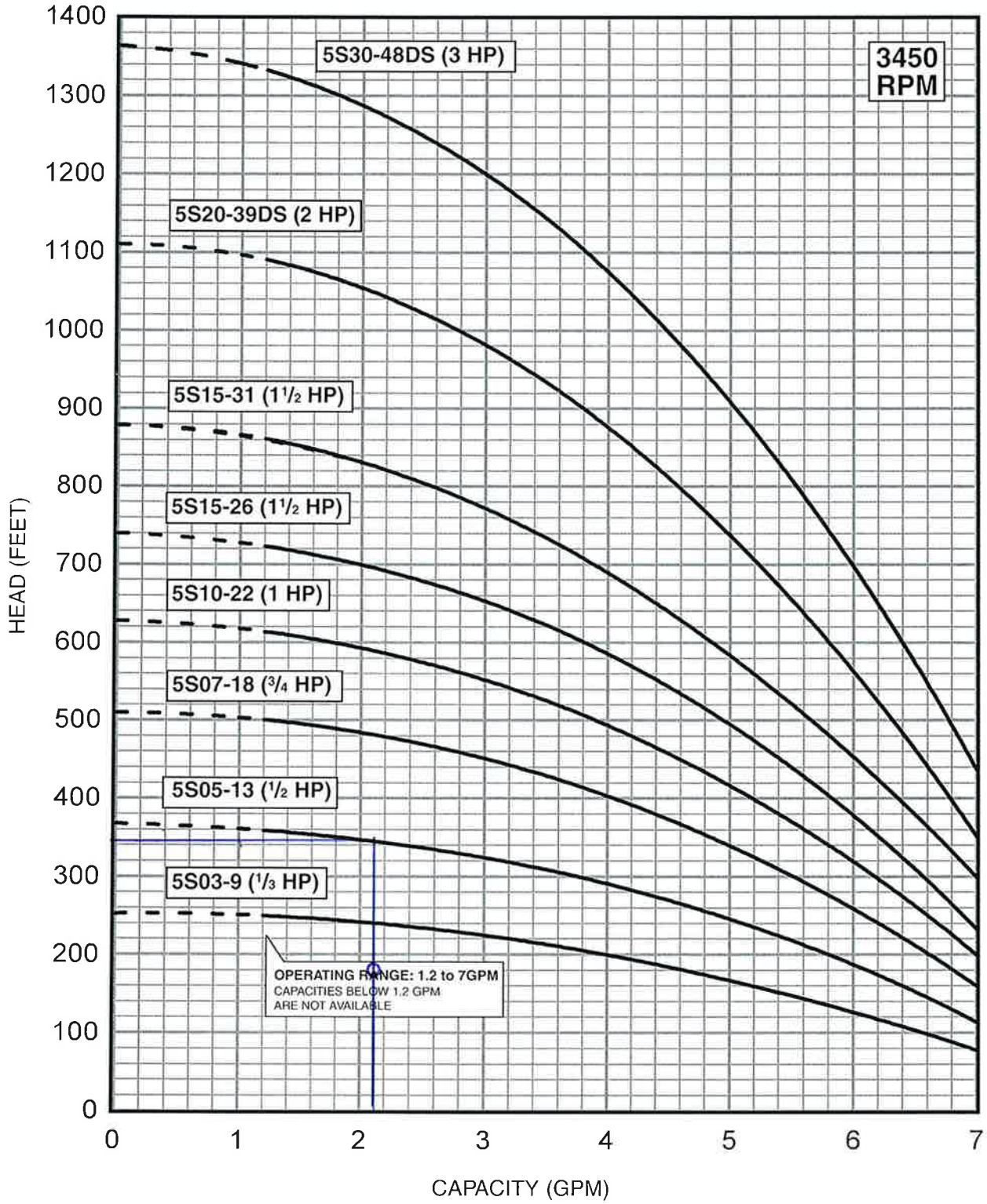
COMPONENT	SPLINED SHAFT (9-26 Stgs.)	CYLINDRICAL SHAFT (31-48 Stgs.)
Check Valve Housing	304 Stainless Steel	304 Stainless Steel
Check Valve	304 Stainless Steel	304 Stainless Steel
Diffuser Chamber	304 Stainless Steel	304 Stainless Steel
Impeller	304 Stainless Steel	304 Stainless Steel
Suction Interconnector	304 Stainless Steel	304 Stainless Steel
Inlet Screen	304 Stainless Steel	304 Stainless Steel
Pump Shaft	304 Stainless Steel	431 Stainless Steel
Straps	304 Stainless Steel	304 Stainless Steel
Cable Guard	304 Stainless Steel	304 Stainless Steel
Priming Inducer	304 Stainless Steel	316 Stainless Steel
Coupling	329/420/431 Stainless Steel	329/420/431 Stainless Steel
Check Valve Seat	NBR/304 Stainless Steel	NBR/316 Stainless Steel
Top Bearing	NBR/304 Stainless Steel	NBR/316 Stainless Steel
Impeller Seal Ring	NBR/PBT (Valox®)	NBR/PPS (Ryton®)
Intermediate Bearings	NBR	304 Stainless Steel
Shaft Washer	Not Required	LCP (Vectra®)
Split Cone	Not Required	304 Stainless Steel
Split Cone Nut	Not Required	316 Stainless Steel

NOTES: Specifications subject to change without notice.
Valox® is a registered trademark of General Electric Co.
Vectra® is a registered trademark of Hoechast Calanese Corporation.
Ryton® is a registered trademark of Phillips 66.

EW-20XX
2.1 gpm @ 175ft TDH

PERFORMANCE CURVES 5 GPM MODEL 5S

FLOW RANGE: 1.2 - 7 GPM **OUTLET SIZE: 1" NPT** **NOMINAL DIA. 4"**



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
4" MOTOR STANDARD, 3450 RPM.

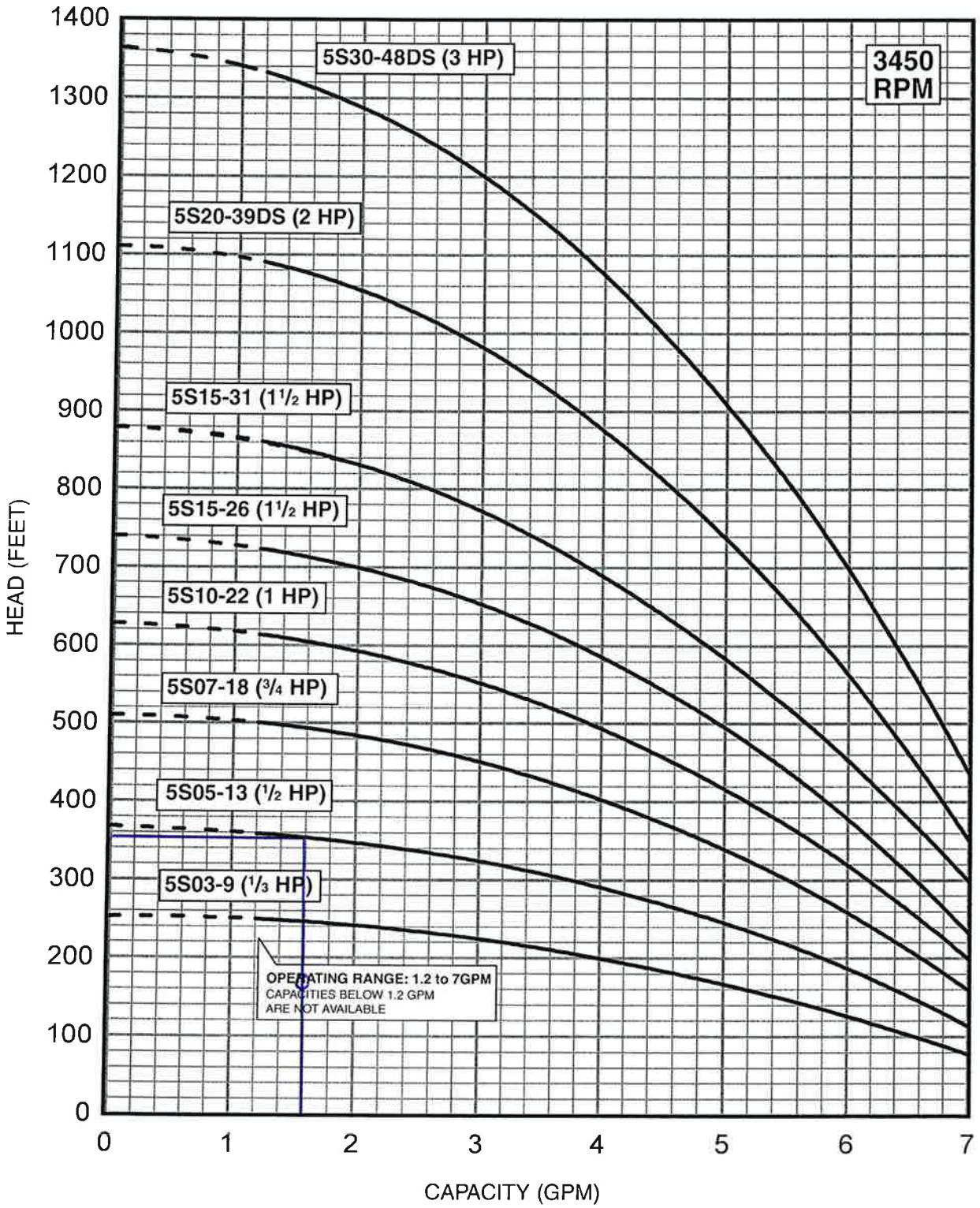
Performance conforms to ISO 9906. 1999 (E) Annex A
Minimum submergance is 2 feet.

*Note: ⅓ Hp Motor Not Available

EW-3001 - EW-3024
1.6gpm @ 175ft TDH

PERFORMANCE CURVES 5 GPM MODEL 5S

FLOW RANGE: 1.2 - 7 GPM **OUTLET SIZE: 1" NPT** **NOMINAL DIA. 4"**



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
4" MOTOR STANDARD, 3450 RPM.

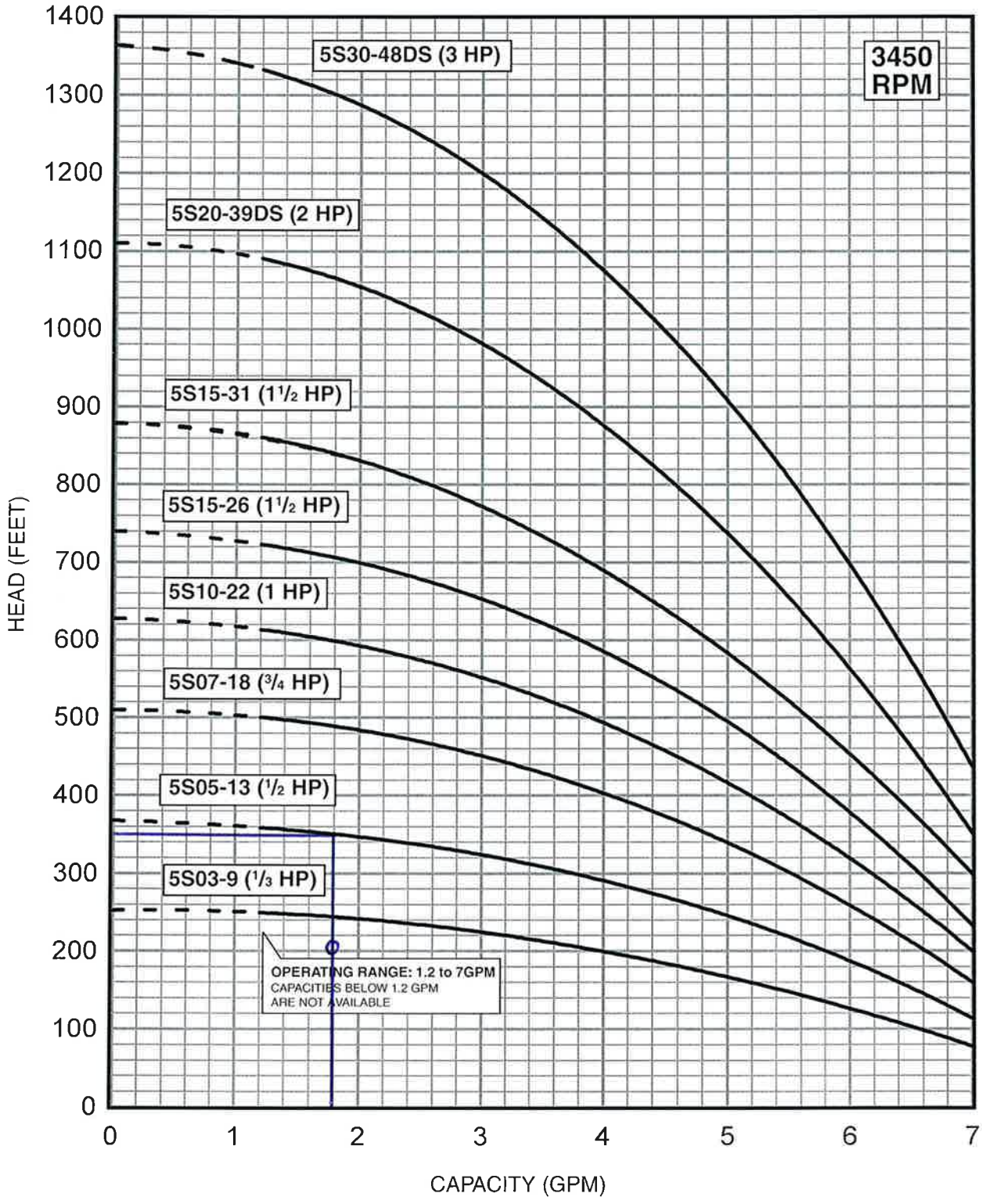
Performance conforms to ISO 9906. 1999 (E) Annex A
Minimum submergance is 2 feet.

* Note: ⅓ Hp Motor Note Available

EW-4001 - EW-4011
1.8gpm @ 205ft TDH

PERFORMANCE CURVES 5 GPM MODEL 5S

FLOW RANGE: 1.2 - 7 GPM **OUTLET SIZE: 1" NPT** **NOMINAL DIA. 4"**



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
4" MOTOR STANDARD, 3450 RPM.

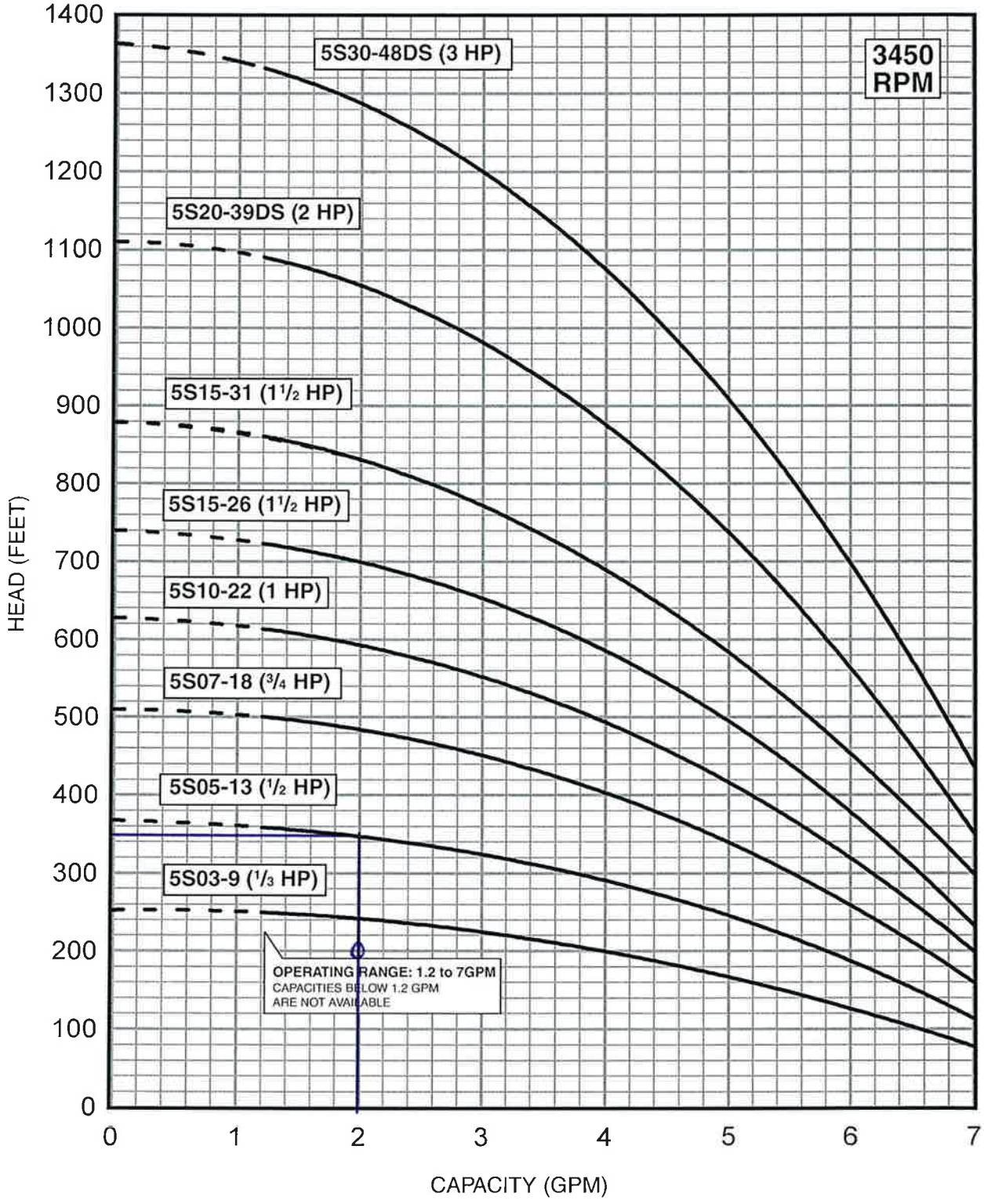
Performance conforms to ISO 9906. 1999 (E) Annex A
Minimum submergance is 2 feet.

*Note: ⅓ Hp Motor Not Available

EW-5001, EW-5002
2.0gpm @ 200ft TDH

PERFORMANCE CURVES 5 GPM MODEL 5S

FLOW RANGE: 1.2 - 7 GPM **OUTLET SIZE: 1" NPT** **NOMINAL DIA. 4"**



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
4" MOTOR STANDARD, 3450 RPM.

Performance conforms to ISO 9906. 1999 (E) Annex A
Minimum submergance is 2 feet.

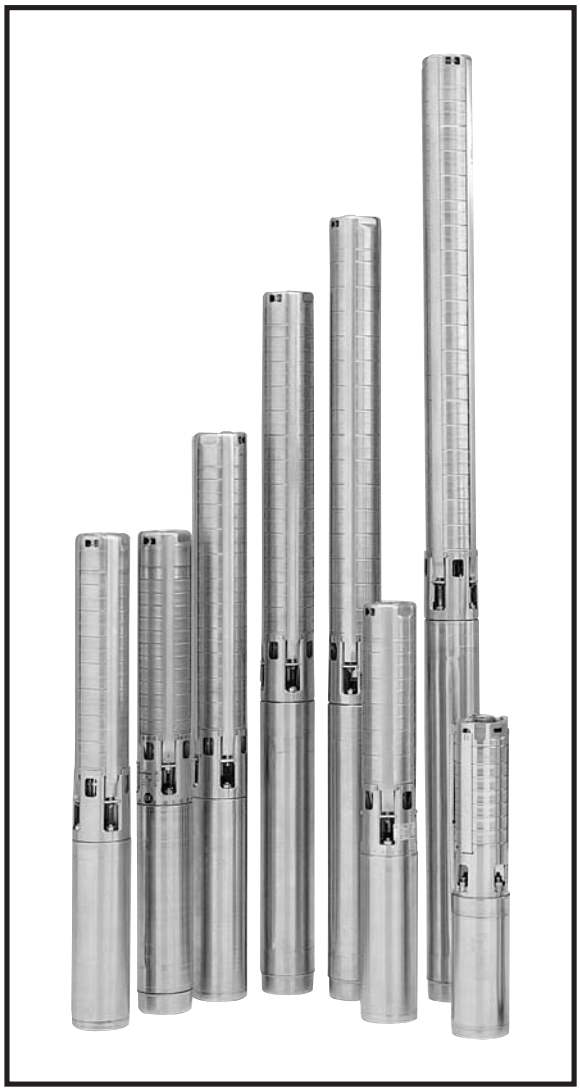
* Note: ⅓ Hp Motor Not Available

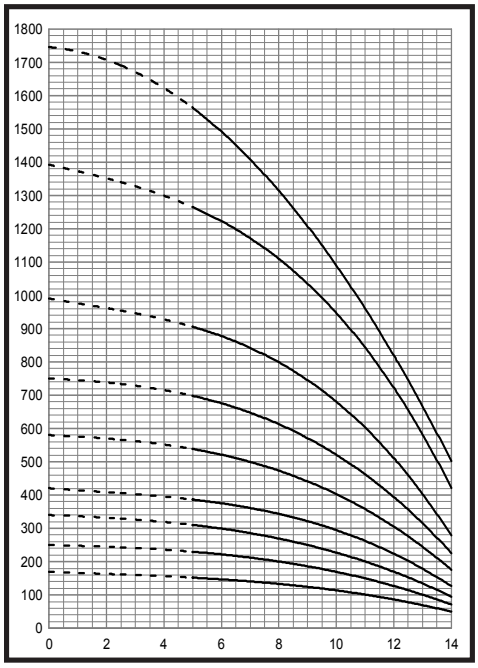
Catalogue and Product Data Sheets

Item	Tag	Description
5	EW-2101, EW-2104	USAS Extraction Trench Submersible Pumps

Easy Selection Chart
Performance Curves and Technical Data

4-Inch Submersible Pumps





Performance Curves



Materials of Construction

Grundfos Stainless Steel Submersible Pumps

4" Submersible
Easy Selection Charts.



R625-EDC-001213-0

25 GPM

SELECTION CHARTS

FLOW RANGE (18 TO 32 GPM)

PUMP OUTLET 1 1/2" NPT

(Ratings are in GALLONS PER MINUTE-GPM)

			DEPTH TO PUMPING WATER LEVEL (LIFT) IN FEET																									
PUMP MODEL	**HP**	**PSI**	**20**	**40**	**60**	**80**	**100**	**120**	**140**	**160**	**180**	**200**	**220**	**240**	**260**	**280**	**300**	**340**	**400**	**460**	**520**	**600**	**700**	**800**	**900**	**1000**	**1100**
25S05-3	**1/2**	20	18.6	6.5	3.3																						
		30	10.5																								
		40																									
		50																									
		60																									
SHUT-OFF PSI:			31	22	13	5																					
25S07-5	**3/4**	0			34.5	29.8	23.9	18.1																			
		20	32.9	28.6	21.8	15.1	7.5																				
		30	27.1	22.5	12.3	2.0																					
		40	19.5	11.8	5.8																						
		50	10.1																								
		60	4.1																								
SHUT-OFF PSI:			57	48	39	31	22	13																			
25S10-7	**1**	0					31.3	28.5	24.3	20.2	12.7	5.1															
		20		33.2	30.3	27.6	22.9	18.3	10.4	2.5	1.3																
		30	33.0	29.9	26.5	23.1	13.0	9.6	4.8																		
		40	29.4	26.6	21.3	16.2	8.2																				
		50	25.3	21.5	14.3	7.0	3.5																				
		60	19.7	13.9	7.0																						
SHUT-OFF PSI:			83	74	65	57	48	39	31	22	13	5															
25S15-9	**1 1/2**	0						32.2	30.0	27.9	24.8	21.6	16.3	10.8													
		20				31.5	29.3	27.2	23.7	20.3	14.5	8.8	4.4														
		30			31.3	29.1	26.4	23.7	18.9	14.2	7.8	1.5															
		40		30.8	28.6	26.3	22.6	18.8	12.8	6.8	3.4																
		50	30.6	28.4	25.5	22.5	17.4	12.3	6.2																		
		60	27.8	25.5	21.3	17.2	11.0	4.8	2.4																		
SHUT-OFF PSI:			109	100	91	83	74	65	57	48	39	31	22	13													
25S20-11	**2**	0						33.1	31.1	29.3	27.6	25.1	22.5	18.5	14.5	9.3											
		20					32.5	30.6	28.8	27.0	24.3	21.5	17.3	13.0	7.8	2.5											
		30				32.0	30.3	28.7	26.4	24.2	20.6	16.9	12.0	7.0	3.5												
		40			31.8	30.1	28.2	26.3	23.3	20.4	15.9	11.4	6.3														
		50		31.5	29.8	28.1	25.7	23.3	19.4	15.6	10.4	5.3	2.7														
		60	31.3	29.6	27.6	25.6	22.4	19.3	14.5	9.8	4.9																
SHUT-OFF PSI:			135	126	118	109	100	92	83	74	66	57	48	40	31	23											
25S30-15	**3**	0										32.3	31.0	29.8	28.4	27.1	25.2	20.7									
		20								31.8	30.6	29.3	28.0	26.6	24.6	22.7	19.8	13.5									
		30						33.0	31.7	30.4	29.2	27.8	26.2	24.5	22.1	19.7	16.4	9.3									
		40					32.8	31.5	30.3	29.0	27.5	26.0	24.0	21.9	19.0	16.1	12.4	4.9									
		50				32.6	31.3	30.0	28.7	27.4	25.7	23.8	21.3	18.8	15.3	12.0	8.2	2.2									
		60			32.4	31.1	29.8	28.6	27.0	25.5	23.3	21.2	18.1	15.0	11.3	7.6	3.8										
SHUT-OFF PSI:					170	161	152	144	135	126	118	109	100	92	83	74	66	48									
25S50-26	**5**	0																32.5	30.3	28.0	25.3	19.9	10.2				
		20															32.3	30.8	28.6	25.9	22.5	15.8	5.0				
		30														32.1	31.3	29.9	27.7	24.7	20.8	13.5	2.5				
		40													32.0	31.3	30.5	29.1	26.7	23.3	18.9	11.0					
		50											32.7	31.8	31.2	30.4	29.7	28.2	25.5	21.8	16.8	8.5					
		60										32.5	31.8	31.0	30.3	29.6	28.8	27.3	24.3	20.0	14.6	5.8					
SHUT-OFF PSI:												253	245	236	227	219	210	193	167	141	115	80	37				

See 25S performance curves for higher head models.
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

DIMENSIONS AND WEIGHTS

MODEL NO.	FIG.	HP	MOTOR SIZE	DISCH. SIZE	DIMENSIONS IN INCHES					APPROX. SHIP WT.
					A	B	C	D	E	
25S05-3	A	1/2	4"	1 1/2" NPT	18.1	9.5	8.6	3.8	3.9	26
25S07-5	A	3/4	4"	1 1/2" NPT	20.9	10.7	10.2	3.8	3.9	28
25S10-7	A	1	4"	1 1/2" NPT	23.7	11.8	11.9	3.8	3.9	29
25S15-9	A	1 1/2	4"	1 1/2" NPT	27.1	13.6	13.5	3.8	3.9	34
25S20-11	A	2	4"	1 1/2" NPT	30.3	15.1	15.2	3.8	3.9	37
25S30-15	A	3	4"	1 1/2" NPT	39.1	20.6	18.5	3.8	3.9	59
25S50-26	A	5	4"	1 1/2" NPT	51.2	23.6	27.6	3.8	3.9	76
25S75-39DS	A	7 1/2	6"	1 1/2" NPT	66.8	24.2	42.6	5.4	4.6	168
25S100-52DS*	B	10	6"	1 1/2" MPT	90.9	25.4	65.5	5.4	5.4	226

NOTES: All models suitable for use in 4" wells, unless otherwise noted.
Weights include pump end with motor in lbs.
* Built into sleeve 1 1/2" MPT discharge, 6" min. well dia.

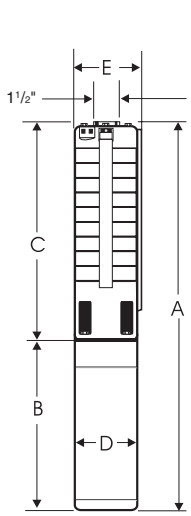


Fig. A

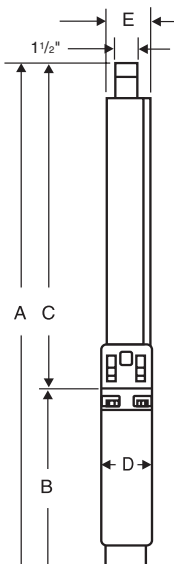


Fig. B

MATERIALS OF CONSTRUCTION

COMPONENT	SPLINED SHAFT (3-26 Stgs.)	CYLINDRICAL SHAFT (39 Stgs.)	DEEP SET (52 Stgs)
Check Valve Housing	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel
Check Valve	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel
Diffuser Chamber	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel
Impeller	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel
Suction Interconnector	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel
Inlet Screen	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel
Pump Shaft	304 Stainless Steel	431 Stainless Steel	431 Stainless Steel
Straps	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel
Cable Guard	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel
Priming Inducer	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel
Coupling	316/431 Stainless Steel	316/431 Stainless Steel	329/416 Stainless Steel**
Check Valve Seat	NBR/304 Stainless Steel	NBR/316 Stainless Steel	NBR/316 Stainless Steel
Top Bearing	NBR	NBR/316 Stainless Steel	NBR/316 Stainless Steel
Impeller Seal Ring	NBR/PBT (Valox®)	NBR/PPS (Ryton®)	NBR/PPS (Ryton®)
Intermediate Bearings	NBR	304 Stainless Steel	NBR/316 Stainless Steel
Shaft Washer	Not Required	LCP (Vectra®)	LCP (Vectra®)
Split Cone	Not Required	304 Stainless Steel	304 Stainless Steel
Split Cone Nut	Not Required	316 Stainless Steel	304 Stainless Steel
Sleeve	Not Required	Not Required	316 Stainless Steel
Sleeve Flange	Not Required	Not Required	304 Stainless Steel
Coupling Key	Not Required	Not Required	302/304 Stainless Steel**

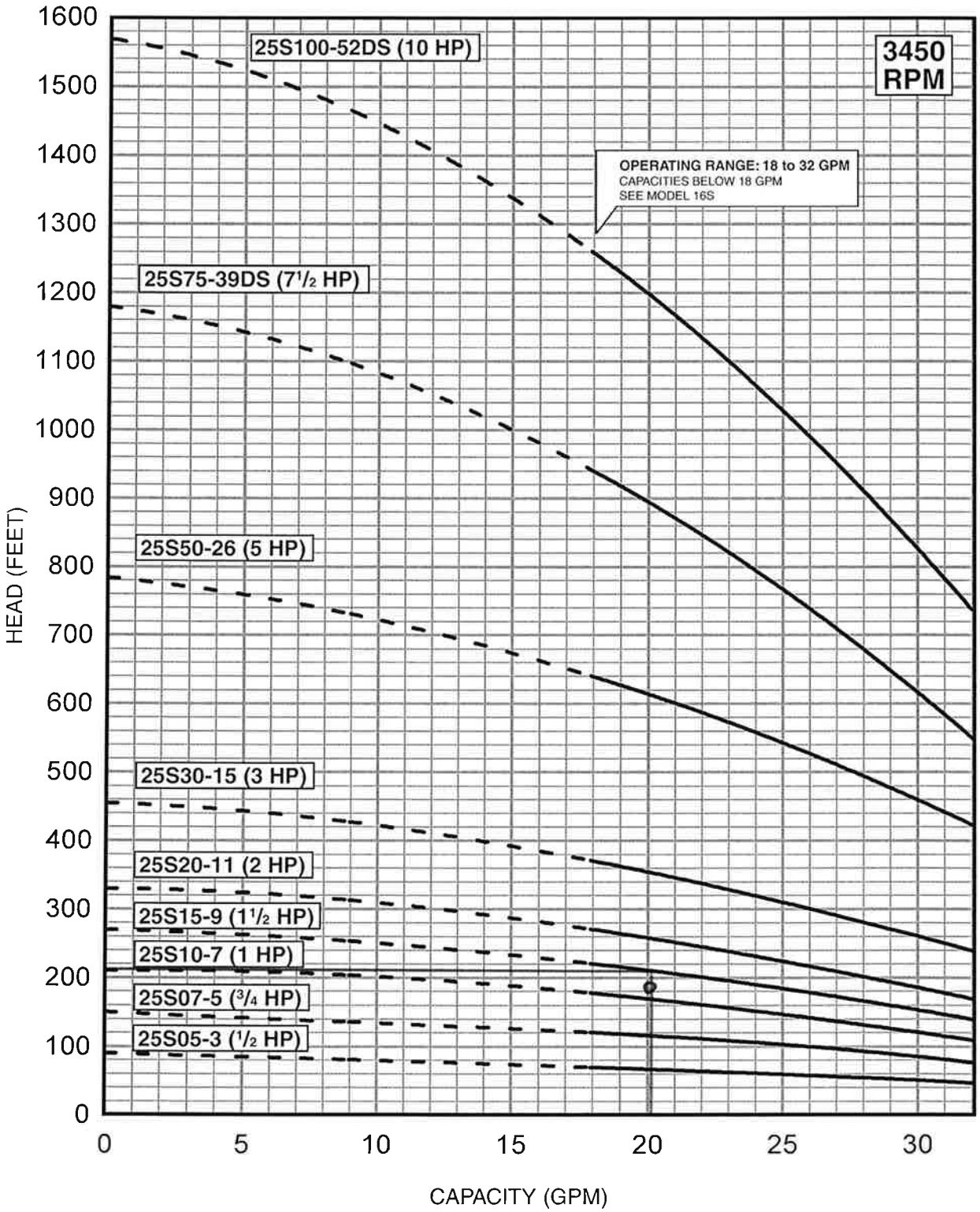
NOTES: Specifications are subject to change without notice.
Valox® is a registered trademark of General Electric Co.
Vectra® is a registered trademark of Hoechast Calanese Corporation.
Ryton® is a registered trademark of Phillips 66.
***Stainless Steel option available.**
** If using 4" non-standard motors, refer to 329/420/431 Stainless Steel for coupling.
A coupling key is not required.

R625-EDC-001213-0

EW-2101 - EW-2104
20.3gpm @ 185ft TDH

PERFORMANCE CURVES 25 GPM MODEL 25S

FLOW RANGE: 18 -32 GPM **OUTLET SIZE: 1½ " NPT** **NOMINAL DIA. 4"**



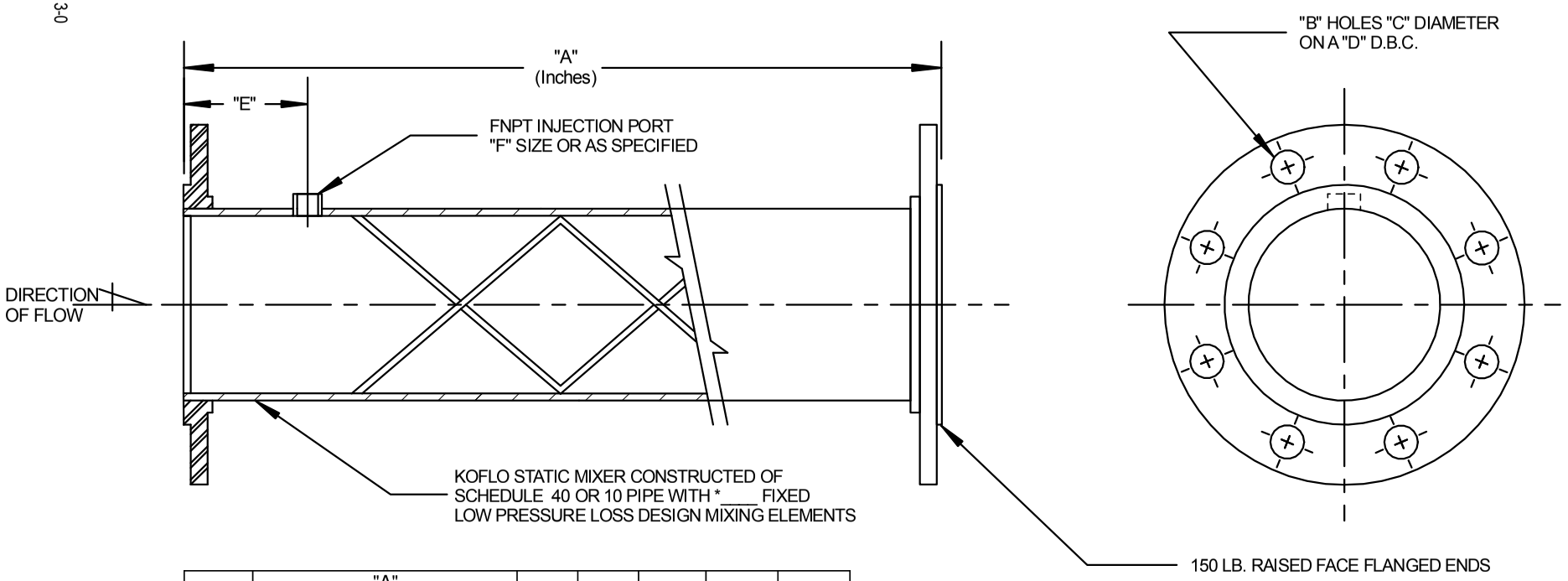
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
4" MOTOR STANDARD, .5 -5 HP/3450 RPM.
6" MOTOR STANDARD,7.5 -10HP/3450 RPM.

Performance conforms to ISO 9906. 1999 (E) Annex A
Minimum submergance is 2 feet.

Catalogue and Product Data Sheets

Item	Tag	Description
6	SM-100	Primary Static Mixer
34	SM-500	Effluent Static Mixer
47	SM-800	Solids Thickening Tank Static Mixer

R625-EDC-001213-0



SIZE	"A" *NUMBER OF ELEMENTS					"B"	"C"	"D"	"E"	"F"
	2	3	4	5	6					
1/2"	5	6	7	8	10	4	5/8"	2-3/8"	1-1/2"	1/4"
3/4"	6	8	9	11	13	4	5/8"	2-3/4"	1-1/2"	1/4"
1"	7	9	11	13	15	4	5/8"	3-1/8"	2"	1/4"
1-1/2"	11	15	18	21	24	4	5/8"	3-7/8"	2-3/4"	1/2"
2"	13	17	21	26	30	4	3/4"	4-3/4"	2-3/4"	1/2"
2-1/2"	15	20	26	31	37	4	3/4"	5-1/2"	3"	1/2"
3"	19	26	33	40	47	4	3/4"	6"	4"	3/4"
4"	23	33	42	52	61	8	3/4"	7-1/2"	4"	3/4"
6"	33	48	61	74	88	8	7/8"	9-1/2"	4"	3/4"
8"	43	61	79	~~	~~	8	7/8"	11-3/4"	5"	1"
10"	51	74	97	~~	~~	12	1"	14-1/4"	5"	1"
12"	60	88	~~	~~	~~	12	1"	17"	6"	1"

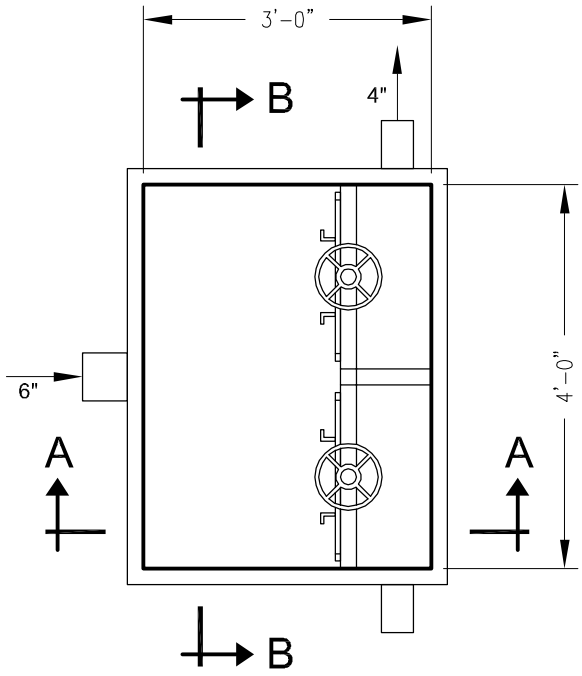
NOTE: SCH 40 IS USED FOR CARBON STEEL MIXERS
SCH 10 IS USED FOR SS/ALLOY MIXERS 3" AND LARGER

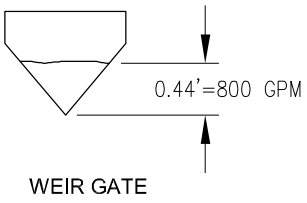
Koflo Corporation
309 CARY POINT DR.
CARY, IL 60013

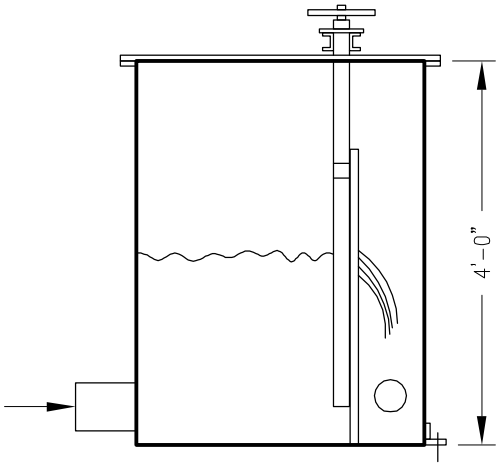
SCALE: NONE	APPROVED BY JLT	DRAWN BY NJF	
DATE: 7/10/06		REVISED 5/30/08	
CUSTOMER:		REVISED	
		REVISED	
MODEL NO: TYPICAL LOW PRESSURE LOSS DESIGN FLANGE MOUNTED MIXER WITH FNPT INJECTION PORT		DRAWING NUMBER: KD-985	

Catalogue and Product Data Sheets

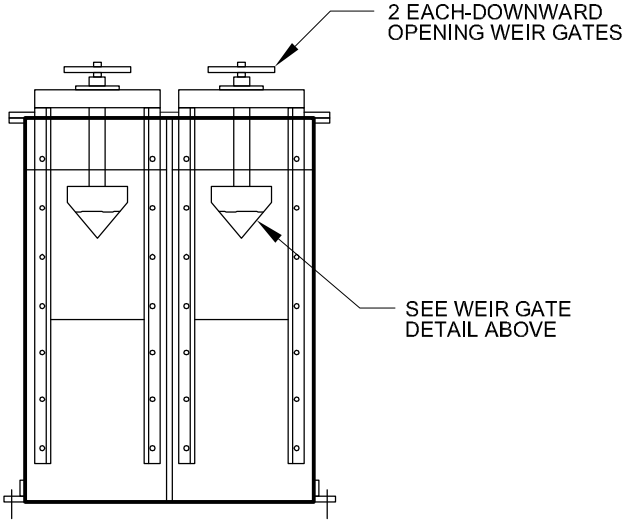
Item	Tag	Description
7	T-100	Primary Settling Tank Splitter Box
12	T-130	Secondary Settling Tank Splitter Box







A-A



B-B

NOTE:
EXTERNAL RIBS NOT SHOWN ON BOX.

SPLITTER BOX DETAIL

R625-EDC-001213-0

WORLD CLASS
Plasti-Fab
COMPOSITE SOLUTIONS



Stop Gates



Heavy Duty Titeseal Gates



Wedging Titeseal Gates

Flow Control Products



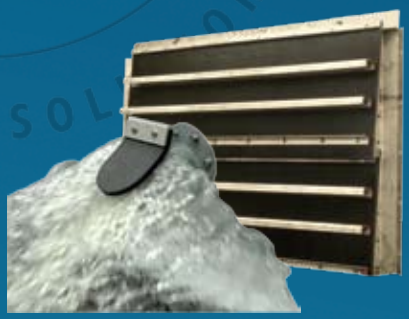
Stop Logs



Slide Gates



Weir Gates



Flap Gates

Plasti-Fab has over 35 years of experience supplying copolymer gates for corrosive municipal water and wastewater treatment, seawater and tidal environs, wetland restoration, and aggressive industrial flow streams. High strength copolymer gates, stop logs, and flap gates are built to meet stringent design specifications. Consider the many advantages of using copolymer gates in your next project and contact Plasti-Fab or your local rep.

R625-EDC-001213-0

The Titeseal Line of Gates

Heavy Duty Titeseal®



Heavy Duty Titeseal® Sluice Gates
- Built to AWWA C-563 Standard*
- Designed for Seating & Unseating Heads to 50ft or More
- High Corrosion Resistance, Low Maintenance
- Stainless Steel or Copolymer Frames are Standard
- Cast-in wall thimbles are not required
- Seals Mounted on Gate

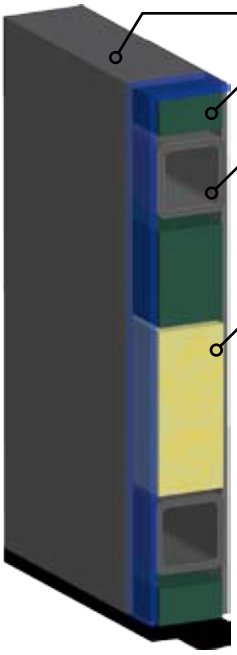
Wedging Titeseal®



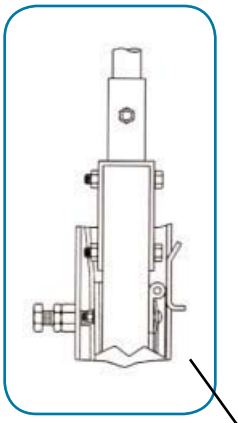
Wedging Titeseal® Gates
- Best Available Technology
- Often Used For Emergency Shut-Off
- For Open Channel Applications
- 4 to 5 Times Lower Leakage Than AWWA C-563*
- Seals Mounted on Gate

The lightweight Heavy Duty Titeseal Gate has excellent corrosion resistance and can be designed to handle aggressive flow stream conditions and higher applied heads.Gates can be 12’ x 12’ or larger and typically half the weight of the traditional cast iron sluice gates. The guide includes a top closure bar that allows the gate to seal around all four sides. The wedging bar and adjustable wedging bolts allow the leakage rate to be adjusted to the lowest possible levels. .

Heavy Duty Titeseal Construction



Will handle high head applications of 50 feet or more in seating or unseating service.





R625-EDC-001213-0

*AWWA C-563 Replaces AWWA C-501 for Composite Fabricated Slide Gates

Stop Gates & Slide Gates



Copolymer Slide Gates and Stop Gates (FRP)
- Individually Molded to the Exact Sizes Specified
- May Be Supplied With or Without Neoprene Seals
- Gates & Guides are UV Stabilized
- Guides May Be Embedded, Surface Mounted or In-Channel Mounted



Stop Gates

Most gates utilize a sandwich construction with a closed-cell polyisocyanurate foam core for high strength and corrosion resistance.

Downward Opening Weir Gates

Downward Opening Weir Gates are used to control upstream water levels and provide a controlled overflow discharge. Operated by mechanical lifts.

Slide Gates

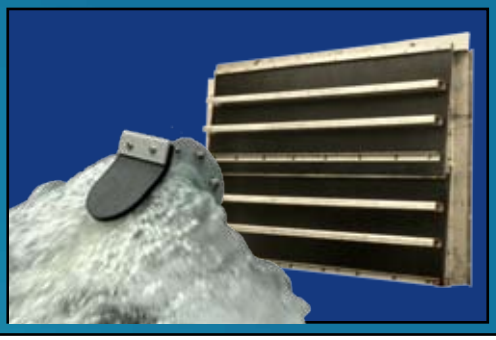
Slide gates are commonly used in open channel and moderate head applications to isolate equipment, divert flow, or close off a wall opening. The gates are reinforced to withstand the specified maximum operating head. Where required, neoprene seals can be included to meet leakage requirements.

Weir Gates



The Plasti-Fab flexible rubber & copolymer flap gates provide low leakage, low maintenance and low head loss. Suitable for seawater and most low pH waters.
-Round & Square Styles Available
-Sizes Range from 4" to 96"
-Lightweight Design
- Molded Reinforced Copolymer Body (Stainless Steel Optional)
-125 lb. Pattern Flange or Wall Mounting (flumes)
-Neoprene Seals

Flap Gates



Gates Specifications

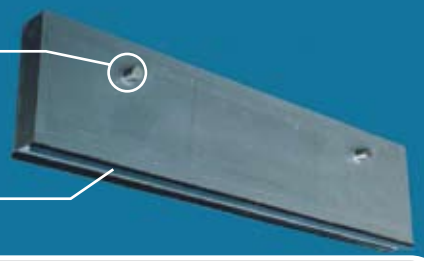
Type of Gate	Size Range	Maximum Normal Design Head		Available as Down-Opening Weir Gate	Max. Expected Leakage Rate Gallons per min.*		Available Gate Materials	Available Guide Frame Materials
		Seating	Unseating		Seat Head	Unseat Head		
Heavy Duty Titeseal Sluice Gates	12" x 12" to 144" x 144"	30 to 60 varies wth size	20 to 40 varies with size	Yes	0.1	0.1	FRP & Stainless Steel	FRP & Stainless Steel
Wedging Titeseal Slide Gates	12" x 12" to 72" x 72"	To Top of Gate	To Top of Gate	No	.027	.027	FRP, Stainless Steel & Aluminum	FRP & Stainless Steel
FRP Slide Gates	12" x 12" to 72" x 72"	To Top of Gate	To Top of Gate	Yes	0.1	0.2	FRP, Stainless Steel & Aluminum	FRP & Stainless Steel
FRP Stop Gates	12" x 12" to 72" x 72"	To Top of Gate	To Top of Gate	No			FRP & Aluminum	FRP & Stainless Steel
Rigid Round Flap Gates	4" to 96"	20 - 30	NA		0.1		Neoprene & FRP	FRP & Stainless Steel
Rectangular Flap Gates	12" to 96"	20 - 30	NA		0.1		Neoprene & FRP	FRP & Stainless Steel
Flexible Flap Gates	12" to 96"	20 - 30	NA		0.1		Neoprene	FRP & Stainless Steel

*Per wetted foot of perimeter

Copolymer Stop Logs

Our stop log sizes range from 1 foot wide to applications over 20 feet wide. Dams, diverstion structures, headworks, pump stations, sludge drying beds, and wetlands are great applications for stop logs





Heavy Duty Copolymer Stop Logs

- Constructed of Copolymer Composite (FRP) That Totally Encapsulates the Internal Steel Reinforcing Structure
- Common Sizes from 2.5 to 12ft Long
- Neoprene Seals Provide Low Leakage
- Highly Resistant to Corrosion and Weathering

Why Copolymer Stop Logs?

Wooden stop logs were used before our grand-fathers were born, why not today? Wood swells as it takes on moisture, and the ends are easily damaged after which decay may start. Seldom were they provided with lifting pins or devices so logs would get damaged, and are difficult to lift. Most of all, wooden stop logs are generally made from old growth redwood or cyprus which is a diminishing resource. Seals may be affixed to copolymer logs thus affecting a good seal which is difficult at best on wooden stop logs.

Stop Log Design Considerations

-Low Theft Concern with Copolymer Stop Logs as Opposed to Aluminum and Stainless. This is especially important considering Stop Logs are often sitting in racks when not in use.
-Stop Logs can be provided in any height.
-Smaller Stop Logs can be raised manually using lifting poles. (Two people can unseat a 3'to 4' Stop Log). Larger Stop Logs will require a lifting beam.
-Storage Racks are also available.

Who Is PLASTI-FAB ?

Plasti-Fab is an innovative company specializing in corrosion resistant equipment with the flexibility to meet your custom needs. For over 35 years, we have produced engineered products designed to meet specific application requirments. We are a service-oriented organization with the experience necessary to recommend workable equipment and installation modifications when required.

Plasti-Fab Manufactures a wide array of corrosion resistant products for the Water and Wastewater Industries. Visit us online at: www.plasti-fab.com

We invite you to tap into our expertise!

PLASTI-FAB INC.
PO Box 100
Tualatin, Oregon 97062-0100
(503)692-5460
Fax:(503)692-1145
www.Plasti-Fab.com



R025-EDC-001213-0

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Plasti-Fab®, INC.

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E-MAIL: sales@plasti-fab.com
WEB: http://www.plasti-fab.com

DOWNWARD OPENING WEIR GATE

The function of a down-opening weir gate is to control the upstream water level, and/or pace the amount of discharge from a water system. At times there will be a level control sensor in the system which is directly connected to, and controlling an oscillating operator, in order to automatically pace the amount of flow discharged, or to maintain a constant upstream water depth.

Depending on the size of the weir opening and the heads involved, the downward opening weir gate can be constructed as a sandwich style gate, a one-inch solid FRP gate, or as a Heavy Duty Titeseal gate. It is best to use those for seating head applications to obtain the best leakage performance. However, they can be designed to perform well for unseating heads as well.

GUIDES: The major difference between the down-opening weir gate and a slide gate is seen in the construction of the guide. The gate must pass down across a sealed channel invert. This means that the down-opening weir gate will almost always be surface-mounted. In addition, the guide will have a spigot back that matches the dimensions of the weir or channel opening, and there will be no bottom guide channel. The seals will be mounted on the guide rather than the gate. Guides can be fabricated using FRP or stainless steel, depending on the style of gate and the application requirements.

LIFTS & STEM: The vast majority of down-opening weir gates will use either a manual or electric actuator. Frequently the electric operators will include a modulating feature that may be controlled by a 4-20 mA signal. The lifts may be mounted on the headrail of a self-contained gate or on a pedestal. Stems will normally be of T-304 or T-316 stainless steel.

Wider weir openings may use a tandem lift and dual stem to help maintain a level weir crest and to keep the gate square in the guide. The general rule of thumb says that, if the gate width is twice the gate height, two stems should be considered.

SEALS: A neoprene J-seal mounted directly to the spigot back on the guide runs down each side of the opening and across the bottom invert. The weir gate will pass up or down over this seal and must remain in contact wit the seal if it is to operate correctly. Weir gates are most effective when the water pressure is pushing the gate against the seal (seating head).

INSTALLATION: A downward opening weir gate requires that the water spill over the top of the gate rather than pass under or around. Deflection is an important consideration when designing and installing these gates. Weir gates are surface mounted using stainless steel anchor bolts, and must have enough room below the channel invert to allow the gate to be fully lowered. The gate is considered full-open when it reaches its lowest point of travel.

WHY BUY PLASTI-FAB?

1. Plasti-Fab weir gates offer high corrosion resistance to a very wide range of acids, caustics, salt water and other aggressive chemicals.

2. Plasti-Fab offers a broad range of down-opening weir gates including sandwich style, one-inch solid FRP gates, Heavy duty Titeseal gates, stainless steel and aluminum if required.

3. Plasti-Fab has over 25 years of experience in fiberglass gate design and has fabricated virtually every type of weir gate available.

4. Plasti-Fab has worked with every major lift manufacturer and can supply any style or type of lift required. You can request handwheel, geared mechanical lifts, portable operators, or modulating electric actuators.

5. Fiberglass weir gates are lightweight and east to install.

Catalogue and Product Data Sheets

Item	Tag	Description
8	T-110A, T-110B	Primary Settling Tanks
10	T-120	Solids Contact Tank
13	T-140A, T-140B	Secondary Settling Tanks
17	T-200	Filter Feed Tank
23	T-300	AOP Feed Tank
32	T-500	Effluent Tank
45	T-800	Backwash Surge Tank
49	T-810	Solids Thickening Tank

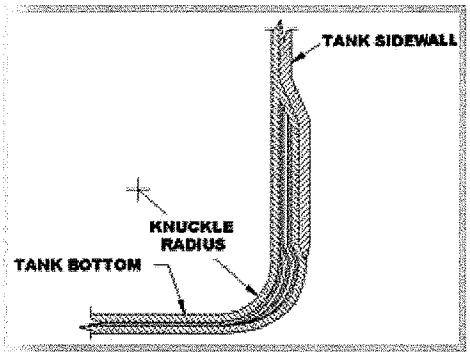
BELDING™
TANK TECHNOLOGIES, INC.

Design Features

Standards

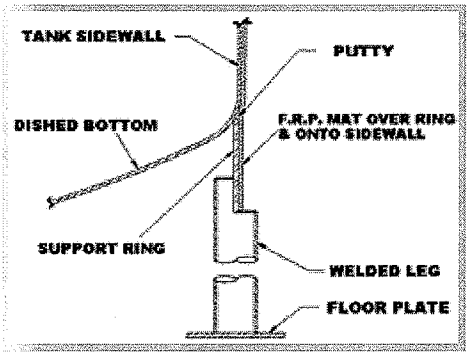
We build all of our tank walls in accordance with the time-tested standards of ASTM D-3299 and ASTM D-4097 specifications for filament winding and contact molding respectively, with ASME RTP-1 (design by rules) fabrication capabilities.

All Belding Tank Technologies, Inc. corrosion barriers are built to a minimum thickness of 110 mil vs. 96 mil as specified by ASTM & ASME.

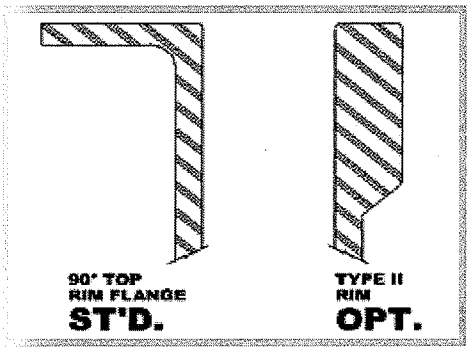


Tank Bottoms

Flat & Sloped - The majority of our Flat and Sloped Bottom tanks use a unitized one-piece bottom to sidewall construction without a seam for greater structural strength. However, we don't stop there. The tank bottom corners include a knuckle radius for maximum resistance against hydrostatic pressures, and corners are easier to clean to help eliminate product contamination.



Cone & Dished - The majority of our Dished Bottom tanks also use a unitized one-piece bottom to sidewall construction without a seam for greater structural strength and ease of cleaning. We utilize both FRP and Steel support structures, overlaying the steel support ring exterior with fiberglass for added resistance against chemical attack. The full circumference support helps eliminate uneven stresses on the tank sidewall



Tank Tops

Closed - Belding Tank® Dome and Flat Top Heads come standard with our 20" or 24" loose cover top manhole with grab handle for convenient opening.

OPEN - Our Open Top tanks come standard with a 90° rim flange, with the option of a one, two or three piece cover. The 90° rim also allows for easy mounting of mixer rails, when required. As a cost saving alternative, a Type II rim is offered when a cover or rails are not required.

Note :
All Belding Tank® 90° rims are formed by means of hand lay-up to the tank sidewall on a platen table to ensure uniformity

Fittings

Belding Tank® flanged nozzles are made via the hand lay-up process as a standard which offers superior strength and corrosion resistance. Conical and plate gusseting is also offered, where added strength is required.

Accessories

Our standard insulated tanks come equipped with a reinforced fiberglass outer protective shell for protection of insulation against damage from mechanical impact and environmental degradation. We also offer a replaceable type heat panel for tanks that need to maintain a given product temperature. Heat panels help eliminate the high cost associated with repair or replacement of wire heating systems which require complete removal of the tank insulation, and later re-insulation of tank after repair or replacement.

R625-EDC-001213-0

BELDING TANK TECHNOLOGIES, INC.

Construction

The laminate Corrosion Barrier is the Inner Surface and Interior Layer combined. The glass content of the Corrosion barrier shall be 27% ± 5% by weight. The most important feature to any fiberglass tank in the corrosion industry is the corrosion barrier of the tank. Each tank Belding Tank Technologies, Inc. manufactures is built using a male mold to help ensure a smooth, resin rich internal finish to aid in corrosion resistance.

Resin Systems

Economy Resin System:

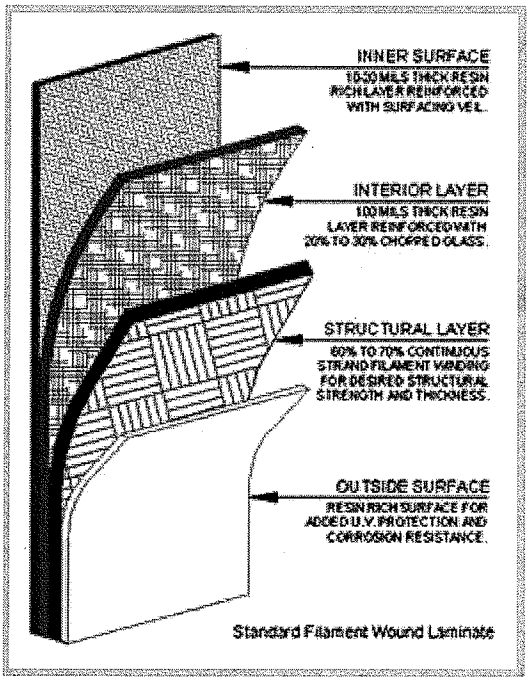
Isophthalic polyester resin throughout the laminate.

Standard Resin System:

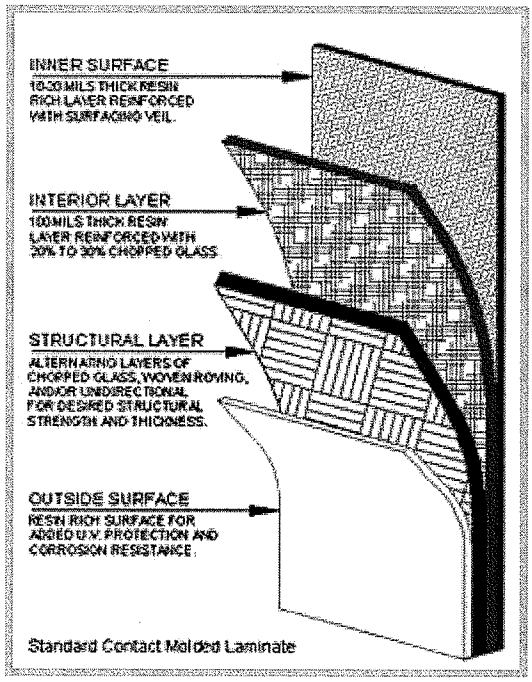
Our "STANDARD" resin system consists of Premium grade Vinyl ester resin in both the Inner Surface and Interior Layer. Isophthalic polyester resin is used in the Structural Layer and Outside Surface.

Premium Resin System:

Premium grade Vinyl ester resin throughout the laminate.



Click here to Enlarge

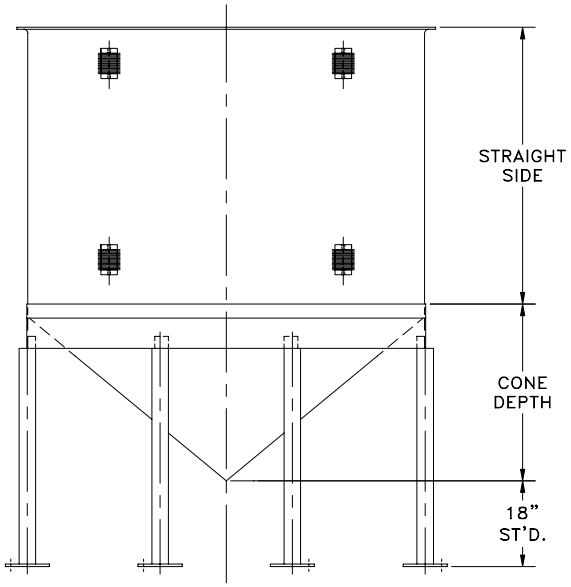


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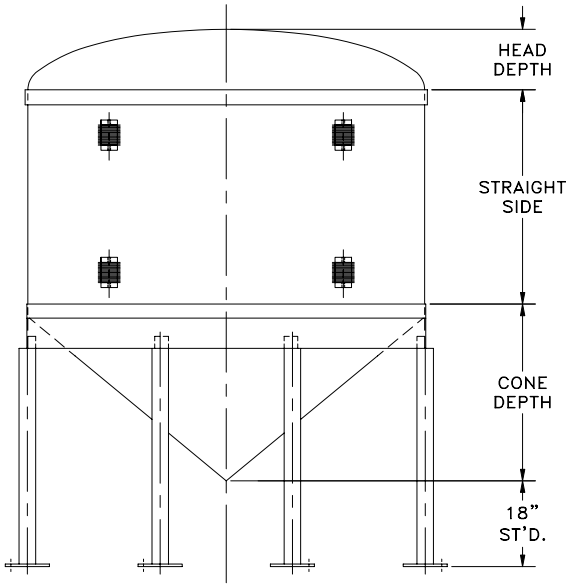
"Quality is our Standard , Customer Service is our Specialty."

R625-EDC-001213-0

MODEL OKV & CKV



C-OKV



C-CKV

CAPACITIES (U.S. Gallons)

Tank Nominal DIAMETER (Inches)	ONE Section STRAIGHT SIDE LENGTH (Inches)											TWO Section			
	24	30	36	42	48	54	60	66	72	78	84	90	96	108	120
24	54	65	77	89	100	112	124	135	147	158	170	181	193	216	240
30	88	107	126	144	163	182	201	220	239	259	278	298	317	350	388
36	112	136	161	186	211	236	262	288	314	340	366	393	419	457	508
42	182	218	254	290	327	363	400	436	473	511	548	585	623	686	759
48	219	264	309	354	400	446	491	538	584	631	677	725	772	849	940
54	326	386	445	505	564	624	683	743	802	862	921	981	1040	1159	1278
60	359	428	498	568	638	709	779	850	922	993	1065	1137	1210	1355	1502
66	518	607	696	785	873	962	1051	1140	1229	1318	1407	1495	1584	1762	1940
72	560	663	765	868	971	1075	1179	1283	1388	1493	1598	1704	1810	2023	2238
84	833	973	1114	1256	1398	1540	1683	1827	1971	2115	2260	2406	2552	2845	3140
90	1073	1239	1404	1569	1734	1900	2065	2230	2395	2561	2726	2891	3056	3387	3717
96	1152	1335	1519	1704	1889	2075	2261	2448	2635	2822	3010	3199	3388	3767	4149
108	1486	1412	1939	2166	2394	2622	2850	3079	3309	3539	3769	4000	4231	4695	5161
120	2012	2300	2590	2880	3170	3462	3753	4046	4339	4633	4927	5222	5517	6110	6706
132	2693	3048	3404	3759	4115	4470	4826	5181	5536	5892	6247	6603	6958	7669	8380
138	2792	3174	3557	3940	4323	4707	5092	5478	5863	6250	6637	7025	7413	8191	8972
144	3204	3627	4050	4475	4900	5326	5753	6181	6609	7039	7469	7900	8332	9198	10068
156	4136	4633	5129	5626	6122	6619	7115	7612	8108	8604	9101	9597	10094	11087	12080
168	4695	5246	5799	6352	6906	7461	8016	8573	9130	9687	10246	10806	11459	12489	13614

DIA. Inches	Gallons Per Inch	Head Depth	Cone Depth	Cone Capacity
24	1.93	4	12	8
30	3.14	5	15	15
36	4.19	6	15	16
42	6.06	7	21	41
48	7.58	8	21	43
54	9.90	9	27	89
60	11.80	10	27	85
66	14.80	11	33	163
72	17.46	12	33	156
84	24.02	14	39	276
90	27.53	15	45	413
96	31.66	16	45	422
108	38.72	18	51	586
120	49.49	20	58	863
132	59.22	22	66	1303
138	64.82	23	65	1271
144	72.39	24	70	1522
156	82.68	26	78	2151
168	93.08	28	82	2496

General Notes:

1. Diameters smaller than 72” are Contact Molded per ASTM D-4097.
2. Diameters 72” and larger are Filament Wound per ASTM D-3299.
3. Carbon steel primed pipe legs with floor pads.
4. Heavy powder coated carbon steel lifting lugs, as required for handling.
5. Standard cone angle is 90° at the apex (Included Angle).

MODEL OKV & CKV

OPTIONAL FEATURES

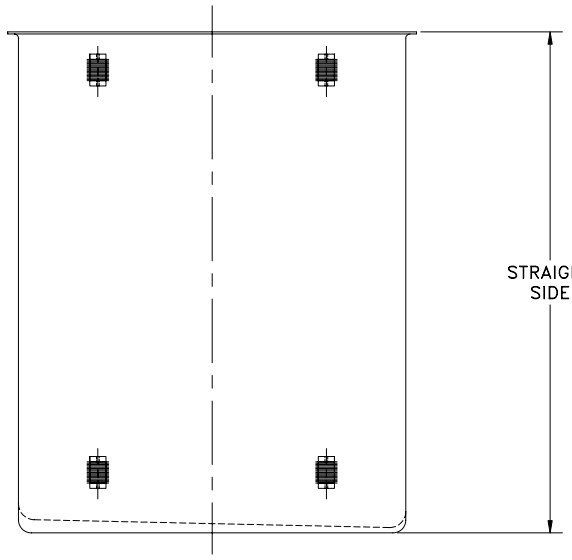
- FRP Skirt Support
- Integral FLAT Top Head
- Flat Cover for Open Top (1 pc. / 2 pc. / 3 pc.)
- 30°, 45° & 60° Cone Angles

CAPACITIES (U.S. Gallons)

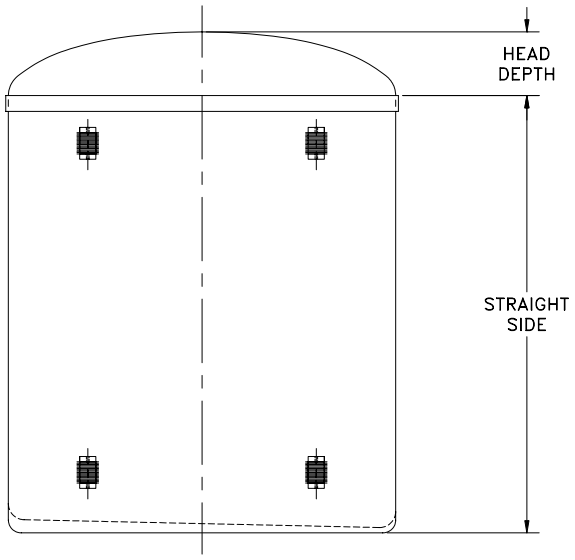
ONE Section — STRAIGHT SIDE LENGTH (Inches) — TWO Section

Tank Nominal DIAMETER (Inches)	132	144	156	168	180	192	204	216	228	240	252	264	276	288	312
24	263	286													
30	426	464	503	542	581	620									
36	560	612	664	717	770	823									
42	832	906	981	1055	1130	1205									
48	1033	1126	1219	1312	1407	1501									
54	1397	1516	1635	1754	1873	1992	2111	2230	2349	2468	2587	2706	2825	2944	3182
60	1616	1759	1902	2046	2190	2335	2480	2626	2773	2920					
66	2117	2295	2473	2651	2828	3006	3184	3362	3539	3717	3895	4072	4250	4428	4783
72	2455	2673	2830	3041	3252	3465	3678	3891	4106	4321	4537	4754	4972	5190	
84	3437	3737	3955	4245	4536	4828	5120	5414	5709	6005	6302	6599	6898	7198	
90	4048	4378	4709	5039	5370	5700	6031	6361	6692	7022	7353	7683	8014	8344	9005
96	4532	4918	5305	5694	6086	6479	6874	7113	7494	7876	8259	8643	9028	9414	10189
108	5628	6098	6569	7042	7517	7994	8472	8953	9270	9736	10203	10671	11140	11610	12552
120	7304	7904	8507	9112	9720	10331	10944	11559	11953	12549	13146	13745	14345	14946	16151
132	9091	9802	10513	11224	11935	12645	13356	14067	14778	15489	16200	16911	17622	18333	19754
138	9754	10540	11327	12117	12909	13704	14501	15112	15892	16673	17455	18238	19023	19809	21384
144	10941	11817	12697	13580	14466	15356	16249	16697	17743	18614	19486	20360	21235	22112	23872
156	13073	14065	15058	16051	17044	18037	19030	20023	21016	22009	23002	23994	24987	25980	27966
168	14743	15876	17011	18149	19116	20236	21358	22482	23607	24733	25862	26991	28123	29256	31526

MODEL OSV-I & CSV-I



C-OSV-I



C-CSV-I

CAPACITIES (U.S. Gallons)

ONE Section | STRAIGHT SIDE LENGTH (Inches) | TWO Section

Tank Nominal DIAMETER (Inches)

	24	30	36	42	48	54	60	66	72	78	84	90	96	108	120
24	43	54	66	78	89	101	113	124	136	147	159	170	182	205	229
30	69	87	106	125	143	162	181	200	220	239	258	278	297	330	368
36	89	114	139	163	189	214	239	265	291	317	343	370	397	435	486
42	132	168	204	240	276	312	349	386	423	460	497	534	572	635	708
48	164	209	254	299	344	390	436	482	528	575	622	669	716	793	885
54	221	280	340	399	459	518	578	637	697	756	816	875	935	1054	1172
60	254	323	393	463	533	603	674	745	816	887	959	1031	1104	1249	1396
66	328	417	506	595	684	773	862	950	1039	1128	1217	1306	1395	1572	1750
72	373	475	577	680	783	887	991	1095	1199	1304	1410	1515	1621	1835	2049
84	511	651	792	934	1076	1218	1361	1504	1648	1792	1937	2082	2228	2521	2816
90	605	770	935	1101	1266	1431	1596	1762	1927	2092	2257	2423	2588	2918	3249
96	666	850	1034	1218	1403	1589	1775	1961	2148	2335	2523	2712	2901	3280	3661
108	817	1044	1270	1497	1725	1952	2181	2410	2639	2869	3099	3329	3561	4024	4489
120	1035	1324	1613	1903	2193	2484	2776	3068	3361	3654	3948	4243	4538	5131	5726
132	1275	1631	1986	2342	2697	3053	3408	3764	4119	4474	4830	5185	5541	6252	6963
138	1360	1742	2124	2507	2890	3274	3659	4044	4430	4816	5203	5590	5978	6756	7536
144	1500	1922	2346	2770	3194	3620	4047	4474	4902	5331	5761	6192	6623	7489	8358
156	1753	2249	2746	3242	3739	4235	4732	5228	5725	6221	6718	7214	7710	8703	9696
168	1930	2481	3033	3586	4140	4694	5250	5805	6362	6920	7478	8037	8597	9719	10844

R625-EDC-001213-0

DIA. Inches	Gallons Per Inch	Head Depth
24	1.93	4
30	3.14	5
36	4.19	6
42	6.06	7
48	7.58	8
54	9.90	9
60	11.80	10
66	14.80	11
72	17.46	12
84	24.02	14
90	27.53	15
96	31.66	16
108	38.72	18
120	49.49	20
132	59.22	22
138	64.82	23
144	72.39	24
156	82.68	26
168	93.08	28

General Notes:

1. Diameters smaller than 72" are Contact Molded per ASTM D-4097.
2. Diameters 72" and larger are Filament Wound per ASTM D-3299.
3. Heavy powder coated carbon steel lifting lugs, as required for handling.
4. ¼" / ft. internal sloped bottom standard.

OPTIONAL FEATURES

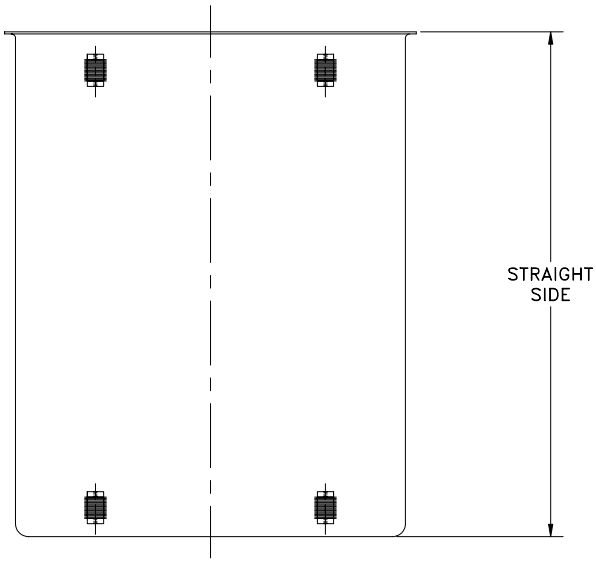
- Integral FLAT Top Head
- Flat Cover for Open Top (1 pc. / 2 pc. / 3 pc.)

CAPACITIES (U.S. Gallons)

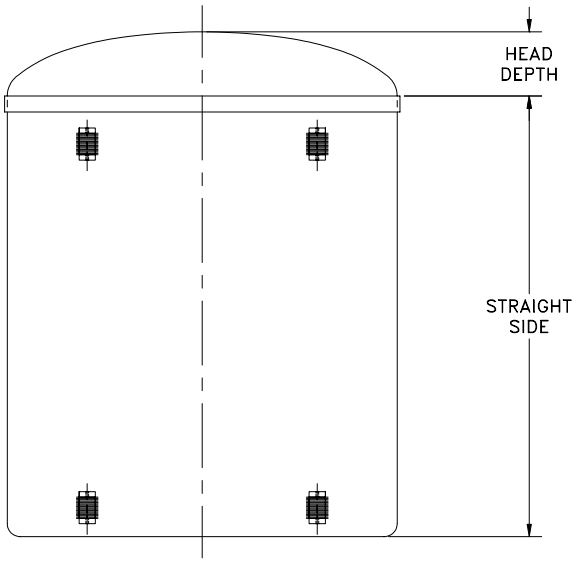
ONE Section | STRAIGHT SIDE LENGTH (Inches) | TWO Section

Tank Nominal DIAMETER (Inches)	132	144	168	192	204	216	240	264	288	312	336	360	384	408	444
24	252	276													
30	406	445	522	600											
36	537	589	694	800											
42	782	856	1004	1154											
48	977	1070	1257	1445											
54	1291	1410	1648	1886	2005	2124	2362	2600	2838	3076	3314	3552	3790	4028	4385
60	1511	1653	1940	2229	2374	2520	2814								
66	1928	2106	2461	2817	2994	3172	3527	3883	4238	4594	4949	5305	5660	6016	6549
72	2266	2483	2852	3276	3489	3703	4132	4565	5001						
84	3113	3412	3922	4504	4797	5090	5681	6275	6873						
90	3579	3910	4571	5232	5562	5893	6554	7214	7875	8536	9197	9858	10519	11180	12172
96	4044	4429	5205	5989	6384	6626	7388	8155	8925	9700	10478	11260	12046	12837	
108	4957	5426	6369	7320	7799	8279	9065	9999	10938	11880	12826	13775	14728	15685	
120	6323	6923	8131	9348	9960	10575	11569	12764	13965	15170	16380	17596	18816	20042	
132	7673	8384	9806	11228	11939	12650	14072	15493	16915	18337	19759	21181	22602	24024	26157
138	8318	9103	10679	12265	13061	13676	15237	16082	18372	19947	21526	23110	24698	26291	
144	9230	10106	11867	13642	14534	15430	16904	18649	20401	22160	23925	25697	27476	29262	31953
156	10689	11682	13668	15654	16647	17640	19625	21611	23597	25583	27569	29554	31540	33526	36505
168	11972	13104	15376	17467	18589	19712	21963	24220	26484	28754	31030				

MODEL OFV & CFV



C-OFV



C-CFV

CAPACITIES (U.S. Gallons)

Tank Nominal DIAMETER (Inches)	ONE Section / STRAIGHT SIDE LENGTH (Inches)									TWO Section					
	24	30	36	42	48	54	60	66	72	78	84	90	96	108	120
24	45	57	68	80	92	103	115	127	139	149	161	173	184	208	231
30	73	91	110	129	148	167	186	205	224	243	263	282	301	334	372
36	95	120	144	169	194	220	245	271	297	323	349	376	403	441	492
42	140	176	212	248	285	321	358	395	431	469	506	543	581	644	717
48	175	220	265	310	356	401	447	494	540	587	633	681	728	804	896
54	236	296	355	415	474	534	593	653	712	772	831	891	950	1069	1188
60	273	342	412	482	552	622	693	764	835	907	979	1051	1124	1270	1417
66	353	442	531	620	709	798	887	975	1064	1153	1242	1331	1420	1597	1775
72	403	505	607	710	813	917	1021	1125	1230	1335	1440	1546	1652	1866	2081
84	555	695	836	978	1120	1262	1405	1549	1693	1837	1982	2128	2274	2567	2862
90	658	823	989	1154	1319	1484	1650	1815	1980	2145	2311	2476	2641	2972	3302
96	727	911	1095	1280	1465	1651	1837	2023	2210	2398	2586	2775	2964	3343	3725
108	897	1124	1350	1578	1805	2033	2262	2491	2720	2950	3180	3411	3643	4106	4572
120	1143	1432	1722	2012	2302	2593	2885	3178	3471	3764	4059	4354	4649	5242	5838
132	1416	1772	2127	2482	2838	3193	3549	3904	4260	4615	4971	5326	5681	6392	7103
138	1515	1897	2280	2663	3046	3431	3815	4201	4587	4973	5360	5748	6136	6915	7695
144	1676	2099	2522	2947	3372	3798	4225	4652	5081	5510	5940	6372	6803	7670	8539
156	1970	2467	2963	3460	3956	4452	4949	5445	5942	6438	6935	7431	7928	8921	9913
168	2183	2734	3287	3840	4394	4949	5504	6061	6618	7176	7734	8294	8854	9977	11102

DIA. Inches	Gallons Per Inch	Head Depth
24	1.93	4
30	3.14	5
36	4.19	6
42	6.06	7
48	7.58	8
54	9.90	9
60	11.80	10
66	14.80	11
72	17.46	12
84	24.02	14
90	27.53	15
96	31.66	16
108	38.72	18
120	49.49	20
132	59.22	22
138	64.82	23
144	72.39	24
156	82.68	26
168	93.08	28

General Notes:

1. Diameters smaller than 72" are Contact Molded per ASTM D-4097.
2. Diameters 72" and larger are Filament Wound per ASTM D-3299.
3. Heavy powder coated carbon steel lifting lugs, as required for handling.

OPTIONAL FEATURES

- Integral FLAT Top Head
- Flat Cover for Open Top (1 pc. / 2 pc. / 3 pc.)

CAPACITIES (U.S. Gallons)

ONE Section — STRAIGHT SIDE LENGTH (Inches) — TWO Section

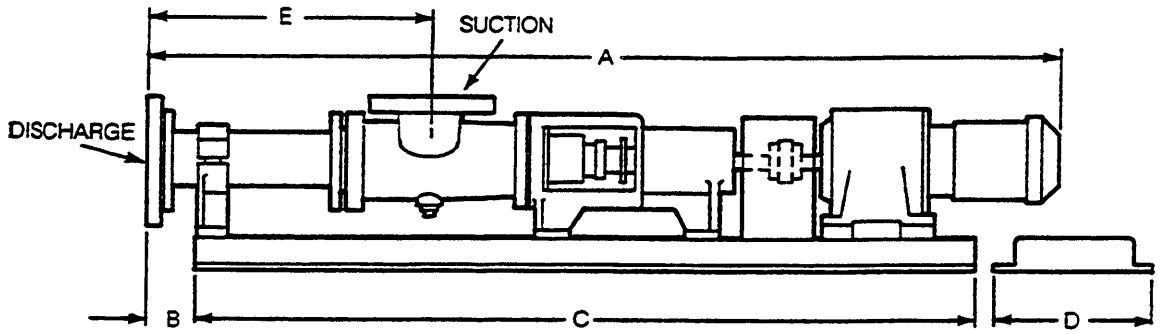
Tank Nominal DIAMETER (Inches)	132	144	168	192	204	216	240	264	288	312	336	360	384	408	444
24	255	278													
30	410	449	526	604											
36	543	595	700	807											
42	790	864	1013	1163											
48	989	1081	1268	1457											
54	1307	1426	1664	1902	2021	2140	2378	2616	2854	3092	3329	3567	3805	4043	4400
60	1530	1673	1960	2249	2394	2541	2835								
66	1953	2131	2486	2842	3019	3197	3552	3908	4263	4619	4974	5330	5685	6041	6574
72	2297	2515	2883	3307	3520	3734	4164	4597	5032						
84	3159	3459	3967	4550	4842	5136	5727	6321	6920						
90	3633	3963	4624	5285	5615	5946	6607	7268	7929	8590	9251	9912	10573	11234	12225
96	4108	4493	5270	6055	6450	6689	7452	8219	8990	9764	10543	11325	12112	12903	
108	5040	5509	6453	7405	7884	8364	9147	10082	11021	11964	12910	13859	14813	15770	
120	6436	7036	8244	9463	10076	10691	11681	12877	14077	15283	16494	17710	18931	20157	
132	7814	8525	9947	11369	12080	12790	14212	15634	17056	18478	19899	21321	22743	24165	26298
138	8478	9263	10841	12428	13225	13836	15397	16963	18533	20109	21689	23273	24863		
144	9412	10289	12051	13828	14721	15617	17085	18831	20584	22343	24109	25882	27662	29448	32141
156	10906	11899	13885	15871	16864	17857	19843	21828	23814	25800	27786	29772	31757	33743	36722
168	12231	13364	15637	17724	18846	19970	22221	24479	26744	29014	31291				

Catalogue and Product Data Sheets

Item	Tag	Description
9	P-110A, P-110B	Primary Solids Transfer Pumps
14	P-140A, P-140B	Secondary Solids Transfer Pumps

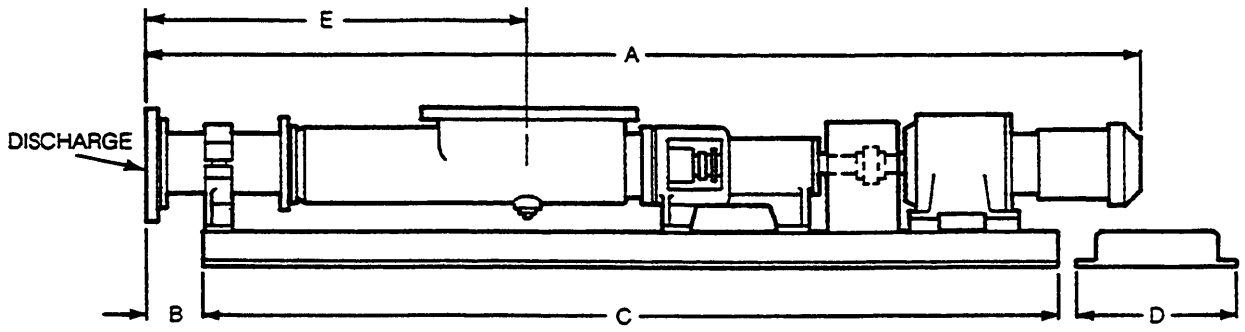
PUMP, DRIVE, AND BASE DIMENSIONS — MOYNO® 1000 PUMPS

IN-LINE GEARMOTOR ARRANGEMENT*



MODEL	A	B	C	D	E	SUCTION	DISC.
A1B	43	1	51	21	7.00	1.50	1.50
A2B	47	1	51	21	11.50	1.50	1.50
A4B	67	6	68	23	23.50	2.50	1.50
A1C	46	1	51	21	9.31	2.00	2.00
A2C	51	1	51	21	14.56	2.00	2.00
A4C	72	3	68	23	27.88	3.00	2.00
A1D	56	3	51	21	11.81	2.50	2.50
A2D	63	6	68	23	18.88	2.50	2.50
A4D	97	5	89	23	41.44	4.00	2.50
A1E	59	3	51	21	14.88	3.00	3.00
A2E	68	5	68	23	23.69	3.00	3.00
A4E	108	8	101	26	50.25	4.00	3.00
A1F	79	4	89	23	23.25	4.00	4.00

MODEL	A	B	C	D	E	SUCTION	DISC.
A2F	90	11	89	23	34.31	4.00	4.00
A4F	133	7	120	30	67.88	6.00	4.00
A1G	85	6	89	23	26.56	4.00	4.00
A2G	97	13	89	23	39.38	4.00	4.00
A4G	140	6	144	32	75.05	6.00	6.00
A1H	101	6	101	26	36.31	6.00	6.00
A2H	116	14	101	26	50.81	6.00	6.00
A1J	106	11	101	26	41.69	6.00	6.00
A2J	126	7	120	30	61.50	6.00	6.00
A1K	113	12	101	26	48.38	6.00	6.00
A2K	139	12	144	32	74.91	6.00	6.00
A1L	133	12	144	32	68.28	6.00	6.00

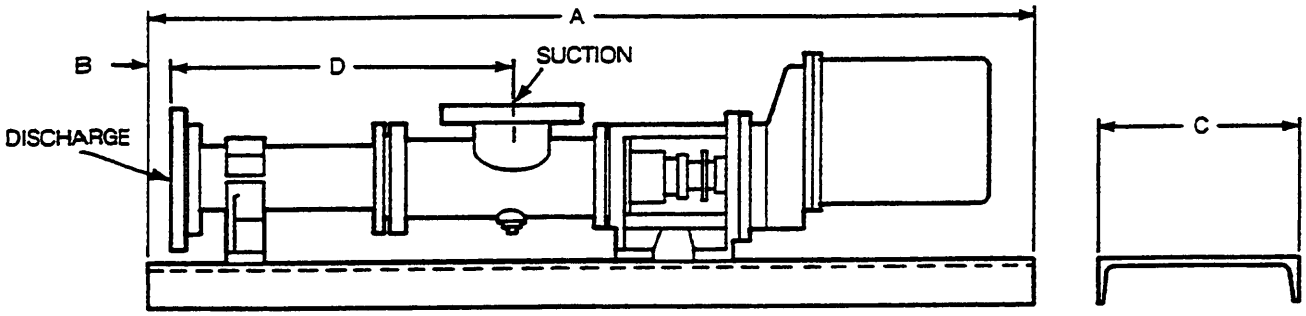


MODEL	A	B	C	D	E	DISC.
C2E	80	8	68	23	33.56	3.00
C2F	100	11	89	23	40.88	4.00
C2G	110	13	101	26	49.38	4.00

*DIMENSIONS FOR ESTIMATION PURPOSES ONLY.
ACTUAL DIM. DEPENDS ON DRIVE SELECTED.

PUMP, DRIVE, AND BASE DIMENSIONS — MOYNO® 1000 PUMPS

CLOSE-COUPLED ARRANGEMENT*



MODEL	A	B	C	D	SUCTION	DISC.
B1B	48	2.75	10	7.00	1.50	1.50
B2B	48	2.75	10	11.50	1.50	1.50
B4B	72	4.00	12	23.50	2.50	1.50
B1C	48	2.88	10	9.31	2.00	2.00
B2C	56	2.88	10	14.56	2.00	2.00
B4C	81	2.62	12	27.88	3.00	2.00
B1D	58	3.62	12	11.81	2.50	2.50
B2D	70	3.62	12	18.88	2.50	2.50
B4D	101	3.25	12	41.44	4.00	2.50
B1E	66	3.50	12	14.88	3.00	3.00
B2E	75	3.62	12	23.69	3.00	3.00
B4E	113	4.25	15	50.25	4.00	3.00
B1F	81	3.25	12	23.25	4.00	4.00
B2F	90	4.25	15	34.31	4.00	4.00

*DIMENSIONS FOR ESTIMATION PURPOSES ONLY.
SPECIFIC DRAWINGS FOR PUMP AND CHANNEL BASE ARE AVAILABLE WITH MOUNTING DIMENSIONS.
CONSULT FACTORY.

R625-EDC-001213-0
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P-110A/B
4.6 gpm @ 50ft TDH

MOYNO

Always the Right Solution™

Section:
1000 Pumps
Date: February 2009

Performance Data

Curve 6.02

Models: A1C, B1C, A2C, B2C
A4C, B4C

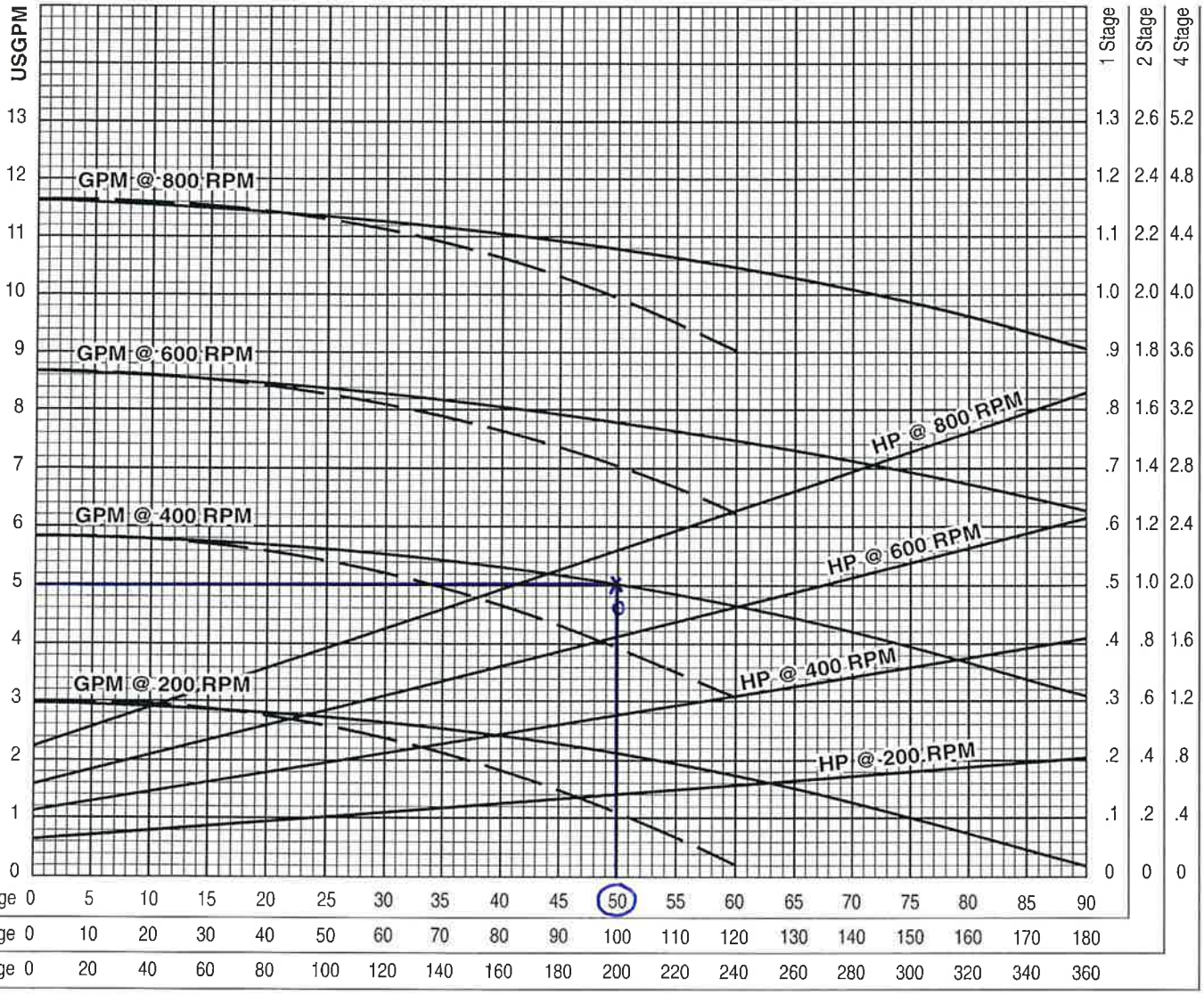
Use appropriate HP and pressure scales for the number of stages required.

NOTE: Pressure limits rated at 87 psi/stage (70 Duro). Some models have additional limits. Please consult factory before making final selection.

		RPM	200	400	600	800
NPSH Required – (Ft.)			0.73	1.40	2.20	2.90
STARTING TORQUE, Minimum Recommended Motor HP*	***73 IN/LB***	1 STG	0.25	0.33	0.50	0.75
	97 IN/LB	2 STG	0.25	0.50	0.75	1.00
	145 IN/LB	4 STG	0.50	0.75	1.00	1.50
Drive End HP Must be added to HP value from curve.		A4C, B4C	0.08	0.16	0.24	0.32

*Based on drives supplying 150% starting torque.

Capacity — 70 Durometer Hardness, — — 55 Durometer Hardness** Data Based on Water @ 68°F **Horsepower**



** Std. Nitrile, EPDM and Fluoroelastomer = 70 Duro.
Std. Natural Rubber = 55 Duor.

(BAR x 1.0197 = kgf/cm²)
(BAR x 14.504 = PSI)
(USGPM = 227.1 L/HR)
(1 kW = 1.3410 HP)

R625-EDC-001213-0

Differential Pressure (PSI)*

P-140 A/B
8.5 gpm @ 50ft TDH

MOYNO

Always the Right Solution™

Section:
1000 Pumps
Date: February 2009

Performance Data

Curve 6.02

Models: A1C, B1C, A2C, B2C
A4C, B4C

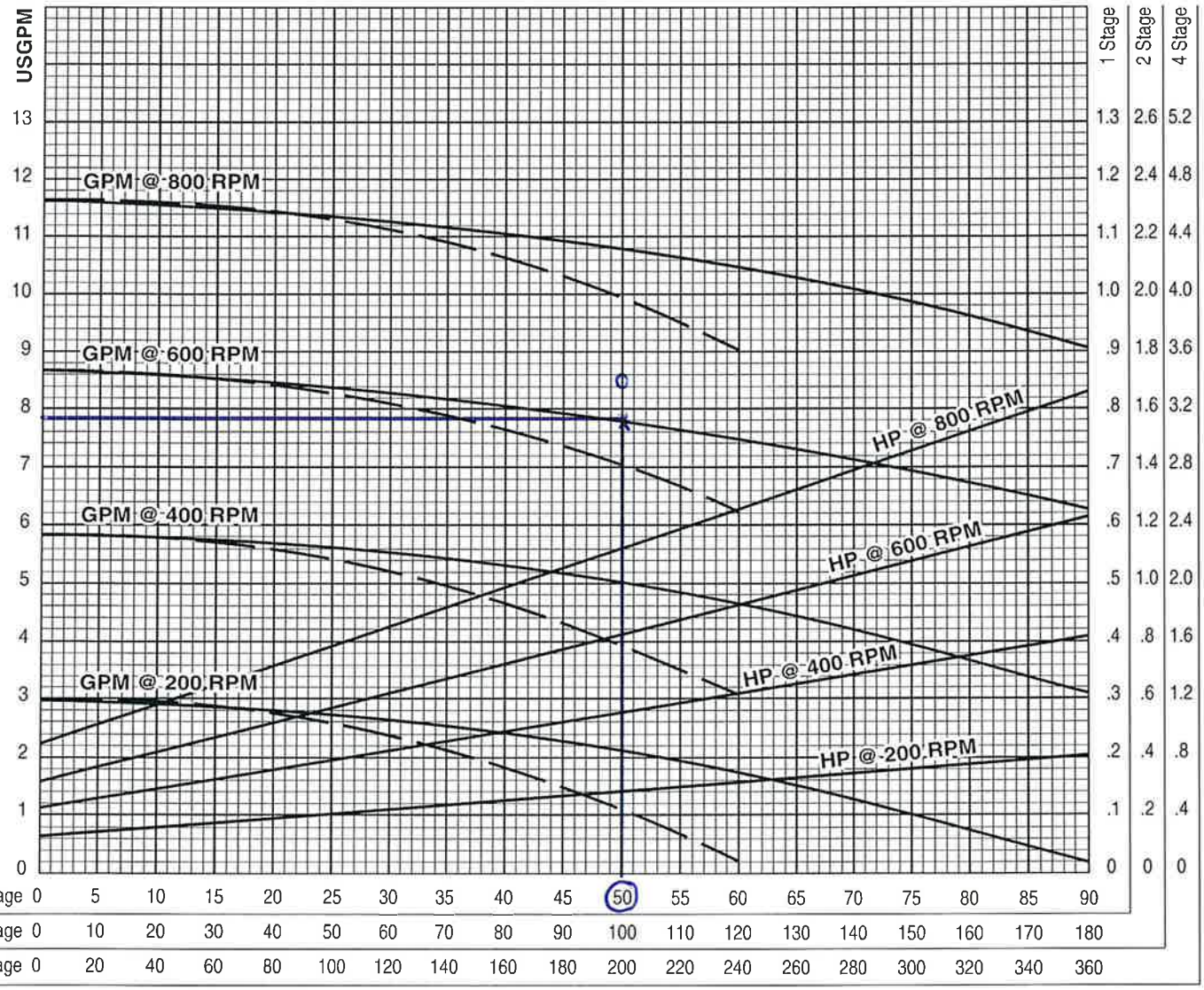
Use appropriate HP and pressure scales for the number of stages required.

NOTE: Pressure limits rated at 87 psi/stage (70 Duro). Some models have additional limits. Please consult factory before making final selection.

			RPM	200	400	600	800
			NPSH Required – (Ft.)	0.73	1.40	2.20	2.90
STARTING TORQUE, Minimum Recommended Motor HP*	***73 IN/LB***	1 STG		0.25	0.33	0.50	0.75
	97 IN/LB	2 STG		0.25	0.50	0.75	1.00
	145 IN/LB	4 STG		0.50	0.75	1.00	1.50
Drive End HP		A4C, B4C		0.08	0.16	0.24	0.32
Must be added to HP value from curve.							

*Based on drives supplying 150% starting torque.

Capacity — 70 Durometer Hardness, — — 55 Durometer Hardness** Data Based on Water @ 68°F **Horsepower**



** Std. Nitrile, EPDM and Fluoroelastomer = 70 Duro.
Std. Natural Rubber = 55 Duor.

(BAR x 1.0197 = kgf/cm²)
(BAR x 14.504 = PSI)
(USGPM = 227.1 L/HR)
(1 kW = 1.3410 HP)

R625-EDC-001213-0

Differential Pressure (PSI)*

Models: A1C, B1C, A2C, B2C, A4C, B4C

HORSEPOWER MULTIPLIERS:

Pump horsepower from the reverse side can be broken into three components: drive end, rotor/stator, and hydraulic.

Temperature affects the rotor/stator HP component only. For applications involving temperatures above 70˚F, it is necessary to adjust the rotor/stator HP component of the horsepower obtained from the reverse side (i.e., the greater of the water HP or Minimum Recommended HP). This new horsepower is referred to as the **Temperature Corrected Horsepower**.

Rotor/stator horsepower can be found from the curve on the previous page. It is the HP at zero pressure for the corresponding RPM and number of stages.

To calculate the Temperature Corrected Horsepower, subtract the rotor/stator HP from the greater of the water or minimum recommended HP. This gives you the drive end/hydraulic HP. Multiply the rotor/stator HP by the appropriate temperature multiplier listed below. Add this adjusted value to the drive end/hydraulic HP to get the total Temperature Corrected Horsepower.

(Degrees F = ⅘C + 32)

FLUID TEMPERATURE	70°F	100°F	125°F	150°F	175°F	200°F
HORSEPOWER MULTIPLIERS						
- Standard Size Rotor	1.00	1.10	1.30	1.60	2.00	2.50
- Undersize Rotor	0.75	0.80	0.85	0.95	1.10	1.60

For applications involving temperatures greater than 200°F, consult the factory.

HORSEPOWER ADDITIVES:

Shown below are HP additives for both water base slurries and for viscous materials. To use these tables, first determine which table applies to your product and enter that table with the appropriate fluid characteristics. Determine the HP additive per 100 RPM and multiply it by the speed of your pump divided by 100. Add the resulting figure to the HP for water from the curve on the preceding page or to the minimum HP for starting from the table at the top of the preceding page, whichever is larger.

If your product is a combination of a slurry and viscous material, determine the appropriate HP additive from both tables below and use whichever is greater.

TABLE I — WATER BASE SLURRIES:

HP ADDER/100 RPM

% Solids	Fine 16 Mesh (1.0 mm) (.039")			Medium 16 to 9 Mesh (1.0-2.0 mm) (.039-.078")			Coarse 9 to 4 Mesh (2.0-5.0 mm) (.078-.185")		
	Number of Stages								
	1	2	4	1	2	4	1	2	4
10	.05	.06	.09	.12	.16	.20	.24	.32	.40
30	.17	.22	.28	.38	.50	.65	.76	1.00	1.30
50	.29	.38	.53	.61	.81	.96	1.22	1.66	1.90

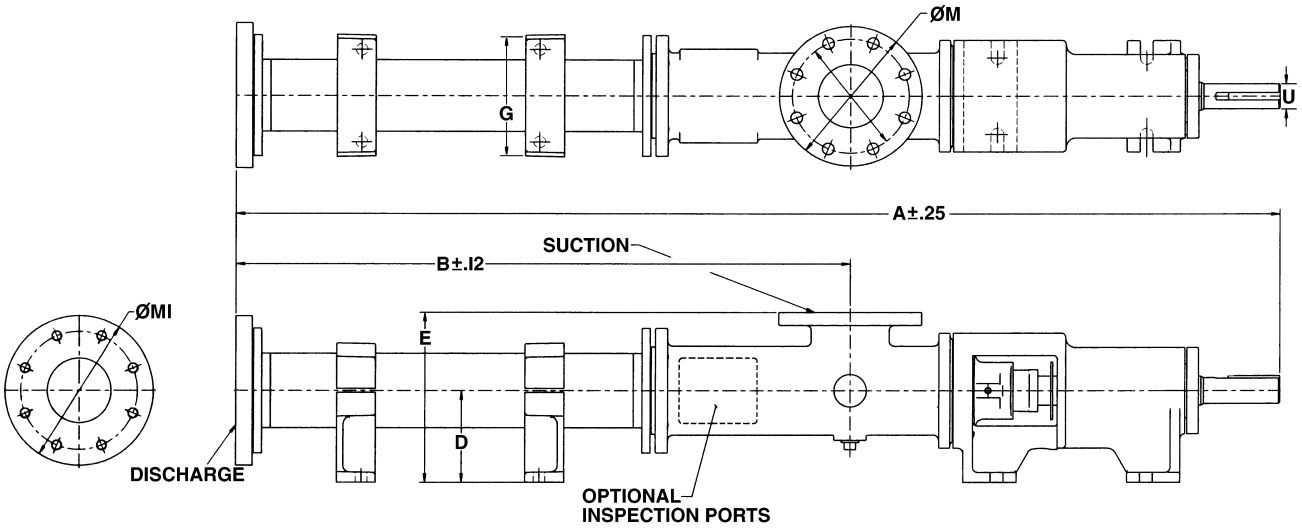
TABLE II — VISCOSITY (NEWTONIAN FLUIDS):

HP ADDER/100 RPM/STAGE

Viscosity (Centipoise)						
1	2,500	5,000	10,000	50,000	100,000	150,000
0	.045	.065	.089	.188	.254	.295

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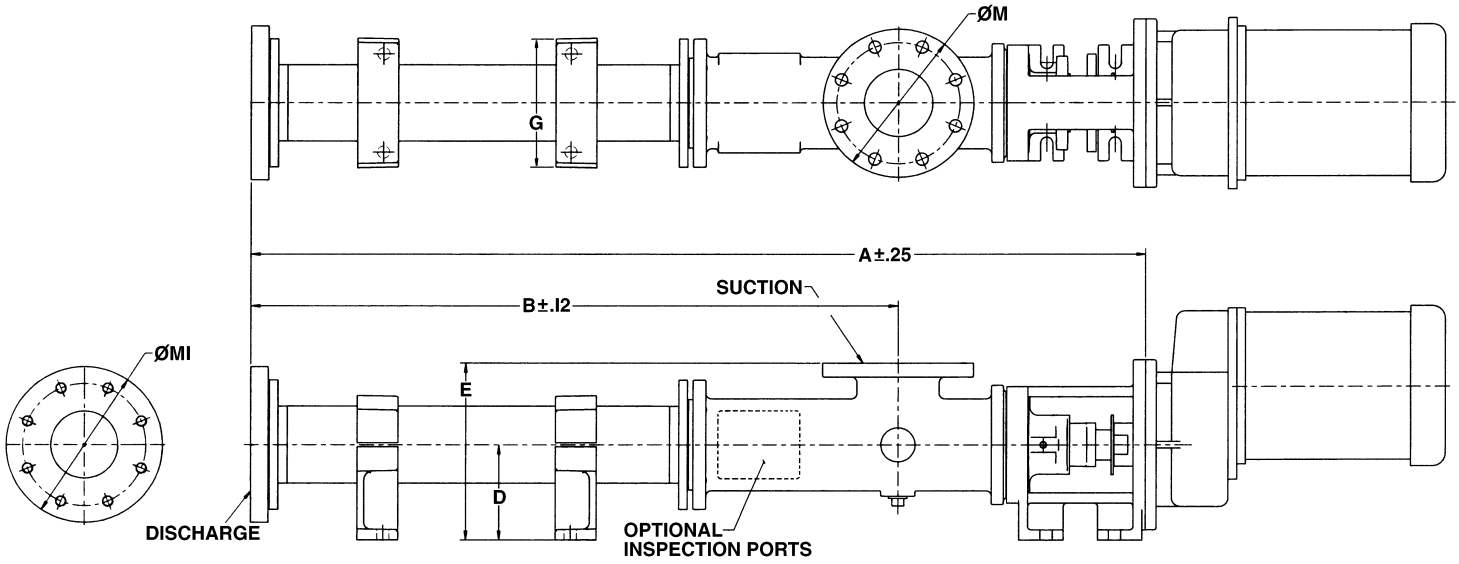
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MODEL NO.	STANDARD PUMP DIMENSIONS						SUCTION		DISCHARGE		PUMP
	A	B	D	E	G	U*	SIZE	M	SIZE	M1	Wt. Lb.
A1B	22.59	7.00	3.54	6.69	4.88	20	1.50	5.00	1.50	5.00	45
A2B	27.09	11.50	3.54	6.69	4.88	20	1.50	5.00	1.50	5.00	48
A1C	25.72	9.31	3.54	6.69	4.88	20	2.00	6.00	2.00	6.00	55
A2C	30.97	14.56	3.54	6.69	4.88	20	2.00	6.00	2.00	6.00	58
A4B	43.89	23.50	4.49	8.44	6.00	30	2.50	7.00	1.50	6.12	90
A1D	32.20	11.81	4.49	8.44	6.00	30	2.50	7.00	2.50	7.00	90
A2D	39.27	18.88	4.49	8.44	6.00	30	2.50	7.00	2.50	7.00	97
A4C	48.64	27.88	4.49	8.44	6.00	30	3.00	7.50	2.00	6.50	115
A1E	35.64	14.88	4.49	8.44	6.00	30	3.00	7.50	3.00	7.50	105
A2E	44.45	23.69	4.49	8.44	6.00	30	3.00	7.50	3.00	7.50	120
A4D	67.56	41.44	5.51	10.25	7.50	40	4.00	9.00	2.50	7.50	220
A1F	49.37	23.25	5.51	10.25	7.50	40	4.00	9.00	4.00	9.00	200
A2F	60.43	34.31	5.51	10.25	7.50	40	4.00	9.00	4.00	9.00	225
A4E	78.87	50.25	5.51	11.00	7.50	40	4.00	9.00	3.00	8.25	285

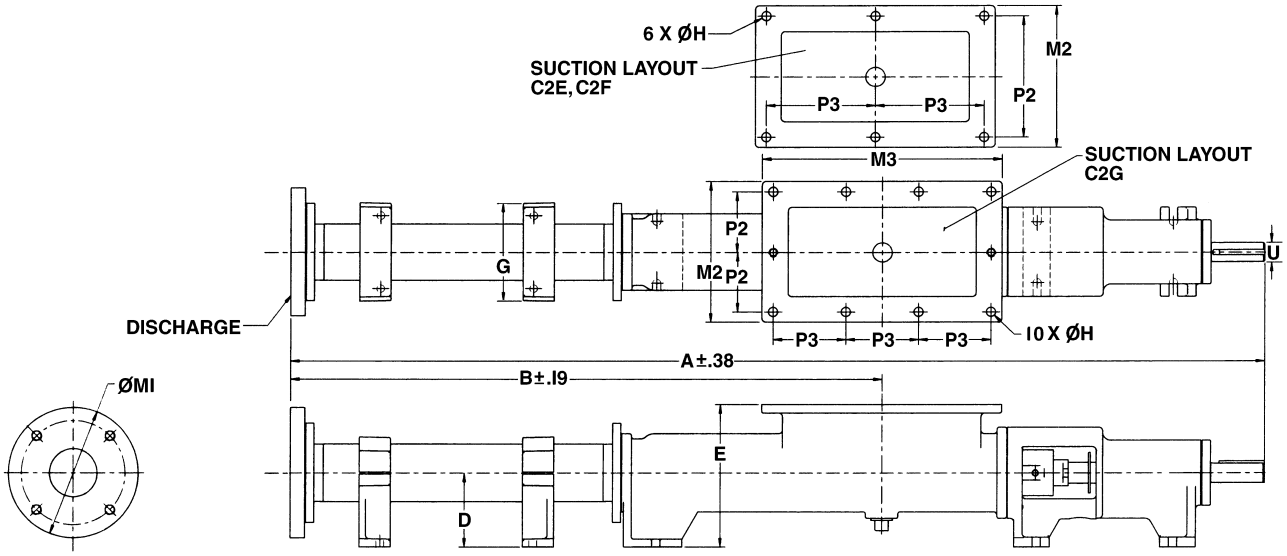
All dimensions in inches (unless noted otherwise).

* Dimensions in millimeters.



MODEL NO.	STANDARD PUMP DIMENSIONS					SUCTION		DISCHARGE		PUMP
	A	B	D	E	G	Size	M	Size	M1	Wt. Lb.
B1B	16.50	7.00	3.54	6.69	4.88	1.50	5.00	1.50	5.00	40
B2B	21.00	11.50	3.54	6.69	4.88	1.50	5.00	1.50	5.00	43
B1C	19.63	9.31	3.54	6.69	4.88	2.00	6.00	2.00	6.00	50
B2C	24.88	14.56	3.54	6.69	4.88	2.00	6.00	2.00	6.00	53
B4B	34.38	23.50	4.49	8.44	6.00	2.50	7.00	1.50	6.12	80
B1D	22.69	11.81	4.49	8.44	6.00	2.50	7.00	2.50	7.00	80
B2D	29.75	18.88	4.49	8.44	6.00	2.50	7.00	2.50	7.00	87
B4C	39.13	27.88	4.49	8.44	6.00	3.00	7.50	2.00	6.50	105
B1E	26.13	14.88	4.49	8.44	6.00	3.00	7.50	3.00	7.50	95
B2E	34.94	23.69	4.49	8.44	6.00	3.00	7.50	3.00	7.50	110
B4D	55.72	41.44	5.51	10.25	7.50	4.00	9.00	2.50	7.50	195
B1F	37.53	23.25	5.51	10.25	7.50	4.00	9.00	4.00	9.00	175
B2F	48.60	34.31	5.51	10.25	7.50	4.00	9.00	4.00	9.00	200
B4E	67.03	50.25	5.51	11.00	7.50	4.00	9.00	3.00	8.25	255

All dimensions in inches.



	SUCTION FLANGE DIMENSIONS					
PUMP SIZE	SUCTION SIZE	M2	P2	M3	P3	H
E	5.51 X 11.42	8.66	7.40	14.56	6.61	6 X .56
F	6.30 X 13.78	10.24	8.98	17.72	8.27	6 X .56
G	7.40 X 15.74	11.58	5.20	19.92	6.22	8 X .56 2 X .500-13 UNC

MODEL NO.	STANDARD PUMP DIMENSIONS						DISCHARGE		PUMP
	A	B	D	E	G	U*	Size	M1	Wt. Lb.
C2E	56.89	33.56	4.49	8.62	6.00	30	3.00	7.50	185
C2F	70.80	40.88	5.51	10.25	7.50	40	4.00	9.00	310
C2G	80.41	49.38	5.51	10.25	7.50	40	4.00	9.00	450

All dimensions in inches (unless noted otherwise). * Dimensions in millimeters.

R625-EDC-001213-0

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Catalogue and Product Data Sheets

Item	Tag	Description
11	M-120	Solids Contact Tank Mixer
54	M-840	Pre-Coat Storage Tank Mixer

LIGHTNIN® Series 10 Mixers.

ONE TOUGH MIXER. ONE EASY CHOICE.



YOU AND LIGHTNIN. THE RIGHT MIX.

LIGHTNIN

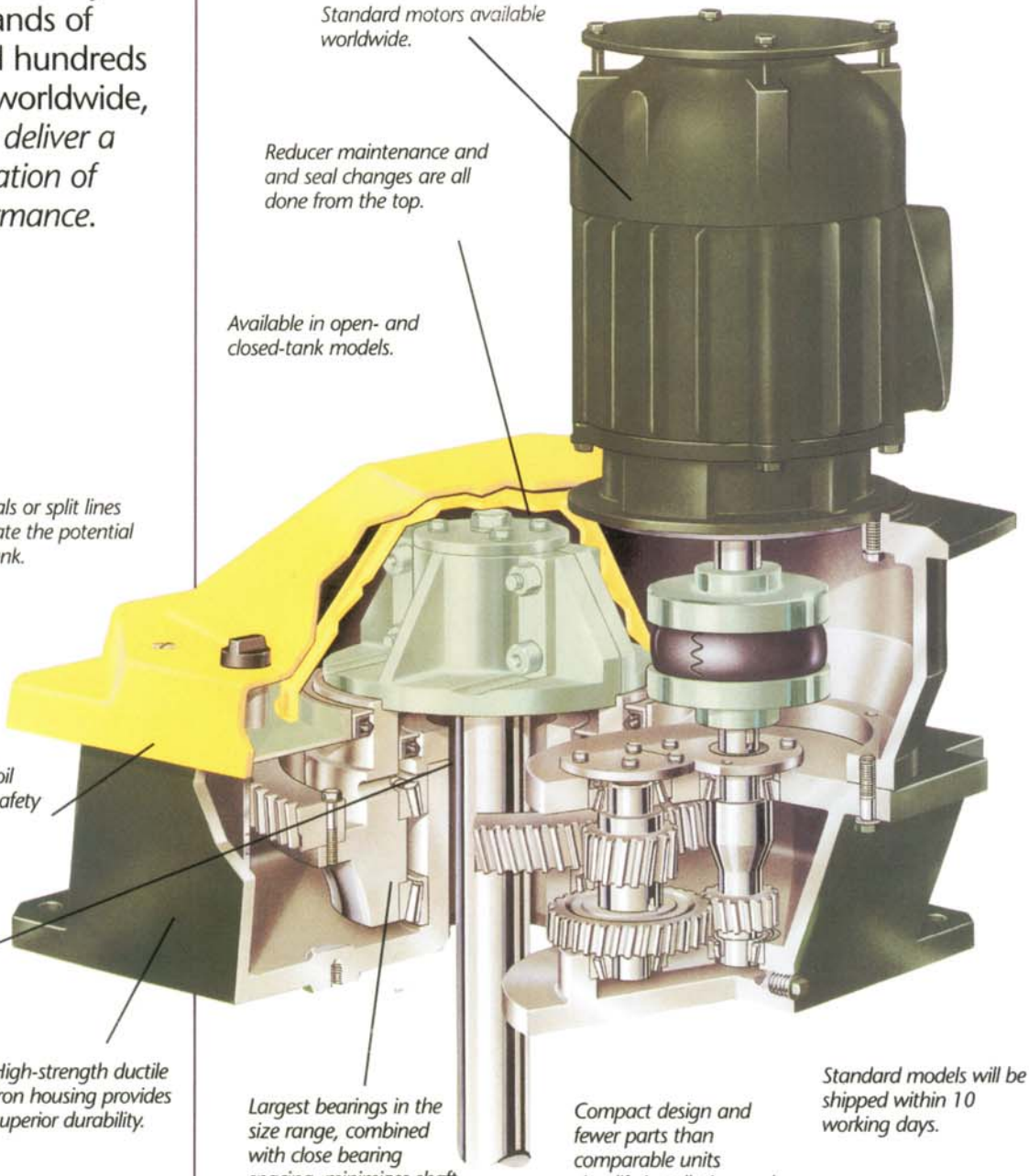
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B-633

LIGHTNIN Series 10 Mixers.

Durable, Versatile, Cost-effective.

One look at this rugged design will tell you, *LIGHTNIN's* field-proven Series 10 is no ordinary mixer. In thousands of installations and hundreds of applications worldwide, *Series 10 mixers deliver a superior combination of value and performance.*



Unmatched Durability

■ ***Long gear and bearing life.***

The largest tapered roller bearings in a mixer of this class help produce an L10 life of 100,000 hours and greater. Designed specifically for mixer service, Series 10 speed reducers are capable of handling large variations in mixer loads, adapting to different process conditions and accommodating long overhung shafts. "Off-the-shelf" speed reducers not designed for mixer service can't make this claim.

In addition, high-quality carburized and ground gearing features a minimum AGMA Service Factor of 1.5 for long life and added protection against shock loading.

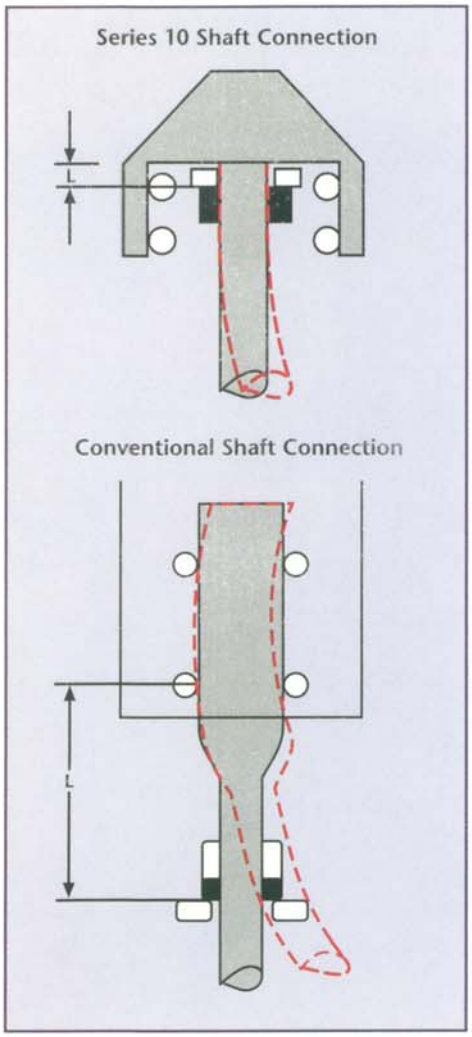
■ ***Unique output shaft connection– the largest of any competitive unit – reduces shaft deflection to extend seal life.***

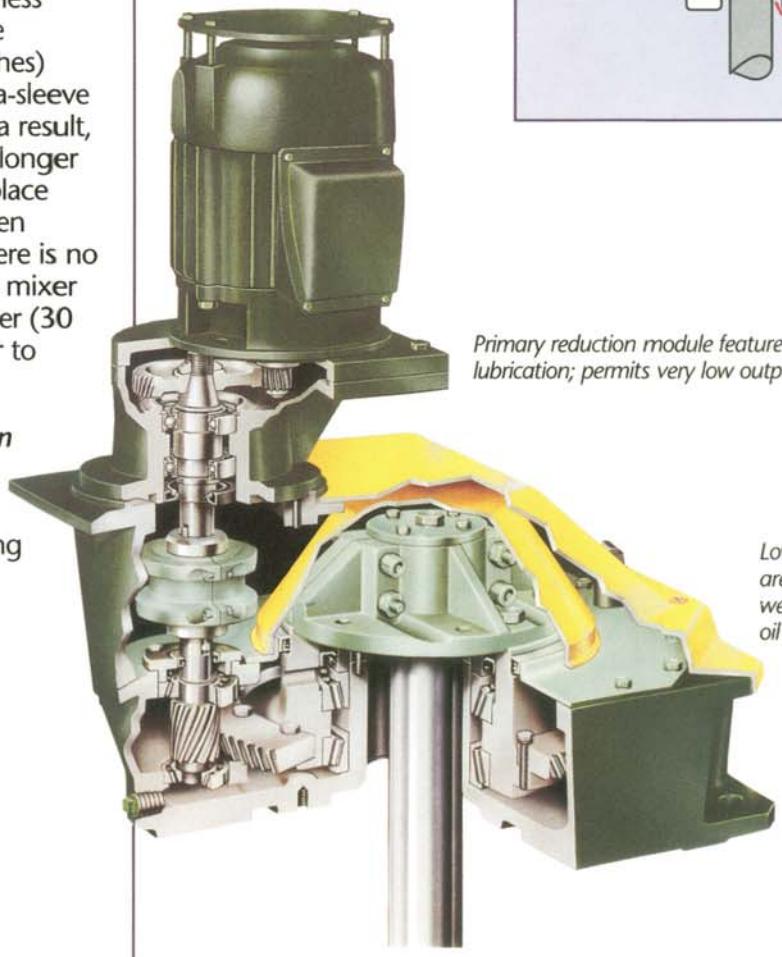
Greater mechanical stiffness reduces deflection at the seal (less than 0.010 inches) compared with seal-on-a-sleeve or cartridge designs. As a result, you'll be able to specify longer overhung shafts and replace seals less frequently. When servicing is called for, there is no output shaft seal on any mixer in the world that's quicker (30 minutes or less) or easier to replace.

■ ***High-strength ductile iron motor pedestal.***

Stable, rigid mounting permits single-point lifting of the drive assembly.

Distance between seal face and rigid support (L) is shorter in Series 10 design compared to conventional design, minimizing shaft deflection at seal face.





Primary reduction module features lifetime lubrication; permits very low output speed.

Low-speed module components are immersed in lubricant. Dry well construction protects against oil leakage.

Excellent Versatility

- ***Wide range of output speeds.***

  Select the combination of output speed and torque that meets your mixing requirements.

- ***Choice of motors.***

  Select the motor that's consistent with your specific plant standards. A wide variety of motor options is available, including explosion-proof and multiple-speed units.

- ***Longer shaft lengths accommodate a wider range of tank configurations.***

  Carbon steel or 316 stainless steel shafts are standard. Shafts in excess of 30 feet in length let you specify Series 10 mixers for large tanks without the need for steady bearings. Alloy and composite shafts are also available.

- ***Choice of mechanical seals.***

  Closed-tank mixers can be equipped with dry-running single mechanical seals or lubricated double mechanical seals for hazardous materials and higher-pressure applications.

- ***Optional seal pedestal design eliminates temperature constraints.***

  Series 10 mixers can be mounted on a pedestal to permit operation up to vessel temperatures of 400°F.

- ***Dry-well construction and no submerged seals prevent oil leakage.***

  An integral reducer housing with drywell construction prevents oil loss, as well as the risk of product contamination. The reducers simply can't leak, even when the mixer is mounted on angle risers. In addition, the absence of submerged oil seals or split lines below the oil level prevent leakage over the tank or into the product.



Optional angle riser brackets let you save up to 15% on tank costs by eliminating the need for baffles.



Shafts in excess of 30 feet in length let you specify Series 10 mixers for large tanks without the need for steady bearings.

Lower Ownership Costs

- ***Fewer moving parts simplifies maintenance.***

  Series 10 mixers let you reduce spare parts inventory, frequency of repair and servicing costs.

- ***Perform routine maintenance quickly.***

  Check, add or change oil without removing the high-strength safety guard. Synthetic oil needs to be changed only once a year. Oil-lubricated gears and bearings do not require grease servicing.

- ***Easiest seal replacement.***

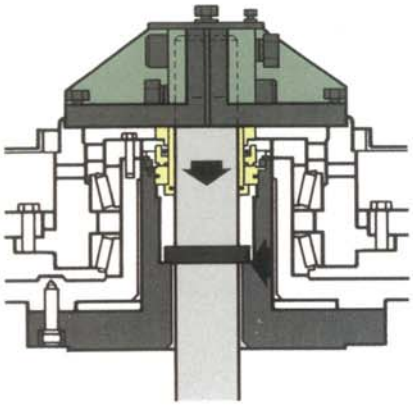
  Seals are replaced from the top of the mixer without disturbing the shaft. No stub shafts, jacking plates or bolts are required.

- ***High-efficiency helical gearing provides more usable power.***

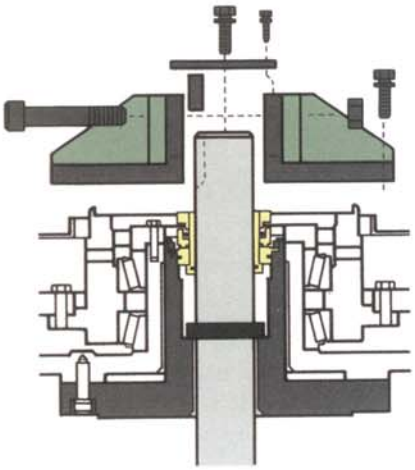
  Efficient in-line helical gearing and parallel shafts minimize horsepower loss through the drivetrain. As a result, virtually all the power you pay for is transferred into the mixing vessel.

30-Minute Seal Replacement

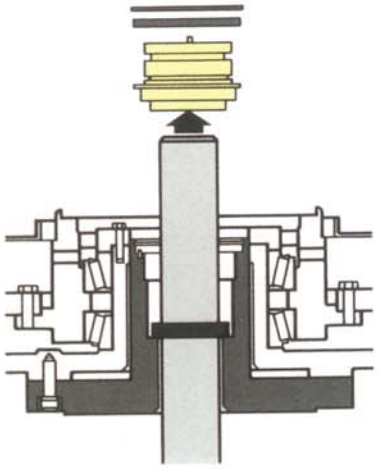






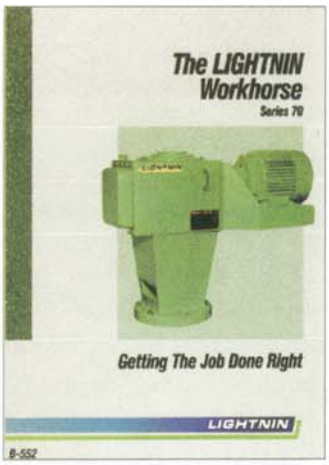




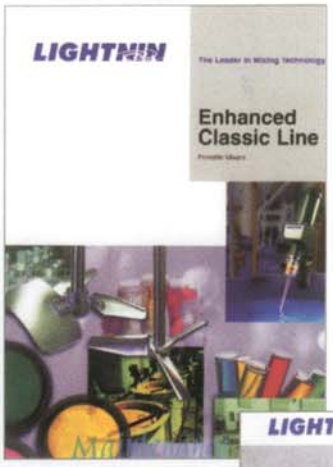


Seal changes are performed in less than 30 minutes. Simply loosen hardware and lower the shaft support collar onto the hub shoulder (1). Once the split coupling has been removed (2), lift off the seal assembly and replace with a new or rebuilt unit (3).

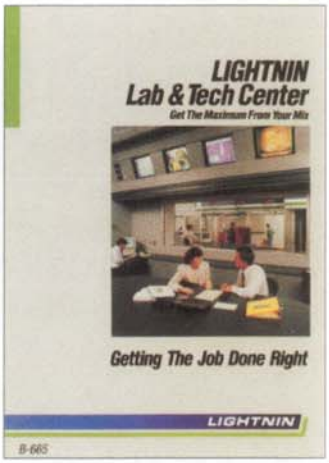
Learn more about these other high-performance mixers from *LIGHTNIN*. Call 1-888-MIX BEST for product literature.



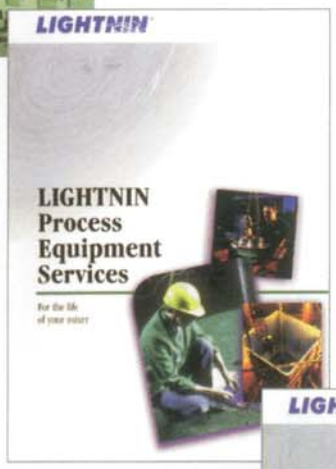
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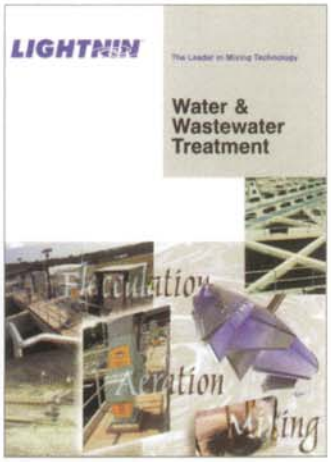
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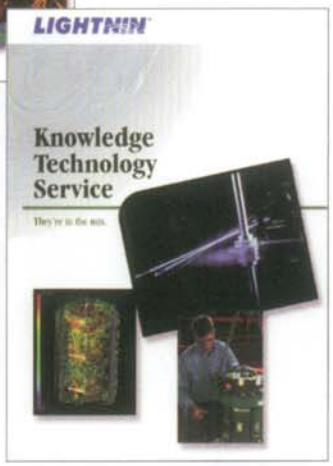
B-665



B-773



B-912



B-901

LIGHTNIN

An SPX Process Equipment Operation

When it comes to mixing better
We never stop

135 Mt. Read Blvd.
Rochester, NY 14611 USA
www.spxprocessequipment.com

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B-633-L-8/05

LIGHTNIN

AN SPX BRAND

Arroyo Process Equipment
201 N Woodlawn Ave
Bartow, Florida 33830 United States
Phone: 863-533-9700 Fax: 863-533-4907
sales@arroyoprocess.com

Quote Form

Attention: **John Perella** **Date:** 07/08/2009

Arcadis
.
Tampa, Florida United States

Project Name: Arcadis - 3400 gallon tank mixer **Quote Number:** 07L-09-3400

Comments: FOB Rochester, NY 14611

Item No	Product	Description	Quantity	Price Each
Mixer	Series 10	Model 14S1	1	$11,284.20
		Add for Material Surcharge		$89.00
		Total Mixer Price Each		$11,373.20

Details:

Motor: 1 HP, TEFC Severe Duty/High Efficiency, 3 ph, 60 Hz, 145TC, 230/460 v, 1200 RPM

Machine:

Gear Reduction Ratio:	14.06
Output Speed:	84 RPM
Flange Size:	8
Mechanical Seal Type:	S10L

Shaft:

Diameter:	2 inches
Length:	121 inches

Impeller(s):

Mid(1), 28 inches, A510E with 32.00 degree Tip Cord Angle

Attachment:	Welded To Shaft
Spacing:	40 inches

Lower, 28 inches, A510E with 32.00 degree Tip Cord Angle with stabilizer

Attachment:	Welded To Shaft
Off Bottom:	26 inches

Other Data:

Wetted Parts Material:	316ss
High Speed Coupling:	Steel-Flex

	Drawing(s):	L-17634, DS-E-868, L-17674, L-16864, L-17738, L-17738
	Total(US Dollars)	$11,373.20

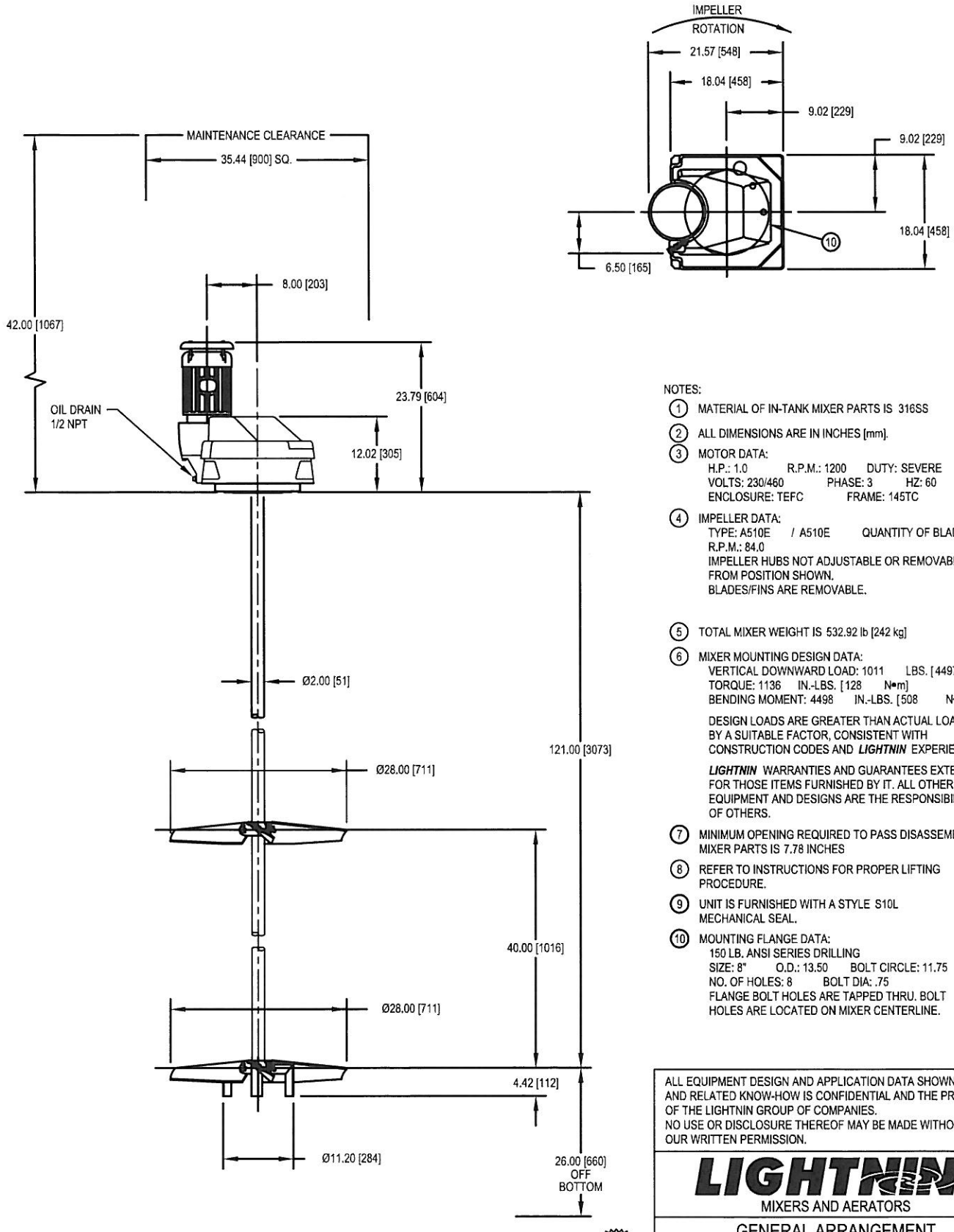
Shipment In: 5 Weeks After Receipt of Order
Payment Terms: NT30 Within 30 days Due net
Delivery Terms: FOB Origin
Quote Expiration Date: 08/07/2009

Please Address Purchase Order to:
LIGHTNIN, an SPX brand
c/o Arroyo Process Equipment
201 N Woodlawn Ave
Bartow, Florida 33830 United States

Thank you,

Mark Lesko
Sales Engineer

DATE: 7/8/2009



NOTES:

1. MATERIAL OF IN-TANK MIXER PARTS IS 316SS
2. ALL DIMENSIONS ARE IN INCHES [mm].
3. MOTOR DATA:
   H.P.: 1.0 R.P.M.: 1200 DUTY: SEVERE
   VOLTS: 230/460 PHASE: 3 HZ: 60
   ENCLOSURE: TEFC FRAME: 145TC
4. IMPELLER DATA:
   TYPE: A510E / A510E QUANTITY OF BLADES: 3 / 3
   R.P.M.: 84.0
   IMPELLER HUBS NOT ADJUSTABLE OR REMOVABLE FROM POSITION SHOWN.
   BLADES/FINS ARE REMOVABLE.
5. TOTAL MIXER WEIGHT IS 532.92 lb [242 kg]
6. MIXER MOUNTING DESIGN DATA:
   VERTICAL DOWNWARD LOAD: 1011 LBS. [4497 N]
   TORQUE: 1136 IN.-LBS. [128 N•m]
   BENDING MOMENT: 4498 IN.-LBS. [508 N•m]

   DESIGN LOADS ARE GREATER THAN ACTUAL LOADS BY A SUITABLE FACTOR, CONSISTENT WITH CONSTRUCTION CODES AND ***LIGHTNIN*** EXPERIENCE.

   LIGHTNIN WARRANTIES AND GUARANTEES EXTEND FOR THOSE ITEMS FURNISHED BY IT. ALL OTHER EQUIPMENT AND DESIGNS ARE THE RESPONSIBILITY OF OTHERS.
7. MINIMUM OPENING REQUIRED TO PASS DISASSEMBLED MIXER PARTS IS 7.78 INCHES
8. REFER TO INSTRUCTIONS FOR PROPER LIFTING PROCEDURE.
9. UNIT IS FURNISHED WITH A STYLE S10L MECHANICAL SEAL.
10. MOUNTING FLANGE DATA:
    150 LB. ANSI SERIES DRILLING
    SIZE: 8" O.D.: 13.50 BOLT CIRCLE: 11.75
    NO. OF HOLES: 8 BOLT DIA: .75
    FLANGE BOLT HOLES ARE TAPPED THRU. BOLT HOLES ARE LOCATED ON MIXER CENTERLINE.

ALL EQUIPMENT DESIGN AND APPLICATION DATA SHOWN HEREIN AND RELATED KNOW-HOW IS CONFIDENTIAL AND THE PROPERTY OF THE LIGHTNIN GROUP OF COMPANIES.
NO USE OR DISCLOSURE THEREOF MAY BE MADE WITHOUT OUR WRITTEN PERMISSION.

LIGHTNIN®
MIXERS AND AERATORS

GENERAL ARRANGEMENT
FOR: ARCADIS

TAG NO.: RATIO: 14.06:1
MIXER MODEL: 14S1

ISO 9001 CERTIFIED

THIS IS A PRELIMINARY DRAWING FOR REFERENCE ONLY. DO NOT USE FOR FINAL CONSTRUCTION.

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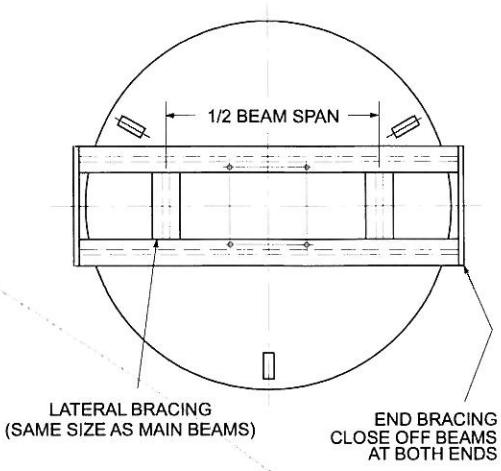
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DRAWING NO. 07L-09-3400-1

LIGHTNIN® SERIES 10 MIXER MOUNTING DESIGN DATA
RECOMMENDED BEAM SELECTIONS
OPEN TANK MODELS

The typical support beams shown are based on A.I.S.C. design guidelines and on ***LIGHTNIN*** deflection criteria considering only the live loads imposed by the mixer. Provisions for personnel, handrails, platforms or other equipment is not shown.

This data is supplied for guidance only and ***LIGHTNIN*** makes no warranties or guarantees regarding the suitability of the design or resulting structure.



MINIMUM MOUNTING BEAM SIZES*

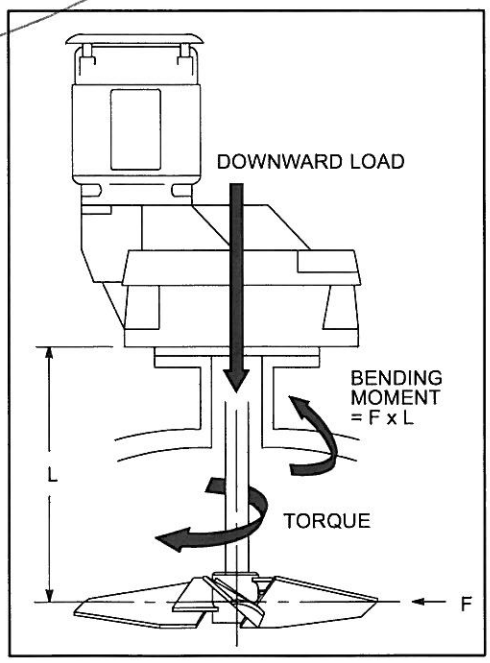
MODEL RANGE	TANK DIAMETER OR BEAM SPAN – FEET				
	UP TO 10'	OVER 10' UP TO 15'	OVER 15' UP TO 20'	OVER 20' UP TO 25'	OVER 25' UP TO 30'
14 & 15	W4 X 13	W6 X 20	W8 X 24	W10 X 33	W10 X 49
16	W5 X 16	W8 X 18	W8 X 28	W10 X 39	W10 X 60
17	W5 X 16	W8 X 18	W8 X 35	W10 X 45	W10 X 68

* Substitution of other beams should not reduce the section by more than 2 lbs per foot.

A common mixer support structure is constructed of two steel beams with lateral and end bracing. Continuous welds are preferred over skip welding of lateral and end braces.

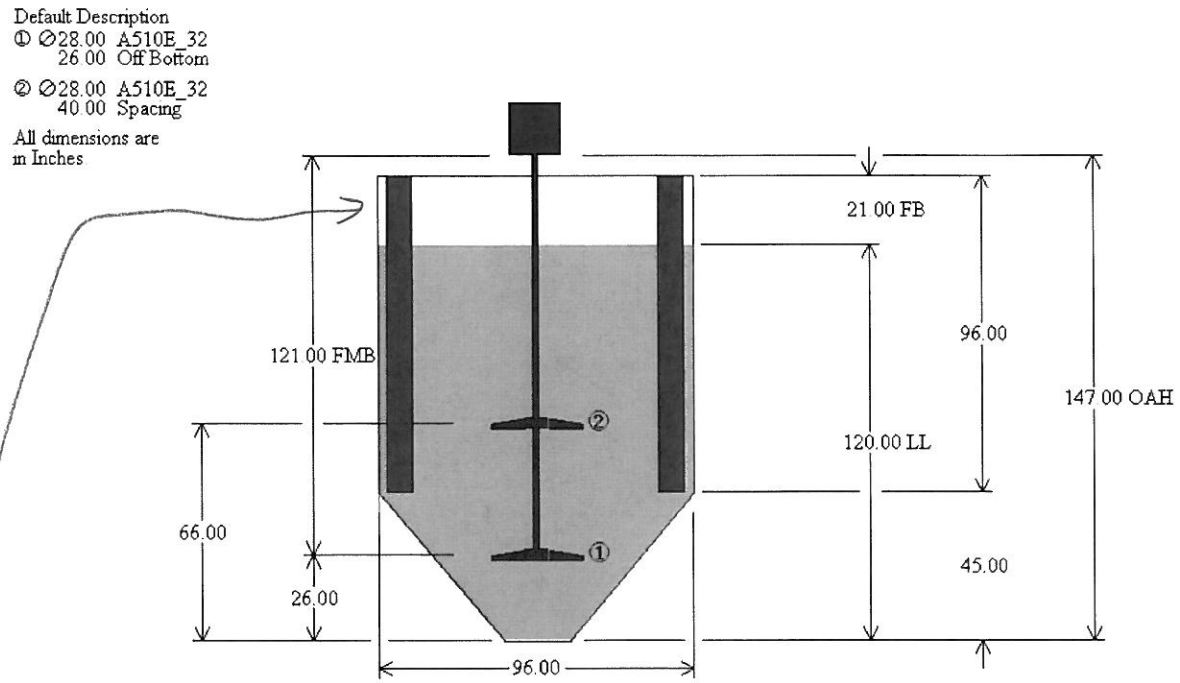
RECOMMENDED DESIGN LOADS
CLOSED TANK MODELS

Each installation should be checked for strength and rigidity using the design loads indicated below or on the installation drawing. These design loads take into account not only the obvious loads of torque and weight, but also the bending moment loads of long, overhung shaft and impeller assemblies. The design loads are greater than actual loads by a suitable factor consistent with construction codes and ***LIGHTNIN*** experience.



LOADS IMPOSED BY MIXER

MODEL RANGE	VERTICAL DOWNWARD LOAD – LBS	TORQUE INCH–LBS	BENDING MOMENT INCH–LBS
14	1,100	3,150	15,000
15, 45	1,500	5,850	15,000
16, 46	2,850	11,550	30,000
17, 47	4,500	20,850	52,500



Baffles needed.

Baffle recomendation

Qty 3 spaced at 120 degrees

width = 8"

off wall = 2.66"

Length - straight side up to max fluid level expected

LIGHTNIN®
EV Series
Portable Mixers



Economy and Value from a name you know and trust.

YOU AND* LIGHTNIN. *THE RIGHT MIX.

LIGHTNIN

R625-EDC-001213-0

LIGHTNIN EV Mixers. Superior economy and value for single-purpose mixing applications.

Now you can buy just as much mixer capability as you need for your specific application, without having to buy features and options that are more than you require. Plus, you get all the quality and reliability you'd expect from the world leader in fluid mixing technology.

- 280 and 350 RPM Gear Drive units feature lower speeds and higher torque for mixing large batches of low-viscosity fluids or smaller batches of high-viscosity fluids.
- Self-aligning, floating gears optimize load sharing and reduce wear.
- 1,725 RPM Direct Drive units are designed for small batch mixing plus high fluid shear applications.
- Switch, cord and plug are **standard** on all single-phase, 60 Hz, non-explosion proof units.
- Flexible motor coupling reduces mechanical starting loads for extended gear life.
- Permanently sealed lubrication reduces maintenance costs.
- Oversized bearings provide superior shaft support.
- Includes *LIGHTNIN*'s 100% performance guarantee.



Variable Speed control is available on all electric models, except XP models.

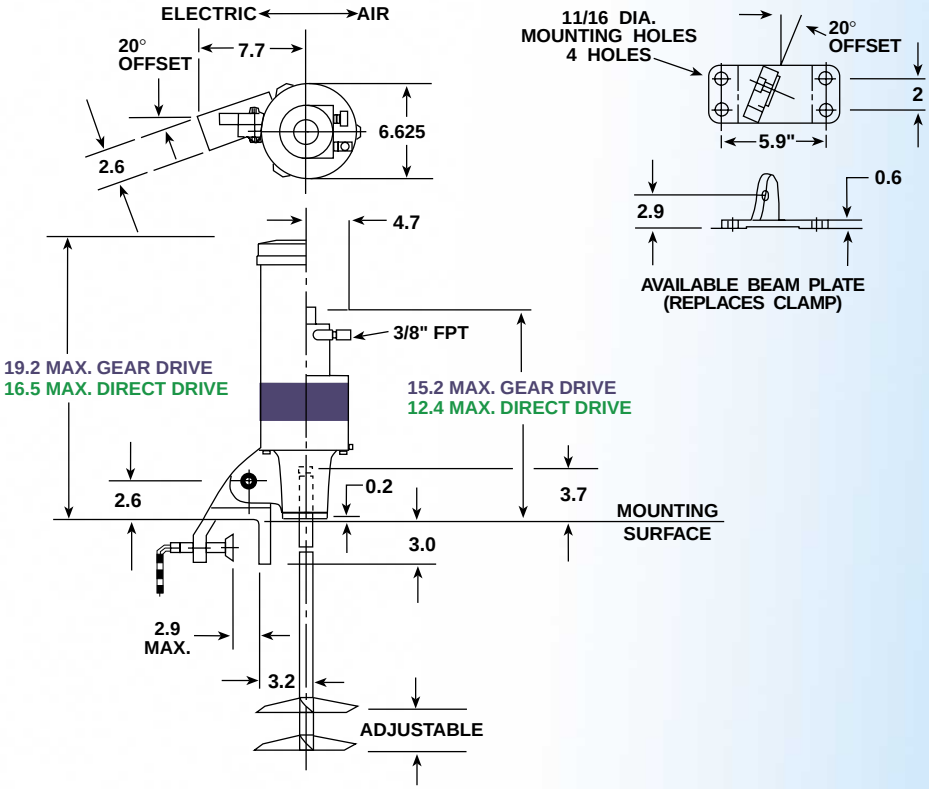


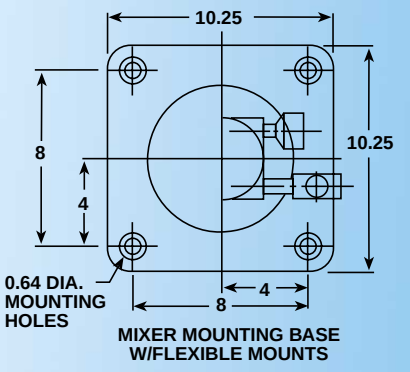
Optional 1/4 to 3/4 hp cool-running air motors can be used in flammable or explosive environments, and in ambient temperatures up to 250°F (120°C).

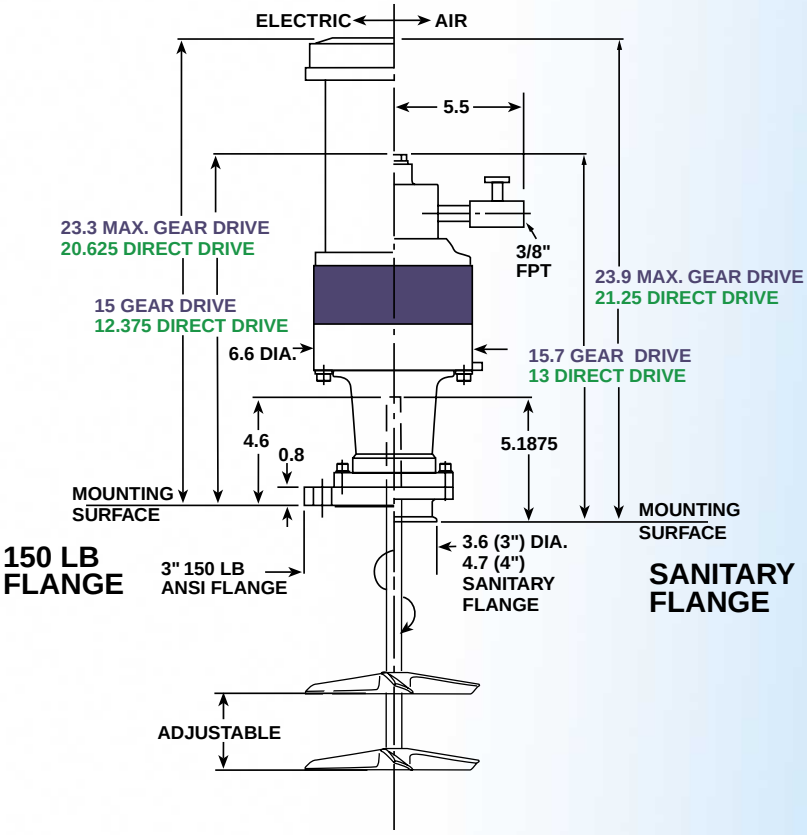


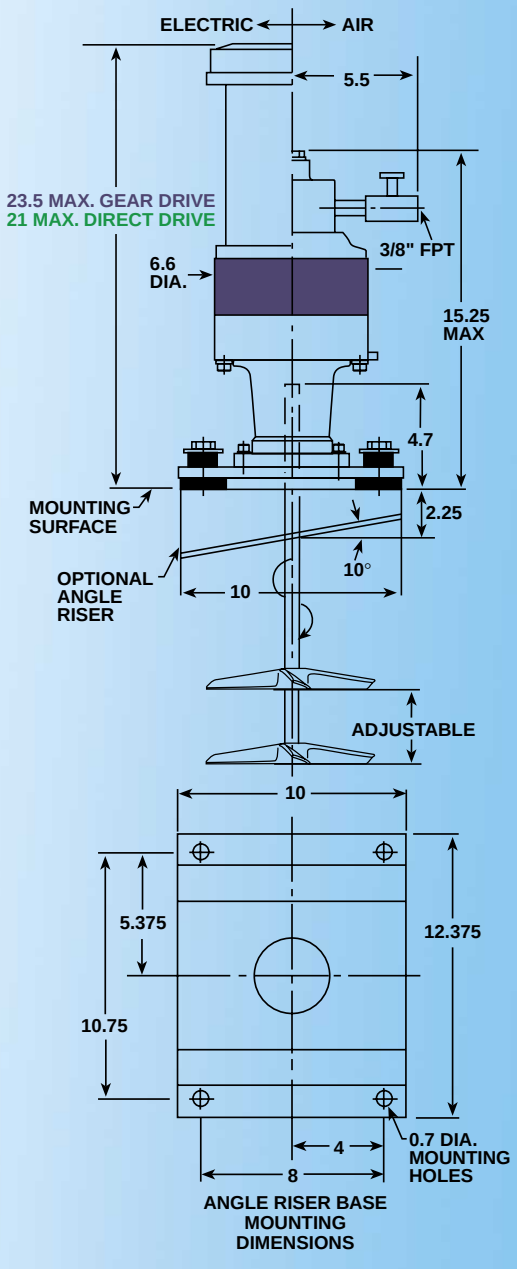


Optional flange mount (above) or plate mount (left) bases are available.









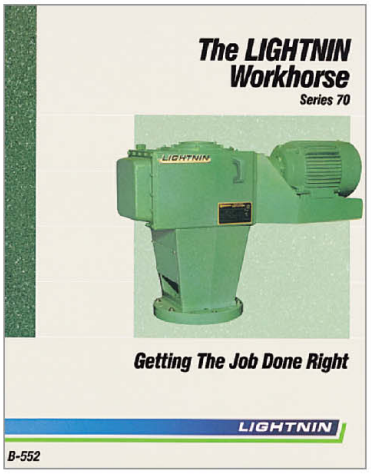
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Contact the LIGHTNIN Experts

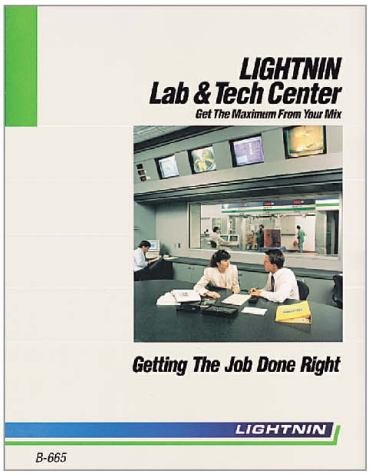
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Visit our website at www.spxprocessequipment.com.

Or call 1-888-MIX-BEST (U.S. and Canada), or +1(585) 436-5550 (Worldwide).



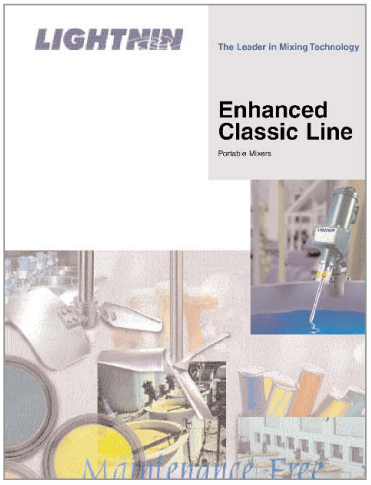
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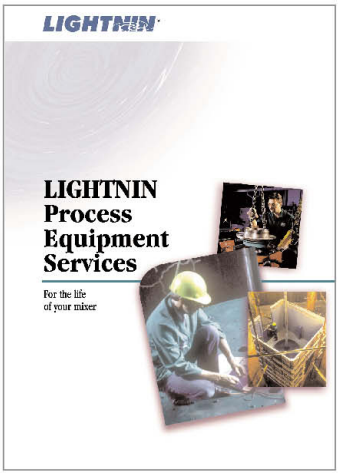
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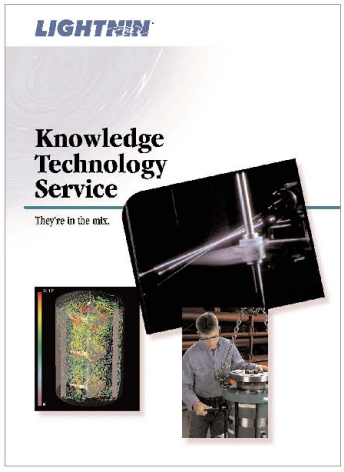
B-633



B-799



B-773



B-901

LIGHTNIN

An SPX Process Equipment Operation

When it comes to mixing We never stop

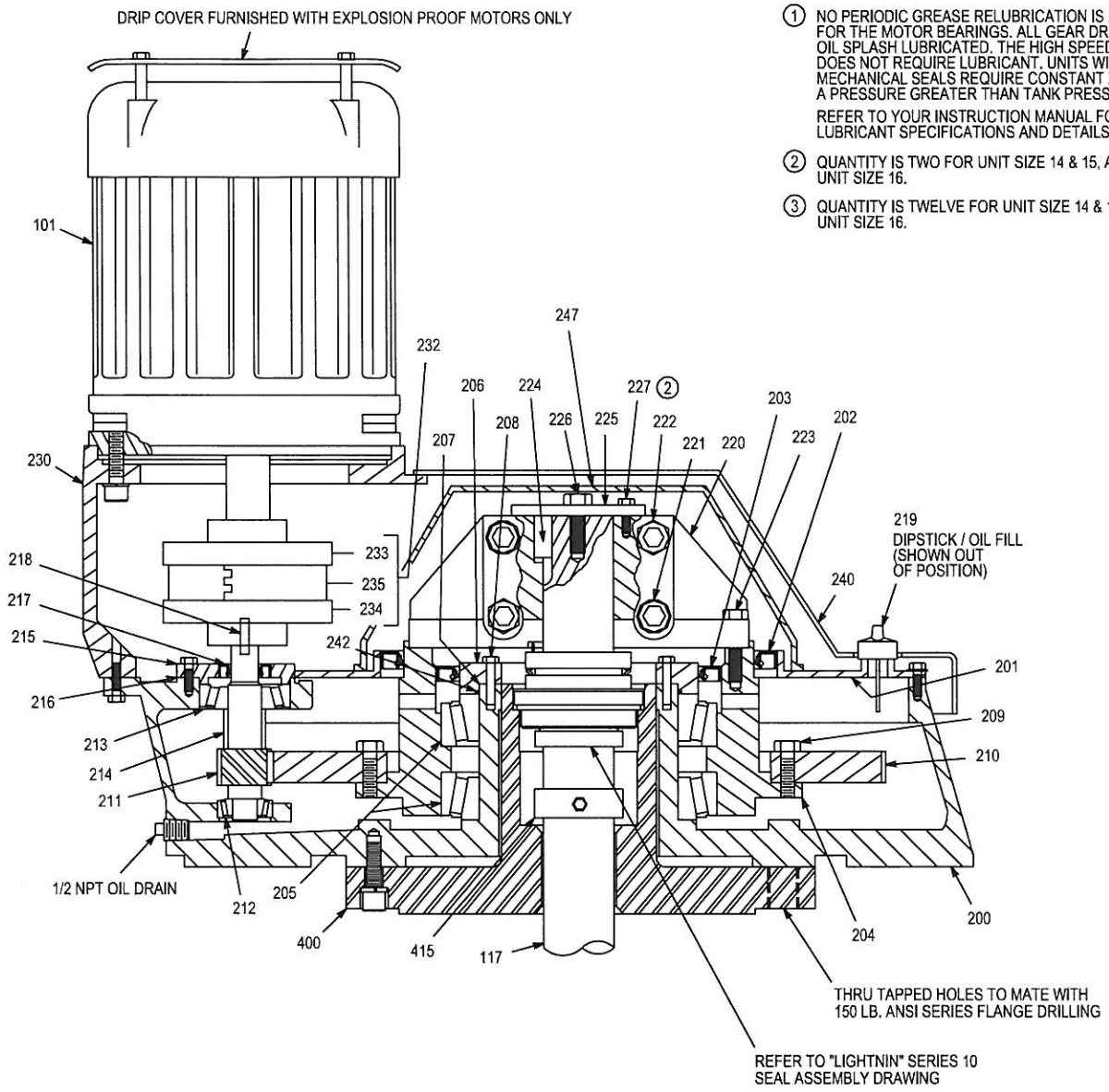
135 Mt. Read Blvd.
Rochester, NY 14611 USA
Telephone: 585-436-5550
Fax: 585-436-5589
www.spxprocessequipment.com

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B-753-L-08/05 R625-EDC-001213-0

NOTES:

1. NO PERIODIC GREASE RELUBRICATION IS REQUIRED EXCEPT FOR THE MOTOR BEARINGS. ALL GEAR DRIVE BEARINGS ARE OIL SPLASH LUBRICATED. THE HIGH SPEED COUPLING DOES NOT REQUIRE LUBRICANT. UNITS WITH DOUBLE MECHANICAL SEALS REQUIRE CONSTANT LUBRICATION AT A PRESSURE GREATER THAN TANK PRESSURE.
   REFER TO YOUR INSTRUCTION MANUAL FOR COMPLETE LUBRICANT SPECIFICATIONS AND DETAILS.
2. QUANTITY IS TWO FOR UNIT SIZE 14 & 15, AND THREE FOR UNIT SIZE 16.
3. QUANTITY IS TWELVE FOR UNIT SIZE 14 & 15, AND SEVEN FOR UNIT SIZE 16.



WHEN ORDERING PARTS, SPECIFY: MODEL & SERIAL NUMBER, ITEM NUMBER AND DRAWING NUMBER

ITEM	PART NAME	ITEM	PART NAME
216	SHIM SET - HIGH SPEED BEARING ADJUSTMENT - SEE NOTE 3	415	SHAFT SUPPORT COLLAR
215	HIGH SPEED BEARING RETAINER	400	MECH. SEAL HUB & FLANGE
214	SPACER - UNIT SIZE 16 ONLY	247	COUPLING SHIELD
213	HIGH SPEED BEARING - UPPER	242	O-RING
212	HIGH SPEED BEARING - LOWER	240	SAFETY GUARD
211	HIGH SPEED PINION & SHAFT	235	FLEXIBLE ELEMENT - SPLIT
210	LOW SPEED GEAR	234	DRIVEN HUB - PINION SHAFT
209	HEX HEAD CAP SCREW - NYLOK	233	DRIVE HUB - MOTOR SHAFT
208	HEX HEAD CAP SCREW - NYLOK	232	H.S. FLEXIBLE COUPLING ASSEMBLY
207	SHIM SET - LOW SPEED BEARING ADJUSTMENT (10 PER SET)	230	MOTOR PEDESTAL
		227	HEX HEAD CAP SCREW - SEE NOTE 2
206	LOW SPEED BEARING RETAINER	226	HEX HEAD CAP SCREW (1)
205	LOW SPEED BEARING (2)	225	THRUST PLATE
204	LOW SPEED GEAR HUB	224	KEY - IMPELLER SHAFT
203	OIL SEAL - INNER	223	HEX HEAD CAP SCREW - NYLOK (8)
202	OIL SEAL - OUTER	222	HEX NUT (4)
201	DRIVE COVER	221	SOCKET HEAD CAP SCREW (4)
200	GEAR DRIVE HOUSING	220	LOW SPEED COUPLING - SPLIT
117	IMPELLER SHAFT	218	KEY - PINION SHAFT
101	MOTOR	217	OIL SEAL - HIGH SPEED

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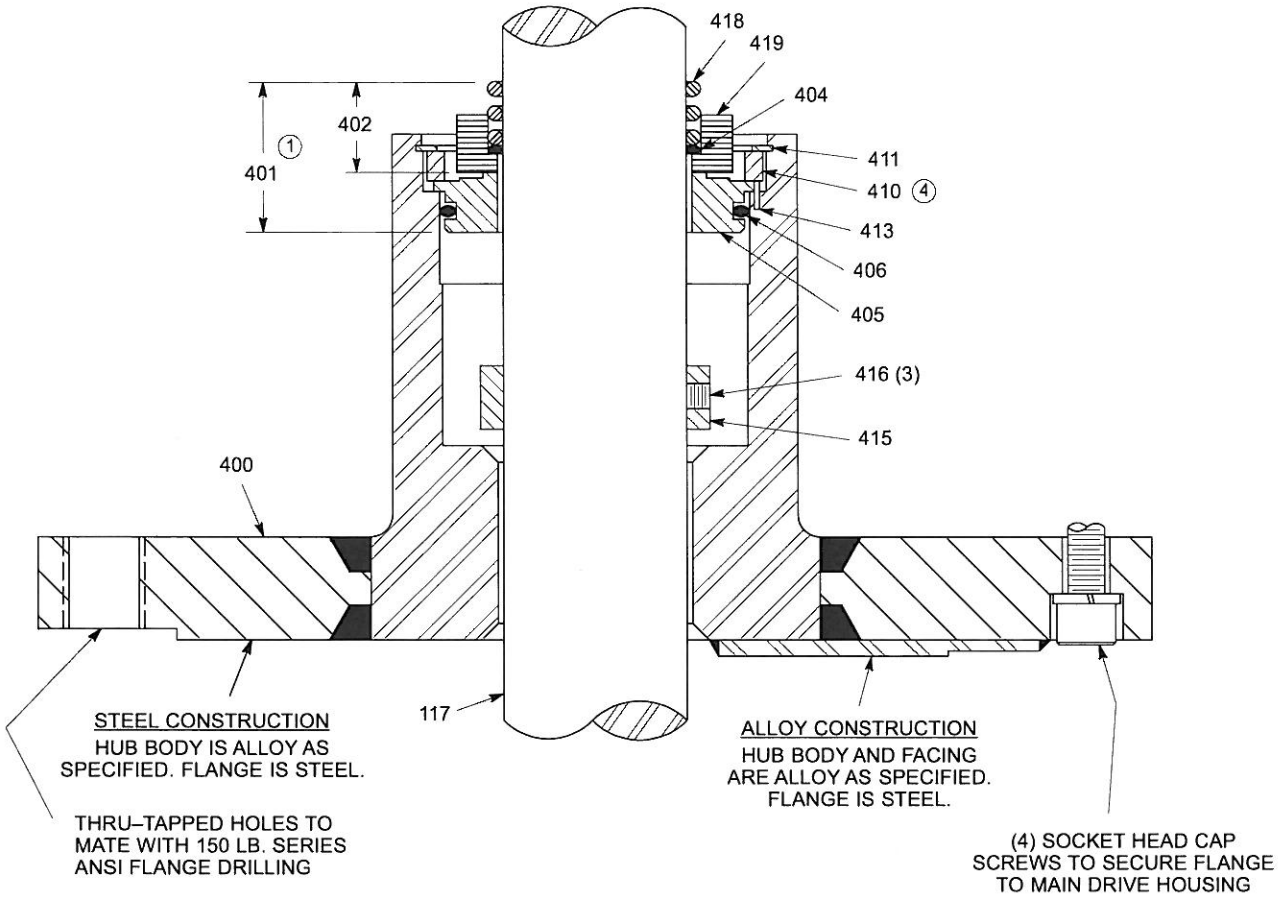
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MIXERS AND AERATORS

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ASSEMBLY DRAWING

SERIES 10™ UNIT SIZE 14, 15 & 16 CLOSED TANK MIXER WITH MECHANICAL SEAL



NOTES:

① THE ***LIGHTNIN*** SEAL ASSEMBLY (401) IS AVAILABLE AS AN ASSEMBLY ONLY. INTERNAL COMPONENTS ARE NOT AVAILABLE AS INDIVIDUAL ITEMS.

② MECHANICAL SEAL LIMITS:
VESSEL TEMPERATURE = 250 ° F. MAX.
VESSEL PRESSURE = VACUUM TO 25 PSIG MAX.

③ STANDARD SEAL ASSEMBLY MATERIALS:
METAL COMPONENTS – STAINLESS STEEL
STATIONARY SEAL FACE – CARBON
ROTARY SEAL FACE – PERAMIC
SEAL RINGS – VITON

④ NOT FURNISHED ON 17 SIZE MIXERS.

ITEM	PART NAME
419	ROTARY SEAL FACE
418	SPRING
416	SOC. HD. SET SCREW (3)
415	SHAFT SUPPORT COLLAR
413	ANTI–ROTATION PIN
411	RETAINING RING
410	SPACER ④
406	SEAL RING
405	STATIONARY SEAL FACE
404	SEAL RING
402	ROTARY SEAL HEAD
401	***LIGHTNIN*** SEAL ASSEMBLY ①
400	HUB & FLANGE
117	IMPELLER SHAFT

WHEN ORDERING PARTS, SPECIFY: MODEL, SERIAL NUMBER, PART ITEM NO. AND DRAWING NO.

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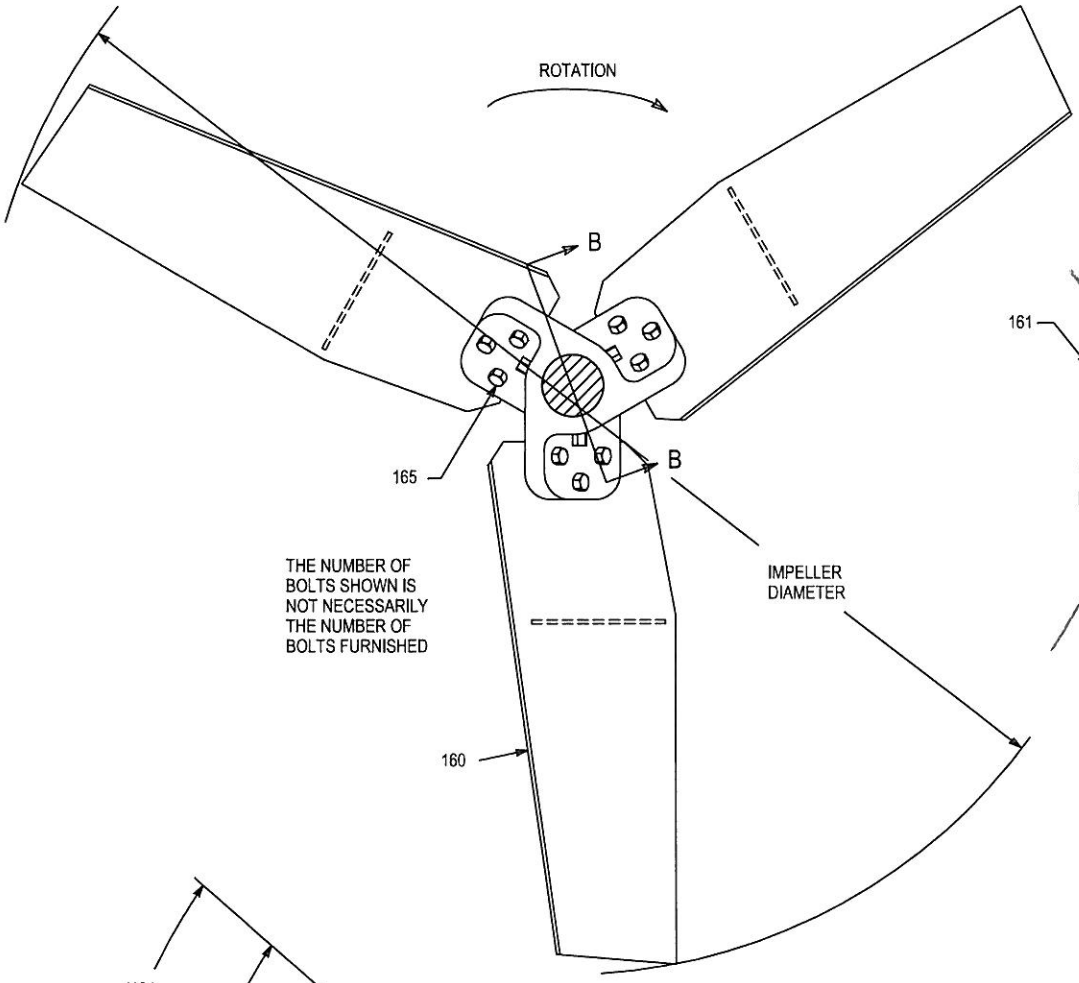
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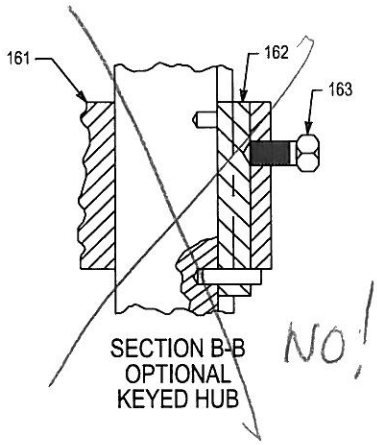
LIGHTNIN

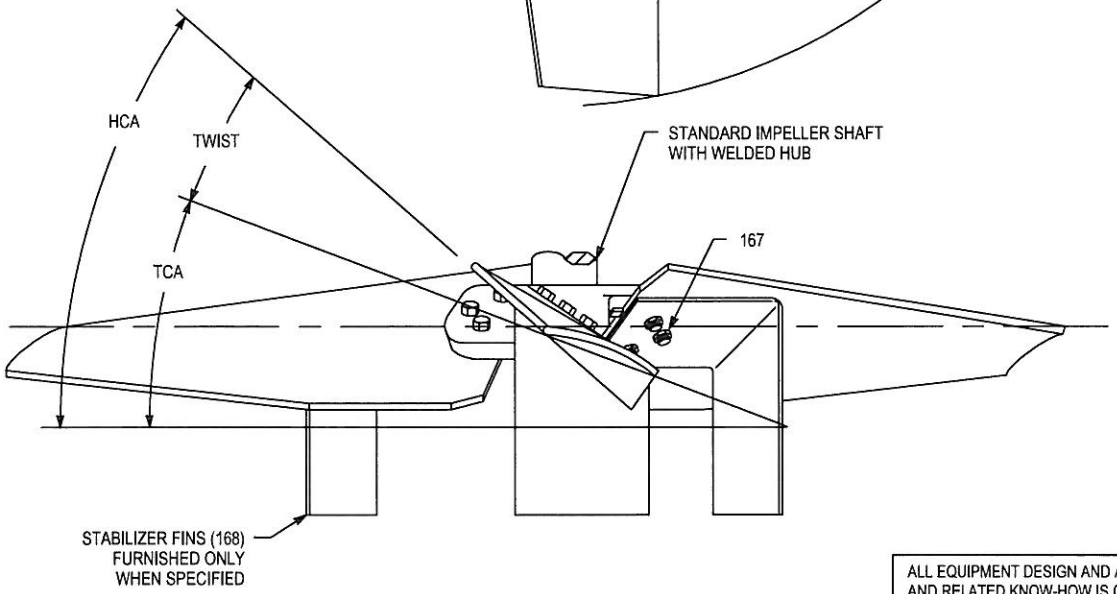
MIXERS AND AERATORS
ASSEMBLY DRAWING

SERIES 10™ LOW PRESSURE MECHANICAL SEAL ASSEMBLY STYLE S 10 L

DRAWING NO. L–16864F







WHEN ORDERING PARTS, SPECIFY:
IMPELLER DIAMETER, ITEM NO., PART NAME, DRAWING NO. AND MIXER SERIAL NO.

ITEM	PART NAME
168	STABILIZER FIN
167	HEX NUT
165	HEX HEAD CAP SCREW
163	SET SCREW — OPTIONAL KEYED HUB
162	HOOK KEY — OPTIONAL KEYED HUB
161	HUB — OPTIONAL KEYED HUB
160	BLADE

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LIGHTNIN®
MIXERS AND AERATORS

ASSEMBLY DRAWING

A510 AND A510E AXIAL FLOW IMPELLER ONE PIECE HUB w/ BOLTED BLADES

LIGHTNIN

AN SPX BRAND

Arroyo Process Equipment
201 N Woodlawn Ave
Bartow, Florida 33830 United States
Phone: 863-533-9700 Fax: 863-533-4907
sales@arroyoprocess.com

Quote Form

Attention: **John Perella** **Date:** 07/08/2009

Arcadis
.
Tampa, Florida United States

Project Name: Arcadis - 300 gallon tank mixer **Quote Number:** 07L-09-0708 rev. A

Comments: FOB Rochester, NY 14611

Item No	Product	Description	Quantity	Price Each
Mixer	EV Series	Model EV5P25	1	$1,415.70
		Add for Material Surcharge		$5.00
		Total Mixer Price Each		$1,420.70

Details:	**Motor:**	.25 HP 3ph, 60Hz, TEFC, 1725 RPM, 208-230/460v, 1.15 S.F., not inverter duty	
	Machine:	Output Speed: Mounting Option:	350 RPM 20 Degree Clamp
	Shaft:	Length (From Mounting Base): Diameter:	54 inches 3/4" inches
	Impeller:	Single 11.2" A310 w/stabilizer	
	Other Data:	Drawing(s): Nominal Operating Speed:	L-17095, L-16701, DS-P-71 350

Total(US Dollars)	$1,420.70

Shipment In: 4 Working Days After Receipt of Order
Payment Terms: NT30 Within 30 days Due net
Delivery Terms: FOB Origin
Quote Expiration Date: 08/07/2009

Please Address Purchase Order to:
LIGHTNIN, an SPX brand
c/o Arroyo Process Equipment
201 N Woodlawn Ave
Bartow, Florida 33830 United States

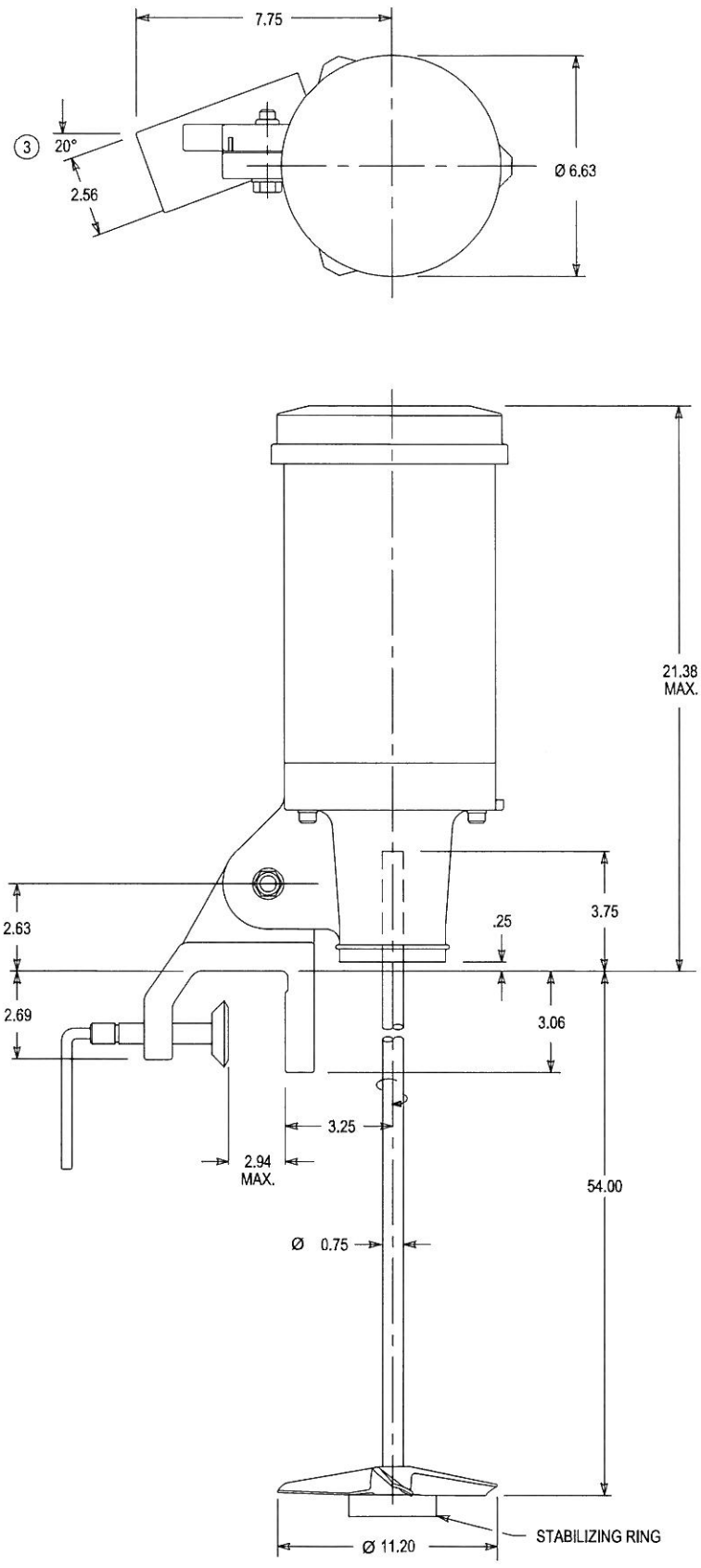
Thank you,

Mark Lesko
Sales Engineer

DATE: 7/8/2009

NOTES:

1. DIMENSIONS ARE IN INCHES AND ARE MAXIMUM.
2. WEIGHT (LESS SHAFT AND IMPELLERS): 53 LBS.
3. UNIT OFFSET 20° HORIZONTALLY, AND ADJUSTABLE 10° (OR MORE) VERTICALLY. UNIT ALSO AVAILABLE WITH 0° OFFSET.
4. MATERIAL OF MIXER PARTS IN CONTACT WITH TANK CONTENTS IS 316SS
5. MOTOR DATA:
   H.P.: .25 R.P.M.: 1725 DUTY: NO
   VOLTS: 230/460 PHASE: 3 Hz: 60
   ENCLOSURE: TEFC IMPELLER R.P.M.: 350.0



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LIGHTNIN®
MIXERS AND AERATORS

GENERAL ARRANGEMENT
FOR: ARCADIS

TAG NO.:
MIXER MODEL: EV5P25 RATIO: 5:1

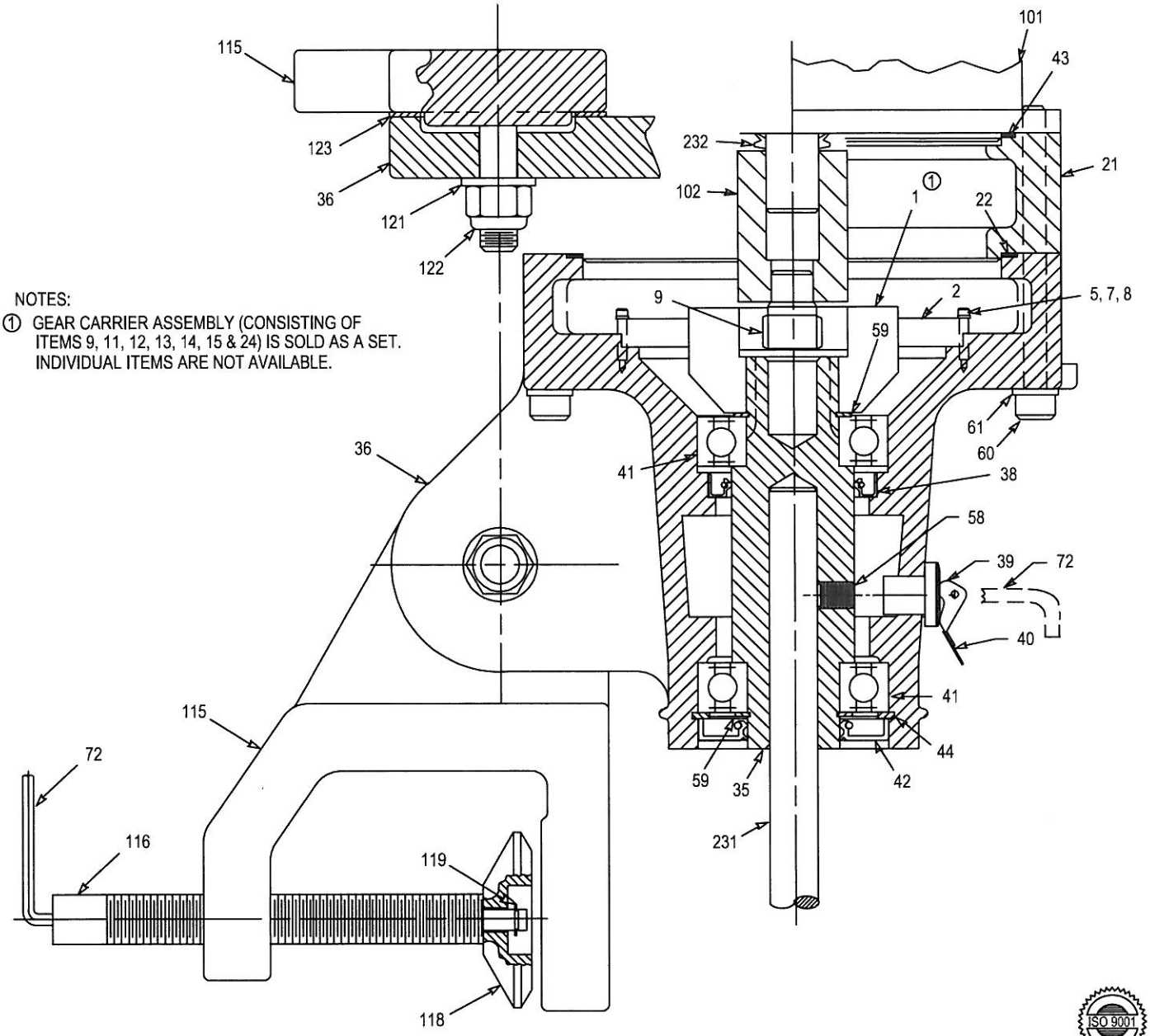
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R625-EDC-001213-0

DRAWING NO. 07L-09-0708 REV. A-1



NOTES:
① GEAR CARRIER ASSEMBLY (CONSISTING OF ITEMS 9, 11, 12, 13, 14, 15 & 24) IS SOLD AS A SET. INDIVIDUAL ITEMS ARE NOT AVAILABLE.

ITEM	PART NAME	ITEM	PART NAME
44	RETAINING RING		
43	GASKET	232	V-RING
42	OIL SEAL	231	MIXER SHAFT
41	BALL BEARING	123	ROTATION INSERT
40	LANYARD	122	HEX LOCKNUT
39	EXPANSION PLUG	121	FLAT WASHER
38	OIL SEAL	119	RETAINING RING
36	HOUSING	118	CUP WASHER
35	DRIVE QUILL	116	CLAMP SCREW
22	GASKET	115	TANK CLAMP
21	SPACER	102	COUPLING
9	SUN GEAR	101	MOTOR
8	FLAT WASHER (4)	72	HEX WRENCH
7	SOCKET HEAD CAP SCREW (4)	61	FLAT WASHER (4)
5	HOLLOW PIN (4)	60	SOCKET HEAD CAP SCREW (4)
2	RING GEAR	59	RETAINING RING
1	GEAR CARRIER ASSEMBLY ①	58	HEX SOCKET SET SCREW - NYLOK

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WHEN ORDERING PARTS, SPECIFY:
MODEL AND SERIAL NUMBER, PART NAME, ITEM NUMBER AND DRAWING NUMBER

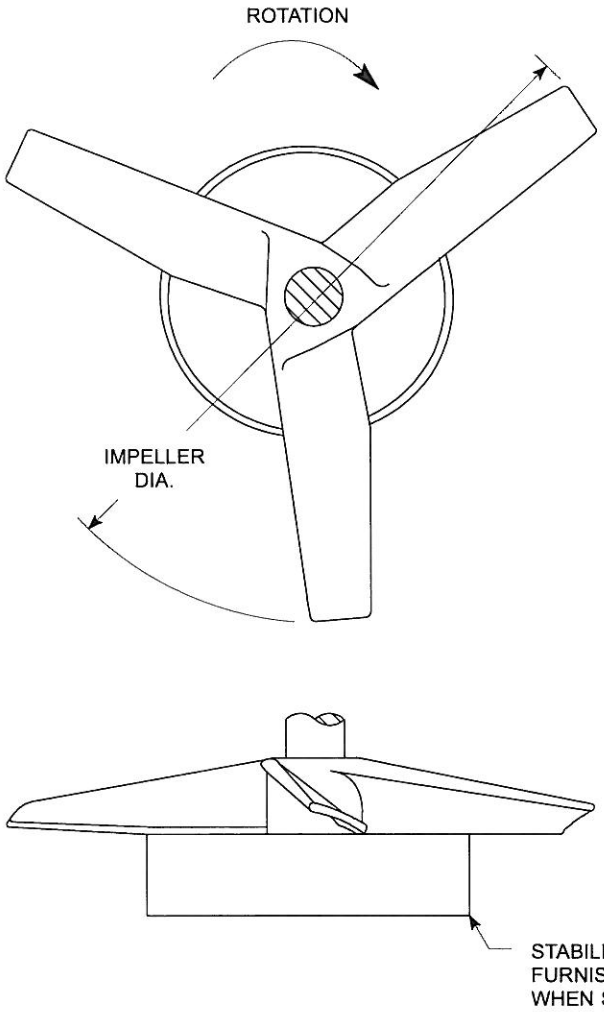
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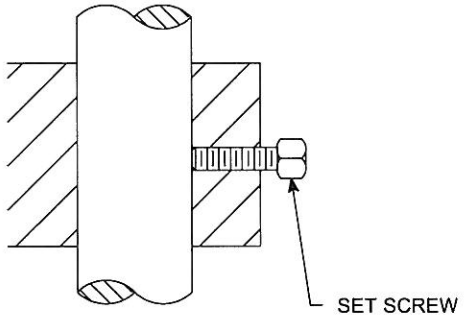
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LIGHTNIN®
MIXERS AND AERATORS

ASSEMBLY DRAWING

EV "P" SERIES MIXER GEAR DRIVE BEARING HOUSING ASSEMBLY





WHEN ORDERING PARTS, SPECIFY:
DRAWING NUMBER, PART NAME, ITEM
NUMBER AND SERIAL NUMBER

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1991

ASSEMBLY DRAWING

A310
AXIAL FLOW IMPELLER

DRAWING NO. L–16701B

Catalogue and Product Data Sheets

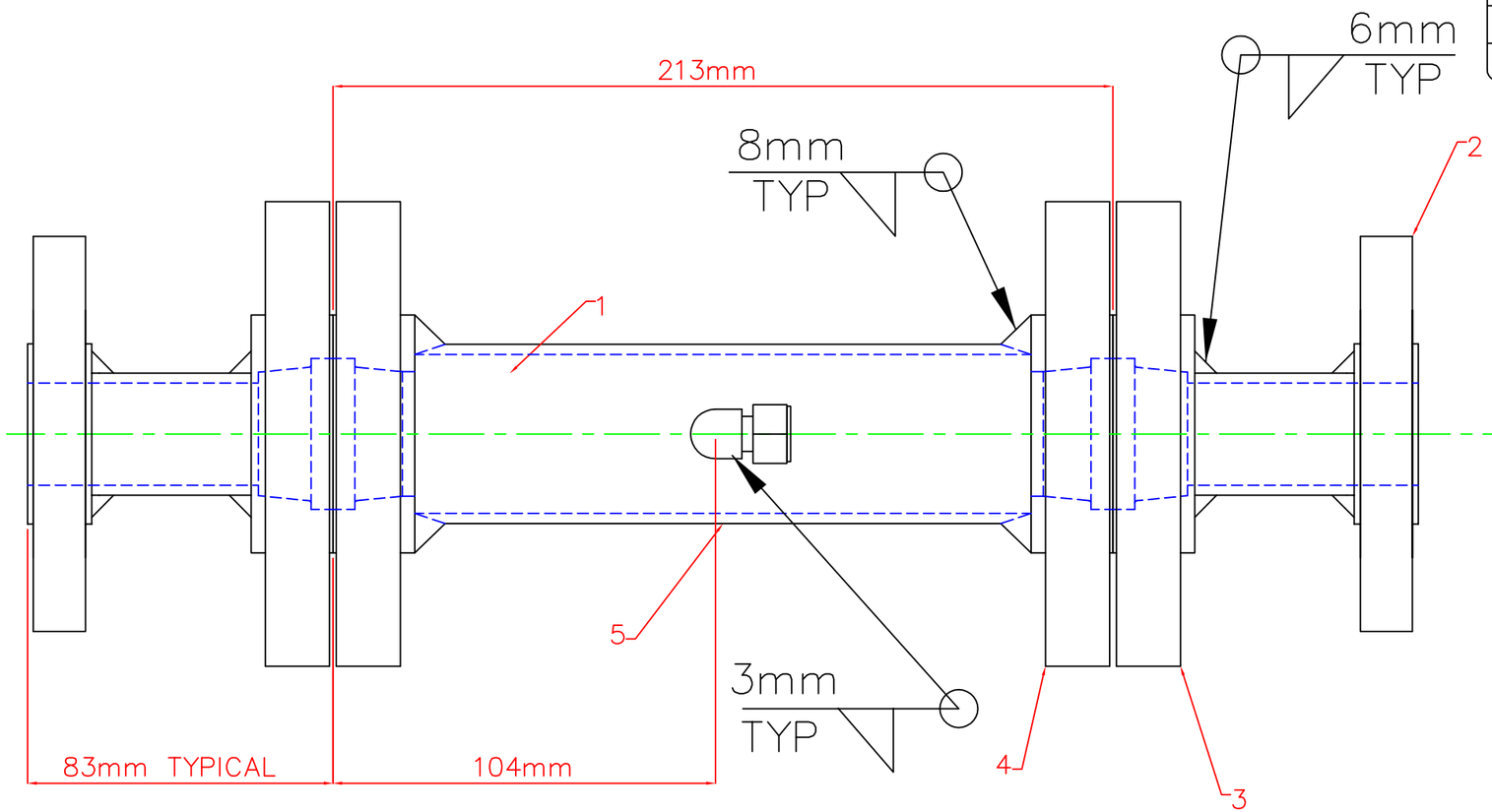
Item	Tag	Description
15	A-150A, A-150B	Aeration Housing

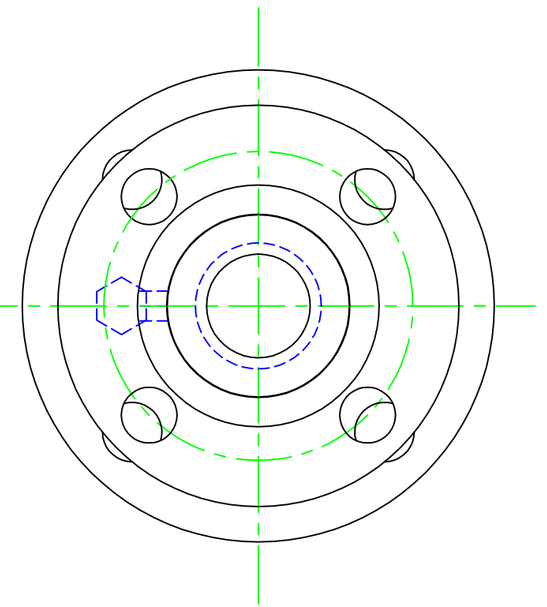
BILL OF MATERIAL

ITEM #	DESCRIPTION	MANUFACTURER	PART#	MATERIAL	CRN#
1	3/8" COMP X 1/4" BW EL	HAMLET	769LNSS-3/8-1/4	SA182-316	-
2	1" #150 RFSO FLANGE	TBD			-
3	OUTBOARD FLANGE	MAASS	DWG# P2C-300	SA182-T316	-
4	INBOARD FLANGE	MAASS	DWG# P2C-300	SA182-T316	-
5	1 1/2" SCH 10 WLD PIPE	TBD	-	SA312-T316	-
6	1/2" X 50mm HEX BOLTS	TBD(PINACLE)	N/A	18-8 GRD 5	-

DESIGNED TO ASME VIII DIV.1 2003 EDITION, 2003 ADDENDA
SERVICE: WATER, NON LETHAL

DESIGN PRESSURE	1030 kPa
DESIGN TEMPERATURE	80 DEG C.
MDMT	-29 DEG C.
PWHT	N/A
COROSION ALLOWANCE	0%
RADIOGRAPHY	NONE
HYDROSTATIC TEST	1550 kPa FOR 1HR
PPR#	PENDING





MAX. AIR FLOW: 50LPM
MAX WATER FLOW: 100LPM

NOTES

R625-EDC-001213-0

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Purifics ES INC.
LONDON , ONTARIO , CANADA
www.purifics.com

IRON REMOVAL
AERATION HOUSING

P8A-802		REVISION	CLIENT JOB No. N/A	
DESIGN: PURIFICS	SCALE: N.T.S.	TYPE: FABRICATION	P.E.S. JOB No. W0815	
DRAWN: JAY PEARCE C.E.T	SHEET No.: SH-A01			
CHECK:	DATE: 2007/12/12	REVISED BY:	REV. DATE:	

Catalogue and Product Data Sheets

Item	Tag	Description
16	P-150A, P-150B	Aeration Recirculation Pumps
38	P-620	POTW Waste Pump
46	P-800A, P-800B	Surge Transfer Pumps

BNPE

ITT

Commercial Water

Goulds Pumps

G&L Series NPE

316L SS

NPE Series End Suction Centrifugal Pumps

Bombas Centrífugas de Succión Final Serie NPE



GOULDS PUMPS

Goulds Pumps is a brand of ITT Corporation.

Goulds Pumps es una marca de fábrica de ITT Corporation.

www.goulds.com

Engineered for life

R625-EDC-001213-0

A Full Range of Product Features
Una Gama Total de Características del Producto

Superior Materials of Construction: Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

High Efficiency Impeller: Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

Casing and Adapter Features: Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

Mechanical Seal: Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

Motors: NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

Materiales Superiores de Construcción: *Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.*

Impulsor de Eficiencia Superior: *El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.*

Características de la Carcasa y del Adaptador: *Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.*

Sello Mecánico: *Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.*

Motores: *Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.*

NPE Product Line Numbering System
Línea de Producto NPE Sistema de Numeración

Example Product Code,
Ejemplo Código del Producto

1 ST 2 C 1 A 4 F

Seal Vent/Flush Option,
Opción de Sello Válvula/ChorroSeal Ven

Mechanical Seal and O-ring
4 = Pre-engineered standard
For optional mechanical seal modify catalog order no. with seal code listed below.

Sello Mecánico y Anillo 'O'
4 = Estándar aprobado
Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (⅝" seal),
Sello Mecánico John Crane Tipo 21 (sello de ⅝")

Seal Code, *Código del Sello*	Rotary, *Rotativo*	Stationary, *Estacionario*	Elastomers, *Elastómeros*	Metal Parts, *Partes Metálicas*	Part No., *Pieza Número*
2	Carbon	Silicon Carbide	EPR	316 SS	10K18
4			Viton		10K55
5	Silicon Carbide		EPR		10K81
6			Viton		10K62

Impeller Option . . . No Adder Required
For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

Código del Impulsor Opcional
Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, *Código del Impulsor*	Pump Size, *Tamaño de la Bomba*		
	1 x 1¼ – 6	1¼ x 1½ – 6	1½ x 2 – 6
	Diameter	Diameter	Diameter
K	–	6⅛	–
G	–	5 15/16	5⅜
H	–	5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	–

Driver, *Conductor*
1 = 1 PH, ODP
2 = 3 PH, ODP
3 = 575 V, ODP
4 = 1 PH, TEFC
5 = 3 PH, TEFC
6 = 575 V, TEFC
7 = 3 PH, XP
8 = 575 V, XP
9 = 3 PH, TEFC Premium Eff.
0 = 1 PH, XP

HP Rating, *HP Potencia*
C = ½ HP E = 1 HP G = 2 HP J = 5 HP
D = ¾ HP F = 1½ HP H = 3 HP

Driver: Hertz/Pole/RPM,
Conductor: Hercios/Polo/RPM
1 = 60 Hz, 2 pole, 3500 RPM
2 = 60 Hz, 4 pole, 1750 RPM
3 = 60 Hz, 6 pole, 1150 RPM
4 = 50 Hz, 2 pole, 2900 RPM
5 = 50 Hz, 4 pole, 1450 RPM

For frame mounted version, substitute the letters "FRM" in these positions.
Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

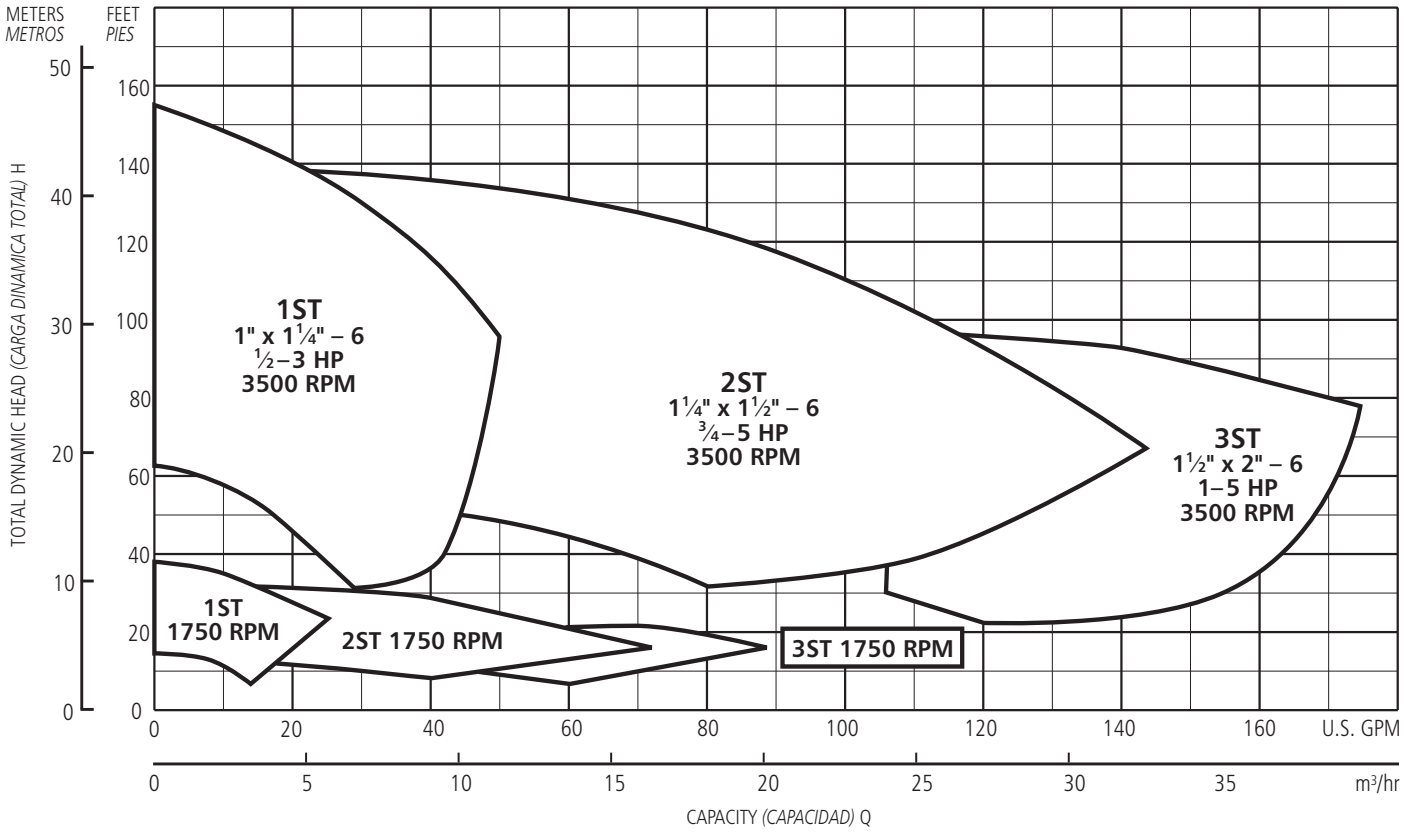
Material
ST = Stainless steel, *Acero inoxidable*

Pump Size, *Tamaño de la Bomba*
1 = 1 x 1¼ – 6 2 = 1¼ x 1½ – 6 3 = 1½ x 2 – 6

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

Performance Coverage (60 Hz)
Alcance de Funcionamiento (60 Hz)



NOTES:

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds Pumps, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds Pumps check available service factor.

NOTAS:

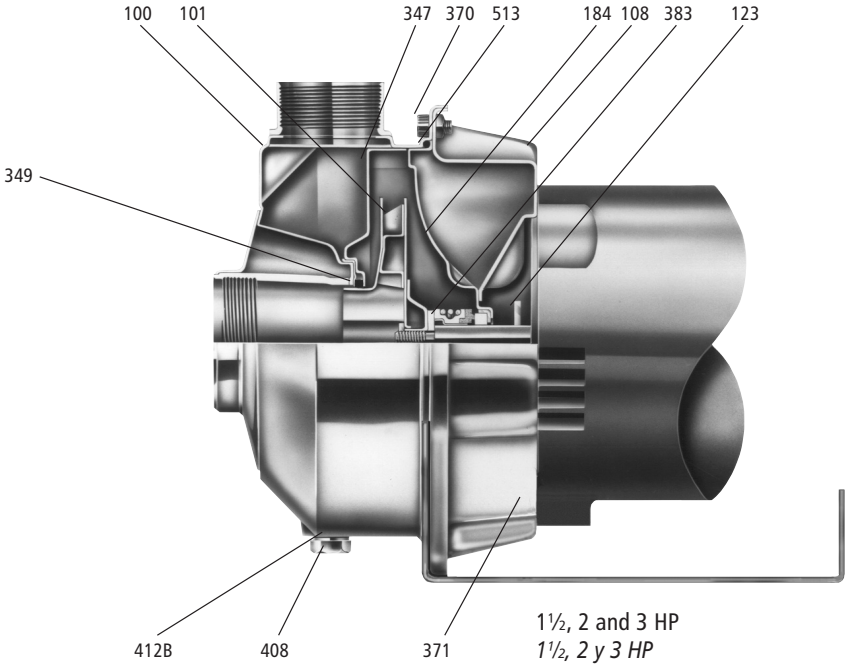
No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

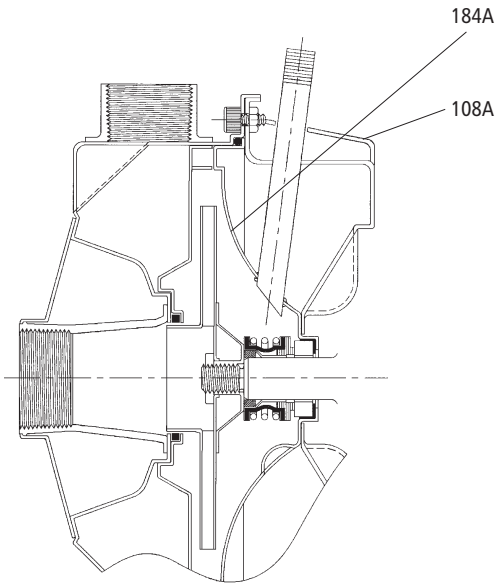
No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds Pumps tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds Pumps.

NPE Close Coupled Pump Major Components: Materials of Construction
Bomba Cerrada Acoplada NPE Componentes Principales: Materiales de Construcción

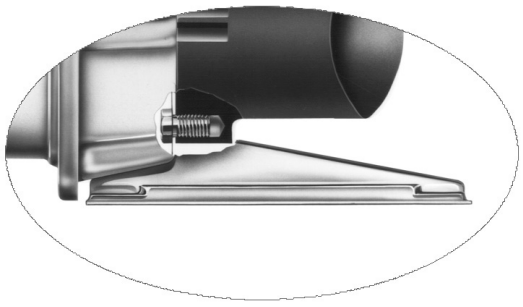


1½, 2 and 3 HP
1½, 2 y 3 HP



Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing; *Carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
101	Impeller; *Impulsor*	
108	Motor adapter; *Adaptador del motor*	
108A	Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor*	
123	Deflector; *Deflector*	BUNA-N
184	Seal housing; *Alojamiento del sello*	AISI 316L SS; *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello*	
347	Guidevane; *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
370	Socket head screws, casing; *Encajes cabezas de tornillos, carcasa*	AISI 410 SS; *AISI 410 Acero inoxidable*
371	Bolts, motor; *Tornillos, motor*	Plated steel; Acero chapeado
383	Mechanical seal; *Sello mecánico*	**see chart, *ver tabla*
408	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton (Standard, *estándar*) EPR (Optional, *Opcional*)
513	O-ring, casing; *Anillo 'O', carcasa*	
Motor *Motor*	NEMA standard, 56J flange; *NEMA estándar, brida 56J*	

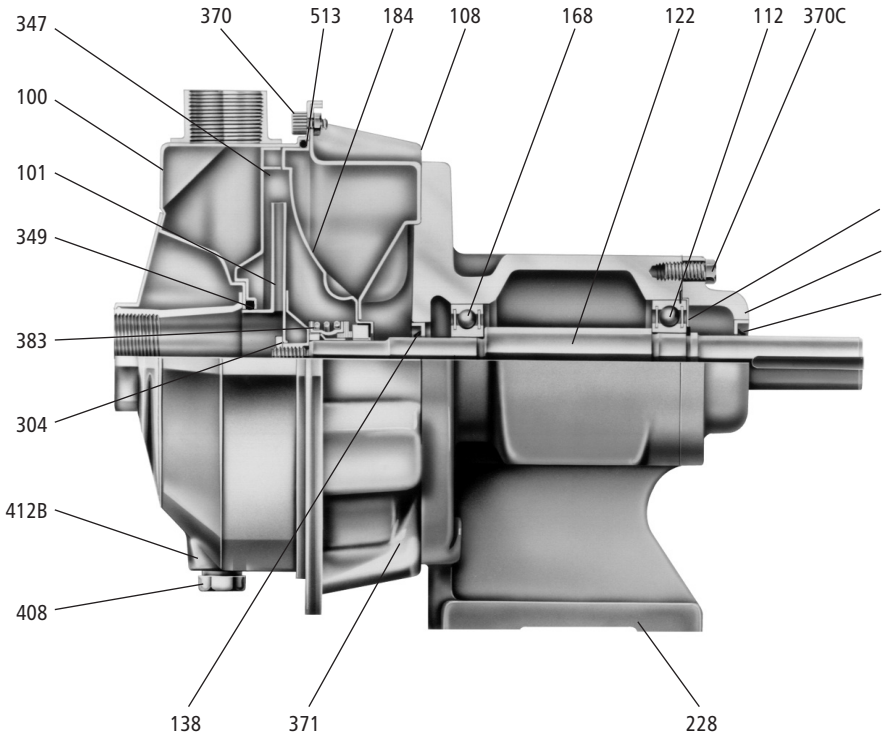


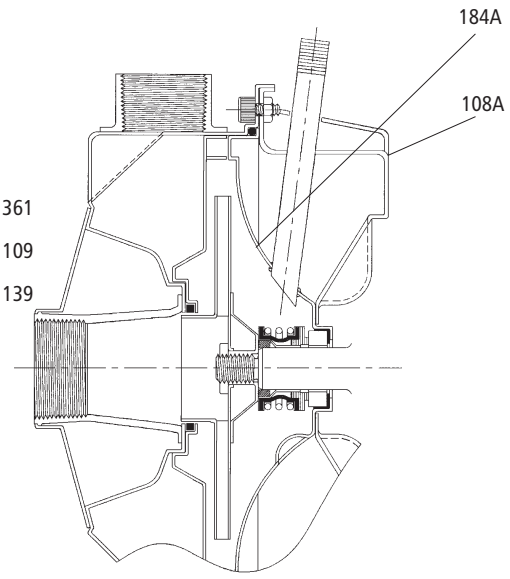
½, ¾ and 1 HP
½, ¾ y 1 HP

Footed motor for 5 HP ODP and TEFC, all explosion proof motors, see page 13.

Motor con pie para 5 HP ODP y TEFC, a prueba de explosiones motores, en la página 13.

NPE Frame Mounted Pump Major Components: Materials of Construction
Bomba NPE de Armazón Montado Componentes Principales: Materiales de Construcción



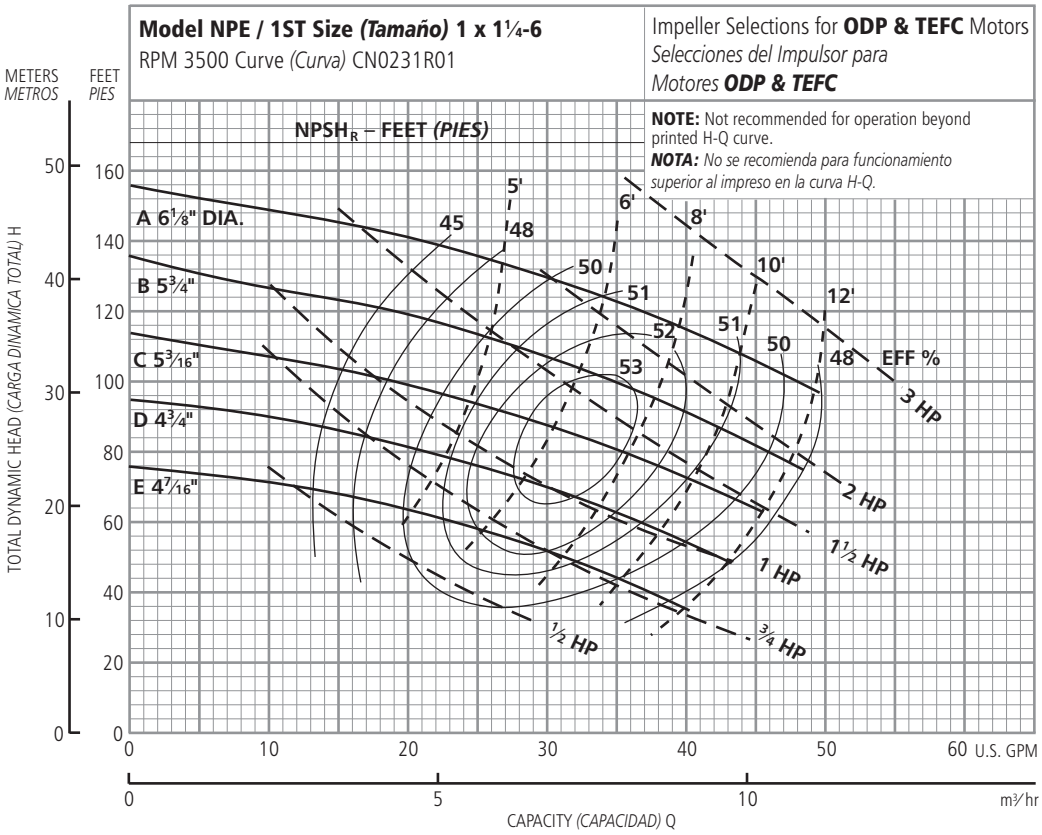


Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing; *Carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
101	Impeller; *Impulsor*	
108	Adapter; *Adaptador*	
108A	Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor*	
109	Bearing cover; *Cubierta de balineras*	Cast iron; *Hierro fundido*
112	Ball bearing (outboard); *Balineras de bolas (exterior)*	Steel; *Acero*
122	Shaft; *Eje*	AISI 316 SS; *AISI 316 Acero inoxidable*
138	Lip-seal (inboard); *Sello cubierto (interior)*	BUNA/steel; *BUNA/acero*
139	Lip-seal (outboard); *Sello cubierto (exterior)*	BUNA/steel; *BUNA/acero*
168	Ball bearing (inboard); *Balineras de bolas (interior)*	Steel; *Acero*
184	Seal housing; *Alojamiento del sello*	AISI 316L SS; *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello*	
228	Bearing frame; *Armazón de balineras*	Cast iron, *Hierro fundido*

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
304	Impeller locknut; *Contratuerca del impulsor*	AISI 316 SS; *AISI 316 Acero inoxidable*
347	Guidevane; *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
361	Retaining ring; *Anillo de retención*	Steel; Acero
370	Socket head screws, casing; *Encaje cabeza del tornillo, carcasa*	AISI 410 SS; *AISI 410 Acero inoxidable*
370C	Hex head screw, bearing cover; *Tornillo de cabeza hexagonal, cubierta de balineras*	Plated steel; *Acero chapeado*
371	Hex head screw, bearing frame; *Tornillo de cabeza hexagonal, armazón de balineras*	Plated steel; *Acero chapeado*
383	Mechanical seal; *Sello mecánico*	**see chart; ver tabla
400	Shaft key; *Llave del eje*	Steel; Acero
408	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316 SS; *AISI 316 Acero inoxidable*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton (Standard, *estándar*) EPR (Optional, *Opcional*)
513	O-ring, casing; *Anillo 'O', carcasa*	

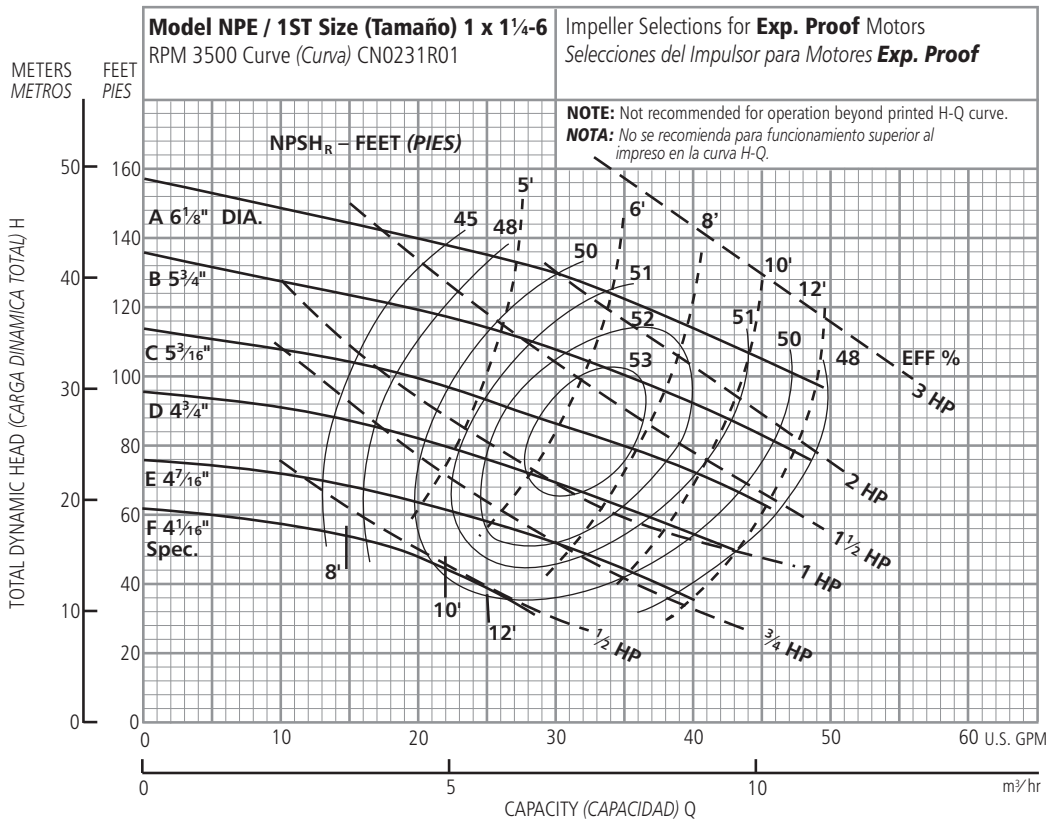
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	½	4⁷⁄₁₆"
D	¾	4¾
C	1	5³⁄₁₆
B	1½	5¾
A	2	6⅛

NOTE: Although not recommended, the pump may pass a ¹⁄₁₆" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄₁₆".*



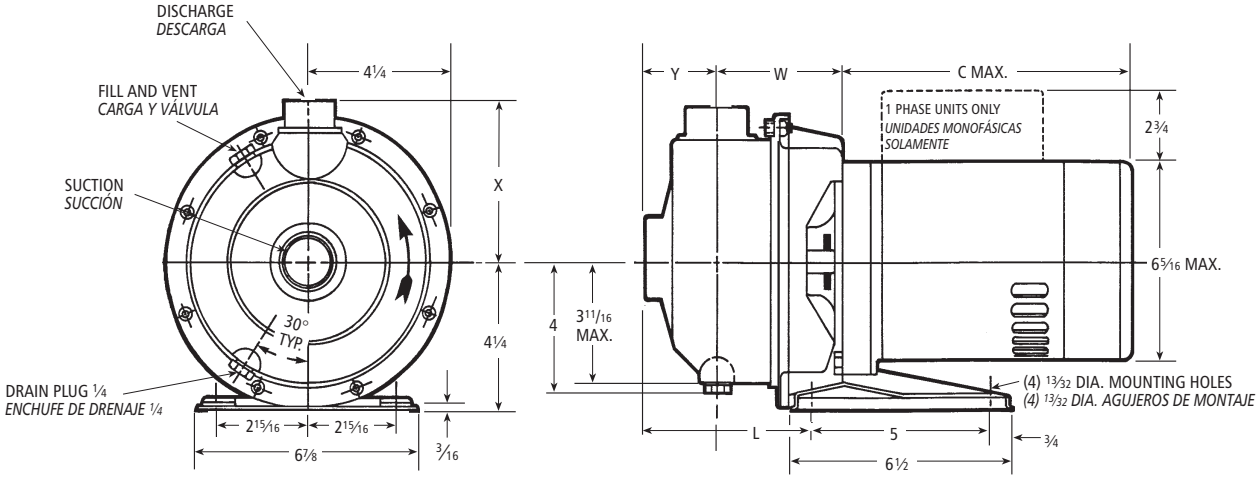
Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	½	4¹⁄₁₆" spec.
E	¾	4⁷⁄₁₆
D	1	4¾
C	1½	5³⁄₁₆
B	2	5¾
A	3	6⅛

NOTE: Although not recommended, the pump may pass a ¹⁄₁₆" sphere.

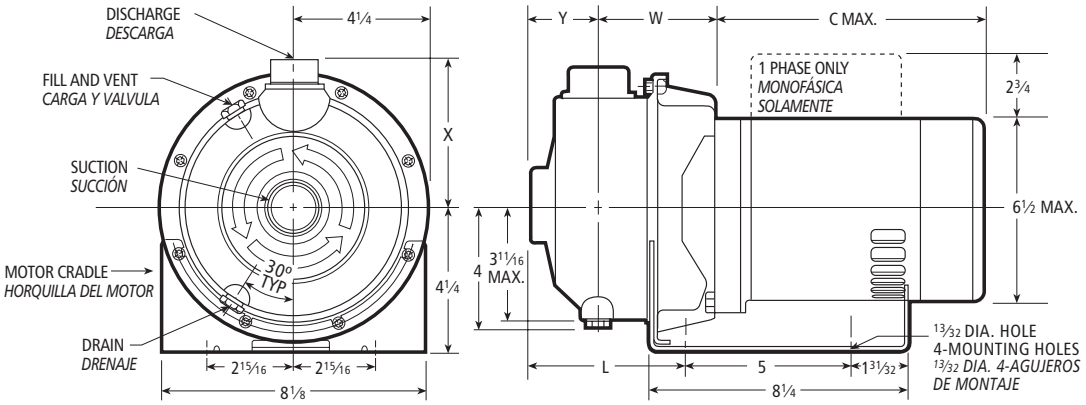
NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄₁₆".*

NPE Close Coupled – Dimensions, Weights and Specifications
NPE Acople Cerrado – Dimensiones, Pesos y Especificaciones

Clockwise Rotation Viewed from Drive End
Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



ODP and TEFC ½, ¾ and 1 HP (standard), *ODP y TEFC ½, ¾ y 1 HP (estándar)*



ODP and TEFC 1½, 2 and 3 HP (standard), *ODP y TEFC 1½, 2 y 3 HP (estándar)*

Specifications
Especificaciones

Capacities to:
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (46 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to:
250° F (121° C)

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
NEMA 56J frame, 1750 RPM, ½ HP. 3500 RPM ½ through 5 HP. Open drip-proof, totally enclosed fan-cooled or explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 and 5 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/460 ODP, TEFC and EX PROOF.

NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
85 GPM (322L/min) a 1750 RPM
170 GPM (643L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (46 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

Temperatura máxima:
250° F (121° C)

Dirección de rotación:
En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:
Armazón 56J NEMA, 1750 RPM ½ HP. 3500 RPM ½ a 5 HP. Cubiertas abiertas resguardadas, totalmente encerradas enfriadas por ventilador o a prueba de explosiones. Eje de acero inoxidable con balineras de bolas.

Monofásicos: *Voltaje 115/230 ODP y TEFC. (modelo 3 y 5 HP – 230 voltios solamente) Se proporciona protección térmica contra sobrecarga construida con reseteo automático.*

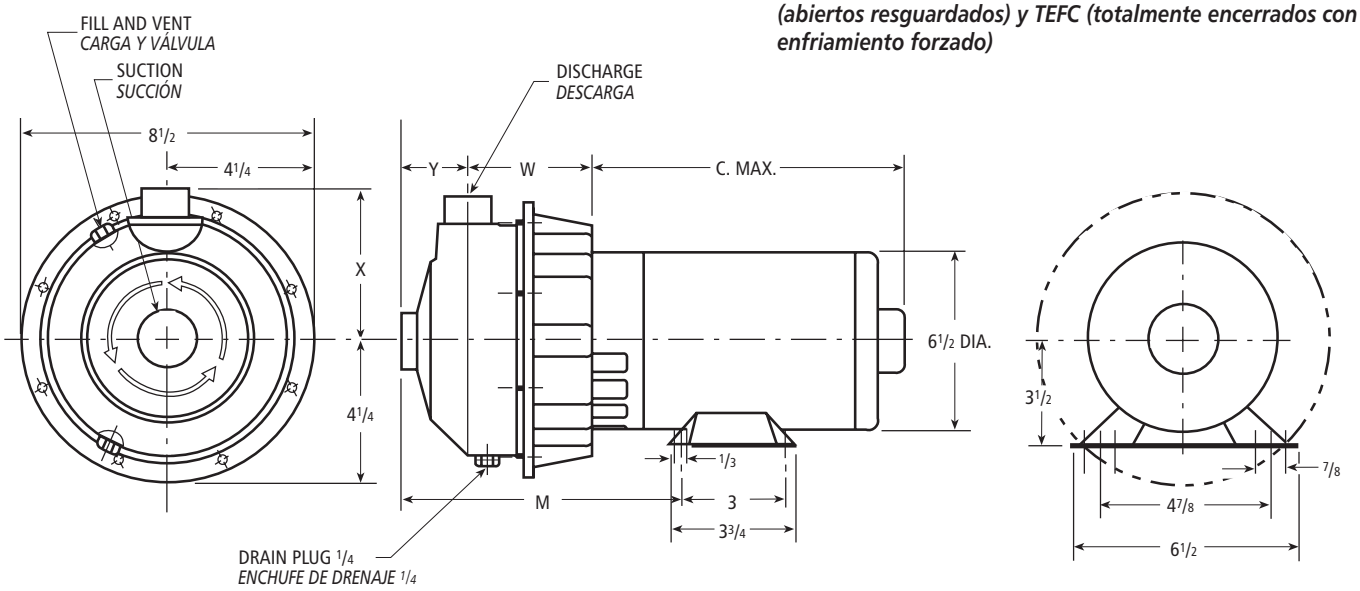
Trifásicos: *Voltaje 208-230/460 ODP, TEFC y EX PROOF.*

NOTA: *Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.*

NPE Close Coupled with Footed Motor, Explosion-proof and 5 HP Motors
NPE Acople Cerrado con Motor con Patas, Motores a Prueba de Explosión Y 5 HP

All Explosion Proof Motors and 5 HP ODP and TEFC

Todos los motores son a prueba de explosiones, 5 HP, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado)



Dimensions – Determined by Pump, *Dimensiones – Determinadas por la Bomba*

Pump, *Bomba*	Suction, *Succión*	Discharge, *Descarga*	HP	W	X	Y	L	M
1ST	1¼	1	½ – 3	3 5/16	4⅜	2	4 9/16	7 5/16
2ST	1½	1¼	¾ – 5	3¾	4½	2⅛	5⅛	7 7/8
3ST	2	1½	1 – 5	3¾	4⅝	2⅛	5⅛	7 7/8

Available Motor Weights and Dimensions, *Pesos y Dimensiones Disponibles del Motor*

HP	Motor Weights, *Pesos del Motor*						C Max. Length, *(Longitud)*
	1 Phase, *Monofásicos*			3 Phase, *Trifásicos*			
	ODP	TEFC	EXP	ODP	TEFC	EXP	
½	16	21	47	19	18	27	9 15/16
¾	19	24	41	21	21	30	10¼
1	22	26	49	23	21	30	11
1½	28	35	56	27	27	37	11 5/16
2	33	39	60	32	33	44	12 1/16
3	40	43	—	41	37	—	12 7/16
5	42	—	—	42	45	—	14¼

Dimensions in inches, weights in pounds.
Dimensiones en pulgadas, pesos en libras.

NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.

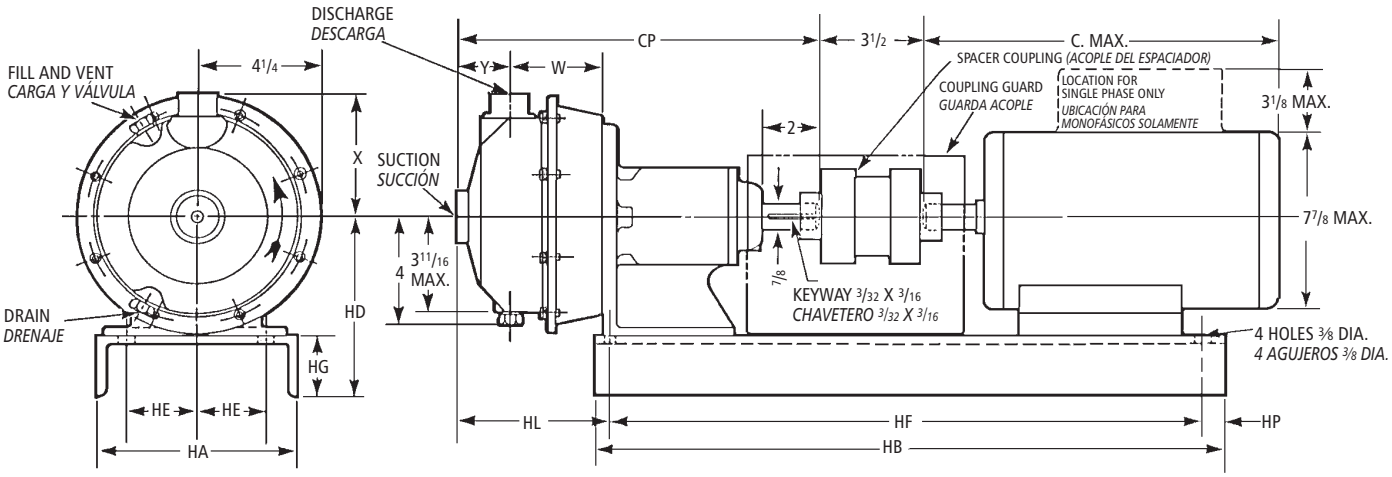
2. Las dimensiones del motor puede que varíen con los fabricantes.

3. Dimensiones en pulgadas, pesos en libras.

4. Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.

5. No usar para propósitos de construcción sin certificar.

NPE Frame Mounted – Dimensions, Weights and Specifications
NPE Armazón Montado – Dimensiones, Pesos y Especificaciones



Specifications
Especificaciones

Capacities to:
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (47 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to:
250°F (121°C)

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
T-frame single and three phase. Open drip-proof, TEFC or explosion proof enclosures are available for 60 Hz, 3500 and 1750 RPM operation.

For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
85 GPM (322L/min) a 1750 RPM
170 GPM (643L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (47 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

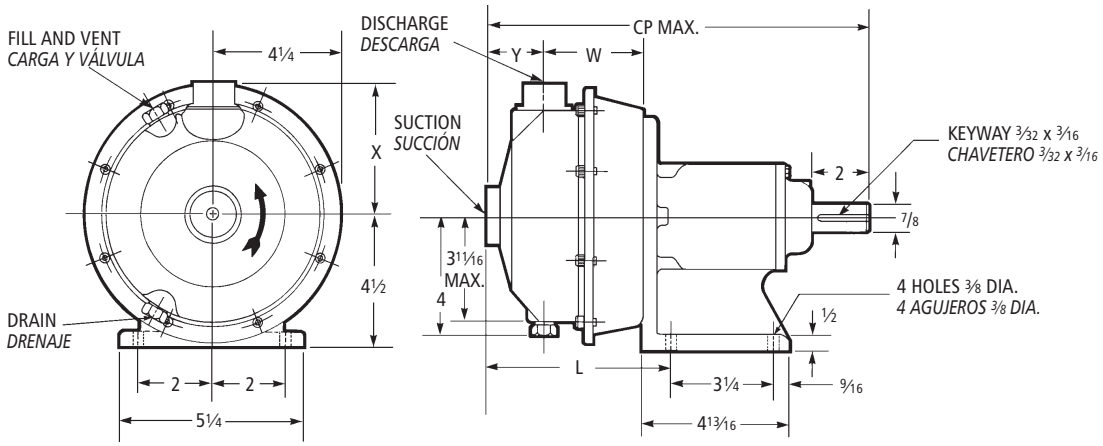
Temperatura máxima:
250°F (121°C)

Dirección de rotación:
En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:
Armazón T- monofásico y trifásico. A prueba de goteo, TEFC o recintos a prueba de explosión están disponibles para funcionamiento de 60 Hz, 3500 y 1750 RPM.

Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.

NPE-F



Dimensions and Weights – Determined by Pump, *Dimensiones y Pesos – Determinados por la Bomba*

Pump, *Bomba*	Suct. NPT, *Succión NPT*	Disch. NPT, *Descarga NPT*	CP	L	W	X	Y	Wt., *Peso*	Dim. "HL" Determined by Pump and Motor, *Dim. "HL" Determinadas por la Bomba y el Motor* Frame, *Armazón* 56	140	180
1ST	1 1/4	1	12 15/16	6 7/16	3 5/16	4 3/8	2	22 1/2	4 9/16		6 7/16
2ST	1 1/2	1 1/4	13 1/2	7	3 3/4	4 1/2	2 1/8	23	5 1/8		7
3ST	2	1 1/2				4 5/8					

Available Motor and Bedplate Dimensions and Weights, *Pesos y Dimensiones Disponibles de la Fundación y del Motor*

Motor Frame, *Armazón del Motor*	HA	HB	HD	HE	HF	HG	HP	Wt. Max., *Peso Máx*	Shims, *Deflector*
56 143T 145T	8	26	6 7/8	3 1/8	22 3/8	2 3/8	1	30	1"
182T 184T	10	26	7 1/4	3 3/4	24	2 3/4	7/8	43	—

NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.*
2. *Las dimensiones del motor puede que varíen con los fabricantes.*
3. *Dimensiones en pulgadas, pesos en libras.*
4. *Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.*
5. *No usar para propósitos de construcción sin certificar.*

Frame Size, *Tamaño del Armazón*	Horsepower, *Fuerza* 3500 RPM Single Phase, *Monofásicos* ODP	TEFC	Three Phase, *Trifásicos* ODP	TEFC	C Max.	Wt. Max., *Peso Máx.*
56	1/2 – 1 1/2	1/2 – 1 1/2	1/2 – 1	1/2 – 1	13	45
143T	—	—	1 1/2	1 1/2	13 3/8	45
145T	2	2	1 1/2 – 3	1 1/2 – 2	14 1/4	52
182T	3	3	5	3	16 5/8	63
184T	5	5	—	5	18 1/8	112

ITT

Commercial Water

Typical Applications, *Aplicaciones Típicas*

Specifically designed for a broad range of general applications traditionally requiring various materials such as all iron, bronze fitted or all bronze construction.

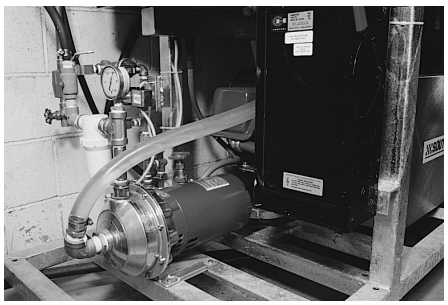
- Water circulation
- Booster service
- Liquid transfer
- Spray system
- Chillers
- Washing/cleaning systems
- Injection molding cooling
- Reverse osmosis
- Air scrubbers
- Heat exchangers
- Filtration systems
- Jockey pumps
- OEM applications
- General water services

Diseñadas específicamente para una amplia variedad de aplicaciones generales, requiriendo tradicionalmente varios materiales, tales como hierro, bronce empotrado o todas las construcciones de bronce.

- *Circulación de agua*
- *Aumento de presión*
- *Transferencia de líquidos*
- *Sistemas de aspersión*
- *Enfriadores*
- *Sistemas de lavado/limpieza*
- *Enfriamiento con molde por inyección*
- *Osmosis reversa*
- *Depuradores de aire*
- *Termopermutadores*
- *Sistemas de filtración*
- *Bombas auxiliares*
- *Aplicaciones OEM*
- *Servicios generales de agua*



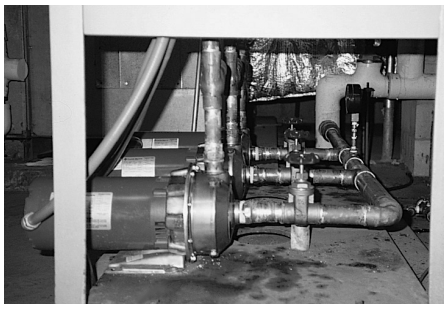
Brewery, *Fábrica de Cerveza*



Car Wash, *Lavadero de Autos*

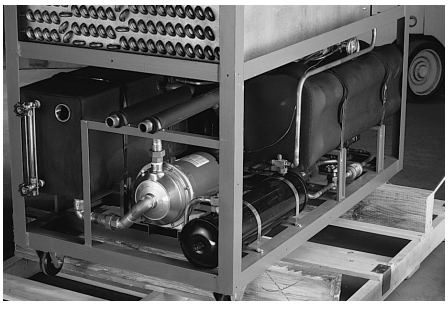
Pure Water/ OEM, *Agua Pura/ OEM*





Pressure Booster System, *Sistema de Aumento de Presión*

Chiller, *Enfriador*



GOULDS PUMPS

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LAS ESPECIFICACIONES ESTÁN SUJETAS A CAMBIO SIN PREVIO AVISO.

BNPE June, 2008

Junio, 2008

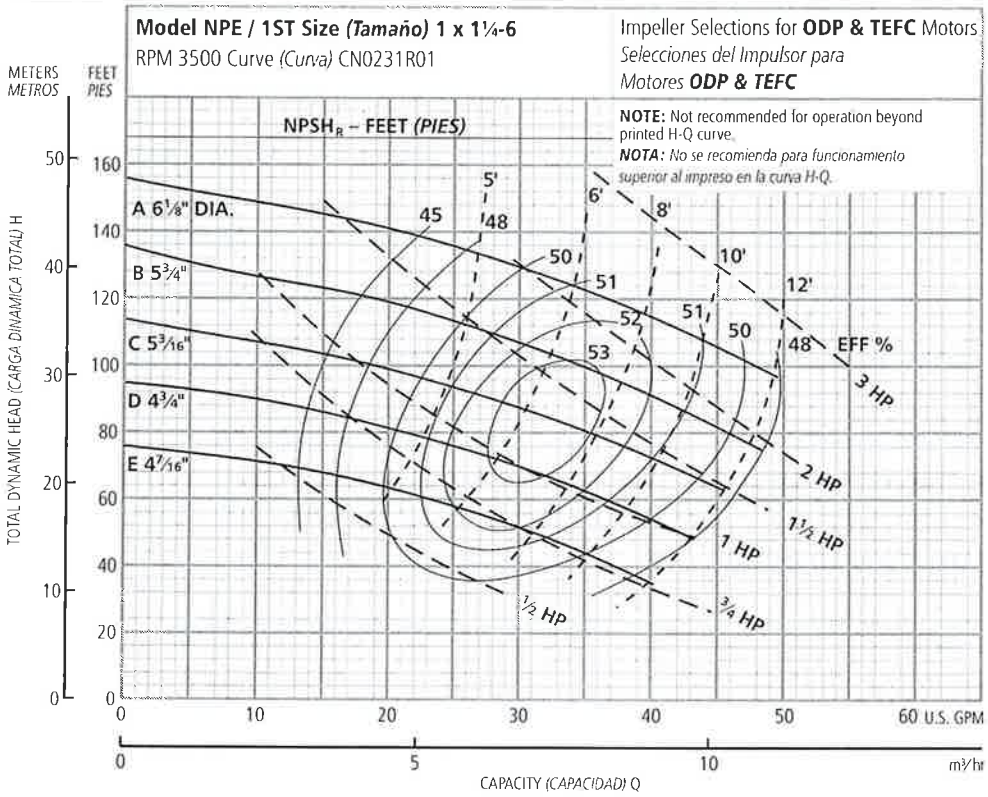
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Engineered for life

R625-EDC-001213-0

Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM

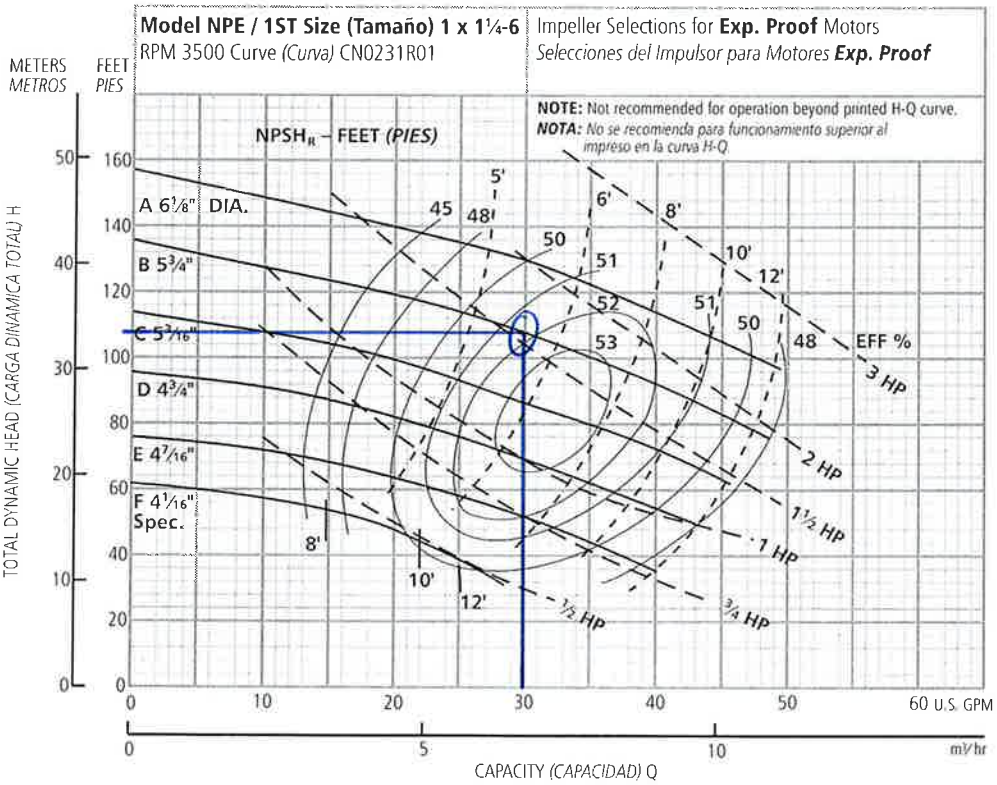
P-150 A/B



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	½	4⁷⁄₁₆"
D	¾	4¾
C	1	5³⁄₁₆
B	1½	5¾
A	2	6⅛

NOTE: Although not recommended, the pump may pass a ¹⁄₁₆" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄₁₆".



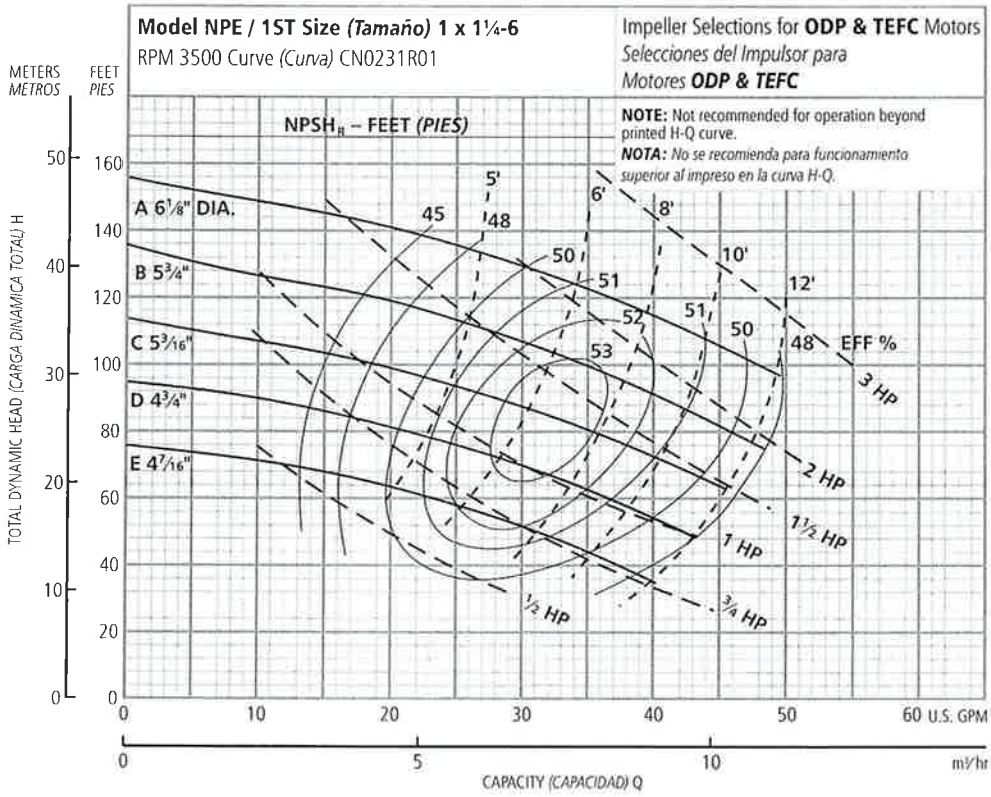
Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	½	4¹⁄₁₆" spec.
E	¾	4⁷⁄₁₆
D	1	4¾
C	1½	5³⁄₁₆
B	2	5¾
A	3	6⅛

NOTE: Although not recommended, the pump may pass a ¹⁄₁₆" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄₁₆".

Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM

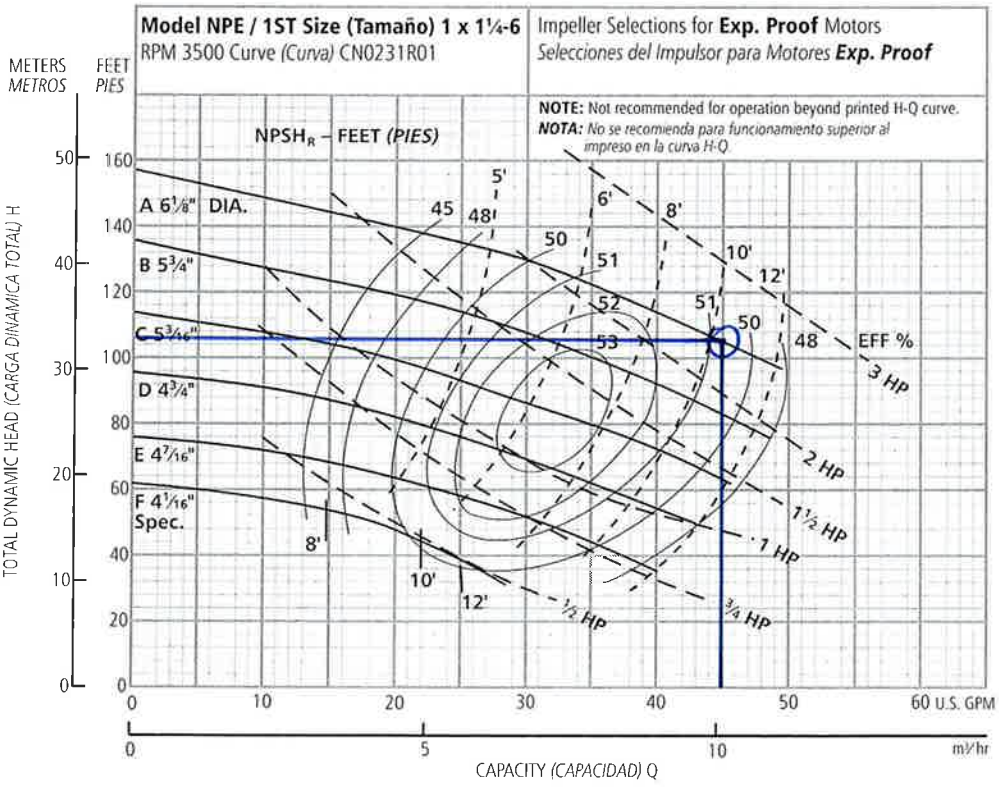
P-620



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	½	4⁷⁄₁₆"
D	¾	4¾
C	1	5³⁄₁₆
B	1½	5¾
A	2	6⅛

NOTE: Although not recommended, the pump may pass a ¹⁄₁₆" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄₁₆".



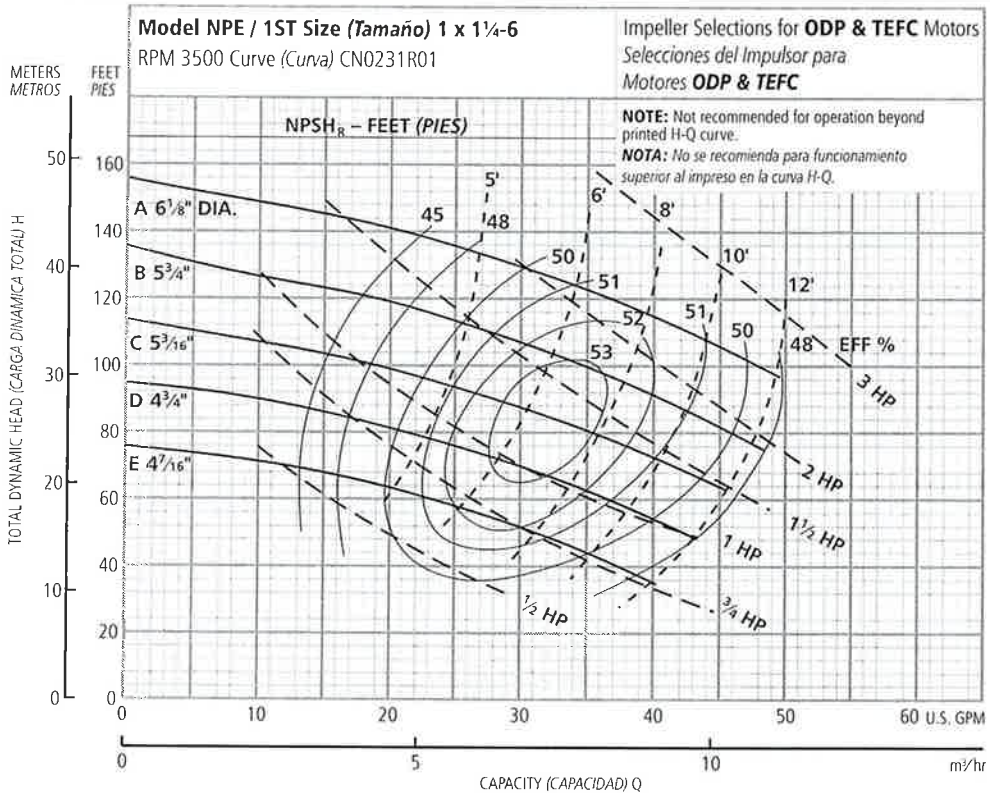
Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	½	4¹⁄₁₆" spec.
E	¾	4⁷⁄₁₆
D	1	4¾
C	1½	5³⁄₁₆
B	2	5¾
A	3	6⅛

NOTE: Although not recommended, the pump may pass a ¹⁄₁₆" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄₁₆".

Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM

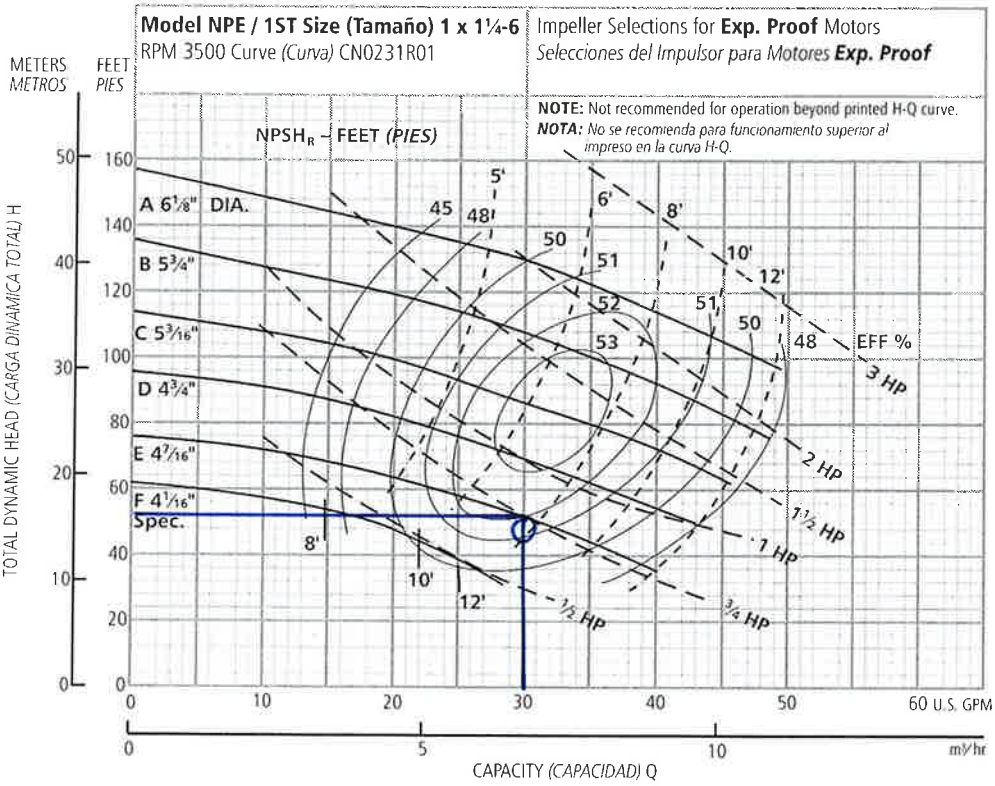
P-800 A/B



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	½	4⁷⁄₁₆"
D	¾	4¾
C	1	5⁵⁄₁₆
B	1½	5¾
A	2	6⅛

NOTE: Although not recommended, the pump may pass a ¹⁄₁₆" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄₁₆".



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	½	4¹⁄₁₆" spec.
E	¾	4⁷⁄₁₆
D	1	4¾
C	1½	5⁵⁄₁₆
B	2	5¾
A	3	6⅛

NOTE: Although not recommended, the pump may pass a ¹⁄₁₆" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄₁₆".

Catalogue and Product Data Sheets

Item	Tag	Description
18	P-200A, P-200B, P-200C	Filter Feed Pumps
20	P-210A, P-210B	Media Filter Backwash Pumps
22	P-230A, P-230B	Ultra-Filter Backwash Pumps
28	P-310A, P-310B, P-310C	AOP Effluent Pumps
30	P-400A, P-400B	GAC Backwash Pumps
33	P-500A, P-500B	Discharge Pumps
37	P-600A, P-600B	Water Softener Feed Pumps
41	P-660	Wetlands Recharge Pump
63	P-1300	Process Water Discharge Pump

ITT

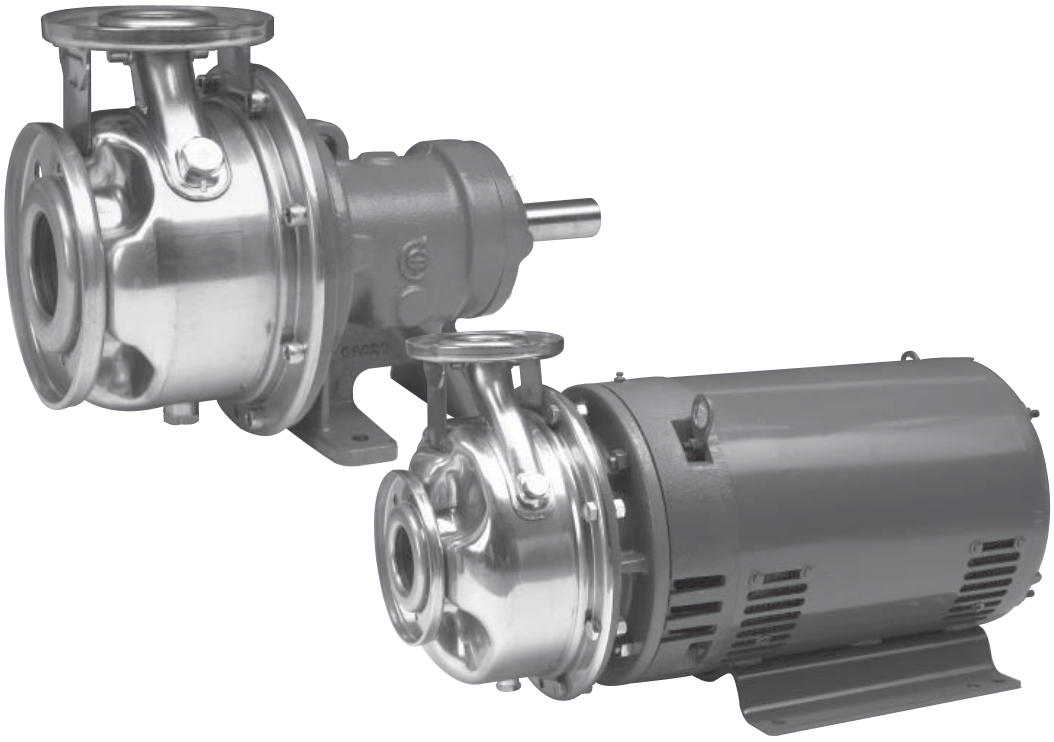
Commercial Water

Goulds Pumps

G&L Series SSH

S & M-Group 316 Stainless Steel End Suction Pumps

Bombas de Succión Final de 316 Acero Inoxidable Grupo-M y S



GOULDS PUMPS

Goulds Pumps is a brand of ITT Residential and Commercial Water.

Goulds Pumps es una marca de fábrica de ITT Agua Residencial y Industrial.

www.goulds.com

Engineered for life

R625-EDC-001213-0

A Full Range of Product Features,
Una Gama Total de Características del Producto

Superior Materials of Construction: AISI Type 316L stainless steel pump parts for reduced corrosion and improved strength and ductility.

Frame Mounted Design: Flexibility of installation and driver arrangements.

Back Pull-Out Design: Simplifies maintenance when used with spacer type coupling.

Cast Iron Power Frame: Rigidly supported, grease lubricated ball bearing assembly.

Mechanical Seal: Standard John Crane Type 21 mechanical seal.

Drive Motors: Standard NEMA design T-frame or JM motors in single or three phase.

Suction and Discharge Flanges: Mate with ANSI class 150 flanges.

Close-Coupled Design: Compact design saves space and simplifies maintenance.

Materiales Superiores de Construcción: *Partes de la bomba de acero inoxidable AISI Tipo 316L para corrosión reducida y fuerza y ductilidad mejoradas.*

Diseño de Armazón Montado: *Flexibilidad de instalación y colocación del motor.*

Diseño de Extracción Trasera: *Simplifica el mantenimiento cuando se usa con el acople tipo espaciador.*

Armazón del Motor de Hierro Fundido: *Rígidamente soportado, con ensamblaje de balineras de bolas lubricadas con grasa .*

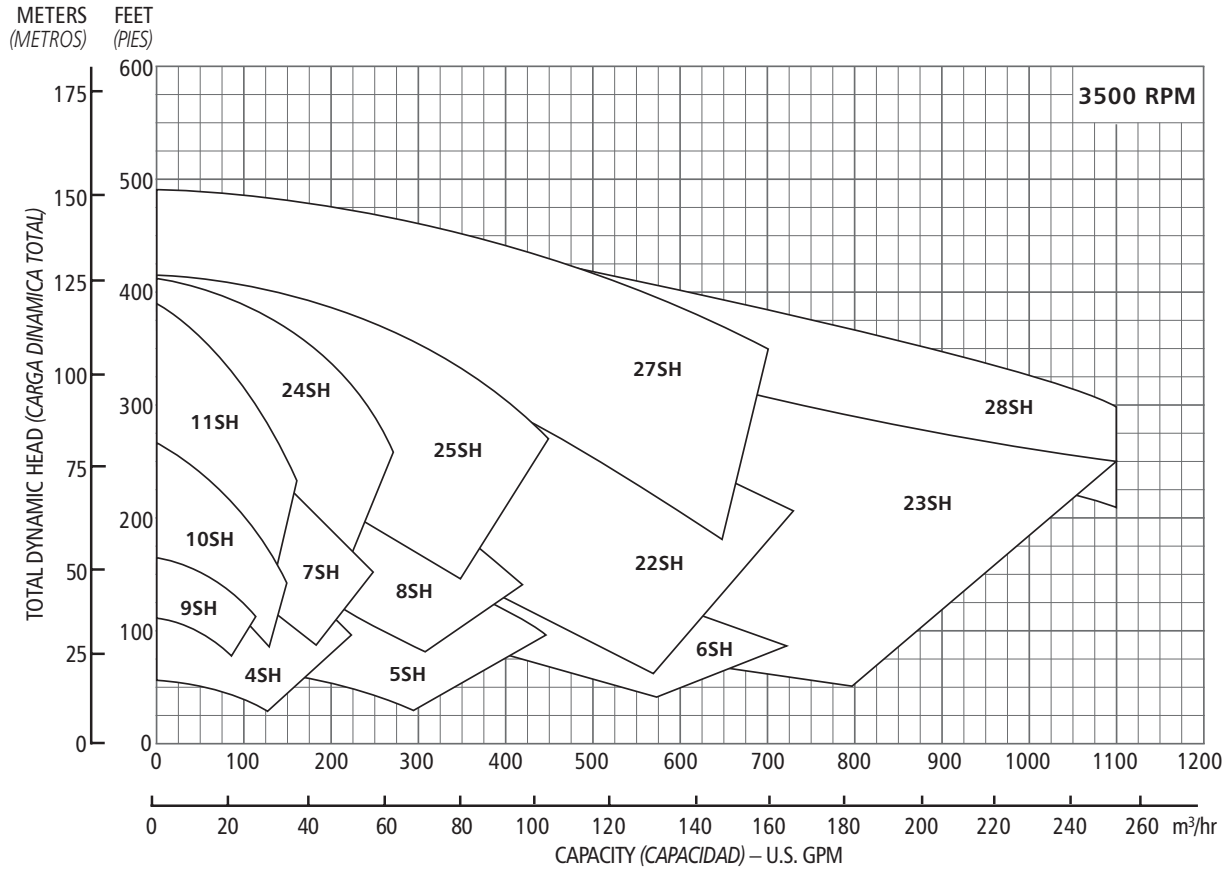
Sello Mecánico: *Sello mecánico estándar John Crane Tipo 21.*

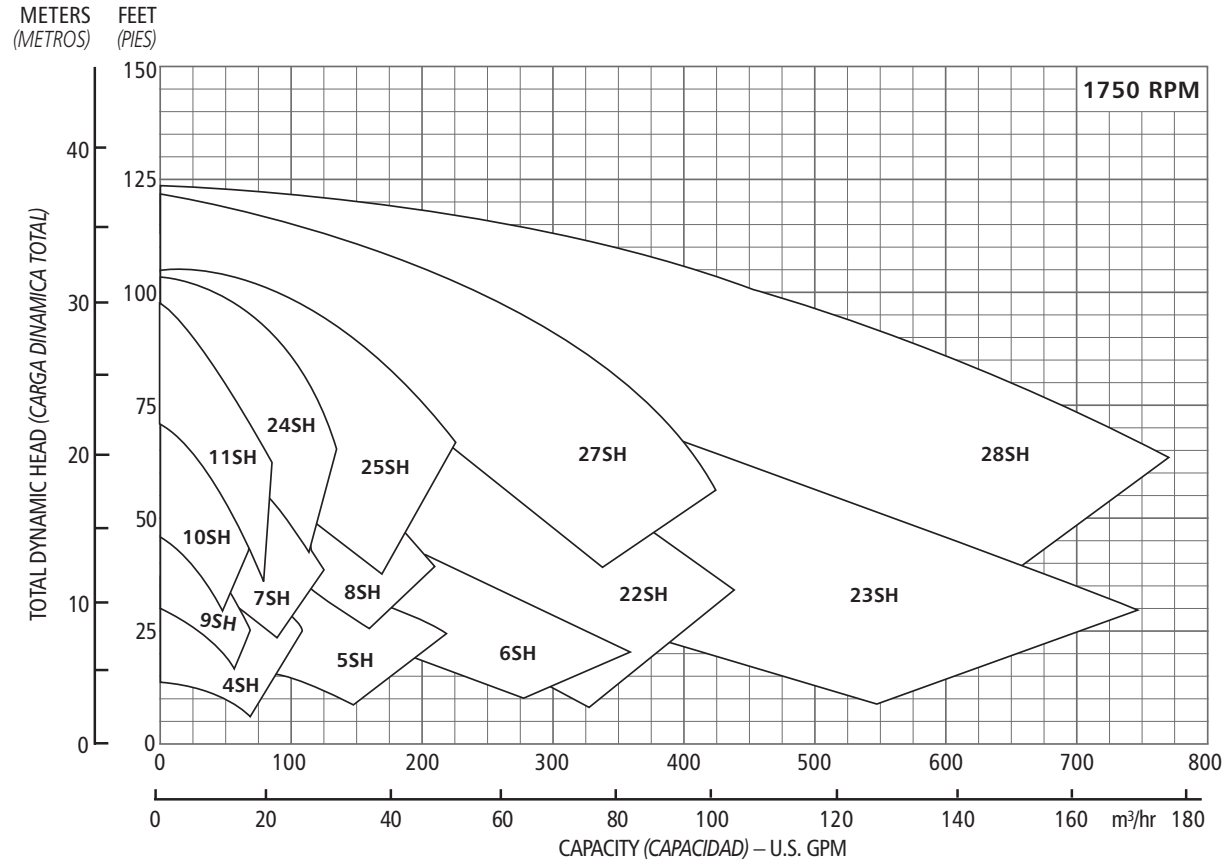
Motores de Accionamiento: *Motores de armazón-T NEMA estándar unifásicos o trifásicos.*

Bridas de Succión y Descarga: *Acoplan con bridas ANSI clase 150.*

Diseño de Acople Cerrado: *El diseño compacto ahorra espacio y simplifica el mantenimiento.*

Performance Coverage, 3500 and 1750 RPM
Alcance de Funcionamiento, 3500 y 1750 RPM





SSH S/M-Group Numbering System
Sistema de Numeración del Grupo-S/M SSH

Example Product Code, *Ejemplo Código del Producto*

24 SH 1 Q 1 2 A 0

Mechanical Seals and O-Ring

0 = Pre-engineered standard

For optional mechanical seal modify catalog order no. with seal code listed below.

Sello Mecánico y Anillo '0'

0 = Estándar aprobado

Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal, *Sello Mecánico John Crane Tipo 21*						
Seal Code, *Código del Sello*	**Rotary, *Rotativo***	**Stationary, *Estacionario***	**Elastomers, *Elastómeros***	**Metal Parts, *Partes Metálicas***	**Part No., *Pieza Número***	
					180-210 Frames, *Armazones*	**250-360 Frames, *Armazones***
0	Carbon	Sil-Carb	Viton	316 SS, *316 Acero inoxidable*	10K27	10K45
2			EPR		10K19	10K20
5	Sil-Carb	Sil-Carb	Viton		10K64	10K65

Impeller Option Code

For optional impeller diameters modify catalog order no. with impeller code listed below.

Select optional impeller diameter from pump performance curve.

Código del Impulsor Opcional

Para diámetros del impulsor opcional modificar el número de orden del catálogo con el código del impulsor anotado abajo.

Seleccionar el diámetro del impulsor opcional de la curva de funcionamiento de la bomba.

Impeller Code, *Código del impulsor*	**Pump Size, *Tamaño de la Bomba***													
	9SH 1 x 2-6 Dia.	**10SH 1 x 2-8 Dia.**	**11SH 1 x 2-10 Dia.**	**4SH 1½ x 2½-6 Dia.**	**7SH 1½ x 2½-8 Dia.**	**5SH 2 x 2½-6 Dia.**	**8SH 2 x 2½-8 Dia.**	**6SH 2½ x 3-6 Dia.**	**22SH 2½ x 3 – 8 Dia.**	**23SH 3 x 4 – 8 Dia.**	**24SH 1½ x 2½ – 10 Dia.**	**25SH 2 x 2½ – 10 Dia.**	**27SH 2½ x 3 – 10 Dia.**	**28SH 3 x 4 – 10 Dia.**
A	6 5/8	8 27/64	10 3/32	6 3/4	8 1/4	6 7/8	8 1/4	7 5/16	9 1/16	9 1/16	9 7/8	9 7/8	10 3/8	10 5/8
B	6 7/16	8 1/16	9 17/32	6 3/8	7 13/16	6 7/16	7 3/4	7 1/8	8 3/4	8 11/16	9 1/2	9 1/2	9 15/16	10 1/4
C	5 11/16	7 11/16	9 1/8	6 1/16	7	5 13/16	7 1/2	6 15/16	8 1/2	8 7/16	9 3/16	9 1/8	9 9/16	9 13/16
D	5 3/8	7 3/8	8 3/4	5 5/8	6 3/4	5 1/2	7 3/16	6 11/16	8 1/4	8 1/16	8 7/8	8 13/16	9 1/4	9 7/16
E		7 1/8		5 5/16	6 7/16	5 1/8	6 7/8	6 3/8	7 7/8	7 11/16	8 9/16	8 3/16	8 3/4	9 1/16
F				4 11/16	6 1/8	4 13/16	6 3/16	6 1/16	7 1/2	7 1/2	8 1/4	7 15/16		8 11/16
G				4 3/8		4 7/16		5 5/8	7 1/8	7 1/8		7 11/16		
H				4 3/16		4 1/4			6 11/16	6 7/8				
J				3 7/8					6 1/2	6 1/2				
K										6				
L										5 1/2				

Motor Enclosure, *Caja del motor*

1 = ODP
2 = TEFC
3 = Explosion Proof, *Prueba de explosiones*
4 = ODP Premium Eff., *Eficiencia superior*
5 = TEFC Premium Eff., *Eficiencia superior*
6 = XP Premium Eff., *Eficiencia superior*
7 = Wash down, *Lavado*

Motor Voltage, *Voltaje del motor*

1 = 115/208-230
2 = 115/230
3 = 230
4 = 230/460
5 = 208-230/460
6 = 460
7 = 575

HP Rating, *Potencia nominal, HP*

C = ½ F = 1.5 J = 5 M = 15 Q = 30 T = 60
D = .75 G = 2 K = 7.5 N = 20 R = 40 U = 75
E = 1 H = 3 L = 10 P = 25 S = 50 V = 100

Driver: Hertz/Pole/RPM, *Fuerza motriz: Hertz/Polos/RPM*

1 = 60/3500/1
2 = 60/3500/3
3 = 60/1750/1
4 = 60/1750/3
5 = 50/2900/1
6 = 50/2900/3

Material

SH = 316L Stainless steel, Acero inoxidable

Pump Size, *Tamaño de la Bomba*

9 = 1 x 2 – 6
10 = 1 x 2 – 8
11 = 1 x 2 – 10
23 = 3 x 4 – 8
27 = 2½ x 3 – 10
4 = 1½ x 2½ – 6
7 = 1½ x 2½ – 8
5 = 2 x 2½ – 6
24 = 1½ x 2½ – 10
28 = 3 x 4 – 10
8 = 2 x 2½ – 8
6 = 2½ x 3 – 6
22 = 2½ x 3 – 8
25 = 2 x 2½ – 10

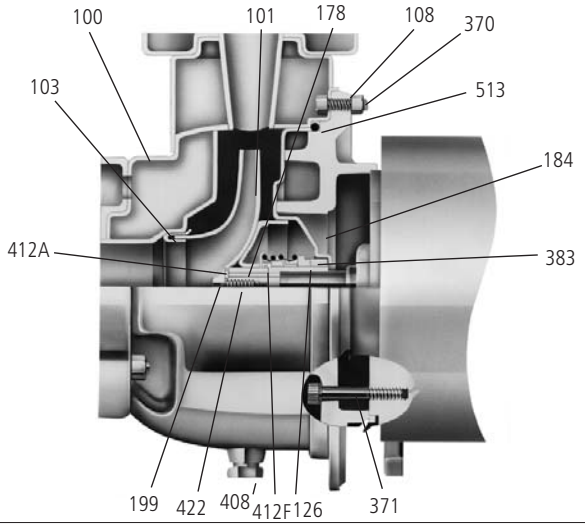
Frame Options, *Opciones de mando*

Substitute, *Substituto*	**Description, *Descripción***
FRM2	7/8" Imp. Bore, *Diámetro interior del impulsor 7/8"*
FRM3	1 1/4" Imp. Bore, *Diámetro interior del impulsor 1 1/4"*

NOTE: Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

NOTA: *No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.*

SSH Close Coupled – Materials of Construction
SSH Acople Cerrado – Materiales de Construcción

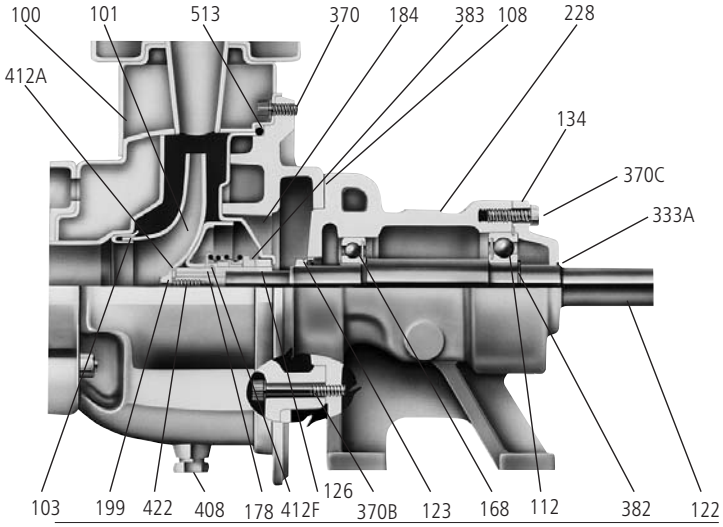


Item No., Description, *Parte No. Descripción*		Materials, *Materiales*
100	Casing, *Carcasa*	316L SS, *316L acero inox.*
101	Impeller, *Impulsor*	
103	Wear ring, *Anillo de desgaste*	
184	Seal housing, *Alojamiento del sello*	
126	Shaft sleeve, *Camisa del eje*	316 SS, *316 acero inox.*
422	Impeller stud, *Perno del impulsor*	Steel, *Acero*
178	Impeller key, *Llave del impulsor*	Carbon steel, *Acero al carbono*
199	Impeller washer, *Arandela del impulsor*	316 SS, *316 acero inox.*
370	Casing bolt with nut (casing to adapter), *Tornillo de la carcasa con tuerca (carcasa para adaptador)*	316L SS, *316L acero inoxidable*
108	Adapter, *Adaptador*	Cast iron ASTM A48 CL20, *Hierro fundido ASTM A48CL20*
371	Hex head cap screw (adapter to motor), *Tornillo de cabeza hexagonal (adaptador para motor)*	Steel SAE 1200 series, *Acero SAE series 1200*
412A	O-ring, Impeller, *Anillo en O, impulsor*	Viton
412F	O-ring, shaft sleeve, *Anillo en O, camisa del eje*	
513	O-ring, *Anillo 'O'*	
408	Drain plug – 3/8 NPT, *Válvula de drenaje – 3/8 NPT*	316L SS, *316 acero inoxidable*
383	Mechanical seal, *Sello mecánico*	See seal chart, *Ver tabla del sello*

Mechanical Seal, *Sello Mecánico*

John Crane Type 21 Mechanical Seal, *Sello Mecánico John Crane Tipo 21*							
Item, *Parte*	Part No., *Pieza Número*		Rotary, *Rotativo*	Stationary, *Estacionario*	Elastomers, *Elastómeros*	Metal Parts, *Partes Metálicas*	Intended Duty, *Servicio Propuesto*
	180-210 *Frames, Armazones*	250-360 *Frames, Armazones*					
383 Options, *383 Opciones*	10K19	10K20	Carbon, *Carbone*	Silicon Carbide, *Carburo de silicona*	EPR	316 SS, *316 Acero inoxidable*	Hot Water, *Agua Caliente*
	10K27	10K45			Viton		Mild Abrasive, *Abrasivo Suave*
	10K64	10K65	Sil-Carb.				Severe Duty, *Deber Severo*

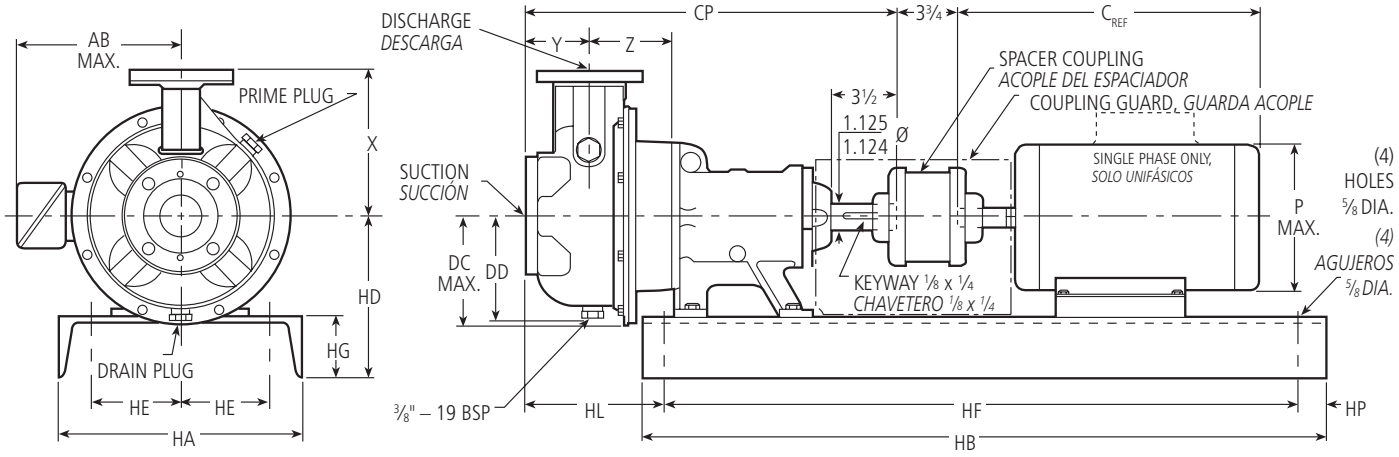
SSH Frame Mounted – Materials of Construction
SSH Armazón Montado – Materiales de Construcción



Item No., Description, *Parte No. Descripción*		Materials, *Materiales*
100	Casing, *Carcasa*	316L SS, *316L acero inox.*
101	Impeller, *Impulsor*	
103	Wear ring, *Anillo de desgaste*	
184	Seal housing, *Alojamiento del sello*	
126	Shaft sleeve, *Camisa del eje*	316 SS, *316 acero inox.*
178	Impeller key, *Llave del impulsor*	Carbon steel, *Acero al carbono*
422	Impeller Stud, *Perno del impulsor*	
199	Impeller washer, *Arandela del impulsor*	316 SS, *316 acero inox.*
370	Casing bolt with nut, *Tornillo de la carcasa con tuerca*	316L SS, *316L acero inox.*
408	Drain plug – 3/8 NPT, *Válvula de drenaje – 3/8 NPT*	
513	O-ring, *Anillo 'O'*	Viton
383	Mechanical seal, *Sello mecánico*	See seal chart, *Ver tabla del sello*
108	Adapter, *Adaptador*	Cast iron ASTM A48CL20, *Hierro fundido ASTM A48CL20*
228	Bearing frame, *Armazón de balineras*	
134	Bearing cover, *Cubierta de balineras*	
122	Pump shaft, *Eje de la bomba*	Carbon steel, *Acero al carbono*
168	Ball bearing (inboard), *Balineras de bolas (interior)*	Steel, *Acero*
112	Ball bearing (outboard), *Balineras de bolas (exterior)*	
382	Retaining ring, *Anillo de sujeción*	
370B	Hex head cap screw (adapter to bearing frame), *Tornillo de cabeza hexagonal (adaptador para armazón de balineras)*	
370C	Hex head cap screw (bearing frame to cover), *Tornillo de cabeza hexagonal (armazón de balineras para cubierta)*	
333A	Lip seal, *Sello cubierto*	BUNA-N
193	*Grease fitting, *Accesorio de grasa*	Steel, *Acero*
123	V-ring deflector, *Deflector anillo 'V'*	BUNA-N

* M-Group only

Channel Steel Bedplate, Clockwise Rotation Viewed from Drive End;
Fundación de Acero, Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



Dimensions and Weights – Determined by Pump,
Dimensiones y Pesos – Determinados por la Bomba

Pump, *Bomba*		Suction*, *Sución**	Discharge*, *Descarga**	CP	DC Max., *DC Máx.*	DD	X	Y	Z	Wt. (lbs.), *Peso (lib.)*	Dimension "HL" Determined by Pump and Bedplate, *Dimensión "HL" determinada la bomba y el motor*				
											Motor Frame Size, *Tamaño del bastidor del motor*				
											143/145	183/184	213/215	254/256	284/286
9SH	1 X 2–6	2	1	16¾	5	4¾	6⅜	3⅛	3⅞	56	9⅛		7⅝	3⅞	
10SH	1 X 2–8				5⅝	5⅜	7⅛			64					
11SH	1 X 2–10			17⁹⁄₁₆	6⅞	6⅝	8⅞	4		86	10		8½	4¾	
4SH	1½ X 2½–6	2½	1½	16⁹⁄₁₆	5	4¾	6⅜	3¼	3⅝	57	9¼		7¾	4	
7SH	1½ X 2½–8			17⁵⁄₁₆	5⅝	5⅜	7⅛	4		66	10		8½	4¾	
5SH	2 X 2½–6		2		5	4¾				57					
8SH	2 X 2½–8				6	5¾	7¹⁵⁄₁₆			68					
6SH	2½ X 3–6	3	2½							59					

* For use with ANSI Class 150 mating flanges.
** Para usar con bridas que casan ANSI clase 150.*

NOTES:
1. All pumps shipped in vertical discharge position. May be rotated in 90° increments. Tighten ⅜ – 16 casing bolts to 12 ft./lbs. torque.
2. Dimensions in inches.
3. Motor dimensions may vary with motor manufacturer.
4. Not to be used for construction purposes.

NOTAS:
1. *Todas las bombas transportadas en posición de descarga vertical. Pueden rotarse en aumentos de 90º. Apretar ⅜ – 16 tornillos de carcasa a 12 pies/libras potencia.*
2. *Las dimensiones en pulgadas.*
3. *Las dimensiones puede que varíen con los fabricantes..*
4. *No para propósitos de construcción.*

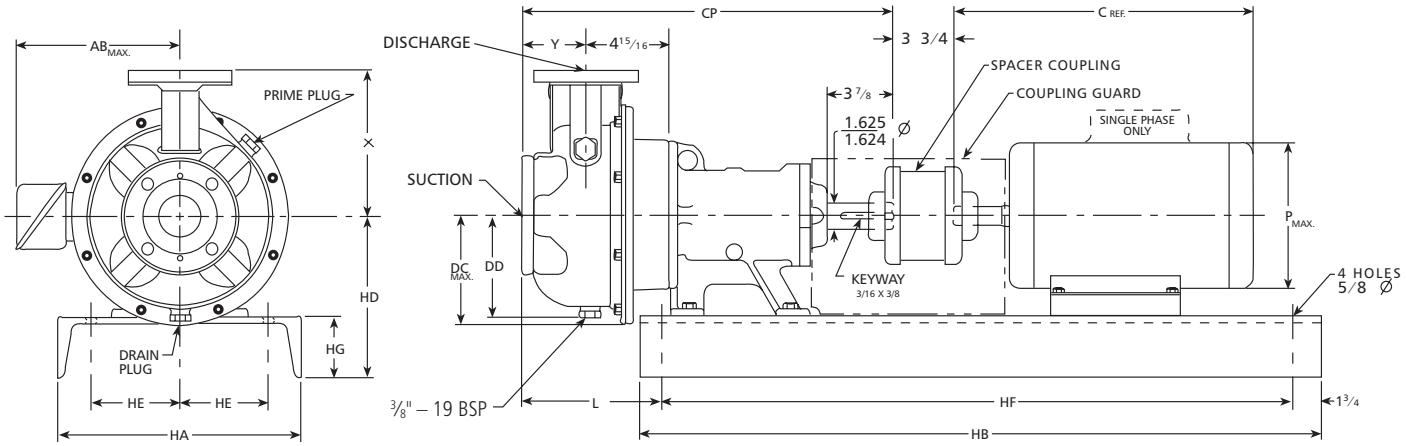
Available Motor and Bedplate Dimensions and Weights,
Pesos y Dimensiones Disponibles de la Fundación y del Motor

Motor Frame, *Armazón del Motor*	HP @ 3500 RPM, *HP a 3500 RPM*				HP @ 1750 RPM, *HP a 1750 RPM*				AB Max., *AB Máx.*	C_{REF}	P Max., *P Máx.*	Wt. Max., *Peso Máx.*	Bedplate Data, *Datos de la Fundación*								
	Single Phase, *Monofásicos*		Three Phase, *Trifásicos*		Single Phase, *Monofásicos*		Three Phase, *Trifásicos*						HA	HB	HD**	HE	HF	HG	HP*	Wt. (lbs.), *Peso (libras)*	Motor Shim	Bearing Frame Shim
	ODP	TEFC	ODP	TEFC	ODP	TEFC	ODP	TEFC														
143T					1	1	1	1	5¼	13⅜	6⅝	45	10	28	8	3¾	24	2¾	¾	48	1¾	—
145T	2	2	2 – 3	2	1½	1½	1½ – 2	1½ – 2		14¼		53										
182T	3	3	5	3	2	2	3	3	5⅞	16⅝	7⅞	74									¾	
184T	5	5	7½	5	3 or 5	3	5	3		18⅛		95										
213T			10	7½					7⅜	18	9⅝	116	12	31	8¼	4¼	29	3	1	65	—	—
215T			15	10						19⅛		136										
254T			20	15					10⅛	21⅝	13	266	13	42	10¼	5¼	38½	4	1¾	110	—	1
256T			25	20						23⅜		264										
284TS			30	25					12⅝	24⅞	15	392	15	44	10½	5¾	40½	3½		124	–	1¾
286TS			40	30						26⅝		432										

Dimensions and weights vary with manufacturers. Dimensions in inches and weights in lbs.
* "HP" Dimensions at motor end only.
** "HD" Dimension for 254T/256T motor frame on 1 x 2-10 only is 11"; A ¾" motor shim and a 1¾" bearing frame shim are required.

Dimensiones y pesos varían con los fabricantes. Dimensiones en pulgadas y pesos en libras.
** Dimensiones "HP" sólo en el extremo del motor.*
*** La dimensión "HD" para el bastidor del motor 254T/256T de 1 x 2 - 10 es sólo 11"; se requieren una cuña del motor de ¾" y una cuña del bastidor de apoyo de 1¾".*

Channel Steel Bedplate, Clockwise Rotation Viewed from Drive End;
Fundación de Acero, Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



Dimensions and Weights – Determined by Pump,
Dimensiones y Pesos – Determinados por la Bomba

Pump	Pump Size, *Tamaño de la Bomba*	Suction*, *Succión**	Discharge*, *Descarga**	CP	DC Max., *DC Máx.*	DD	L	X	Y	Wt. (lbs.), *Peso (libras)*
24SH	1½ x 2½-10	2½	1½	23	6⅞	6⅝	10⅛	8 15/16	4	125
25SH	2 x 2½-10		2							125
22SH	2½ x 3-8	3	2½		6⅛	5⅞				125
27SH	2½ x 3-10				6⅞	6⅝		9 15/16		134
23SH	3 x 4-8	4	3	24			11⅛		5	136
28SH	3 x 4-10				7⅝	7⅜		11⅛		148

* For use with ANSI class 150 mating flanges.
** Para usar con bridas que casan ANSI clase 150.*

NOTE:
1. Pumps will be shipped with top vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position and tighten ⅜ – 16 bolts to 12 ft./lbs.
2. ALL dimensions in inches.
3. Not for construction purposes.

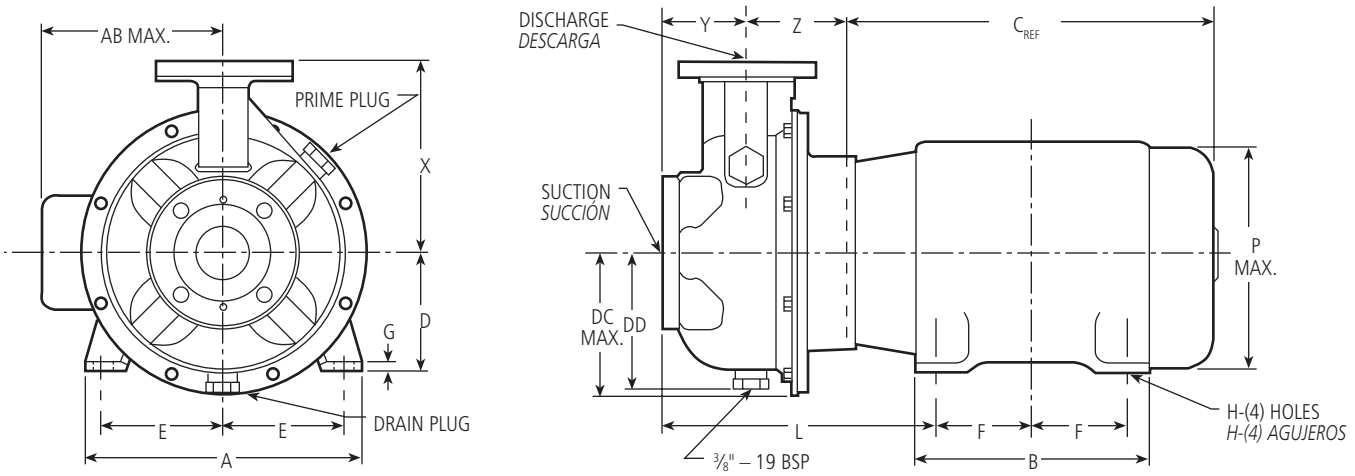
NOTA:
1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar ⅜ – 16 tornillos a 12 pies/libras.*
2. *TODAS las dimensiones en pulgadas.*
3. *No para propósitos de construcción.*

Available Motor and Bedplate Dimensions and Weights,
Pesos y Dimensiones Disponibles de la Fundación y del Motor

Motor Frame, *Armazón del Motor*	HP @ 3500 RPM		HP @ 1750 RPM – T-Frame Only				AB Max., *AB Máx.*	C Ref.	P Max., *P Máx.*	Wt. Max., *Peso Máx.*	Bedplate Data, *Datos de la Fundación*						
	Three Phase, *Trifásicos*		Single Phase, *Monofásicos*		Three Phase, *Trifásicos*						HA	HB	HD	HE	HF	HG	Wt. (lbs.), *Peso (libras)*
	ODP	TEFC	ODP	TEFC	ODP	TEFC											
184T			3 or 5	3	5	5	5⅞	18⅛	7⅞	95	13	42	10¼	5¼	38½	4	111
213T					7½	7½	7⅜	18	9⅝	116							
215T	15				10	10		19⅛		136							
254T	20	15			15	15	9½	21⅝	13	266							
256T	25	20			20	20		23⅜		264							
284TS/T	30	25			25	25	12⅝	24⅞	15	392	15	44	10½	5¾	40½	3½	124
286TS/T	40	30						26⅝		422							
324TS/T	50	40					14⅛	28¾	17⅜	592	18	48	12	7¼	44½	4	183
326TS/T	60	50						30¼		634							
364TS/T	75	60					15⅛	31⅝	18⅞	834			13				
365TS/T	100	75						32⅝		1000							
405TS/T		100					18	36⅞	20⅝	1060	22	56	14	7¼	52½	4	214

Dimensions and weights vary with manufacturers. Dimensions in inches and weights in lbs.
Dimensiones y pesos varían con los fabricantes. Dimensiones en pulgadas y pesos en libras.

(All dimensions in inches and weights in lbs. Do not use for construction purposes.)
(Todas las dimensiones en pulgadas y pesos en libras. No usar para propósitos de construcción.)



Pump, *Bomba*		150 lb. Flange, *Brida de 150 lib.*		DC Max., *DC Máx.*	DD	X	Y	Z	DIM. "L" (Motor Frame Size) *DIM. "L" (Tamaño del Armazón del Motor)*				Wt. (lbs.), *Pesos (libras)*
		Suct.*, *Succ.**	Disch.*, *Desc.**						143/145	182/184	213/215	254/256	
9SH	1 x 2 – 6	2	1	5	4¾	6⅜	3⅛	3⅞	9⅜	10½	11½	—	24
10SH	1 x 2 – 8			5⅞	5⅜	7⅛							32
11SH	1 x 2 – 10			6⅞	6⅝	8⅞	4		10¾	11⅜	12⅜	12⅝	54
4SH	1½ x 2½ – 6	2½	1½	5	4¾	6⅜	3¼	3⅝	9¾	10⅜	11⅜	—	25
7SH	1½ x 2½ – 8			5⅞	5⅜	7⅛	4		10½	11⅛	12⅛	12⅜	34
5SH	2 x 2½ – 6		2	5	4¾	7⅛							25
8SH	2 x 2½ – 8			6	5¾	7 15/16							36
6SH	2½ x 3 – 6	3	2½		4¾								27

* For use with ANSI class 150 mating flanges.
** Para usar con bridas que casan ANSI clase 150.*

NOTE:
1. Pumps shipped in vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, and tighten ⅜ – 16 bolts to 12 ft./lbs., 7/16 – 14 bolts to 20 ft./lbs.
2. ALL dimensions in inches.
3. Motor dimensions may vary with motor manufacturer.
4. Not for construction purposes.

NOTA:
1. *Las bombas se transportarán en descarga vertical como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar ⅜ – 16 tornillos a 12 pies/libras, 7/16 – 14 tornillos a 20 pies/libras.*
2. *TODAS las dimensiones en pulgadas.*
3. *Las dimensiones puede que varíen con los fabricantes.*
4. *No para propósitos de construcción.*

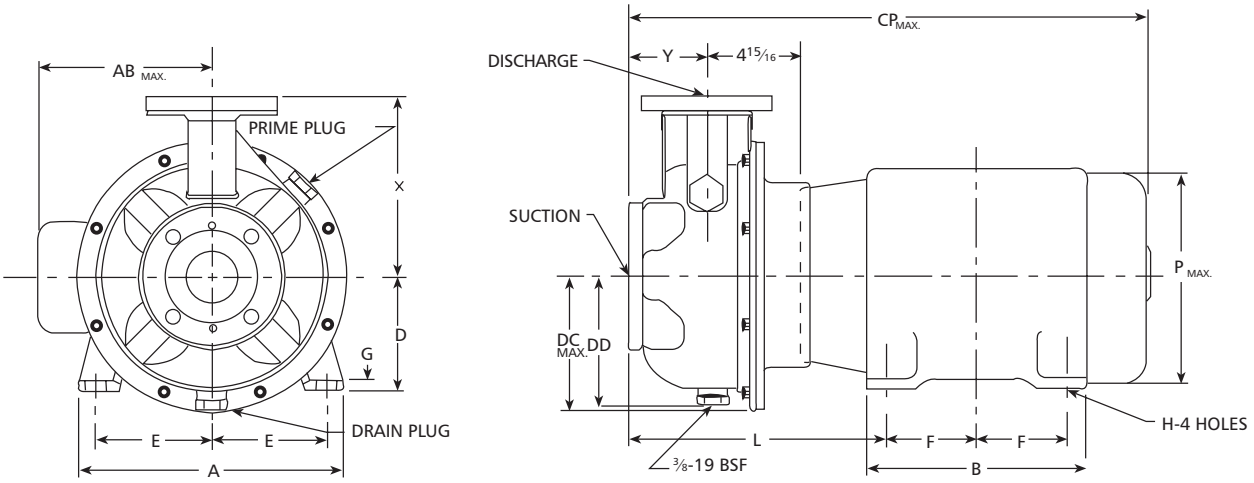
Dimensions Determined by JM Motor Frame, *Dimensiones Determinadas por el Armazón del Motor JM*

JM Frame, *JM Armazón*	A	AB	B	D	E	F	G	C_{REF}	H Dia., *H Diám.*	P Max., *P Máx.*	Motor Wt. (lbs.) *Peso Motor (lib.)*
143JM	6½	5¼	6	3½	2¾	2	⅛	11¼	11/32	6⅝	41
145JM						2½					57
182JM	8½	6⅞	6½	4½	3¾	2¼	3/16	13½	13/32	7⅞	77
184JM						2¾					97
213JM	9½	7⅜	8	5¼	4¼	2¾	7/32	15½		9⅝	122
215JM						3½					155
254TCZ	11¼	9	9½	6¼	5	4⅛	¼	18⅝	17/32	11½	265
256TCZ			11¾			5					320

Motor Frame Selections, *Selecciones del Armazón del Motor*

Motor Frame, *Armazón del Motor*	Motor Horsepower, *Potencia del Motor*							
	3500 RPM, *3500 RPM*				1750 RPM, *1750 RPM*			
	1Ø, *Monofásicos*		3Ø, *Trifásicos*		1Ø, *Monofásicos*		3Ø, *Trifásicos*	
	ODP	TEFC	ODP	TEFC	ODP	TEFC	ODP	TEFC
143JM	–	–	–	–	–	–	1	1
145JM	2	2	2-3	2	1-1½	1-1½	1½-2	1½-2
182JM	3	3	5	3	2	2-3	3	3
184JM	5	5	7½	5	3	–	5	5
213JM	7½	–	10	7½	5	–	7½	7½
215JM	10	–	15	10-15	–	–	–	–
254TCZ	–	–	20	–	–	–	–	–
256TCZ	–	–	25	20	–	–	–	–

(All dimensions in inches and weights in lbs. Do not use for construction purposes.) *(Todas las dimensiones en pulgadas y pesos en libras. No usar para propósitos de construcción.)*



Dimensions "L" Determined by Pump and Motor, *Dimensiones "L" Determinadas por la Bomba y el Motor*																
Pump	**Pump Size,** ***Tamaño de la Bomba***	**Suction*,** ***Succión****	**Discharge*,** ***Descarga****	**CP Max.,** ***CP Máx.***	**DC Max.,** ***DC Máx.***	**DD**	**X**	**Y**	**Wt. (lbs.),** ***Peso (libras)***	**Motor Frame Size,** ***Tamaño del Armazón del Motor***						
										140	**180**	**210**	**250**	**280**	**320**	**360**
24SH	1½ x 2 ½-10	2½	1½	34½	6⅞	6⅝	8 15/16	4	75	10½	11⅛	12⅛	13⅞		14⅜	—
25SH	2 x 2½-10		2	36					75							15
22SH	2½ x 3-8	3	2½		6⅛	5⅞			72	—						
27SH	2½ x 3-10				6⅞	6⅝	9 15/16		84	—	—					
23SH	3 x 4-8	4	3	37				5	86	11½	12⅛	13⅜	14⅞		15⅜	16
28SH	3 x 4-10				7⅝	7⅜	11⅛		98	—	—					

* For use with ANSI class 150 mating flanges.
** Para usar con bridas que casan ANSI clase 150.*

NOTES:
1. Pumps shipped in vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, and tighten ⅜ – 16 bolts to 12 ft./lbs., 7/16 – 14 bolts to 20 ft./lbs., ½ – 13 bolts to 35 ft./lbs.
2. Motor dimensions may vary with motor manufacturer.
3. Not for construction purposes.

NOTAS:
1. *Las bombas se transportarán en descarga vertical como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar ⅜ – 16 tornillos a 12 pies/libras, 7/16 – 14 tornillos a 20 pies/libras, ½ – 13 tornillos a 35 pies/libras.*
2. *TODAS las dimensiones en pulgadas.*
3. *No para propósitos de construcción.*

Dimensions Determined by JM Motor Frame, *Dimensiones Determinadas por el Armazón del Motor JM*

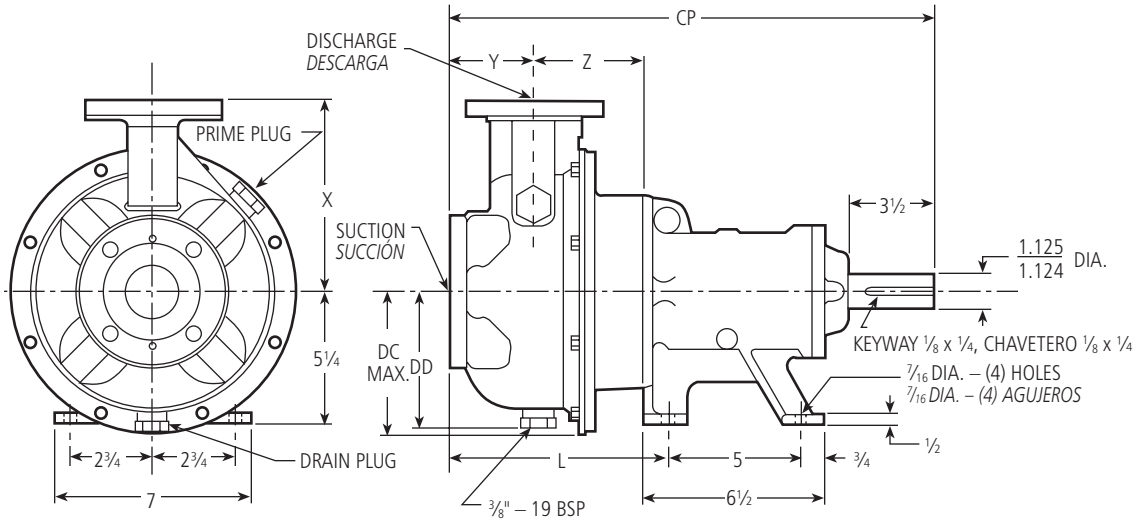
Frame, ***Armazón***	**A**	**AB Max.**	**B**	**D**	**E**	**F**	**G**	**H**	**P Max.,** ***P Máx.***
145JM	6½	5¼	6	3½	2¾	2½	⅛	11/32	7 3/16
182JM	8½	5⅞	6½	4½	3¾	2¼	3/16	13/32	8½
184JM						2¾			
213JM	9½	7⅜	8	5¼	4¼		7/32		10 3/16
215JM						3½			
254JM	11¼	9	11¾	6¼	5	4⅛	1/4	17/32	13¼
256JM						5			
284JM	12¼	12¼	12¼	7	5½	4¾			15
286JM						5½			
324JM	14	13¼	14	8	6¼	5¼	5/16	21/32	16 15/16
326JM						6			
364TCZ	17¾	15⅛	15½	9	7	5⅝	1		19
365TCZ						6⅛			

364TCZ and 365TCZ frames are built with 326JM shaft extensions.
Dimensions may vary with manufacturer.
Los armazones 364TCZ y 365TCZ se construyen con extensiones del eje 326JM.
Las dimensiones puede que varíen con los fabricantes.

Motor Frame Selections, *Selecciones del Armazón del Motor*

Frame, ***Armazón***	**Motor Horsepower,** ***Potencia del Motor***						**Wt. Max.,** ***Peso Máx.***
	3500 RPM		**1750 RPM**				
	3 PH, ***Trifásicos***		**1 PH,** ***Monofásicos***		**3 PH,** ***Trifásicos***		
	ODP	**TEFC**	**ODP**	**TEFC**	**ODP**	**TEFC**	
145JM	–	–	–	–	2	2	57
182JM	–	–	2	2, 3	3	3	77
184JM	–	–	3	–	5	5	97
213JM	10	–	5	–	7½	7½	141
215JM	15	10	–	–	10	10	155
254JM	20	15	–	–	15	15	265
256JM	25	20	–	–	20	20	320
284JM	30	25	–	–	25	25	419
286JM	40	30	–	–	–	–	422
324JM	50	40	–	–	–	–	562
326JM	60	50	–	–	–	–	625
364TCZ	75	60	–	–	–	–	775
365TCZ	100	75, 100	–	–	–	–	905

364TCZ and 365TCZ frames are built with 326JM shaft extensions.
Los armazones 364TCZ y 365TCZ se construyen con extensiones del eje 326JM.



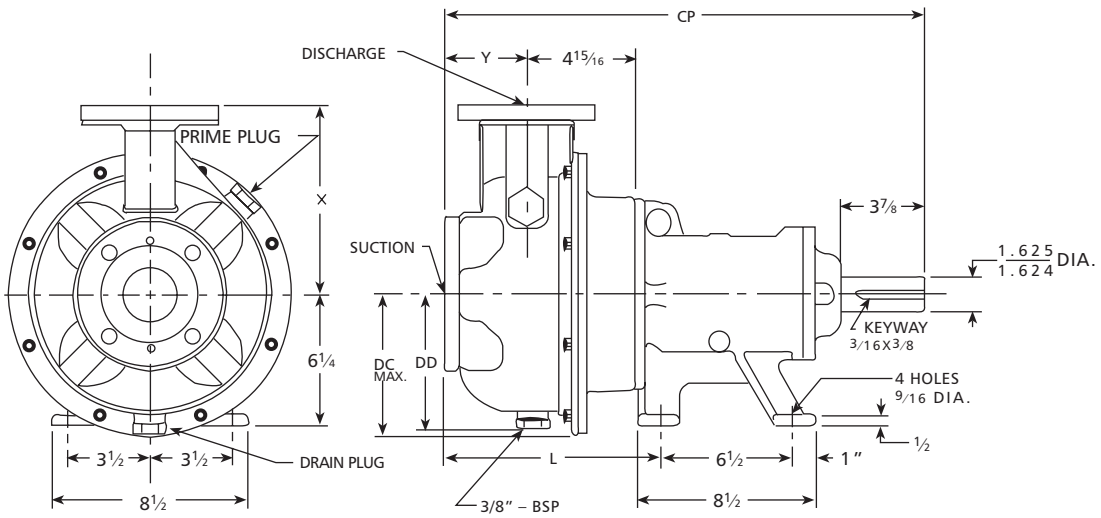
Dimensions and Weights – Bare Pump Only,
Dimensiones y Pesos – Solamente Bomba

Pump, *Bomba*		150 lb. Flange, *Brida de 150 lib.*		DC Max., *DC Máx.*	DD	CP Max., *CP Máx.*	L	X	Y	Z	Wt. (lbs.), *Peso (libras)*
		Suction*, *Succión**	Discharge*, *Descarga**								
9SH	1 x 2 – 6	2	1	5	4¾	16¾	7⅞	6⅜	3⅛	3⅞	56
10SH	1 x 2 – 8			5⅝	5⅜			7⅛			64
11SH	1 x 2 – 10			6⅞	6⅝	17 9/16	8¾	8⅞	4		86
4SH	1½ x 2½ – 6	2½	1½	5	4¾	16 9/16	7¾	6⅜	3¼	3⅝	57
7SH	1½ x 2½ – 8			5⅝	5⅜	17 5/16	8½	7⅛	4		65
5SH	2 x 2½ – 6		2	5	4¾						57
8SH	2 x 2½ – 8			6	5¾			7 15/16			68
6SH	2½ x 3 – 6	3	2½								59

* For use with ANSI class 150 mating flanges.
** Para usar con bridas que casan ANSI clase 150.*

NOTE:
1. Pumps will be shipped with top vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, and tighten ⅜–16 bolts to 12 ft./lbs., 7/16 – 14 bolts to 20 ft./lbs.
2. ALL dimensions in inches.
3. Not for construction purposes.

NOTA:
1. Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar ⅜ – 16 tornillos a 12 pies/libras, 7/16 – 14 tornillos a 20 pies/libras.
2. TODAS las dimensiones en pulgadas.
3. No para propósitos de construcción.



Dimensions and Weights – Bare Pump Only,
Dimensiones y Pesos – Solamente Bomba

Pump	Pump Size, *Tamaño de la Bomba*	Suction*, *Succión**	Discharge*, *Descarga**	CP	DC Max., *DC Máx.*	DD	L	X	Y	Wt. (lbs.), *Peso (libras)*
24SH	1½ x 2½-10	2½	1½	23	6 7/8	6 5/8	10 1/4	8 15/16	4	125
25SH	2 x 2½-10		2							125
22SH	2½ x 3-8	3	2½		6 1/8	5 7/8				125
27SH	2½ x 3-10				6 7/8	6 5/8		9 15/16		134
23SH	3 x 4-8	4	3	24			11 1/4		5	136
28SH	3 x 4-10				7 5/8	7 3/8		11 1/8		148

* For use with ANSI class 150 mating flanges.
** Para usar con bridas que casan ANSI clase 150.*

NOTES:
1. Pumps will be shipped with top vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 3/8–16 bolts to 12 ft./lbs.
2. Motor dimensions may vary with motor manufacturer.
3. Not for construction purposes.

NOTAS:
1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar 3/8 – 16 tornillos a 12 pies/libras.*
2. *TODAS las dimensiones en pulgadas.*
3. *No para propósitos de construcción.*

Specifications
Especificaciones

Capacities to:
1100 GPM (250 m^3/hr) at
3500 RPM 775 GPM (177 m^3/hr)
at 1750 RPM

Heads to:
525 feet THD (158 m) at
3500 RPM
130 feet THD (40 m) at
1750 RPM

Maximum working pressures to: 230 PSI (15 bars)

Maximum temperatures to:
250°F (121°C)

All wetted components of AISI: Type 316L stainless steel material.

Rotation: Clockwise when viewed from motor end.

Enclosed impeller and replaceable wear ring:
for high efficiency and maximum wear life.

Motor (close coupled):
NEMA standard JM shaft open drip-proof, totally enclosed and explosion-proof enclosures, 60 Hz, 1750 or 3500 RPM.
Single phase ODP (115/230 V)
1750 RPM, 1 – 5 HP.
Three phase ODP. TEFC/Exp. proof (208 – 230/460 V).
3500 RPM, 2 – 100 HP
1750 RPM, 1 – 25 HP

NOTE: Overload protection must be provided. Contactor with overload for single phase or starter with heaters for three phase ordered separately.

Motor (frame mounted):
NEMA standard T-frame open drip-proof, totally enclosed and explosion-proof (three phase only) enclosures 60 Hz, 1750 or 3500 RPM.
Single phase (115/230 V)
1750 RPM, 1 – 5 HP
Three phase (208 – 230/460 V)
3500 RPM, 3 – 125 HP
1750 RPM, 1 – 25 HP

NOTE: Overload protection must be provided. Contactor with overload for single phase or starter with heaters for three phase ordered separately.

Optional: Rigid carbon steel bedplate, sheet metal coupling guard designed to OSHA specifications and T.B. WOODS type "SC" spacer couplings.

Capacidades:
1100 GPM (105 m^3/hr) a
3500 RPM 775 GPM (177 m^3/hr) a
1750 RPM

Cargas:
525 pies THD (158 m) a 3500 RPM
130 pies THD (40 m) a 1750 RPM

Presión de trabajo máxima:
230 PSI (15 baras)

Temperatura máxima:
250°F (121°C)

Todos los componentes mojados de AISI: *Material de acero inoxidable tipo 316L.*

Rotación: *En dirección de las agujas del reloj visto desde el extremo final del motor.*

Impulsor encerrado y anillo de desgaste reemplazable:
para alta eficiencia y máxima durabilidad.

Motor (acople cerrado): *Eje a prueba de goteo JM estándar NEMA, totalmente encerrado y recintos a prueba de explosión, 60 Hz, 1750 ó 3500 RPM.*
Unifásicos ODP (115/230 V)
1750 RPM, 1 – 5 HP
Trifásicos ODP. TEFC/a prueba de explosión (208 – 230/460 V).
3500 RPM, 2 – 100 HP
1750 RPM, 1 – 25 HP

NOTA: *Se debe de proporcionar protección térmica contra sobrecarga. Contactor con protección térmica contra sobrecarga para unifásicos o arrancadores con calentadores para trifásicos se piden por separado.*

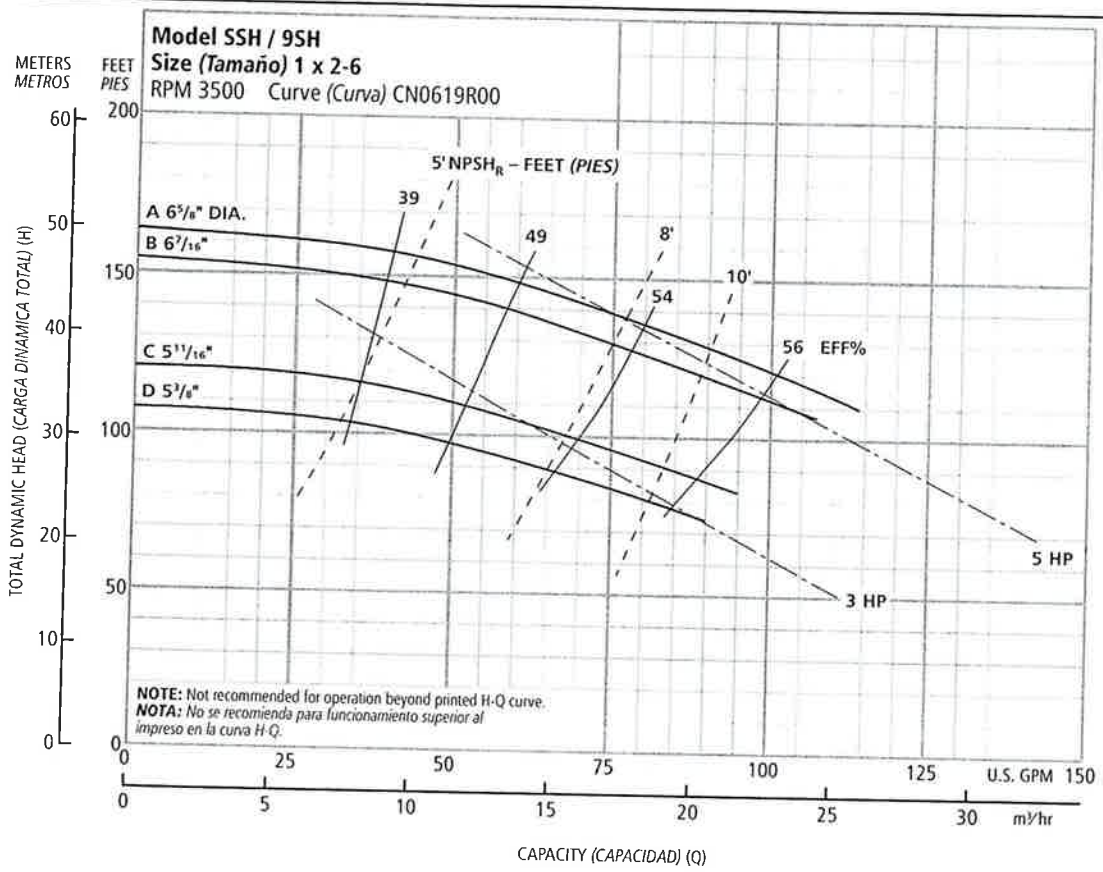
Motor (armazón montado):
Armazón abierto T a prueba de goteo estándar NEMA, totalmente encerrado y recintos a prueba de explosión (trifásicos solamente) 60 Hz, 1750 ó 3500 RPM.
Unifásicos (115/230 V)
1750 RPM, 1 – 5 HP.
Trifásicos (208 – 230/460 V)
3500 RPM, 3 – 125 HP
1750 RPM, 1 – 25 HP

NOTA: *Se debe de proporcionar protección térmica contra sobrecarga. Contactor con protección térmica contra sobrecarga para unifásicos o arrancadores con calentadores para trifásicos se piden por separado.*

Opcional: *Fundación rígida de acero al carbono, guarda acople de metal laminado diseñado según las especificaciones OSHA y acoples del espaciador T.B. WOODS tipo "SC".*

Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM

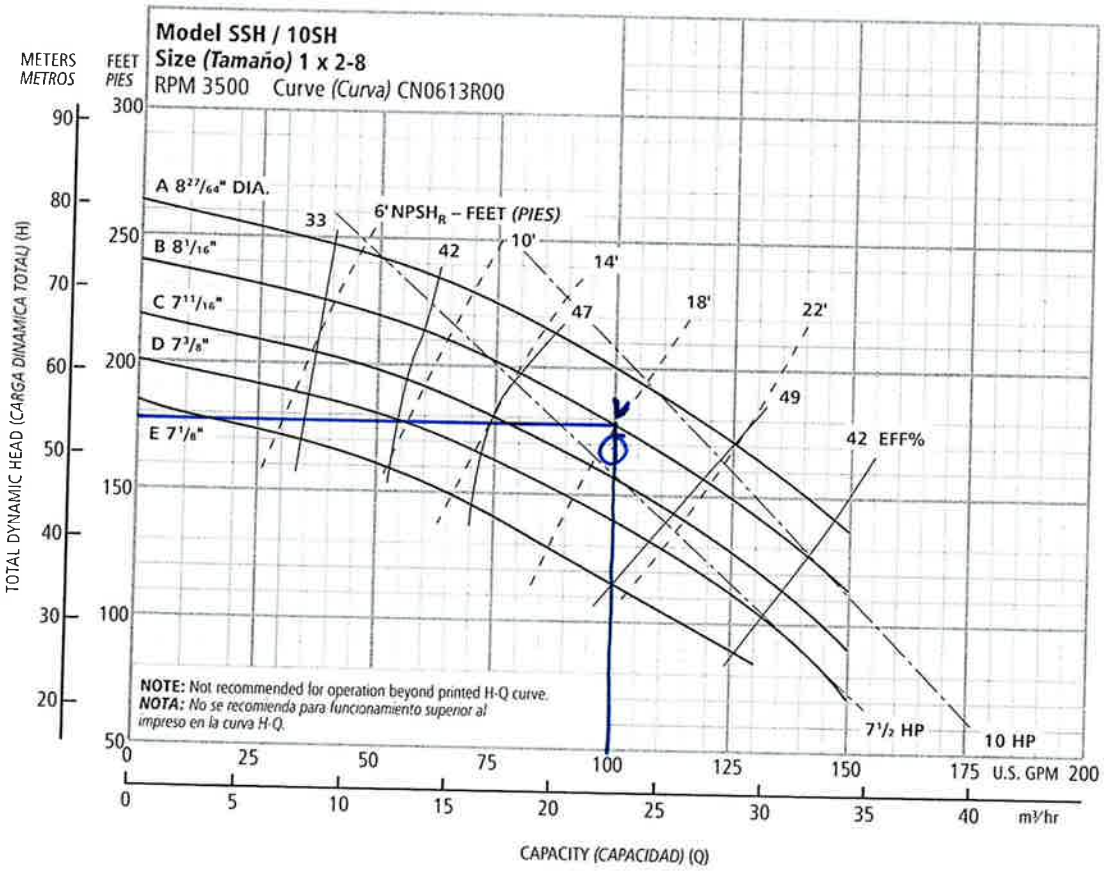
P-200 A/B/C



Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	Dia., *Diá.*	Standard HP Rating, *Estándar HP Potencia*
A	6⅝"	5
B	6⁷/₁₆	5
C	5¹¹/₁₆	3
D	5⅜	3

NOTE: Pump will pass a sphere to ⅛" diameter.

NOTA: La bomba pasará una esfera a ⅛" diámetro.



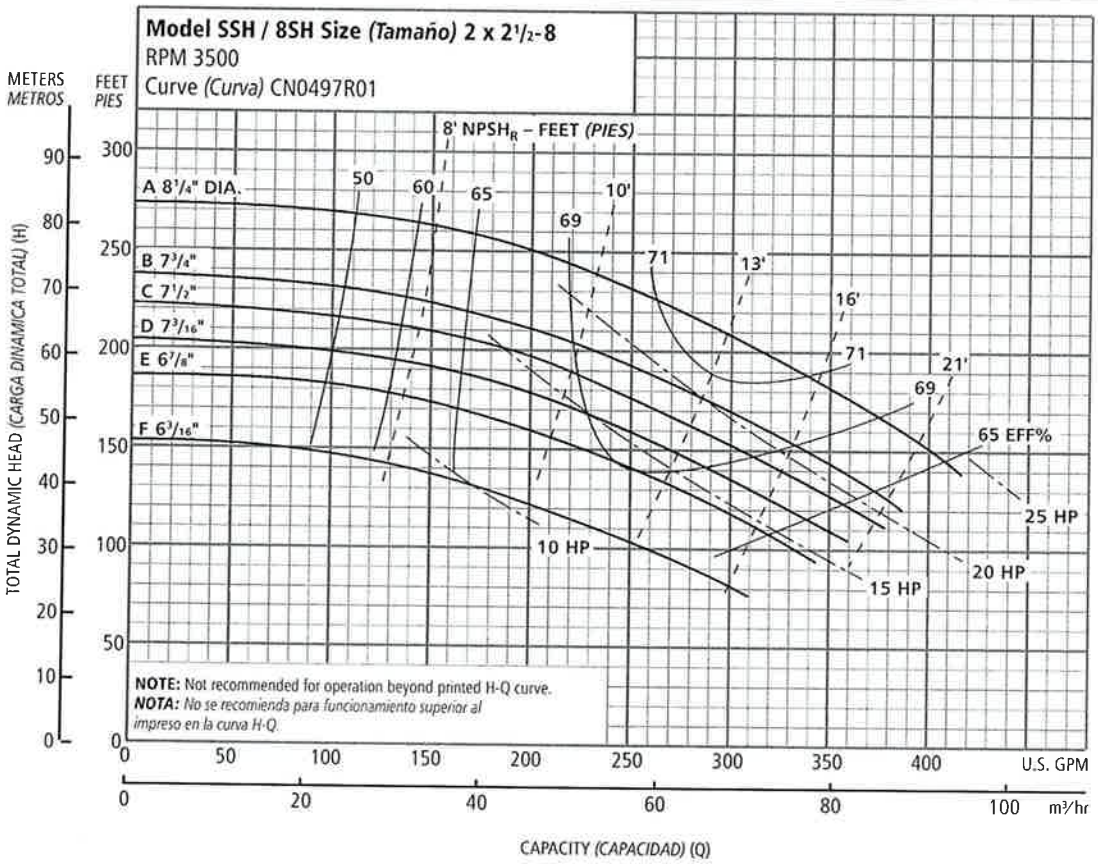
Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	Dia., *Diá.*	Standard HP Rating, *Estándar HP Potencia*
A	8²⁷/₆₄"	10
B	8¹/₁₆	10
C	7¹¹/₁₆	7½
D	7⅜	7½
E	7⅛"	7½

NOTE: Pump will pass a sphere to ⅛" diameter.

NOTA: La bomba pasará una esfera a ⅛" diámetro.

Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM

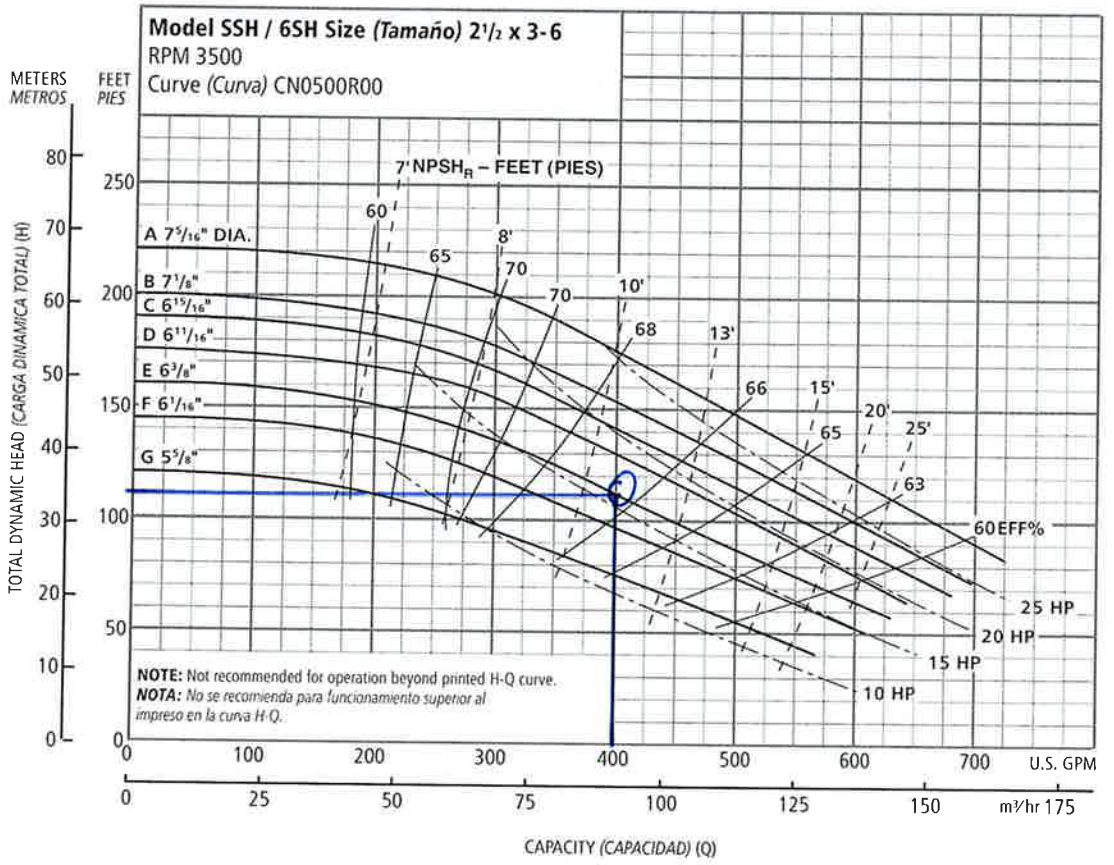
P-210 A/B



Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	Dia., *Diá.*	Standard HP Rating, *Estándar HP Potencia*
A	8¼"	25
B	7¾	20
C	7½	20
D	7³/₁₆	15
E	6⅞	15
F	6³/₁₆	10

NOTE: Pump will pass a sphere to ¼" diameter.

NOTA: La bomba pasará una esfera a ¼" diámetro.

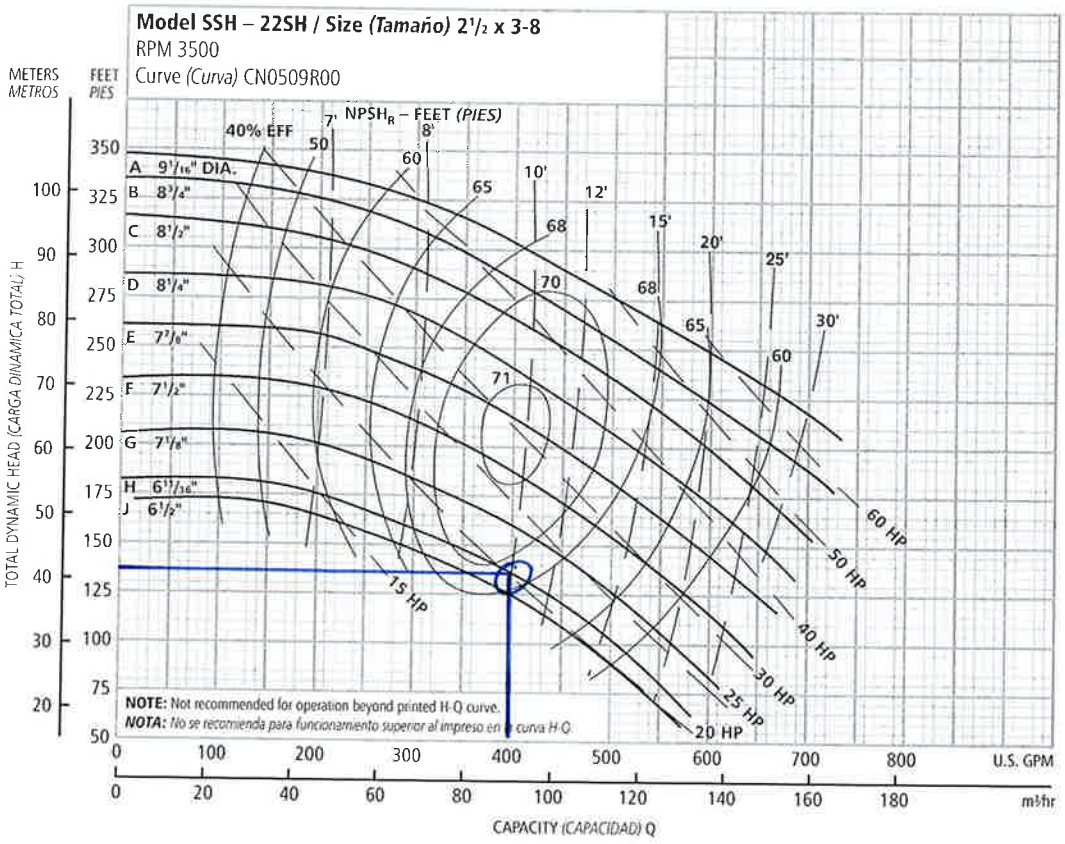


Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	Dia., *Diá.*	Standard HP Rating, *Estándar HP Potencia*
A	7⁵/₁₆"	25
B	7⅛	25
C	6¹⁵/₁₆	20
D	6¹¹/₁₆	20
E	6⅜	15
F	6¹/₁₆	15
G	5⅝	10

NOTE: Pump will pass a sphere to 5/16" diameter.

NOTA: La bomba pasará una esfera a 5/16" diámetro.

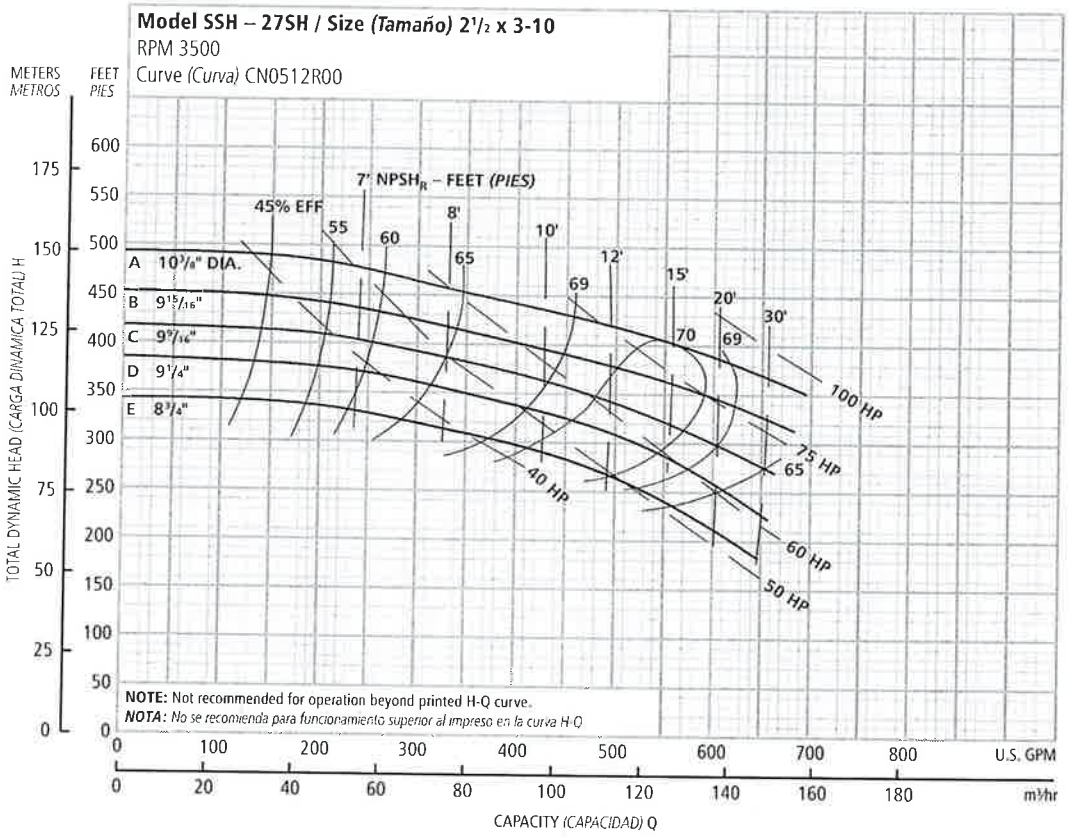
P-230 A/B



Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	**Dia., *Diá.***	**Standard HP Rating, *Estándar HP Potencia***
A	9 1/16"	60
B	8 3/4	50
C	8 1/2	50
D	8 1/4	40
E	7 7/8	40
F	7 1/2	30
G	7 1/8	25
H	6 11/16	20
J	6 1/2	20

NOTE: Pump will pass a sphere to 19/32" diameter.

NOTA: *La bomba pasará una esfera a 19/32" diámetro.*



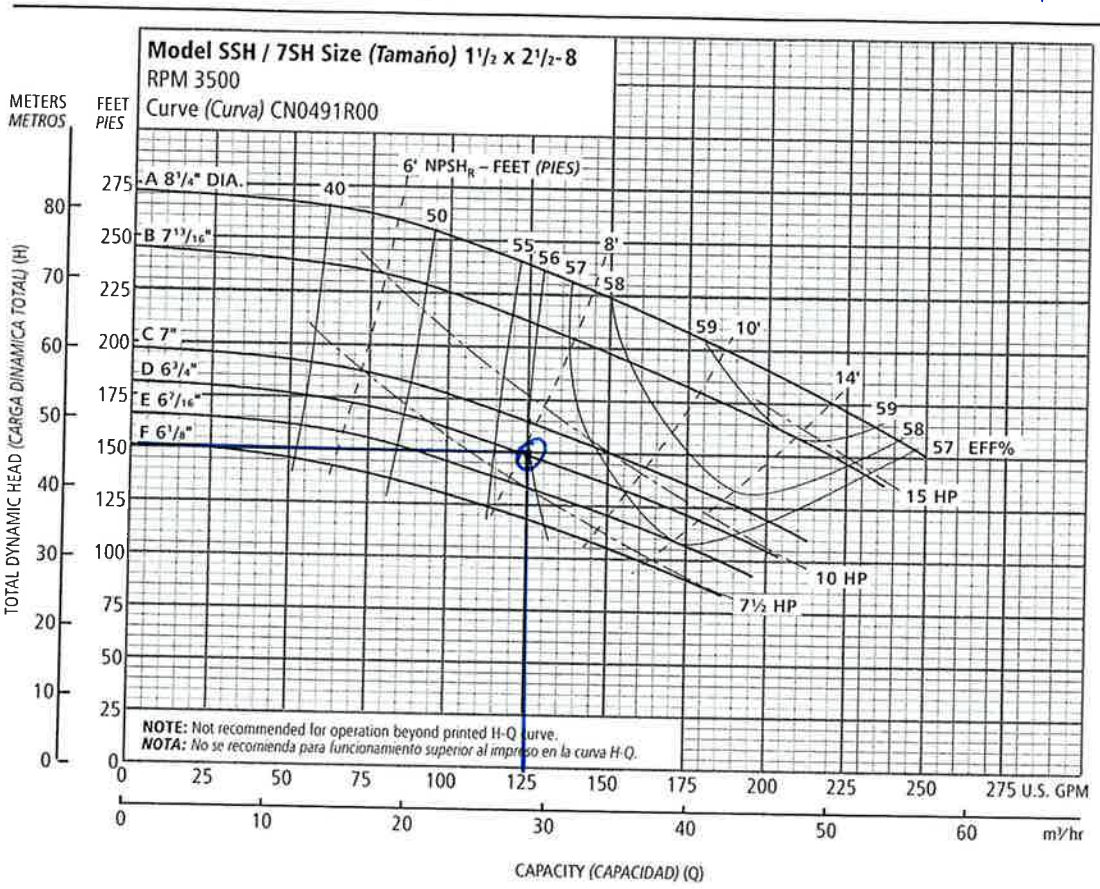
Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	**Dia., *Diá.***	**Standard HP Rating, *Estándar HP Potencia***
A	10 3/8"	100
B	9 15/16	75
C	9 9/16	75
D	9 1/4	60
E	8 3/4	50

NOTE: Pump will pass a sphere to 19/32" diameter.

NOTA: *La bomba pasará una esfera a 19/32" diámetro.*

Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM

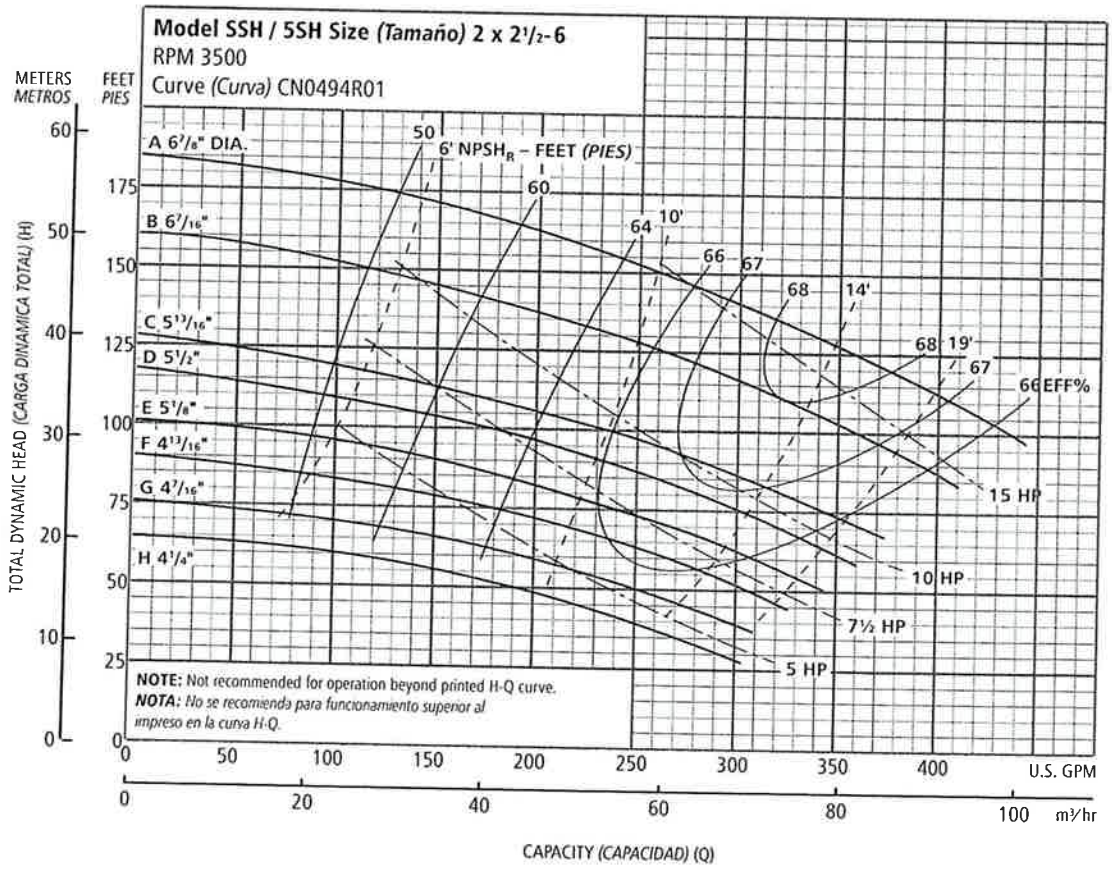
P-310 A/B/C



Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	**Dia., *Diá.***	**Standard HP Rating, *Estándar HP Potencia***
A	8¼"	15
B	7 13/16	15
C	7	10
D	6¾	10
E	6 7/16	7½
F	6⅛	7½

NOTE: Pump will pass a sphere to 3/16" diameter.

NOTA: La bomba pasará una esfera a 3/16" diámetro.



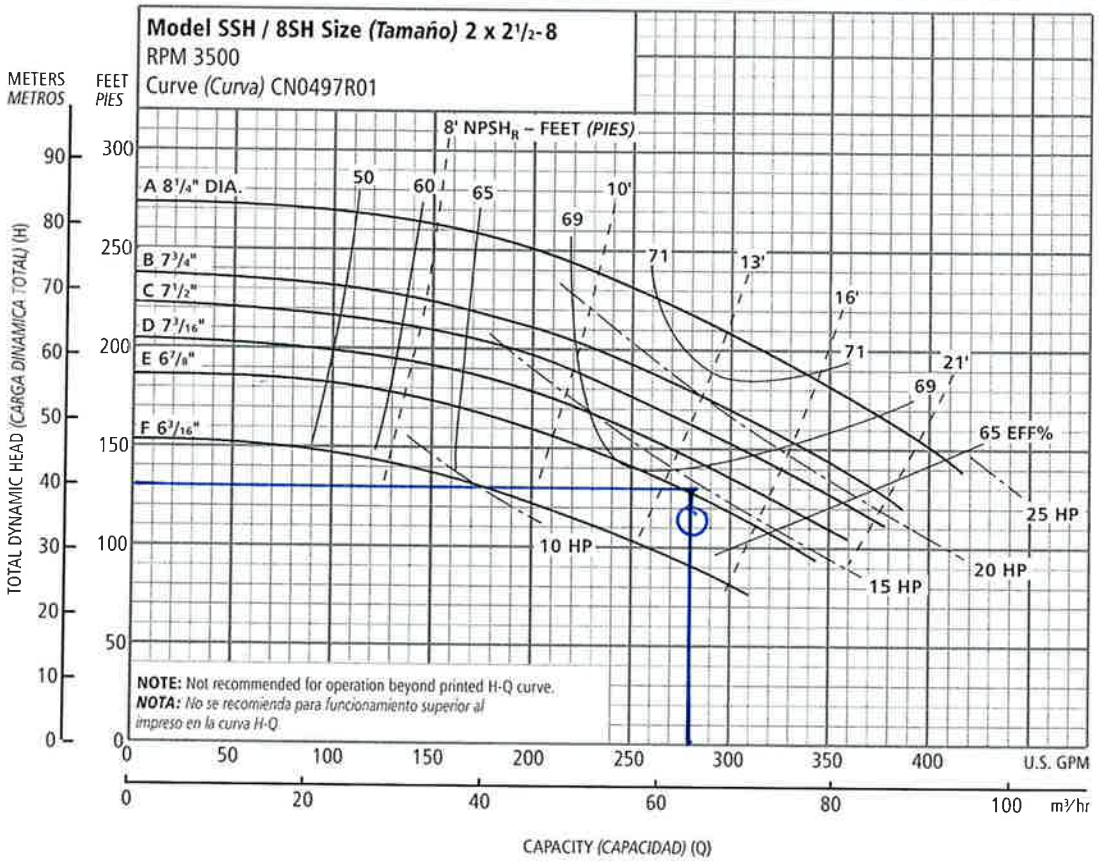
Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	**Dia., *Diá.***	**Standard HP Rating, *Estándar HP Potencia***
A	6⅞"	15
B	6 7/16	15
C	5 13/16	10
D	5½	10
E	5⅛	7½
F	4 13/16	7½
G	4 7/16	5
H	4¼	5

NOTE: Pump will pass a sphere to 5/32" diameter.

NOTA: La bomba pasará una esfera a 5/32" diámetro.

Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM

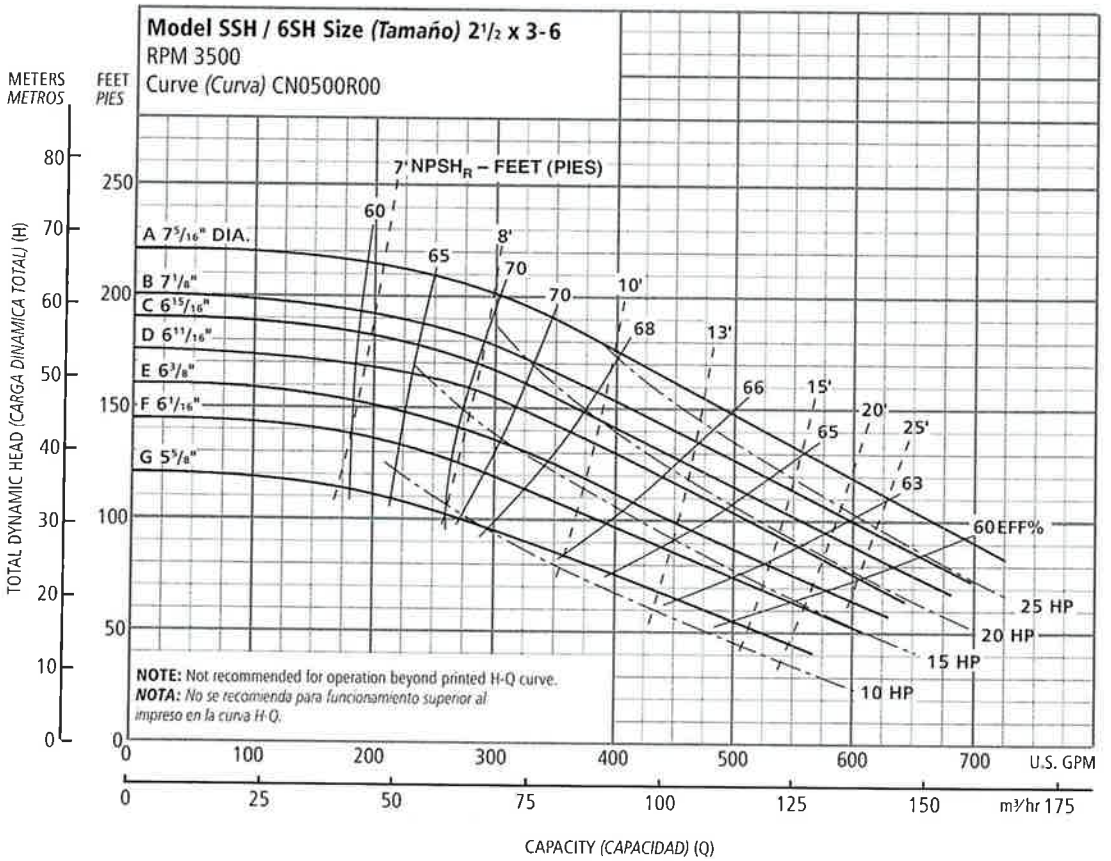
P-400 A/B



Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	Dia., *Diá.*	Standard HP Rating, *Estándar HP Potencia*
A	8¼"	25
B	7¾	20
C	7½	20
D	7³/₁₆	15
E	6⅞	15
F	6³/₁₆	10

NOTE: Pump will pass a sphere to ¼" diameter.

NOTA: La bomba pasará una esfera a ¼" diámetro.



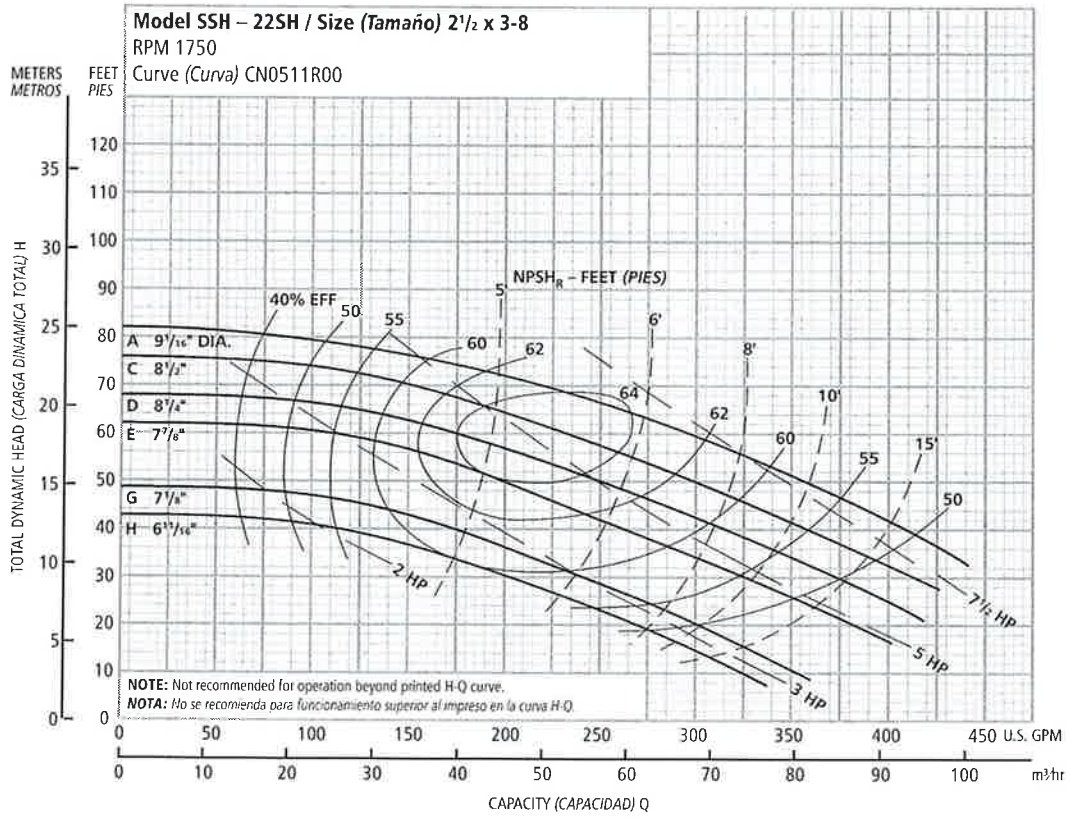
Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	Dia., *Diá.*	Standard HP Rating, *Estándar HP Potencia*
A	7⁵/₁₆"	25
B	7⅛	25
C	6¹⁵/₁₆	20
D	6¹¹/₁₆	20
E	6⅜	15
F	6¹/₁₆	15
G	5⅝	10

NOTE: Pump will pass a sphere to ⁵/₁₆" diameter.

NOTA: La bomba pasará una esfera a ⁵/₁₆" diámetro.

Performance Curves – 60 Hz, 1725 RPM
Curvas de Funcionamiento – 60 Hz, 1725 RPM

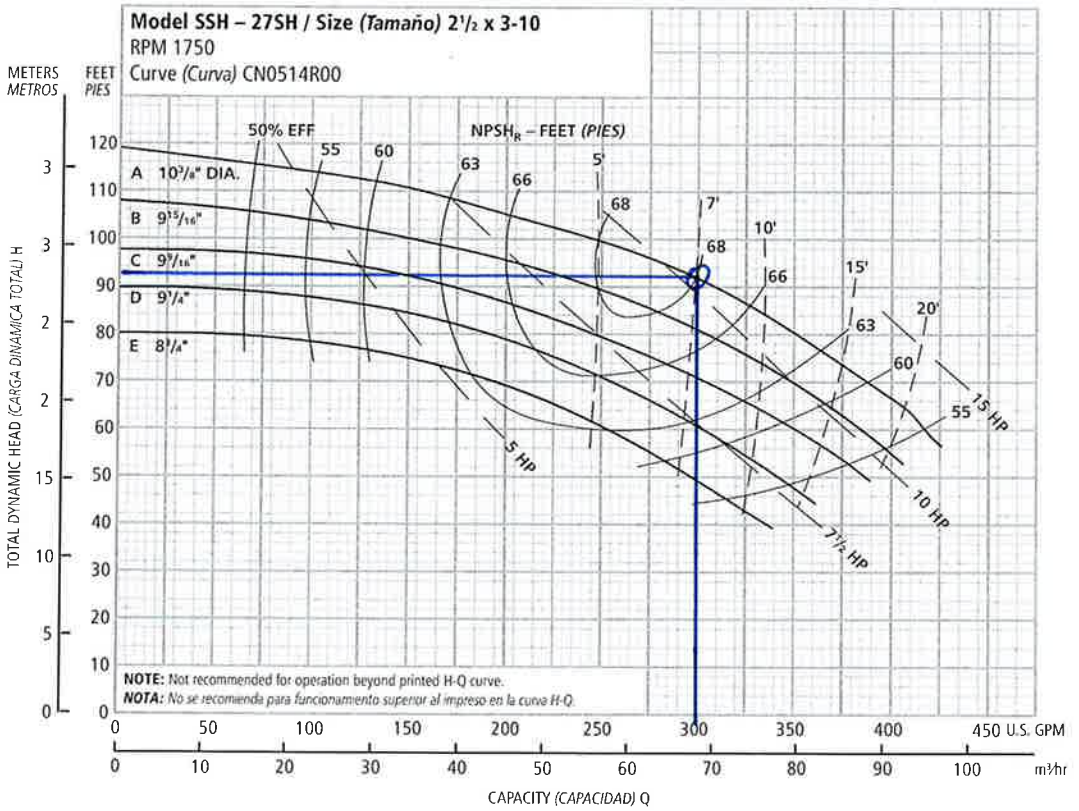
P-500 A/B



Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	**Dia., *Diá.***	**Standard HP Rating, *Estándar HP Potencia***
A	9 1/16"	7½
C	8½	7½
D	8¼	5
E	7⅞	5
G	7⅛	3
H	6 11/16	3

NOTE: Pump will pass a sphere to 19/32" diameter.

NOTA: La bomba pasará una esfera a 19/32" diámetro.



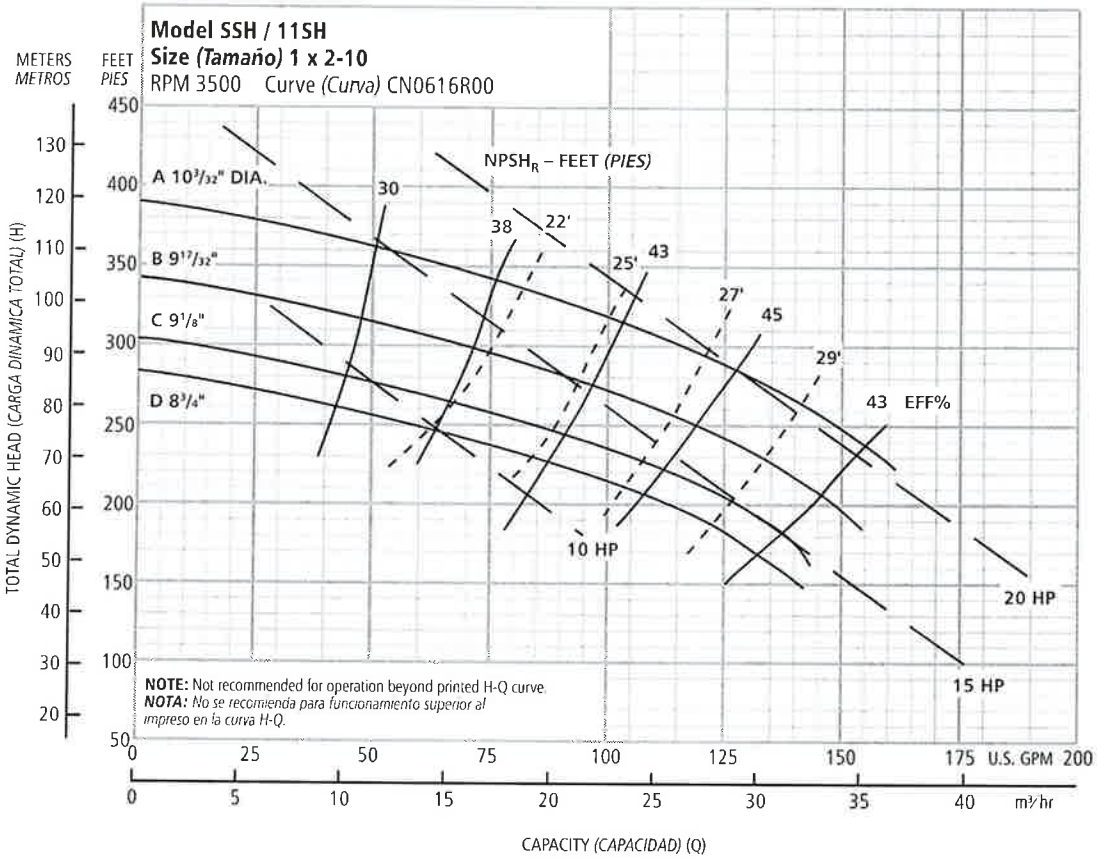
Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	**Dia., *Diá.***	**Standard HP Rating, *Estándar HP Potencia***
A	10⅜"	15
B	9 15/16	10
C	9 9/16	10
D	9¼	7½
E	8¾	7½

NOTE: Pump will pass a sphere to 19/32" diameter.

NOTA: La bomba pasará una esfera a 19/32" diámetro.

Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM

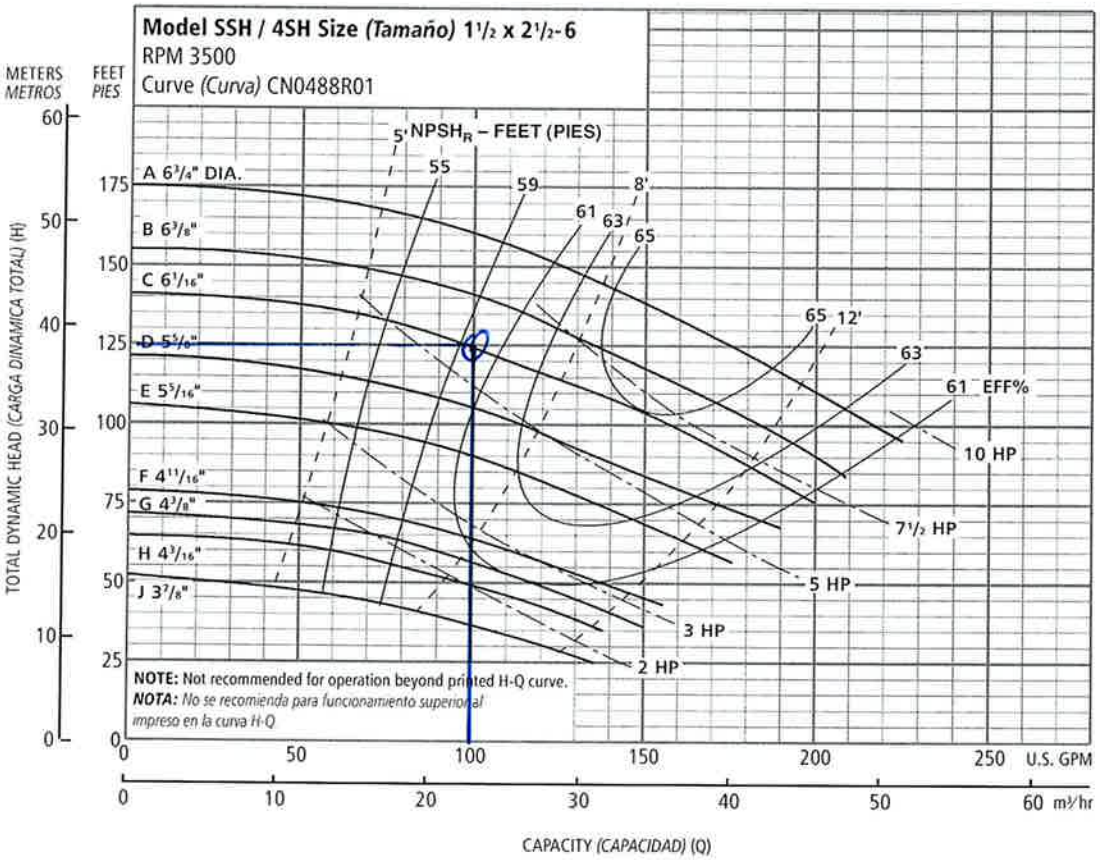
P-600 A/B



Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	Dia., *Diá.*	Standard HP Rating, *Estándar HP Potencia*
A	10 3/32"	20
B	9 17/32	15
C	9 1/8	15
D	8 3/4	15

NOTE: Pump will pass a sphere to 1/8" diameter.

NOTA: La bomba pasará una esfera a 1/8" diámetro.



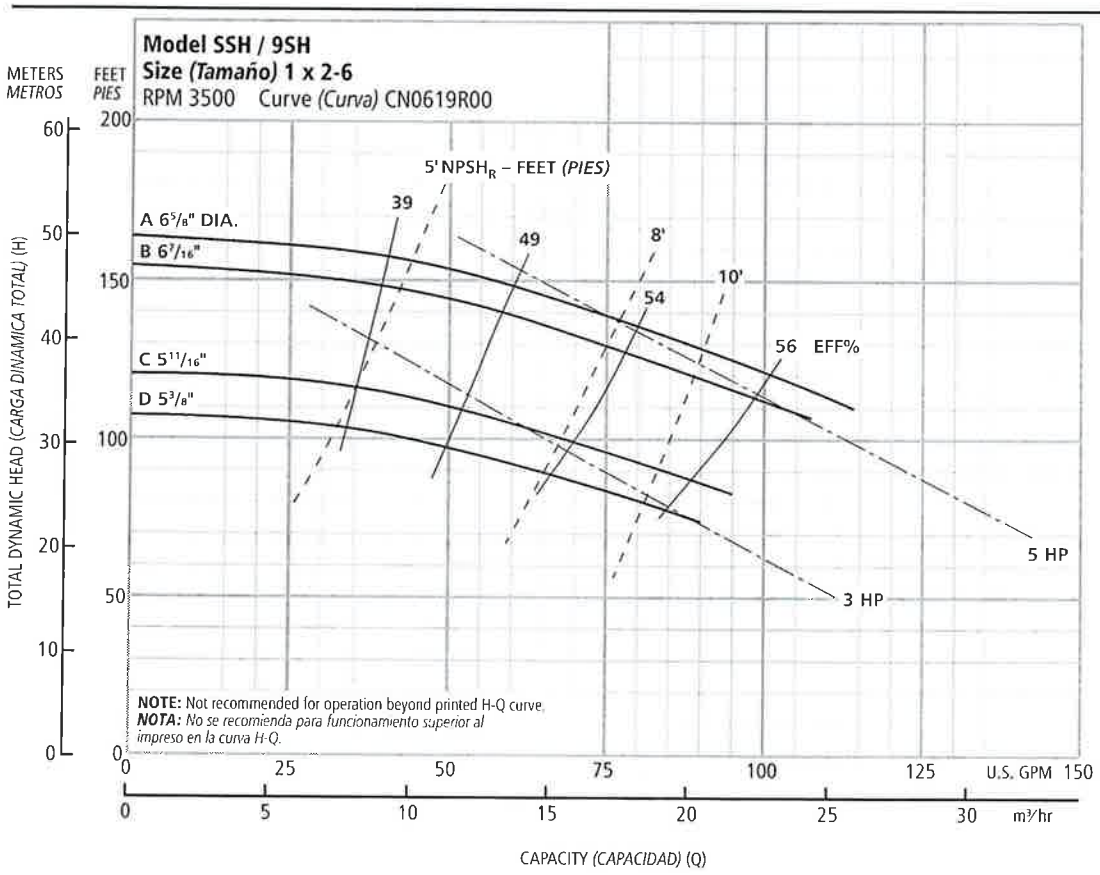
Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	Dia., *Diá.*	Standard HP Rating, *Estándar HP Potencia*
A	6 3/4"	10
B	6 3/8	7 1/2
C	6 1/16	7 1/2
D	5 5/8	5
E	5 5/16	5
F	4 11/16	3
G	4 3/8	3
H	4 3/16	2
J	3 3/8	2

NOTE: Pump will pass a sphere to 3/16" diameter.

NOTA: La bomba pasará una esfera a 3/16" diámetro.

Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM

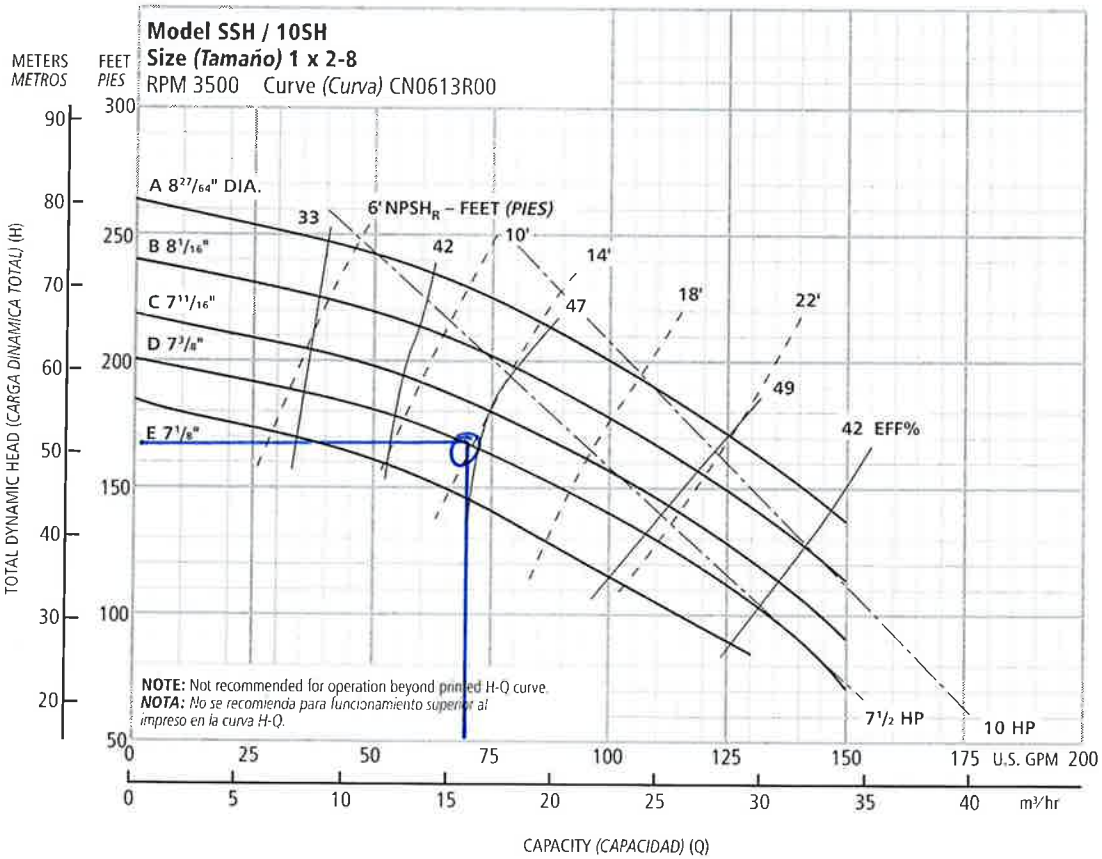
P-660



Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	Dia., *Diá.*	Standard HP Rating, *Estándar HP Potencia*
A	6⅝"	5
B	6⁷⁄₁₆	5
C	5¹¹⁄₁₆	3
D	5⅜	3

NOTE: Pump will pass a sphere to ⅛" diameter.

NOTA: La bomba pasará una esfera a ⅛" diámetro.



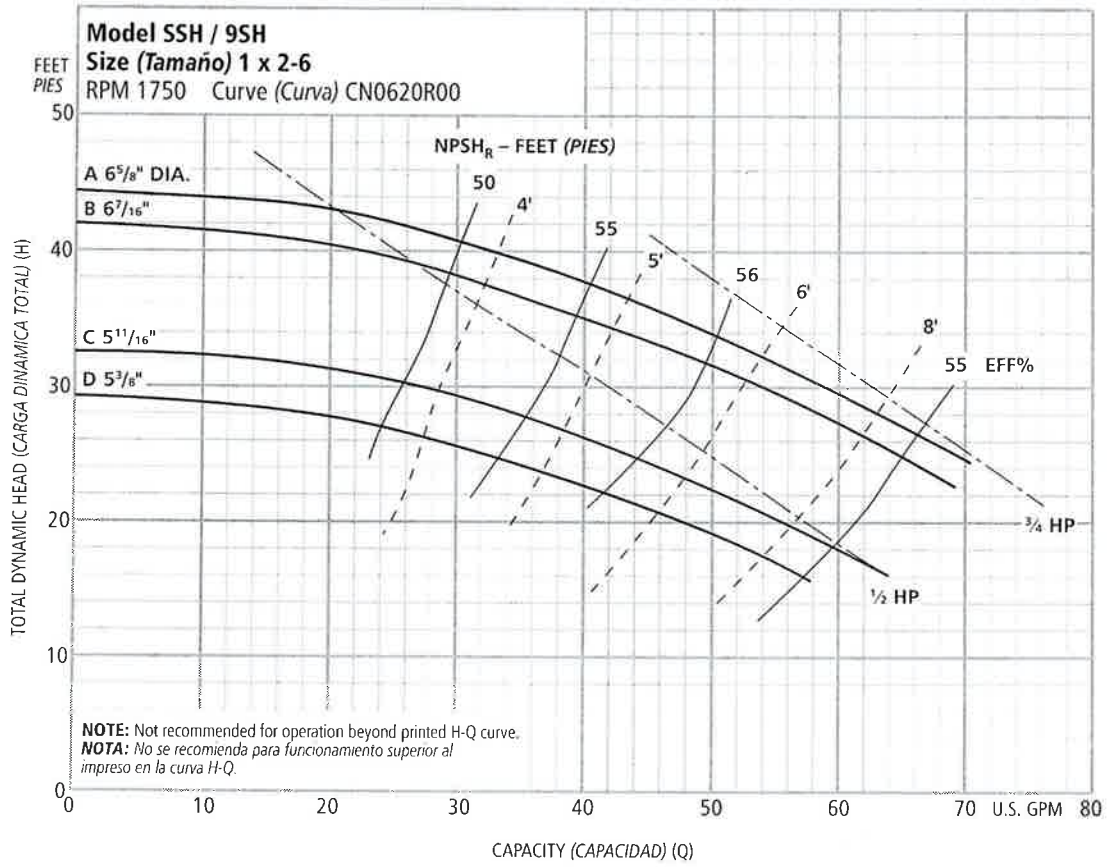
Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	Dia., *Diá.*	Standard HP Rating, *Estándar HP Potencia*
A	8²⁷⁄₆₄"	10
B	8¹⁄₁₆	10
C	7¹¹⁄₁₆	7½
D	7⅜	7½
E	7⅛"	7½

NOTE: Pump will pass a sphere to ⅛" diameter.

NOTA: La bomba pasará una esfera a ⅛" diámetro.

Performance Curves – 60 Hz, 1750 RPM
Curvas de Funcionamiento – 60 Hz, 1750 RPM

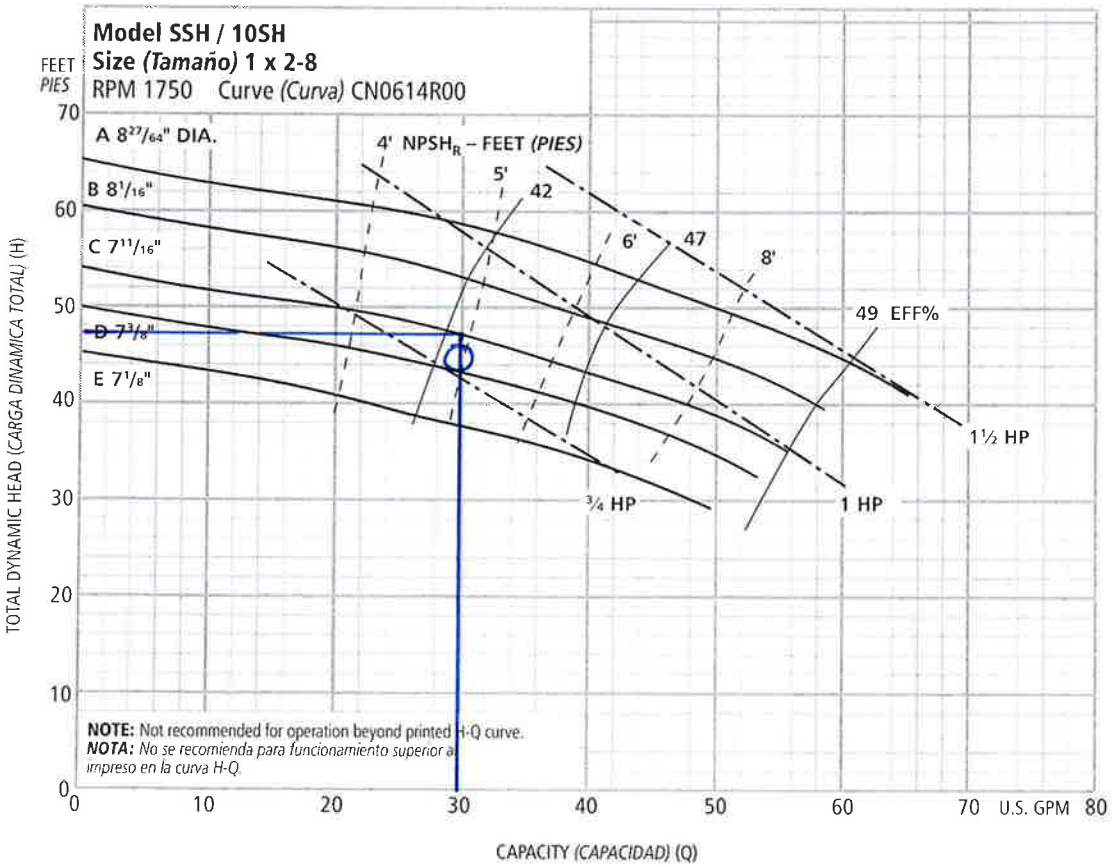
P-1300



Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	Dia., *Diá.*	Standard HP Rating, *Estándar HP Potencia*
A	6⅝"	¾
B	6⅞"	¾
C	5¹¹⁄₁₆"	½
D	5⅜"	½

NOTE: Pump will pass a sphere to ⅛" diameter.

NOTA: La bomba pasará una esfera a ⅛" diámetro.



Optional Impeller, *Impulsor Opcional*		
Impeller Code, *Código del Impulsor*	Dia., *Diá.*	Standard HP Rating, *Estándar HP Potencia*
A	8²⁷⁄₆₄"	1½
B	8¹⁄₁₆"	1½
C	7¹¹⁄₁₆"	1
D	7⅜"	¾
E	7⅛"	¾

NOTE: Pump will pass a sphere to ⅛" diameter.

NOTA: La bomba pasará una esfera a ⅛" diámetro.

Catalogue and Product Data Sheets

Item	Tag	Description
24	P-300A, P-300B	High Flow AOP Feed Pumps
25	P-300C	Low Flow AOP Feed Pumps

GOULDS PUMPS HUDSON PUMP

Wade Young

July 6, 2009

HUDSON PUMP

Proposal No: LKWAY09-07-06 03
Item No: ARCADIS 300 @ 189

MODEL:3196 MTi SIZE:2x3-10 QTY: 1

i-FRAME™

Operating conditions

SERVICE

LIQUID	Water Temp. 70.0 deg F, SP.GR 1.000, Viscosity 1.000 cp, rated / max. suction pressure 0.0 / 0.0 psi g
CAPACITY Rated	300.0 gpm
HEAD	189.0 (ft)

Performance at 3560 RPM

PUBLISHED EFFY	62.0% (CDS)
RATED EFFY	61.0% with contract seal
RATED POWER	23.5 hp (incl. Mech. seal drag 0.44). (Run out 28.6 hp)
NPSHR	14.7 ft
DISCH PRESSURE(R)	83.3 psi g (98.7 psi g @ Shut off) Based on 0.0 psi g Suc.press
PERF. CURVE	5024-3 (Rotation CW viewed from coupling end)
SHUT OFF HEAD	228.1 ft
MIN. FLOW	Continuous Stable: 85.5 gpm Hydraulic: 85.5 gpm Thermal: N/A

Materials

CONSTRUCTION	Ductile iron
CASING	Ductile iron (max.casing.pres. @ rated temperature 250.0 psi g)
ST.BOX COVER	Ductile iron
IMPELLER	Ductile iron - Open (7.1250 in rated, max=10.0000 in, min=6.0000 in)
CASING GASKETS	Aramid Fiber with EPDM Rubber
IMPELLER O-RING	Teflon
SHAFT MATERIAL	SAE 4140
SHAFT SLEEVE	316SS
LUBRICATION	Flood oil
SEAL CHAMBER	Standard non cooled
GLAND	316SS Flush quench and drain
BEARINGS	6309 (Inboard) 3309 (Outboard)
COUPLING	T.B. Wood`s - Duraflex- WES-4-S.F. 1.00
COUPLING GUARD	Carbon steel
BASEPLATE	Cast iron camber top B00058A

Sealing Method

MECHANICAL SEAL	John Crane 5611Q X(1)F(50)1XO(58)1 (Carbon vs Silicon Carbide with Viton) - (Cartridge - Single)

Flanges

150# flat face

Liquid end features

Impeller balanced to ISO 1940 G6.3

Frame Connections

Bearing frame drain
Bottle oiler connection
Frame cooler access
Oil fill connection

Frame features

Condition Monitor
Ductile iron frame adapter
Inpro VBXX-D Hybrid Bearing Isolators
Premium Severe Duty Thrust Bearings

Piping

Flush supplied by customer and mounted by customer

Testing

Non witnessed casing hydrostatic-test

Painting

Goulds Blue standard painting

Warranty

5 Year Extended Warranty (All the components, manufactured by ITT Goulds pumps, in the liquid end and power end are covered).

Driver : Electric motor Manufacturer : Pump mfg`s Choice

FURNISHED BY	Pump mfg	MOUNTED BY	Pump mfg
RATING	30.0 hp (22.4 KW)	ENCLOSURE	TEFC - Epact Efficient
PHASE/FREQ/VOLTS	3/60 Hz/230/460	SPEED	3600 RPM
INSULATION/SF	F/1.15	FRAME	286TS

Weights and Measurements

TOTAL NET UNIT WEIGHT / VOLUME	805.5 lb / 10.3 ft³
TOTAL GROSS UNIT WEIGHT / GROSS VOLUME	901.5 lb / 19.1 ft³

Program Version 1.30.0.0

Our offer does not include specific review and incorporation of any Statutory or Regulatory Requirements and the offer is limited to the requirements of the design specifications. Should any Statutory or Regulatory requirements need to be reviewed and incorporated then the Customer is responsible to identify those and provide copies for review and revision of our offer.

Our quotation is offered in accordance with our comments and exceptions identified in our proposal.

Click here to download the pump Bulletin

Click here to learn more about the new *i-FRAME™*

PUMPSMART FLOW ECONOMY ESTIMATES

FIXED SPEED

14.1
gpm/kW

Expected range for typical operation 11.7 to 16.3 gpm/kW



PUMPSMART

20.0
gpm/kW

Expected range for typical operation 16.0 to 23.5 gpm/kW

Click Here To Learn More!

Estimated Annual Savings 2,619 USD

Standard Datasheet

CENTRIFUGAL PUMP SPECIFICATION

CLIENT	CONTRACT NO:
ADDRESS:	BY: Wade Young DATE:
PLANT LOCATION: UNITED STATES	APPROVED: DATE:
ITEM: ARCADIS 300 @ 189	EQUIP.IDENT.NO:

PUMPING CONDITIONS

FLUID PUMPED:	Water			PUMP MATERIAL CLASS	Ductile iron		
PUMPING TEMP. (PT)	21.1	deg C	70.0 deg F	VISCOSITY @ PT	1.000	CP	PH
SPECIFIC GRAVITY @ PT	1.000			DENSITY @ PT	0.0	Lb/ft³	
VAPOR PRESS. @ PT	mmHg	0.00	PSI ABS	SOLIDS CONTENT		%WT	

PERFORMANCE CHARACTERISTICS

CAPACITY, GPM	NORMAL	0.0	RATED	300.0	MIN. HYDRAULIC / THERMAL FLOW	85.5 / N/A	
TDH, FT: NORMAL	RATED	189.0	DISCH.PRESSURE	83.3	PSI G		
SUCTION PRESS., PSI G	RATED	0.0	MAXIMUM	0.0			
NPSH, FT ABS: AVAIL.(NORMAL)	0.0	(RATED)	14.7	REQD	BY PUMP CURVE NO.	5024-3	
BHP, hp (RATED)	23.5	(MAX)	28.6	EFFICIENCY (NORMAL)		(RATED)	61.0

PUMP DESCRIPTION

TYPE	3196 MTi	SIZE	2x3-10	RPM	3560	ROTATION	■ CW	☐ CCW	
IMPELLER TYPE	Open	DIA. in (RATED)	7.1250	(MAX)	10.0000	(MIN BY MFR)	6.0000		
☐ PACKING TYPE	SIZE	NO. OF RINGS	0	SEAL CAGE	☐ YES	☐ NO			
■ MECH.SEAL MFR and MODEL/DYN SEAL	John Crane 5611Q X(1)F(50)1XO(58)1 (Carbon vs Silicon Carbide with Viton)								
SUCTION ■ FLGD ☐ SCRD	SIZE 3"	ANSI 150#	LB.ASA	FACING FF	POSITION ■ CL	☐ SIDE	☐ FACING UP		
DISCHARGE ■ FLGD ☐ SCRD	SIZE 2"	ANSI 150#	LB.ASA	FACING FF	POSITION ■ TOP CTR	☐ TANGENT	☐ SIDE		
BEARINGS (MFR AND TYPE): RADIAL	6309	THRUST	3309	(VERT.) THRUST	☐ UP	☐ DOWN			
MATERIAL: CASING	Ductile iron	IMPELLER	Ductile iron	SHAFT/SLEEVE	SAE 4140 / 316SS				
SPECIAL MATERIAL									
CASING: ☐ VENT	NPT ☐ DRAIN	NPT	GAGE CONN. ☐ SUCTION	☐ DISCHARGE	3/8 / 3/8	NPT			
STUFF.BOX: ☐ TAP FOR FLUSH	NPT ☐ TAP FOR DRAIN	NPT	☐ JACKETED	NPT CONN:COOL WATER RQD GPM					
CASING: NO OF STAGE	1	MOUNTING: ☐ CENTERLINE	■ FOOT	☐ BRACKET	☐ VERTICAL				
CASING SPLIT: ☐ HORZ	■ VERTICAL	TYPE OF VOLUTE: ■ SINGLE	☐ DOUBLE	☐ DIFFUSER					
COVER PLATE ☐ JACKETED	NPT CONN.	☐ GLAND COOLING NPT CONN.	BEARING HOUSING ☐ JACKETED	NPT					
PUMP BUILT TO: ■ ANSI	☐ API STD 610	☐ SPECIAL	SPECIFICATIONS						
COUPLING TYPE:	Spacer	MAKE:	T.B. Wood's / Duraflex- WES-4	GUARD:	Carbon steel				
LUBRICATION:	Flood oil	HYDROSTATIC TEST PRESSURE:	0.0	PSI G					
WEIGHT (LB): PUMP	250.0	DRIVER	395.0	BASEPLATE	155.0				
PUMP SERIAL NO.:									
PUMP CURVE NO.:	5024-3								
SECTIONAL DWG.NO.:									

DRIVER

■ ELECTRIC MOTOR	30.0 HP	230/460 V	3 PH	CPS	3600 RPM	EQUIP #		
MFR	Pump mfg's Choice	CLASS		GROUP				
☐ STEAM TURBINE MFR		STEAM	PSI G	EXHAUST	PSI G			
☐ SPECIAL: MFR								

REMARKS:

REV.NO.	REVISION	BY	DATE	APPD	DATE	VENDOR ITT Corporation
						P.O.NO
						C.O.NO
						P.O.ITEM NO

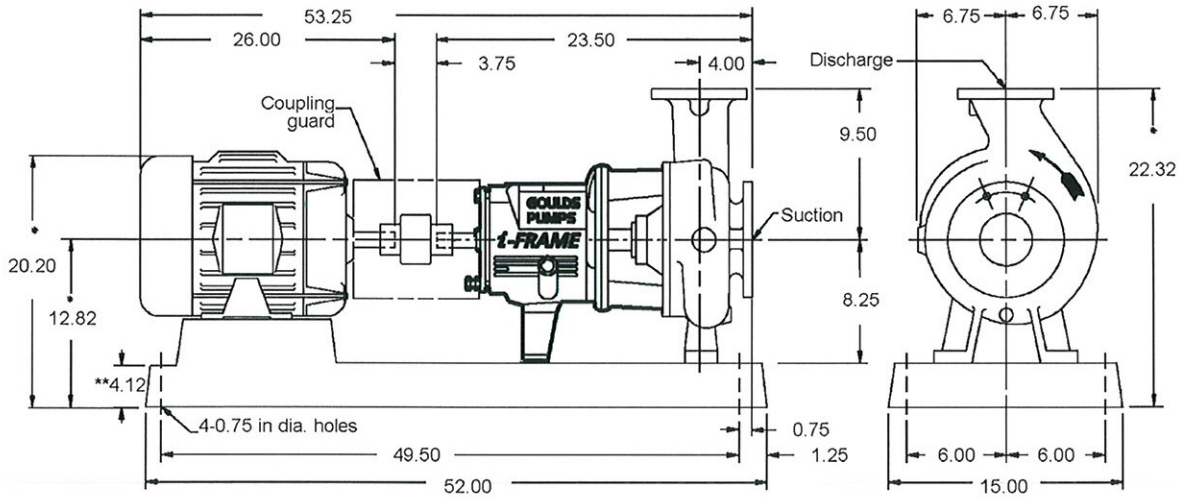
ACCOUNT DIST.NO.
DELIVERY
NOT BEFORE DATE

GOULDS PUMPS

OUTLINE DRAWING

Model 3196 MTi
Size 2x3-10

ITT



Pump specification

SUCT.FLANGE SIZE	*3"*	DRILLING	*ANSI 150#*	FACING	*FF*	FINISH	*SERRATED*
DISCH.FLANGE SIZE	*2"*	DRILLING	*ANSI 150#*	FACING	*FF*	FINISH	*SERRATED*
PUMP ROTATION (LOOKING AT PUMP FROM MOTOR)				*CW*			
TYPE OF LUBRICATION	*FLOOD OIL*					COOLED	*NO*
TYPE OF STUFFING BOX	*STANDARD NON COOLED*					COOLED	*NO*
TYPE OF SEALING	*MECHANICAL SEAL*						

Weights and Measurements

PUMP	*250.0 lb*
MOTOR/CPLG	*395.0/5.5 lb*
BASEPLATE	*155.0 lb*
TOTAL	*805.5 lb*
GR.VOLUME w/BOX	*19.1 ft³*
GR.WEIGHT w/BOX	*901.5 lb*

Motor specification

MOTOR BY	*PUMP MFG*	MOUNT BY	*PUMP MFG*	MFG.	*PUMP MFG`S CHOICE*
FRAME	*286TS*	POWER	*30.0 hp*	RPM	*3600*
PHASE	*3*	FREQUENCY	*60 HZ*	VOLTS	*230/460*
INSULATION	*F*	S.F.	*1.15*		
ENCLOSURE	*TEFC - EPACT EFFICIENT*				

Auxiliary specification

COUPLING BY	*PUMP MFG*	CPLG TYPE	*T.B. WOOD`S DURAFLEX- WES-4*
CPL GUARD BY	*PUMP MFG.*	CPLG GUARD MATL	*CARBON STEEL*
BASEPLATE	*CAST IRON CAMBER TOP B00058A*		
MECH.SEAL	*JOHN CRANE 5611Q X(1)F(50)1XO(58)1 (CARBON VS SILICON CARBIDE WITH VITON)*		

Notes and References

- MTR DIMENSIONS ARE APPROXIMATE
- INSTALL FOUNDATION BOLTS IN PIPE SLEEVES
- ALLOW FROM 0.75 to 1.50in. FOR GROUTING. SEE INSTRUCTION BOOK FOR DETAILS.

*Tolerance is +0 -0.5

** Foundation bolt grip thickness

FOR PUMP TAPPED OPENINGS REFER TO DWG.:
TLKWAY09-07-06 03 / ARCADIS 300 @ 189

DRAWING IS FOR REFERENCE ONLY.
NOT CERTIFIED FOR CONSTRUCTION UNLESS SIGNED.

Customer: HUDSON PUMP
Serial No:
Customer P.O. No:
Item No: ARCADIS 300 @ 189
End User: HUDSON
Service:

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ITT Corp

All dimensions are in inches.
Drawing is not to scale
Weights (lbs) are approximate

R625-EDC-001213-0

DRAWING NO LKWAY09-07-06 03/ARCADIS 300 @ 189

FORM # ED0048

Program Version 1.30.0.0

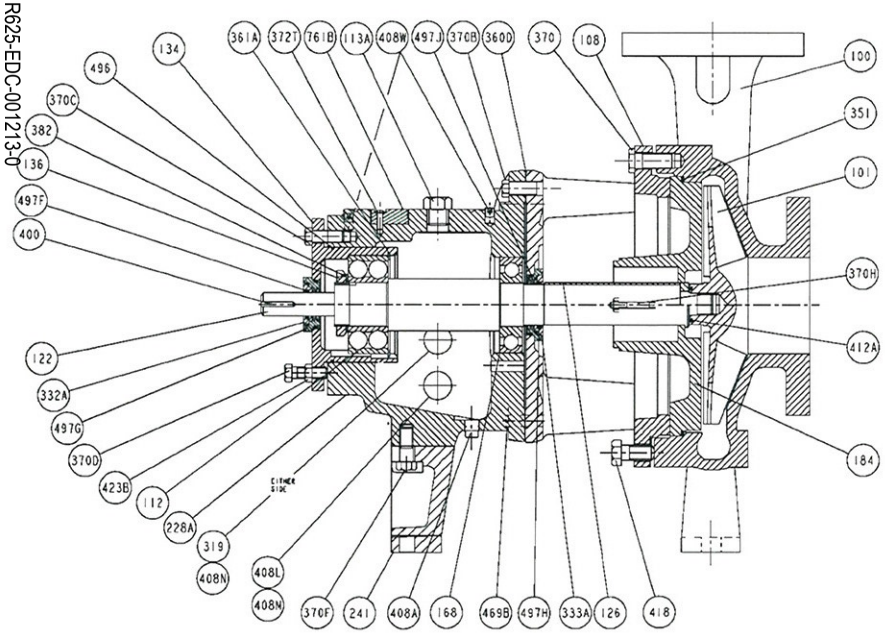
GOULDS PUMPS

CROSS SECTIONAL DRAWING

Model 3196 MTi
Size 2x3-10

ITT

R625-EDC-001213-0



* Recommended spare parts

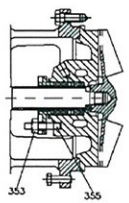
\# Items not illustrated

BILL OF MATERIAL

ITEM	QTY		PART NAME	MATERIAL		ASTM#
100	1		CASING	DUCTILE IRON	DI 6	A395-88
101	1	*	IMPELLER W/O-RING	DUCTILE IRON	DI 6	A536-84
108	1	*	FRAME ADAPTER	DUCTILE IRON	DI 6	A536-84
112	1	*	BALL BEARING OUTBOARD			
113A	1		PIPE,PLUG OIL FILL			
122	1	*	SHAFT	ALLOY STL 4140	4140	A434
126	1	*	SHAFT SLEEVE			
134	1		BEARING HOUSING	CAST IRON	CI 45	A48
136	1	*	BEARING LOCK NUT			
168	1	*	BALL BEARING (INBOARD)			
183	1	#	BEDPLATE IS NOT PRE-ENGIN	CAST IRON	CI 45	A48
184	1	*	ST BOX COVER	DUCTILE IRON	DI 6	A395-88
228A	1		FRAME	CAST IRON	CI	A48
232	1	#	MOTOR HUB			
233	1	#	PUMP HUB			
235B	1	#	CPLG SPACER HUB			
241	1		FR.FOOT OR Y BASE	CAST IRON	CI	A48
319	1		SIGHT WINDOW			
332A	1	*	LAB SEAL OB			
333A	1	*	LAB SEAL IB			
351	1	*	CASE GASKET	ARAMID FIBER W/EPDM RUBBER		
353	1		GLAND STUD			
354	1	#	GLAND WASHER			
355	1		HEX NUT (GLAND STUD)			
357K	2	#	NUT,HEX (COVER TO ADAPT)	304SS		A276-95
358A	1	#	PLUG,PIPE (FLUSH CONN ST B	CARBON STEEL	GR B	A307
358N	1	#	GLAND PLUG			
360D	1	*	GASKET,ADAPTER	PACKING NITRILE RBR 3047		
361A	1	*	RETAINING RING BRG HSG			
370	12		H CAP SCREW (CASE)	CARBON STEEL	GR B	A307
370B	4		H CAP SCREW (FRAME-ADPTR	CARBON STEEL	GR B	A307
370C	3		H CAP SCREW (BRG HSG-FRA	CARBON STEEL	GR B	A307
370D	3		H CAP SCREW (IMPLR ADJ)	CARBON STEEL	GR B	A307
370F	2		H CAP SCREW (FR-FR.FOOT)	CARBON STEEL	GR B	A307
370H	2		STUD (COVER)	304SS		A276-95
382	1	*	BEARING LOCKWASHER			
383	1	* #	MECHANICAL SEAL (ORDERED			
400	1	*	SQ END KEY (CPLG)	CARBON STEEL	1018/1020	A108
408A	1		PIPE PLUG (OIL DRAIN)			
408L	1		PIPE PLUG (FRAME CLG IN)			
408M	1		PIPE PLUG (FR CLG OUT)			
408N	1		PIPE PLUG (SIGHT OILER)			
408W	2		PIPE PLUG (PROSMART)			
412A	1	*	O-RING IMPLR	TEFLON		A3651
418	3		H TAP BOLT	304SS		A276-95
423B	3		NUT,JAM IMPELLER ADJ	CARBON STEEL	GR B	A307
469B	2	*	DOWEL PIN (FRAME-ADPTR)			
496	1	*	O-RING BRG HOUSING	BUNA-N		
497F	1	*	O-RING LAB SEAL	VITON		
497G	1	*	O-RING LAB SEAL	BUNA-N		
497H	1	*	O-RING LAB SEAL	VITON		
497J	1	*	O-RING LAB SEAL	BUNA-N		
497L	1	* #	ORING,RADIAL O.B	VITON		
497N	1	* #	ORING,THRUST O.D	VITON		
501	1	#	CPLG GUARD ASSY	CARBON STEEL		
528A	2	#	WASHER,PLAIN FRAME FOOT			
761B	1		MONITOR,LCCM			
902	1	* #	MAINTENANCE KIT			
906	1	#	REPAIR KIT			

SEAL CHAMBER

STUFFING BOX
NON-JACKETED



REFER TO SEAL DRAWING NO. (TO FOLLOW):

Customer: HUDSON PUMP
Serial No:
Customer P.O. No:
Item No: ARCADIS 300 @ 189
End User: HUDSON
Service:

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ITT Corp

DRAWING NO LKWAY09-07-06 03/ARCADIS 300 @ 189

FORM # ED0334 +335

Program Version 1.30.0.0

Model: 3196	Size: 2x3-10	Group: MTi	60Hz	RPM: 3560	Stages: 1

Job/Inq.No. :
Purchaser : HUDSON PUMP
End User : HUDSON
Rev. : 0
Issued by : Wade Young
Item/Equip.No. : ARCADIS 300 @ 189
Quotation No. : LKWAY09-07-06 03
Date : 07/06/2009
Service :
Order No. :
Certified By :

Operating Conditions

Liquid:	Water
Temp.:	70.0 deg F
S.G./Visc.:	1.000/1.000 cp
Flow:	300.0 gpm
TDH:	189.0 ft
NPSHa:	
Solid size:	
% Susp. Solids (by wtg):	

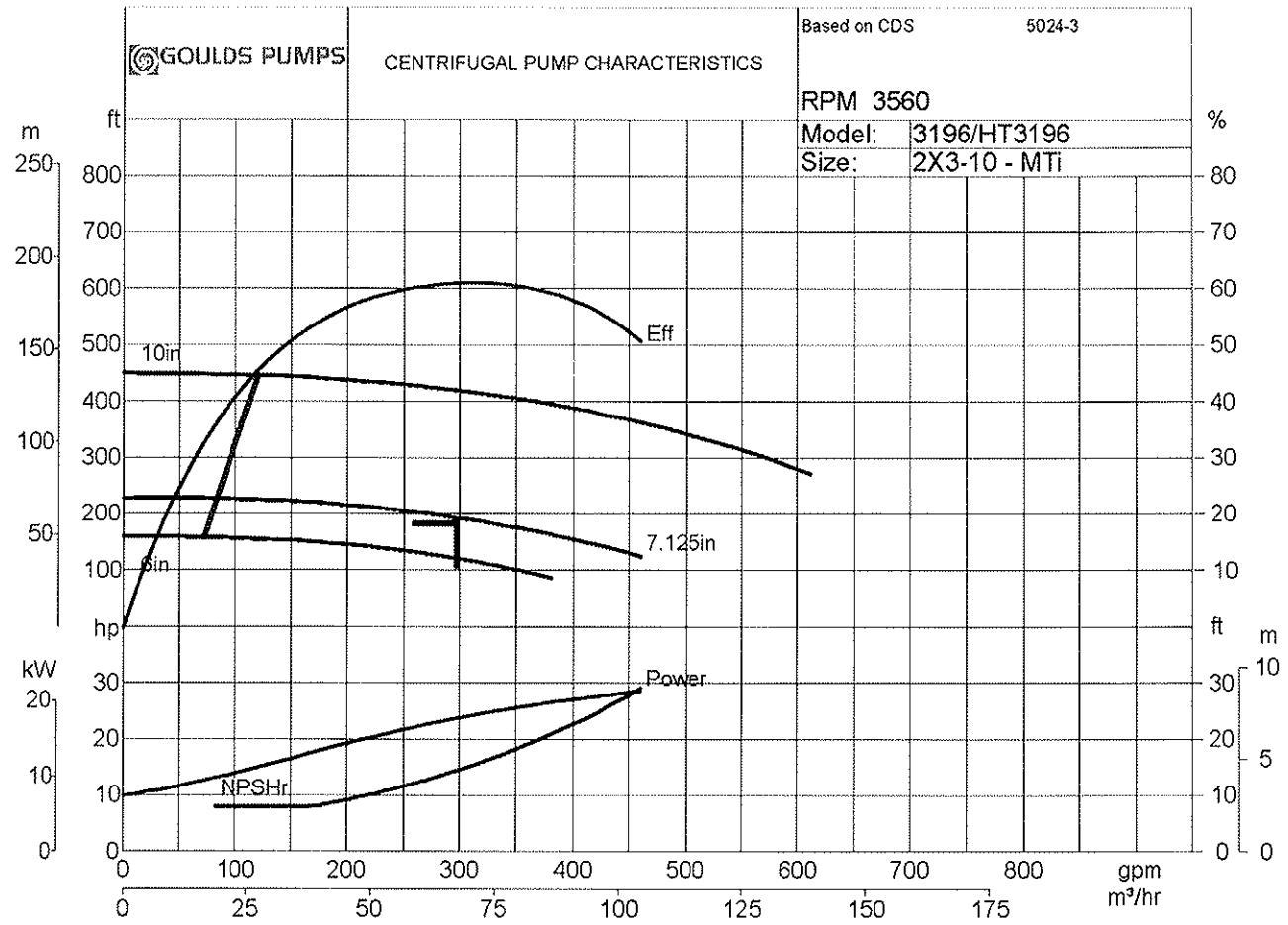
Max. Solids Size: 0.3750 in

Pump Performance

Published Efficiency:	62.0 %
Rated Pump Efficiency:	61.0 %
Rated Total Power:	23.5 hp
Non-Overloading Power:	28.6 hp
Imp. Dia. First 1 Stg(s):	7.1250 in
NPSHr:	14.7 ft
Shut off Head:	228.1 ft
Vapor Press:	

Suction Specific Speed:	8,673 gpm(US) ft
Min. Hydraulic Flow:	85.5 gpm
Min. Thermal Flow:	N/A

Notes: 1. Elevated temperature effects on performance are not included.



ITT

Wade Young

GOULDS PUMPS HUDSON PUMP

July 6, 2009

HUDSON PUMP

Proposal No: LKWAY09-07-06 03
Item No: ARCADIS 150 @ 122

MODEL:3196 STi SIZE:1.5x3-6 QTY: 1

i-FRAME™

Operating conditions

SERVICE	
LIQUID	Water Temp. 70.0 deg F, SP.GR 1.000, Viscosity 1.000 cp, rated / max. suction pressure 0.0 / 0.0 psi g
CAPACITY Rated	150.0 gpm
HEAD	122.0 (ft)

Performance at 3520 RPM

PUBLISHED EFFY	68.0% (CDS)
RATED EFFY	64.0% with contract seal
RATED POWER	7.2 hp (incl. Mech. seal drag 0.37). (Run out 9.1 hp)
NPSHR	8.8 ft
DISCH PRESSURE(R)	54.5 psi g (62.0 psi g @ Shut off) Based on 0.0 psi g Suc.press
PERF. CURVE	2076-8 (Rotation CW viewed from coupling end)
SHUT OFF HEAD	143.2 ft
MIN. FLOW	Continuous Stable: 18.6 gpm Hydraulic: 18.6 gpm Thermal: N/A

Materials

CONSTRUCTION	316SS
CASING	316SS (max.casing.pres. @ rated temperature 275.0 psi g)
ST.BOX COVER	316SS
IMPELLER	316SS - Open (5.6250 in rated, max=6.0625 in, min=4.0000 in)
CASING GASKETS	Aramid Fiber with EPDM Rubber
IMPELLER O-RING	Teflon
SHAFT MATERIAL	SAE 4140
SHAFT SLEEVE	316SS
LUBRICATION	Flood oil
SEAL CHAMBER	Taper bore plus with VPE
GLAND	316SS Flush quench and drain
BEARINGS	6207 (Inboard) 3306 (Outboard)
COUPLING	Rexnord - Omega Rex Elastomer- ES-3 (standard orange element)-S.F. 1.00
COUPLING GUARD	Carbon steel
BASEPLATE	Cast iron camber top B00050A

Sealing Method

MECHANICAL SEAL	John Crane 5611Q X(1)F(50)1XO(58)1 (Carbon vs Silicon Carbide with Viton) - (Cartridge - Single)

Flanges

150# flat face

Liquid end features

Impeller balanced to ISO 1940 G6.3

Frame Connections

Bearing frame drain
Bottle oiler connection
Frame cooler access
Oil fill connection

Frame features

Condition Monitor
Ductile iron frame adapter
Inpro VBXX-D Hybrid Bearing Isolators
Premium Severe Duty Thrust Bearings

Piping

Flush supplied by customer and mounted by customer

Testing

Non witnessed casing hydrostatic-test

Painting

Goulds Blue standard painting

Warranty

5 Year Extended Warranty (All the components, manufactured by ITT Goulds pumps, in the liquid end and power end are covered).

Driver : Electric motor Manufacturer : Pump mfg`s Choice

FURNISHED BY	Pump mfg	MOUNTED BY	Pump mfg
RATING	10.0 hp (7.5 KW)	ENCLOSURE	TEFC - Epact Efficient
PHASE/FREQ/VOLTS	3/60 Hz/230/460	SPEED	3600 RPM
INSULATION/SF	F/1.15	FRAME	215T

Weights and Measurements

TOTAL NET UNIT WEIGHT / VOLUME	336.4 lb / 4.4 ft³
TOTAL GROSS UNIT WEIGHT / GROSS VOLUME	385.4 lb / 9.7 ft³

Program Version 1.30.0.0

Our offer does not include specific review and incorporation of any Statutory or Regulatory Requirements and the offer is limited to the requirements of the design specifications. Should any Statutory or Regulatory requirements need to be reviewed and incorporated then the Customer is responsible to identify those and provide copies for review and revision of our offer.

Our quotation is offered in accordance with our comments and exceptions identified in our proposal.

Click here to download the pump Bulletin

Click here to learn more about the new *i-FRAME™*

PUMPSMART FLOW ECONOMY ESTIMATES

FIXED SPEED

22.5
gpm/kW

Expected range for typical operation 17.5 to 26.8 gpm/kW



PUMPSMART

31.5
gpm/kW

Expected range for typical operation 26.2 to 35.4 gpm/kW

Click Here To Learn More!

Estimated Annual Savings 833 USD

Standard Datasheet

CENTRIFUGAL PUMP SPECIFICATION

CLIENT	CONTRACT NO:
ADDRESS:	BY: Wade Young DATE:
PLANT LOCATION: UNITED STATES	APPROVED: DATE:
ITEM: ARCADIS 150 @ 122	EQUIP.IDENT.NO:

PUMPING CONDITIONS

FLUID PUMPED:	Water			PUMP MATERIAL CLASS	316SS		
PUMPING TEMP. (PT)	21.1	deg C	70.0 deg F	VISCOSITY @ PT	1.000	CP	PH
SPECIFIC GRAVITY @ PT	1.000			DENSITY @ PT	0.0	Lb/ft³	
VAPOR PRESS. @ PT		mmHg	0.00 PSI ABS	SOLIDS CONTENT		%WT	

PERFORMANCE CHARACTERISTICS

CAPACITY, GPM	NORMAL 0.0	RATED 150.0	MIN. HYDRAULIC / THERMAL FLOW	18.6 / N/A	
TDH, FT: NORMAL	RATED 122.0	DISCH.PRESSURE	54.5	PSI G	
SUCTION PRESS., PSI G	RATED 0.0	MAXIMUM	0.0		
NPSH, FT ABS: AVAIL.(NORMAL)	0.0	(RATED) 8.8	REQD	BY PUMP CURVE NO.	2076-8
BHP, hp (RATED)	7.2	(MAX) 9.1	EFFICIENCY (NORMAL)	(RATED)	64.0

PUMP DESCRIPTION

TYPE	3196 STi	SIZE	1.5x3-6	RPM	3520	ROTATION	■ CW ☐ CCW
IMPELLER TYPE	Open	DIA. in (RATED)	5.6250	(MAX)	6.0625	(MIN BY MFR)	4.0000
☐ PACKING TYPE	SIZE	NO. OF RINGS	0	SEAL CAGE	☐ YES	☐ NO	
■ MECH.SEAL MFR and MODEL/DYN SEAL	John Crane 5611Q X(1)F(50)1XO(58)1 (Carbon vs Silicon Carbide with Viton)						
SUCTION ■ FLGD ☐ SCRD	SIZE 3"	ANSI 150#	LB.ASA	FACING FF	POSITION ■ CL	☐ SIDE	☐ FACING UP
DISCHARGE ■ FLGD ☐ SCRD	SIZE 1.5"	ANSI 150#	LB.ASA	FACING FF	POSITION ■ TOP CTR	☐ TANGENT	☐ SIDE
BEARINGS (MFR AND TYPE): RADIAL	6207	THRUST	3306	(VERT.) THRUST	☐ UP	☐ DOWN	
MATERIAL: CASING	316SS	IMPELLER	316SS	SHAFT/SLEEVE	SAE 4140 / 316SS		
SPECIAL MATERIAL							
CASING: ☐ VENT	NPT ☐ DRAIN	NPT	GAGE CONN.	☐ SUCTION	☐ DISCHARGE	1/4 / 1/4	NPT
STUFF.BOX: ☐ TAP FOR FLUSH	NPT ☐ TAP FOR DRAIN	NPT	☐ JACKETED	NPT CONN:COOL WATER RQD GPM			
CASING: NO OF STAGE	1	MOUNTING: ☐ CENTERLINE	■ FOOT	☐ BRACKET	☐ VERTICAL		
CASING SPLIT: ☐ HORZ	■ VERTICAL	TYPE OF VOLUTE: ■ SINGLE	☐ DOUBLE	☐ DIFFUSER			
COVER PLATE ☐ JACKETED	NPT CONN.	☐ GLAND COOLING NPT CONN.		BEARING HOUSING ☐ JACKETED		NPT	
PUMP BUILT TO: ■ ANSI	☐ API STD 610	☐ SPECIAL	SPECIFICATIONS				
COUPLING TYPE:	Spacer	MAKE:	Rexnord / Omega Rex Elastomer- ES-3 (standard orange element)	GUARD:	Carbon steel		
LUBRICATION:	Flood oil	HYDROSTATIC TEST PRESSURE:	0.0	PSI G			
WEIGHT (LB): PUMP	92.0	DRIVER	160.0	BASEPLATE	80.0		
PUMP SERIAL NO.:							
PUMP CURVE NO.:	2076-8						
SECTIONAL DWG.NO.:							

DRIVER

■ ELECTRIC MOTOR	10.0 HP	230/460 V	3 PH	CPS	3600 RPM	EQUIP #	
MFR	Pump mfg`s Choice	CLASS		GROUP			
☐ STEAM TURBINE MFR		STEAM	PSI G	EXHAUST	PSI G		
☐ SPECIAL: MFR							

REMARKS:

REV.NO.	REVISION	BY	DATE	APPD	DATE	VENDOR ITT Corporation
						P.O.NO
						C.O.NO
						P.O.ITEM NO

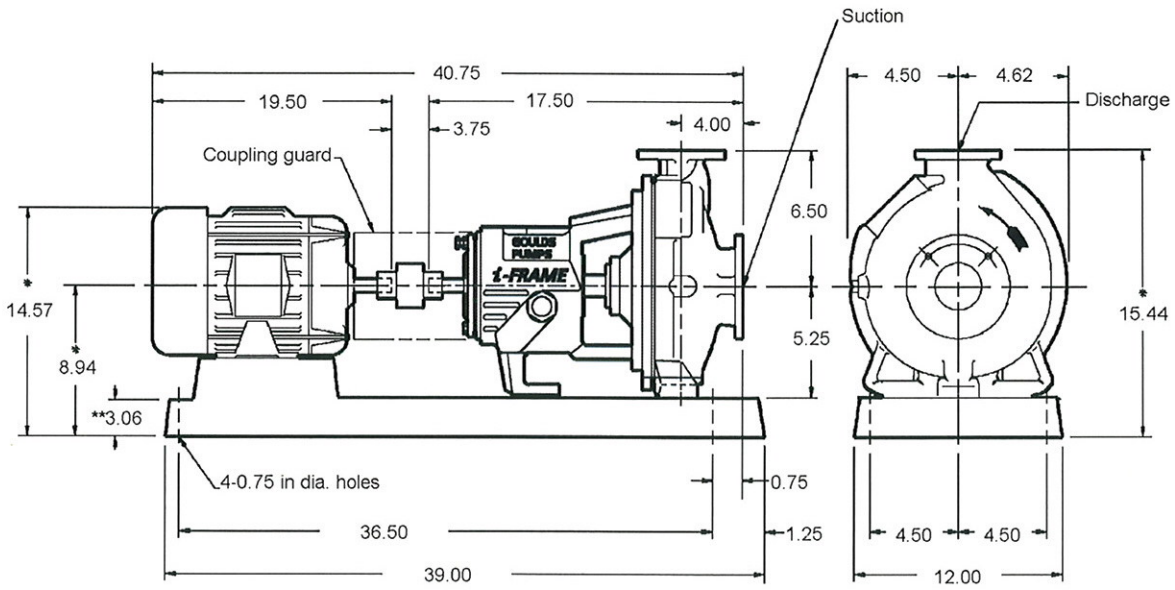
ACCOUNT DIST.NO.
DELIVERY
NOT BEFORE DATE

GOULDS PUMPS

OUTLINE DRAWING

Model 3196 STi
Size 1.5x3-6

ITT



Pump specification

SUCT.FLANGE SIZE	*3"*	DRILLING	*ANSI 150#*	FACING	*FF*	FINISH	*SERRATED*
DISCH.FLANGE SIZE	*1.5"*	DRILLING	*ANSI 150#*	FACING	*FF*	FINISH	*SERRATED*
PUMP ROTATION (LOOKING AT PUMP FROM MOTOR)			*CW*				
TYPE OF LUBRICATION	*FLOOD OIL*					COOLED	*NO*
TYPE OF STUFFING BOX	*TAPER BORE PLUS WITH VPE*					COOLED	*NO*
TYPE OF SEALING	*MECHANICAL SEAL*						

Weights and Measurements

PUMP	*92.0 lb*
MOTOR/CPLG	*160.0/4.4 lb*
BASEPLATE	*80.0 lb*
TOTAL	*336.4 lb*
GR.VOLUME w/BOX	*9.7 ft³*
GR.WEIGHT w/BOX	*385.4 lb*

Motor specification

MOTOR BY	*PUMP MFG*	MOUNT BY	*PUMP MFG*	MFG.	*PUMP MFG`S CHOICE*
FRAME	*215T*	POWER	*10.0 hp*	RPM	*3600*
PHASE	*3*	FREQUENCY	*60 HZ*	VOLTS	*230/460*
INSULATION	*F*	S.F.	*1.15*		
ENCLOSURE	*TEFC - EPACT EFFICIENT*				

Auxiliary specification

COUPLING BY	*PUMP MFG*	CPLG TYPE	*REXNORD OMEGA REX ELASTOMER- ES-3 (STANDARD ORANGE ELEMENT)*
CPL GUARD BY	*PUMP MFG.*	CPLG GUARD MATL	*CARBON STEEL*
BASEPLATE	*CAST IRON CAMBER TOP B00050A*		
MECH.SEAL	*JOHN CRANE 5611Q X(1)F(50)1XO(58)1 (CARBON VS SILICON CARBIDE WITH VITON)*		

Notes and References

- MTR DIMENSIONS ARE APPROXIMATE
- INSTALL FOUNDATION BOLTS IN PIPE SLEEVES
- ALLOW FROM 0.75 to 1.50in. FOR GROUTING. SEE INSTRUCTION BOOK FOR DETAILS.

*Tolerance is -0.50 +0

** Foundation bolt grip thickness

FOR PUMP TAPPED OPENINGS REFER TO DWG.:
TLKWAY09-07-06 03 / ARCADIS 150 @ 122

DRAWING IS FOR REFERENCE ONLY.
NOT CERTIFIED FOR CONSTRUCTION UNLESS SIGNED.

Customer: HUDSON PUMP
Serial No:
Customer P.O. No:
Item No: ARCADIS 150 @ 122
End User: HUDSON
Service:

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All dimensions are in inches.
Drawing is not to scale
Weights (lbs) are approximate

R625-EDC-001213-0

DRAWING NO LKWAY09-07-06 03/ARCADIS 150 @ 122

FORM # ED0062

Program Version 1.30.0.0

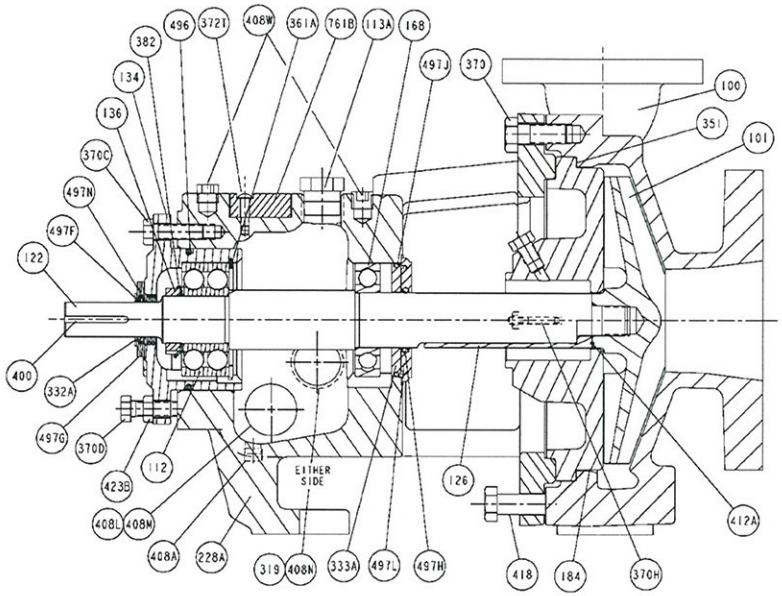
GOULDS PUMPS

CROSS SECTIONAL DRAWING

Model 3196 STi
Size 1.5x3-6

ITT

R625-EDC-001213-0



* Recommended spare parts

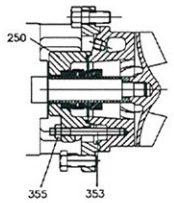
\# Items not illustrated

BILL OF MATERIAL

ITEM	QTY		PART NAME	MATERIAL	ASTM#
100	1		CASING	316SS 316SS C	A743, A744
101	1	*	IMPELLER W/O-RING	316SS 316SS C	A743, A744
112	1	*	BALL BEARING OUTBOARD		
113A	1		PIPE,PLUG OIL FILL		
122	1	*	SHAFT	ALLOY STL 4140 4140	A434
126	1	*	SHAFT SLEEVE		
134	1		BEARING HOUSING	CAST IRON CI 45	A48
136	1	*	BEARING LOCK NUT		
168	1	*	BALL BEARING (INBOARD)		
183	1	#	BEDPLATE IS NOT PRE-ENGIN	CAST IRON CI 45	A48
184	1	*	ST BOX COVER		
228A	1		FRAME	DUCTILE IRON DI 6	A536-84
232	1	#	MOTOR HUB		
233	1	#	PUMP HUB		
235G	1	#	FLEX ELEMENT		
319	1		SIGHT WINDOW		
332A	1	*	LAB SEAL OB		
333A	1	*	LAB SEAL IB		
351	1	*	CASE GASKET	ARAMID FIBER W/EPDM RUBBER	
353	1		GLAND STUD		
354	1	#	GLAND WASHER		
355	1		HEX NUT (GLAND STUD)		
357K	2	#	NUT,HEX (COVER TO ADAPT)	304SS	A276-95
358N	1	#	GLAND PLUG		
361A	1	*	RETAINING RING BRG HSG		
370	4		H CAP SCREW (CASE)	304SS	A276-95
370C	3		H CAP SCREW (BRG HSG-FRA	CARBON STEEL GR B	A307
370D	3		H CAP SCREW (IMPLR ADJ)	CARBON STEEL GR B	A307
370H	2		STUD (COVER)	304SS	A276-95
382	1	*	BEARING LOCKWASHER		
383	1	* #	MECHANICAL SEAL (ORDERED		
400	1	*	SQ END KEY (CPLG)	CARBON STEEL 1018/1020	A108
408A	1		PIPE PLUG (OIL DRAIN)		
408L	1		PIPE PLUG (FRAME CLG IN)		
408M	1		PIPE PLUG (FR CLG OUT)		
408N	1		PIPE PLUG (SIGHT OILER)		
408W	2		PIPE PLUG (PROSMART)		
412A	1	*	O-RING IMPLR	TEFLON	A3651
418	2		H TAP BOLT	304SS	A276-95
423B	3		NUT,JAM IMPELLER ADJ	CARBON STEEL GR B	A307
496	1	*	O-RING BRG HOUSING	BUNA-N	
497F	1	*	O-RING LAB SEAL	VITON	
497G	1	*	O-RING LAB SEAL	BUNA-N	
497H	1	*	O-RING LAB SEAL	VITON	
497J	1	*	O-RING LAB SEAL	BUNA-N	
497L	1	*	ORING,RADIAL O.B	VITON	
497N	1	*	ORING,THRUST O.D	VITON	
501	1	#	CPLG GUARD ASSY	CARBON STEEL	
761B	1		MONITOR,LCCM		
902	1	* #	MAINTENANCE KIT		
906	1	#	REPAIR KIT		

SEAL CHAMBER

TAPER BORE-TM PLUS



REFER TO SEAL DRAWING NO. (TO FOLLOW):

Customer: HUDSON PUMP
Serial No:
Customer P.O. No:
Item No: ARCADIS 150 @ 122
End User: HUDSON
Service:

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ITT Corp

DRAWING NO LKWAY09-07-06 03/ARCADIS 150 @ 122

Model: 3196	Size: 1.5x3-6	Group: STi	60Hz	RPM: 3520	Stages: 1

Job/Inq.No. :
Purchaser : HUDSON PUMP
End User : HUDSON
Rev. : 0
Issued by : Wade Young
Item/Equip.No. : ARCADIS 150 @ 122
Quotation No. : LKWAY09-07-06 03
Date : 07/06/2009
Service :
Order No. :
Certified By :

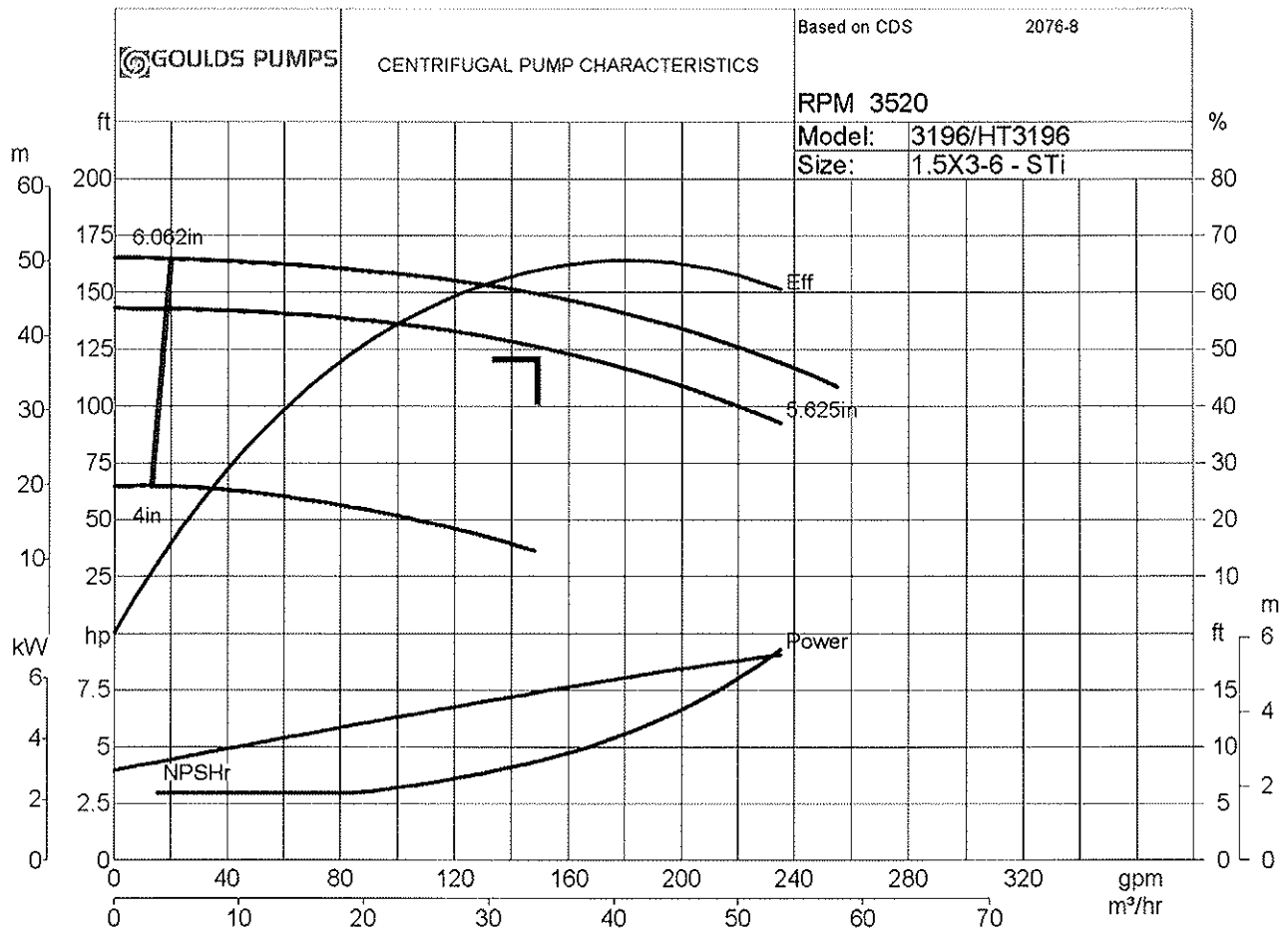
Operating Conditions

Liquid:	Water	Published Efficiency:	68.0 %	Suction Specific Speed:	7,945 gpm(US) ft
Temp.:	70.0 deg F	Rated Pump Efficiency:	64.0 %	Min. Hydraulic Flow:	18.6 gpm
S.G./Visc.:	1.000/1.000 cp	Rated Total Power:	7.2 hp	Min. Thermal Flow:	N/A
Flow:	150.0 gpm	Non-Overloading Power:	9.1 hp		
TDH:	122.0 ft	Imp. Dia. First 1 Stg(s):	5.6250 in		
NPSHa:		NPSHr:	8.8 ft		
Solid size:		Shut off Head:	143.2 ft		
% Susp. Solids (by wtg):		Vapor Press:			

Max. Solids Size: 0.4380 in

Pump Performance

Notes: 1. Elevated temperature effects on performance are not included.



ITT

Catalogue and Product Data Sheets

Item	Tag	Description
19	F-210A, F-210B, F-210C	Media Filters

Yardney
WATER MANAGEMENT SYSTEMS, INC.

- INDUSTRIAL
- PRESSURIZED
- IN-LINE

MULTI-MEDIA FILTRATION SYSTEMS



Yardney high rate automatic backwashing **Multi-Media** filters are designed for enhanced capacity water filtration. These permanent media automatic backwashing filters will remove organic and/or inorganic suspended solids down to 5-10 microns in size and will entrap greater amounts of suspended solid contaminants than sand media filters. Through the use of automatically controlled backwashing, the filter will operate "on line" for extended periods of time prior to the short backwashing cycle. Automatic filter operation is monitored on both elapsed time as well as pressure differential. When the controller "calls" for a backwash as a result of pressure differential or elapsed time, the backwashing function utilizes a portion of the clean filtered water produced by the system to clean the media. Single tank systems utilize unfiltered water for backwashing. Optional external backwash water sourcing systems are available for both single and multiple tank systems.

- EXCELLENT FOR SUSPENDED SOLIDS REMOVAL DOWN TO 5-10 MICRONS
- UNITS SHIPPED COMPLETELY ASSEMBLED ON STRUCTURAL SKIDS
- 3M SCOTCHKOTE 134 FUSION BONDED EPOXY LININGS
- 60" DEEP SAND MEDIA TANK SHELLS ARE STANDARD
- AUTOMATIC BACKWASH VALVES IN CAST IRON, STAINLESS TRIM- (AIR OR WATER POWERED)
- SOLID STATE CONTROLS WITH INTEGRAL ADJUSTABLE PRESSURE DIFFERENTIAL SWITCH.
- FLANGED OR GROOVED OPTIONS AVAILABLE FOR INLET AND OUTLET CONNECTIONS
- REMOVEABLE TYPE 304 STAINLESS UNDER-DRAINS
- IDEAL FOR RAW WATER FILTRATION OR PRE-TREATMENT OF R.O. OR D.I. SYSTEMS AND IN-LINE DISPOSABLE CARTRIDGE OR BAG FILTERS
- EASY INSTALLATION AND START-UP
- ASME CODE STAMP AVAILABLE (OPTIONAL)
- NEMA 4X CONTROLS HOUSING AVAILABLE (OPTIONAL)
- FILTERED WATER BACKWASH ON MULTIPLE TANK SYSTEMS

Yardney Water Management Systems, Inc.
6666 Box Springs Blvd., Riverside, CA U.S.A.
Phone: (951) 656-67l6 or (800) 854-4788 ●Fax (951) 656-3867
Website: www.yardneyfilters.com ● Email: sales@yardneyfilters.com

R625-EDC-001213-0

LIT-ILDATA-MM-002-1206

Yardney
WATER MANAGEMENT SYSTEMS, INC.

INDUSTRIAL IN-LINE PRESSURIZED MULTI-MEDIA FILTRATION SYSTEMS

ENGINEERING & SIZING DATA FOR SINGLE & MULTIPLE TANK SYSTEMS MULTI-MEDIA FILTRATION SYSTEMS – 60" SIDE SHELL TANKS DESIGNED FOR **HIGH QUALITY FILTRATION APPLICATIONS** FOR REMOVAL OF SUSPENDED SOLIDS DOWN TO **5-10 MICRONS** IN SIZE

	Service Flow rates									Approximate Shipping Weight Lbs.			Approximate Space Requirement		
Model Number	Normal Flow Range GPM	Peak Flow Rate GPM	Total Filtration Area (Sq. Ft.)	Dia. X Side Shell (Inches)	Multi-Media Cu. Ft.	Back-Wash GPM	Inlet/Outlet Size	Back-wash Line Size	Standard Maximum Working Pressure	Equip.	Media	Approximate Operating Weight Lbs.	Length	Width	Height
MM-2460-1A	16-47	63	3.15	24 X 60	12.0	47	2"	2"	100 PSI	465	1210	2200	3' 1"	2' 4"	8' 0"
MM-2460-2A	32-95	126	6.30	24 X 60	24.0	47	3"	2"	100 PSI	875	2468	4500	4' 5"	2' 4"	8' 6"
MM-2460-3A	48-142	189	9.45	24 X 60	36.0	47	3"	2"	100 PSI	1330	3578	6750	6' 9"	2' 4"	8' 6"
MM-3060-1A	25-74	98	4.91	30 X 60	20.0	74	3"	3"	100 PSI	680	2116	3650	4' 8"	2' 9"	8' 6"
MM-3060-2A	50-147	196	9.82	30 X 60	40.0	74	4"	2"	100 PSI	1140	4205	7050	5' 5"	2' 9"	8' 8"
MM-3060-3A	75-221	294	14.73	30 X 60	60.0	74	4"	2"	100 PSI	1740	5846	10,600	8' 3"	2' 9"	8' 8"
MM-3660-1A	35-107	142	7.10	36 X 60	28.5	107	3"	3"	100 PSI	840	3022	5150	4' 8"	3' 3"	8' 10"
MM-3660-2A	70-213	284	14.20	36 X 60	57.0	107	4"	4"	100 PSI	1485	5617	10,100	6' 5"	3' 3"	9' 3"
MM-3660-3A	105-320	426	21.30	36 X 60	85.5	107	4"	4"	100 PSI	2420	8364	15,350	9' 9"	3' 3"	9' 3"
MM-4860-1A	63-189	252	12.60	48 X 60	51.5	189	4"	4"	80 PSI	1160	5138	9150	5' 7"	4' 3"	9' 10"
MM-4860-2A	126-378	504	25.20	48 X 60	103.0	189	6"	4"	80 PSI	2360	10,101	18,300	8' 5"	4' 3"	10' 2"
MM-4860-3A	189-567	756	37.80	48 X 60	154.5	189	6"	4"	80 PSI	3450	15,064	27,300	12' 9"	4' 3"	10' 2"
MM-4860-4A	252-756	1008	50.40	48 X 60	206.0	189	8"	4"	80 PSI	5070	20,002	36,850	17' 1"	4' 3"	10' 4"
MM-4860-5A	315-945	1260	63.00	48 X 60	257.5	189	10"	4"	80 PSI	6060	25,065	45,850	22' 2"	4' 3"	10' 2"
MM-4860-6A	378-1134	1512	75.60	48 X 60	309.0	189	10"	4"	80 PSI	7150	30,028	54,850	26' 6"	4' 3"	10' 2"
MM-5460-1A	80-239	318	15.91	54 X 60	65.5	239	4"	4"	80 PSI	1350	6423	11,400	5' 10"	4' 9"	10' 4"
MM-5460-2A	160-477	636	31.82	54 X 60	131.0	239	6"	4"	80 PSI	2710	12,746	22,850	9' 4"	4' 9"	10' 8"
MM-5460-3A	240-716	954	47.73	54 X 60	196.5	239	6"	4"	80 PSI	4080	17,366	34,250	14' 2"	4' 9"	10' 8"
MM-5460-4A	320-955	1272	63.64	54 X 60	262.0	239	8"	4"	80 PSI	5540	25,417	45,750	19' 9"	4' 9"	10' 10"
MM-5460-5A	400-1193	1590	79.55	54 X 60	327.5	239	10"	4"	80 PSI	6940	31,740	57,200	24' 7"	4' 9"	10' 8"
MM-5460-6A	480-1432	1908	95.46	54 X 60	393.0	239	10"	4"	80 PSI	8320	38,088	68,650	29' 5"	4' 9"	10' 8"

Single Tank Models I.D. – 1A Multiple Tank Models I.D. – 2A, 3A, 4A, 5A, 6A

Standard Systems Include:

- Filtered water backwash on multi-tank systems
- All interior surfaces fusion epoxy coated with 3M Scotchkote 134
- Advanced solid-state automation with elapsed timer and pressure differential control
- Skid mounted on structural steel skid
- Liquid-filled stainless steel pressure gauges
- Grooved coupling in/out standard (flanged available – consult factory
- Automatic diaphragm operated non-corrosive brass or cast iron valves
- Systems provided with interconnecting piping
- Removable type 304 stainless steel cross-flow underdrain standard
- ASME code stamped available – consult factory
- Filtration media is included in the system definition and pricing.

STANDARD MEDIA SPECIFICATIONS:

Gravel Pack:	½" X ¾" crushed rock
Garnet:	INTERFACE MEDIA
Garnet:	WORKING MEDIA
Anthracite:	PRE-FILTER MEDIA

NOTE: For optional media grades, consult factory.
NOTE: Media shipping weight includes gravel pack.
NOTE: For higher working pressure operation requirements, consult factory.

"Excellence In Filtration For A Better World"

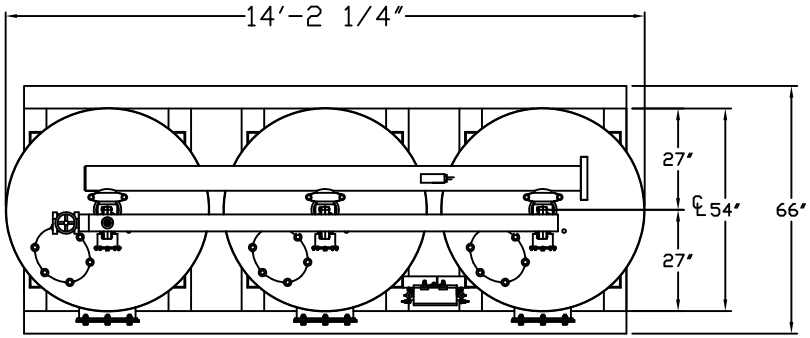
Yardney Water Management Systems, Inc.
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Website: www.yardneyfilters.com ● Email: sales@yardneyfilters.com

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LIT-ILDATA-MM-002-1206

R625-EDC-001213-0

MODEL MM 5460-3A

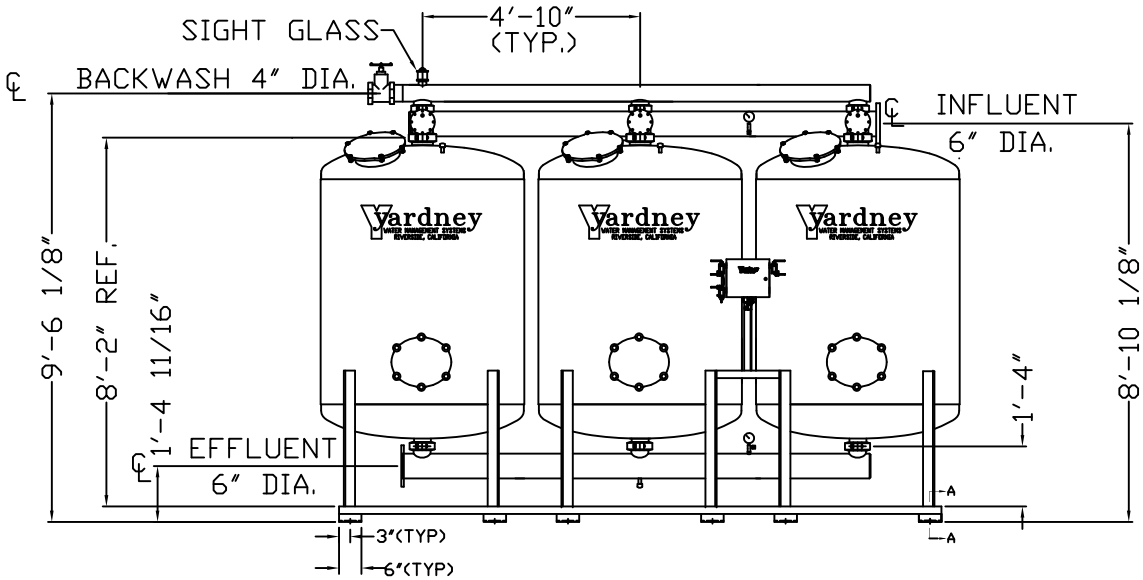


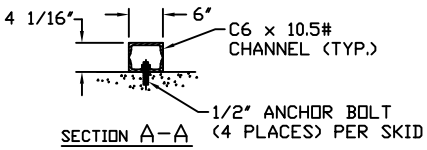
1. FLOW RATE DESIGN = 240-716 GPM; MAX TO 954 GPM.
2. MAXIMUM WORKING PRESSURE - 80 PSI .
3. ELECTRICAL REQUIREMENTS:
   - CONTROLLER 120V;
   - SOLENOIDS 24VAC; FACTORY WIRED
4. AIR SUPPLY REQUIRED: 2 CFM @ 70 PSIG (MIN.).
5. MEDIA REQUIREMENT PER TANK:

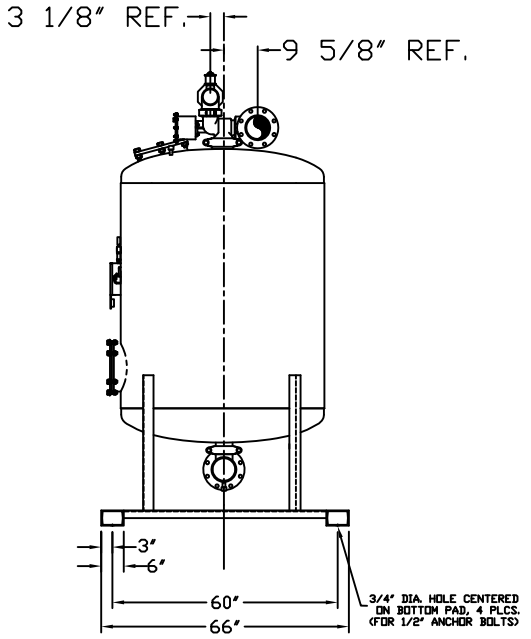
A. 1/2"x3/4" CRUSHED ROCK	- 9.5 CU. FT. .
B. 1.45mm GARNET	- 8.0 CU. FT. .
C. 0.35mm GARNET	- 24.0 CU. FT. .
D. 0.75mm ANTHRACITE	- 24.0 CU. FT. .

6. WEIGHTS: (APPROX.)

EQUIPMENT	- 4,080 LBS (LESS MEDIA)
MEDIA	- 17,366 LBS
OPERATION	- 34,250 LBS







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Yardney WATER MANAGEMENT SYSTEMS RIVERSIDE, CALIFORNIA

SYM	REVISIONS	BY	DATE	APP
C	ADDED SIGHT GLASS	DTC	10-05	APP
B	CORRECTED GPM FLOW RATES	DTC	10-05	APP
A	STANDARDIZED NOTES	DTC	9-05	APP

APPROVALS | DATE
DRAWN BY K.A.T. 10/6/05
CHECKED BY
APPROVED BY
ARCHITECTURAL SCALE
USED ON

MODEL MM 5460-3A

SIZE D | DRAWING NO. 9500546003 | REV C
SCALE | SYS SER# SYSTEM\MM | SHEET 1 OF 1

PRODUCT BULLETIN

High-Rate Granular Filter Media for the Removal of
Arsenic, Radium, Iron, Manganese and Hydrogen Sulfide
from Water Supplies

LayneOx™ operates both as a classical filter working with an oxidant and as a catalytic media due to its ability to accelerate the reaction between the oxidizing agent and the iron, manganese, arsenic and hydrogen sulfide present.

In groundwater, all chemical constituents are in a state of equilibrium in a reducing environment. Dissolved iron, manganese, arsenic and hydrogen sulfide will stay in solution until they are exposed to an oxidizing environment. Utilizing **LayneOx™** and an oxidant additive immediately before the raw water enters the filter causes these compounds to adsorb, oxidize, and precipitate.

Iron and manganese that are not oxidized become catalytically precipitated and then adsorbed directly on the media. Most of the manganous manganese is rapidly removed in the first few inches of the media where it is further oxidized to manganese dioxide. The adsorbed manganese, iron, arsenic and precipitated sulfur are expelled during backwash. Any insoluble ferric hydroxide particulate growths are also expelled during backwash.

For arsenic removal, the arsenic is coprecipitated with the iron onto the **LayneOx™** media as ferric arsenate. When hydrous manganese oxide (HMO) is added, radium is also removed with **LayneOx™**.

A continuous reaction occurs with the addition of the oxidant, regenerating the media surface and replenishing the manganese dioxide. Adsorption kinetics relate manganese dioxide removal to a media's manganese oxide concentration.

Because it contains a naturally high manganese dioxide content, **LayneOx™** provides a higher adsorption capacity and faster reaction kinetics than other media.

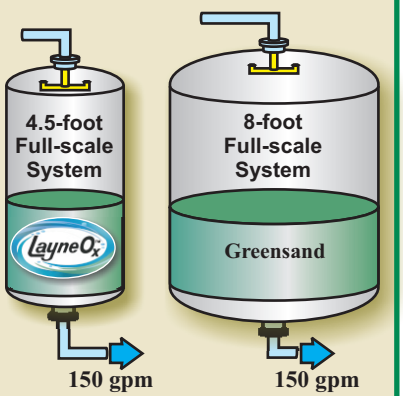


This Delaware utility water treatment plant utilizes **LayneOx™** media to remove iron and manganese at a rate of 1600 gpm.

Advantages in the design of LayneOx™ include:

- High surface loading rates of 6-12 gpm/ft^2 are possible
- Catalytic media using backwash to remove contaminant solids
- Utilize chlorine or other common oxidants
- 10-30 second reaction time with oxidant additive
- Catalyzes the oxidation and removal of iron, manganese and hydrogen sulfide
- Oxidized contaminants precipitate onto media and are backwashed away
- Co-precipitates arsenic with iron as ferric arsenate
- Reduces operating costs by removing manganese without the need to feed permanganate
- Reduces equipment size
- Eliminates need for detention basin
- LayneOx™ is superior to manganese greensand both in capacity and reaction rate for all these contaminants.

Smaller Footprint with LayneOx™



LayneOx™ Media Specifications



* 8 x 20 mesh



** 20 x 40 mesh

Screen size, US sieve	8 x 20 mesh*; 20 x 40 mesh**
Color	Black
Physical form	Black granular particulate
Moisture content	Less than 0.5% as shipped
Bulk density as shipped	120 pounds/cu ft
Backwashed density	110 pounds/cu ft
Uniformity coefficient	<1.65
Effective size	1.0 - 1.3mm*; 0.3 - 0.5mm**
Manganese dioxide content	70-80% by weight throughout media matrix
CAS#	1313-13.9
NSF 61	Compliant
H_2S capacity	300 gr/cu ft

Operating Conditions

pH range	6-9
Temperature	Groundwater ambient
Surface loading rate	8-15 gpm/sq ft
Pressure drop (bed + underdrain)	2 psig @ 15 gpm/sq ft* 4 psig @ 9 gpm/sq ft**
Terminal ΔP	10 psig
Bed depth	36 inches - 48 inches
Media contact time	2 minutes minimum
Air scour rate	3 scfm/sq ft with 5 gpm/sq ft water for 10 minutes, followed by 12-15 gpm/sq ft (water only) for 5 minutes
Backwash (without air scour)	30 gpm/sq ft*; 25 gpm/sq ft** 5 minutes
Bed expansion freeboard	50% of bed depth
Typical oxidant	Chlorine
Oxidant form	Gas or 12.5% sodium hypochlorite
Oxidant contact time	10-30 seconds
Oxidant point of addition	Inlet to LayneOx™ filter
Typical oxidant dosage	0.5-2.0 ppm
Media life	Over 10 years
Removal efficiency	Up to 99%+ for iron, manganese
Backwash frequency	Typically once every 24-48 hours

* Values for 8 x 20 mesh media
** Values for 20 x 40 mesh media
Product specifications are subject to change without notice

Typical System Features

- ASME Section VIII, Div. 1 Code pressure vessels
- Filter vessels, piping for raw water, backwash supply, backwash return, rinse-to-drain and controls shipped as integrated shop-assembled system
- Automated valves and PLC controlled operation flow control for each filter and backwash
- Flow rate and integrated flow indication
- Differential pressure indicators
- Strategically located sample points
- Ductile iron, carbon steel piping
- Primed and painted vessels, piping
- Galvanized support skid
- System and media delivery, installation and startup
- NSF epoxy lining

Optional Features

- NSF abrasion-resistant vessel lining
- Manual valve systems
- Vessel relief valves
- PVC piping
- Oxidant feed system and oxidant residual analyzer
- Air scour system
- High-efficiency backwash water recovery system

Layne Christensen Company - Complete Services for High-capacity Water Supply

Corporate Headquarters
1900 Shawnee Mission Parkway
Mission Woods, Kansas 66205
913.362.0510 • FAX: 913.362.0133
www.laynechristensen.com

Water Treatment Division
97 Chimney Rock Road
Bridgewater, New Jersey 08807
800.269.4590 • FAX: 732.469.7966
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Regional Representative:

R625-EDC-001213-0

Catalogue and Product Data Sheets

Item	Tag	Description
21	F-230A, F-230B, F-230C	Ultrafiltration System

Membrane Systems Series 82, 83 and 86

Crown Solutions

Cost-Effective Water Purification

Membrane filtration has been proven to offer cost-effective purification of water for a variety of applications. Creating water solutions for more than 20 years, Crown Solutions offers membrane technology for industrial processes including:

- Purifying process water
- Providing high purity water to utility systems
- Treating wastewater streams for recycling and reuse

Crown Solutions' membrane systems are delivered fully assembled on skids and are factory tested to minimize installation costs and simplify start-up. With three design sizes: Series 82, 83 and 86, the membrane systems are designed for flow rates ranging from 10 gpm to more than 1000 gpm. To further customize the systems, the designs can use a variety of membranes, including ultra filtration, nanofiltration and reverse osmosis membranes.

Ultra Filtration (UF) membranes remove sub-micron sized particles and high molecular weight organics from water streams.
Nanofiltration (NF) membranes remove in excess of 98% of divalent dissolved solids, as well as a significant amount of monovalent species.
Reverse Osmosis (RO) membranes remove 99% or more of all dissolved solids.

Benefits that Make a Difference

- Minimized capital costs with membrane housing that hold six standard 8-inch diameter RO membranes or four standard UF membranes.
- Built-in Clean-In-Place (CIP) provisions for each stage for more effective cleanings.



Series 86 Membrane Systems *treat flow rates from 25 to 1000+ gpm and can be designed using ultra filtration, nanofiltration and reverse osmosis membranes.*

- Pressure indication at all critical points for tracking system performance, which extends the life of system components.
- Industrial Programmable Logic Control (PLC) with operator interface allows for reliable, flexible operation.
- Automatic periodic flushing of system helps maintain optimal membrane performance
- Prefilter housing included on all RO and NF systems for pump and membrane protection.
- True flow control valves ensure stable flows and minimize vibration and noise.

Options

- CIP piping and pump integrated into skid
- Motor starters and electrical disconnects
- External communications
- Single skid for multiple systems
- Two pass designs

VEOLIA WATER
Solutions & Technologies

R625-EDC-001213-0

Membrane Systems
Series 82, 83 and 86

Series 83 Membrane Systems

treat flow rates from 25 to 100+ gpm and can be designed using ultra filtration, nanofiltration, and reverse osmosis membranes.



Series 82 Membrane Systems

treat flow rates from 10 to 25 gpm and can be designed using nanofiltration and reverse osmosis membranes.



Crown Solutions

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Vandalia, OH 45377
Toll free: 1-800-875-4075
Tel. 1-937-890-4075
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www.crownsolutions.com
info@crownsolutions.com

R625-EDC-001213-0

UltraFltration System – Triplex – 3 x 100 gpm

PFD Tag No. F-230 A, B & C

Functional Description

An Ultrafiltration system model number CUF-3-862-100 XFlow by Crown solutions will be provided. The system will consist of three UltraFiltration (UF) Trains, shop assembled and skid mounted on a single structural steel skid, wired, tubed, piped and tested. All structural steel will be prepared and finished painted in the shop. The assembly will include face piping, values and field instruments.

General

Number of Skids	One (1)
Material of Skid	Carbon Steel (painted)
Design Flow – Each Train	100 gpm
Design Flow – Total System	300 gpm

Strainers

Number of Strainers	Three (3), one (1) per train
Manufacturer	Amiad Filtomat
Model	Filtomat M104LP
Material	316 SS, Epoxy lined

UF Membranes

Membranes per Train	Eight (8) per UF train
Membranes total system	Twenty-four (24)
Manufacture	NORIT
Model	XIGA SXL-225
Membrane Material	Polyethersulfone (PES) and Polyvinylpyrrolidone (PVP) blend

Membrane Vessels

Number per Train	Two (2) per UF train
Total Number	Six (6)
Vessel Element Capacity	Four (4) MF elements per vessel
Manufacturer	Codeline
Pressure Rating	150 psig, non - code

Pipe

Material of construction	4” Sch 80 PVC main inlet and outlet, 3” Sch 80 PVC on each train.
Arrangement:	Service and backwash piping assembly pre-built and mounted on skid with manual isolation and actuated service control valves

Main Process Valves

Automatic (air-to-air actuated) and manual, 3" & above	Bray butterfly valves; cast iron body, EPDM seat, nylon coated ductile iron disc.
Automatic (air-to-air actuated) and manual, 2" & below	Asahi ball valves, PVC body, EPDM seat and PVC ball.

Gauge Isolation / Sample Valves (low pressure)

Manufacturer / model	Flow-Tek, Series 5000
Type/Size	Ball valve, Unibody, reduced port, ¼" – ½"
Material of Construction	316 stainless steel, PTFE seats

Instrumentation

Process

Flow Meters	Three (3) MagFlow Meters
Manufacture	Endress Hauser
Model	10P50-EL0A1AA0B4AA
Locations	
UF permeate	One(1) per train
Pressure Transmitter	Three (3) to control Filter Pump VFDs
Manufacture	Endress Hauser
Model	PMP41-RC13P6C11G1
Locations	
MF permeate	One(1) per train
Flow Switch	Six (6)
Manufacturer	Gems
Model	FS 150
Locations	
UF Vent	Three (3), one (1) per train
Integrity testing drain line	Three (3), one (1) per train

Analytical

Turbidity Meter	Three (3)
Manufacturer	Hach
Model Number	1720E-6010100
Locations	
UF permeate	One (1) per train

Controls

Panel	One (1) NEMA 4X with terminal strip and solenoids prewired and tubed to valves and instruments
Skid	Carbon steel w/ corrosion resistant urethane coating

Pump Skid – UF Backwash and Chemically Enhanced Backwash (CEB)

PFD Tag No. P-230 A & B

Functional Description

One UF Backwash and Chemically Enhanced Backwash skid model number PS-2-360 CEB by Crown Solutions is to be provided. The UF system is backwashed (back flushed) to maintain performance, both permeate capacity and quality. The backwash pump will be an end suction centrifugal pump each equipped with a VFD. The MF Backwash and Chemically Enhanced Backwash (CEB) Skid provides and maintains a pressurized flow controlled supply of MF permeate water. Chemicals are automatically added to this stream to remove the crud accumulated from the raw feed water, enhance system performance and condition the membranes to maintain optimal operating conditions

A typical Backwash sequence would be:

- Pump ramp up (15 sec) to design backwash flow rate at high flux (150 gfd) for 30-seconds, pump ramp down (15 sec 0 to off).

Two different CEB cycles are typically implemented. CEB1A is executed with a mixture of NaOH + NaOCl and CEB1B is executed with HCl.

CEB1A and CEB1B are executed consecutively, as follows:

- Backwash Cycle: Pump ramp up (15 sec) to backwash at high flux (150 gfd) for 30 seconds, Pump ramp down. (15 sec).
- CEB1A chemical dosing and pump flow at moderate flux (75 gfd) for 65 seconds to flood the membranes with solution, Soak for 10 minutes (pump off), pump ramp up to high flux Backwash for 70 seconds to flush out chemicals, pump ramp down to moderate flux (75 gfd)
- CEB1B chemical dosing with pump flow at moderate flux (75 gfd) for 65 seconds to flood the membranes with solution, Soak for 10 minutes (pump off), pump ramp up to high flux backwash for 70 seconds to flush out chemicals, pump ramp down to Off,

Chemical dosing is automatically accomplished using eductors with automatic valves, and instrumentation to monitor the amount of chemicals being used.

The unit shop assembled, wired, tubed, piped and tested. Face piping and values are shop installed along with the chemical dosing eductor assembly.

General

Number of Skids	One (1)
Number of Pumps	Two (2), common for all trains, one in operation, one stand by
Design Flow	360 gpm @ 40 psi (Backwash) 180 gpm @ 40 psi (Chemically Enhanced Backwash)
Manufacturer	Goulds

Model	3196
Material	316 SS
Horsepower and RPM	15, 1800
Electrical Rating	480/3/60
VFD	Two (2), Allen Bradley PowerFlex

Piping

Main Service and BW	3” & 4” Sch 80 PVC

Eductors

Number of Eductors	Three (3), one per chemical feed
Manufacturer	Mazzei
Model	1078
Material	Polyvinylidene Fluoride (PVDF)

Chemical Feed Tanks

Number of Tanks	Three (3), one per chemical feed
Volume	60 gallons each
Materials	Polyethylene
Dimension	33.5"D x 34"H
Manufacturer	Synder

Pipe

Service	Sch 80 PVC, with socket weld fittings

Main Process Valves

Manual, 3” and above	Bray butterfly valves; cast Iron body, EPDM seat, and nylon coated ductile iron disc.
Automatic (air open spring close) 2” and below	Asahi ball valves, PVC body, EPDM seat and PVC ball.
Manual, 2” and below	Asahi globe valves; PVC body, EPDM seat, PVC ball
Check, 3”	Centerline Crane; cast iron body, EPDM seat, and 316 stainless steel disc.
Check, 2” and below	Asahi valves, PVC body, EPDM seat, PVC ball

Gauge Isolation / Sample Valves (low pressure)

Manufacturer / model	Flow-Tek, Series 5000
Type/Size	Ball valve, Unibody, reduced port, ¼” – ½”
Material of Construction	316 stainless steel, PTFE seats
Actuator	Lever handle

Instrumentation

Process

Pressure Gauge	(2)
Manufacturer	WIKA
Model	Type 233.53
Locations	
Pump Discharge	Two (2), one per pump

Flow Meters	One (1) MagFlow Meters
Manufacture	Endress Hauser
Model	10P1H-EL0A1AA0B4AA (4”)
Locations	
Pump common discharge header	One (1)
Rotameter	
Manufacture	King Instruments
Model	7331-7-6-3-43W
Locations	
Hydrochloric Acid feed	One (1)
Sodium Hydroxide Feed	One (1)
Sodium Hypochlorite Feed	One (1)
Pressure Transmitter	One (1)
Manufacture	Endress Hauser
Model	PMP41-RC13P6C11G1
Locations	Model, Endress Hauser
Pump common discharge header	One (1)
Controls	
Panel	One (1) NEMA 4X with terminal strip and solenoids prewired and tubed to valves and instruments
Skid	Carbon steel w/ corrosion resistant urethane coating

Integrated Control System

Functional Description

One (1) common Main Control Panel (MCP) by Crown Solutions shall be supplied for controlling, monitoring and alarming the UF system. The MCP will be shop assembled, wired and tested before being shipped to the field.

General

Number of Enclosures	One (1)

Equipment Description

Enclosure

Dimensions	60”x38”x12”
Manufacturer	Hoffmann
Model	CP6036
Material	Stainless Steel
Ratings	NEMA 4X

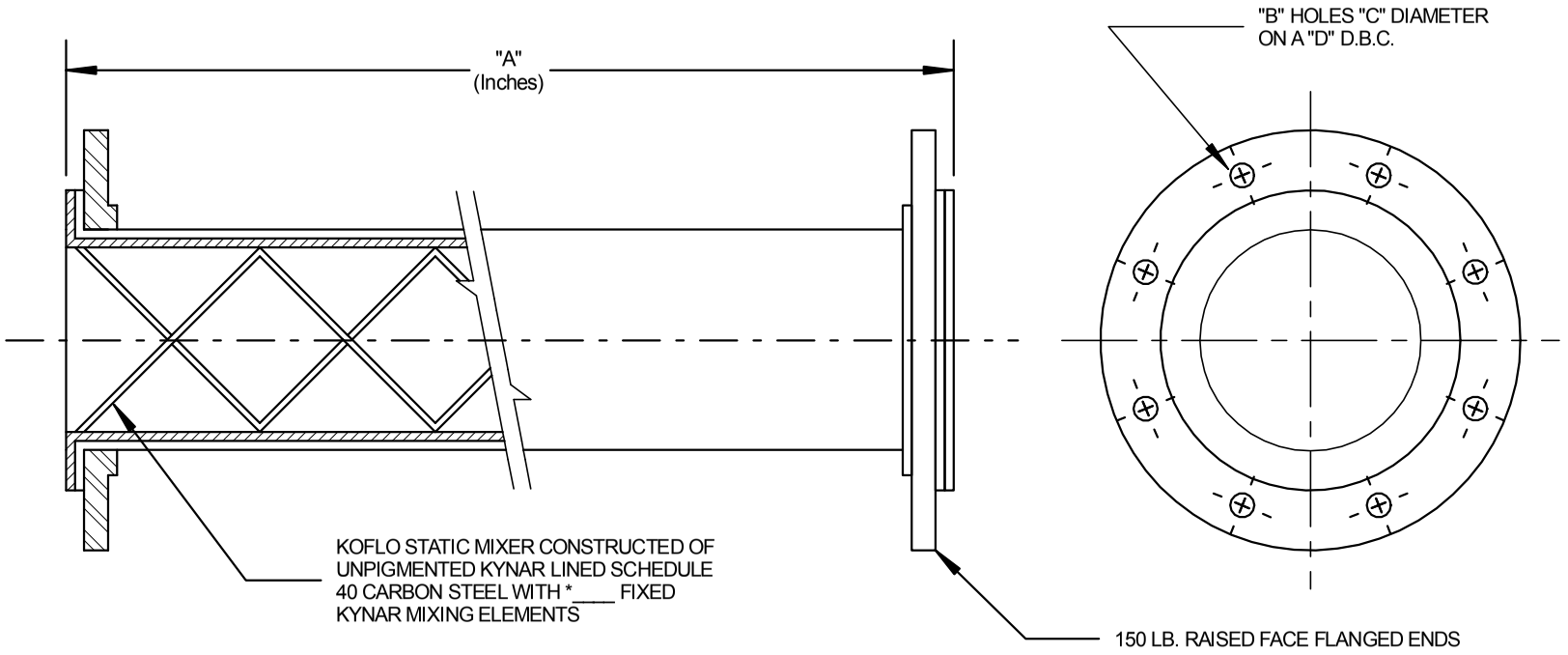
Main Components

PLC	Allen Bradley CompactLogix
Power Supply	Allen Bradley
Back Panel	Hoffmann
HMI	Allen Bradley PanelView 600+ 5.5-inch Color TFT Display, Ethernet, RS-232 & Modular Communications Interface,
Input and Output Cards	Allen Bradley
Horn	Federal Signal

Catalogue and Product Data Sheets

Item	Tag	Description
26	SM-300	AOP Static Mixer

R625-EDC-001213-0



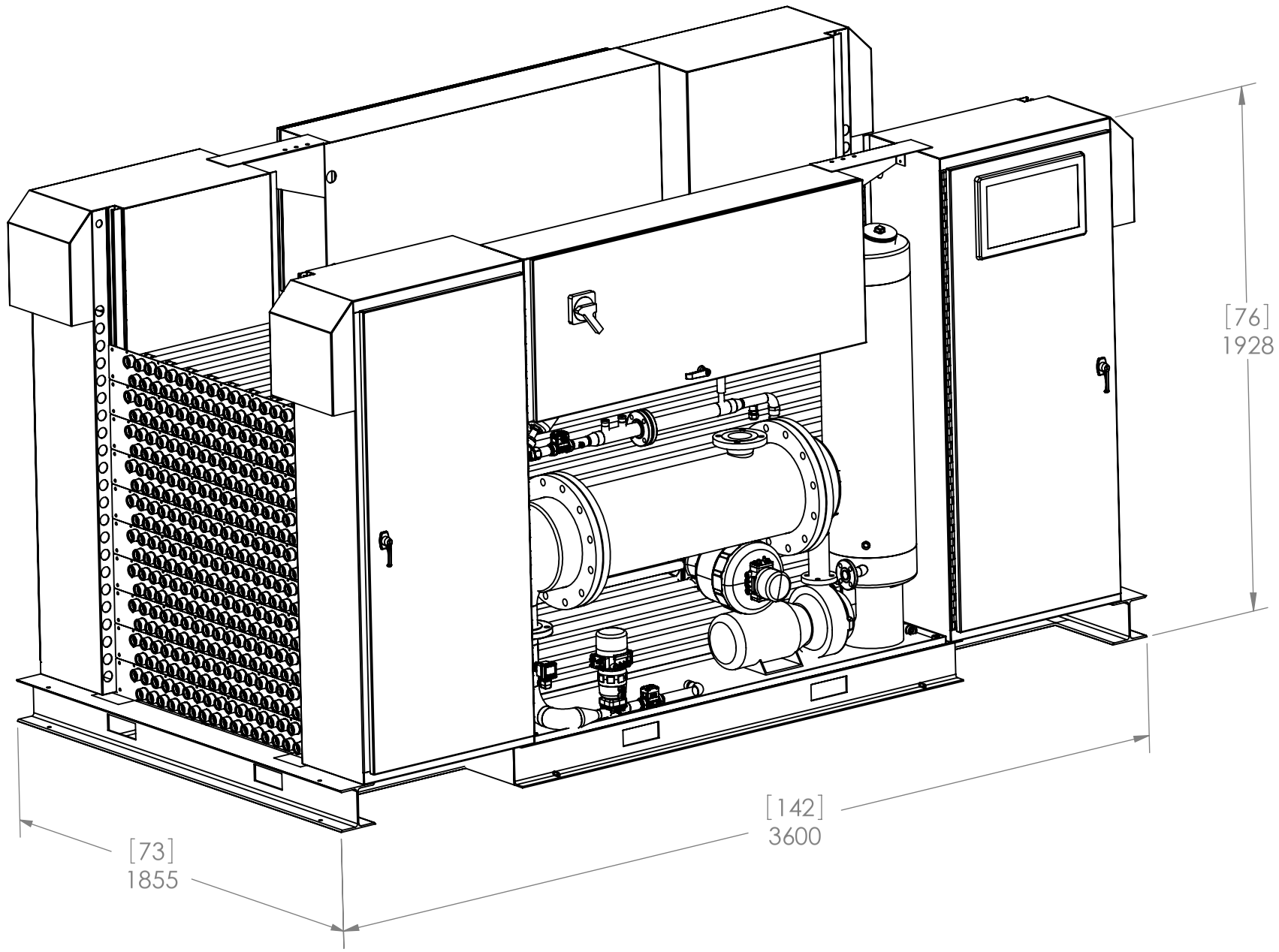
SIZE	"A" *NUMBER OF ELEMENTS					"B"	"C"	"D"	MODEL NUMBER
	2	3	4	5	6				
1"	6	6	6	6	7	4	5/8"	3-1/8"	1-40-10- * -3
1-1/2"	6	6	8	10	12	4	5/8"	3-7/8"	1.5-40-10- * -3
2"	6	8	11	14	16	4	3/4"	4-3/4"	2-40-10- * -3
2-1/2"	7	10	13	16	19	4	3/4"	5-1/2"	2.5-40-10- * -3
3"	9	12	16	20	23	4	3/4"	6"	3-40-10- * -3
4"	12	17	21	26	31	8	3/4"	7-1/2"	4-40-10- * -3
6"	17	25	33	41	48	8	7/8"	9-1/2"	6-40-10- * -3

Koflo Corporation
309 CARY POINT DR.
CARY, IL 60013

SCALE: NONE	APPROVED BY JLT	DRAWN BY NJF	
DATE: 10/15/01		REVISED 5/28/08	
CUSTOMER:		REVISED	
		REVISED	
MODEL NO: KYNAR LINED MIXER		DRAWING NUMBER: KD-992	

Catalogue and Product Data Sheets

Item	Tag	Description
27	PC-310A, PC-310B, PC-310C	AOP System



SPECIFICATIONS:

130KW TREATMENT POWER
UP TO 125 GPM
BUILT IN HMI
CERAMIC MEMBRANES FOR LONG LIFE
480VAC POWER

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R625-EDC-001213-0

THIRD ANGLE

UNLESS SPECIFIED:
DIMENSIONS ARE IN mm
TOLERANCES: +/- 1mm
ANGULAR: +/- 2 DEG

Purifics®

10 DDL PHOTO-CAT TREATMENT SYSTEM

DESIGN: JDP	PART NO. 2020-010-000	DWG NO. P9A-122	REV: 0.0	
DRAWN: JDP			REV BY: JDP	
CHECK: BB	DATE: 4/20/2009	SCALE: 1:20	SHEET 1 OF 1	B SIZE
			REV DATE: 5/22/2009	

Catalogue and Product Data Sheets

Item	Tag	Description
29	F-400A, F-400B, F-400C, F-410A, F-410B, F-410C	Liquid Phase Granular Activated Carbon Vessels

Water Technologies

PV® Series High Pressure Liquid Phase Adsorption Systems

PV-5000SYS, PV-10000SYS

SIEMENS

APPLICATIONS

The PV® Series Systems are designed for use in a wide range of low/high flow and pressure applications.

- Groundwater remediation
- Wastewater filtration
- Tank rinse water treatment
- Pilot testing
- Underground storage tank clean up
- Leachate treatment
- Dechlorination
- Spill cleanup
- Hydrotesting

INSTALLATION, STARTUP AND OPERATION

Siemens can provide a total service package that includes utilizing OSHA trained personnel providing on-site carbon changeouts, packaging and transportation of spent carbon for recycling at our RCRA permitted reactivation facilities.

At the time of purchase or rental of the adsorbers, arrangements should be made for the reactivation of the spent carbon. Siemens will provide instructions and assistance on how to obtain acceptance of the spent carbon at our reactivation facilities. Spent carbon cannot be accepted for reactivation until the acceptance process is completed.



BENEFITS & DESIGN FEATURES

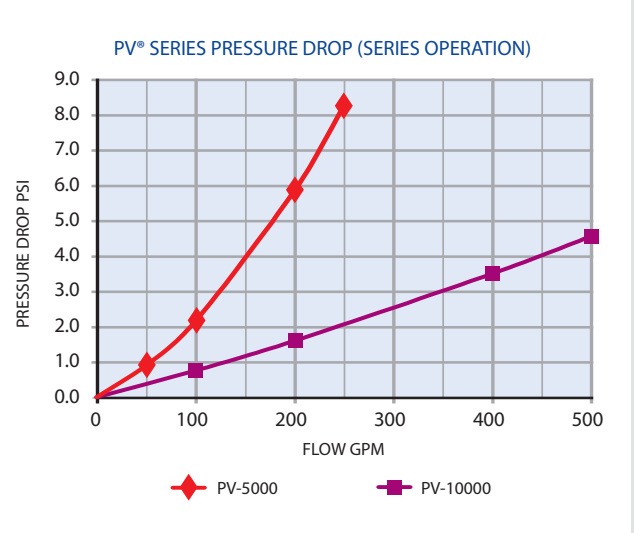
- SSPC-SP5, NSF-approved epoxy lining, rust preventative epoxy primer urethane exterior finish.
- Top and side manways permit easy access and inspection of vessels internals and linings.
- Skid-mounted for easy handling and installation.
- Optimized underdrain system for low pressure drop operation.
- Piping manifold allows either adsorber to be used in the lead or lag position.
- Series or parallel operation.
- PV-5000 is shipped complete with face piping assembled and GAC loaded; no on-site assembly is required.
- PV-10000SYS GAC transfer via slurry piping (4" Sch 10 304L SS).

SPECIFICATIONS		
	PV®-5000SYS	**PV®-10000SYS**
Dimensions (Dia. x Overall Height – Approx.)	72" x 11'4"	96" x 15'5"
Footprint (Length x Width)	16'8" x 8'	22'8" x 10'
Inlet Connection, (Top)	4"	6"
Outlet Connection, (Bottom)	4"	6"
Manway, Top & Lower Side	(2)14" X 18"	14" X 18"/20"
Internal Piping	304L SS	304L SS
Interior Coating (All Units)	Epoxy	Epoxy
Exterior Coating (All Units)	Epoxy/Urethane	Epoxy/Urethane
Vessel Weight (lbs.):		
Shipping (Skid)	16,800 (Two vessels, piping, carbon)	15,500 (Two vessels, piping)
Operating (Approx.)	40,000	85,000
Flow, GPM (Nominal Per Vessel)	250	500
Pressure, PSIG (Maximum)1	75	75
Temperature, °F. (Maximum)	150	150
Pounds Of Carbon (Per Vessel)	5,000	10,000
Contact Time, Minutes (@ Max Flow Per Vessel)	5	5
Backwash Rate, GPM (8 x 30 Mesh @ 55°F)	185	325

1The PV® Series adsorbers are not ASME code stamped. Pressure rating applies to liquid only.
For detailed dimensional information or drawings, contact your local Siemens sales representative.
For information on the HP® Series ASME code stamped adsorbers, contact your local Siemens representative.

Safety Note: Wet activated carbon readily adsorbs atmospheric oxygen. Dangerously low oxygen levels may exist in closed vessels or poorly ventilated storage areas. Workers should follow all applicable state and federal safety guidelines for entering oxygen depleted areas.

All information presented herein is believed reliable and in accordance with accepted engineering practices. Siemens makes no warranties as to completeness of information. Users are responsible for evaluating individual product suitability for specific applications. Siemens assumes no liability whatsoever for any special, indirect or consequential damages arising from the sale, resale or misuse of its products.



The information provided in this literature contains merely general descriptions or characteristics of performance which in actual case of use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of the contract.

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Siemens
Water Technologies

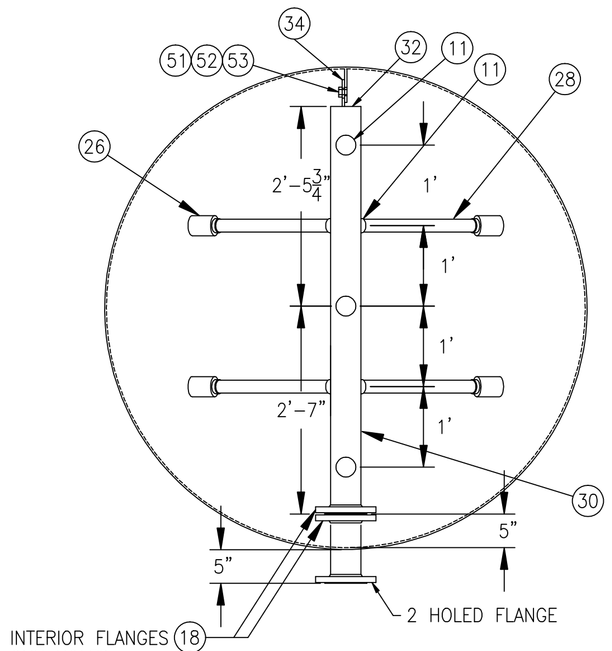
Environmental Services
2430 Rose Place
Roseville, MN 55113
800.525.0658 phone

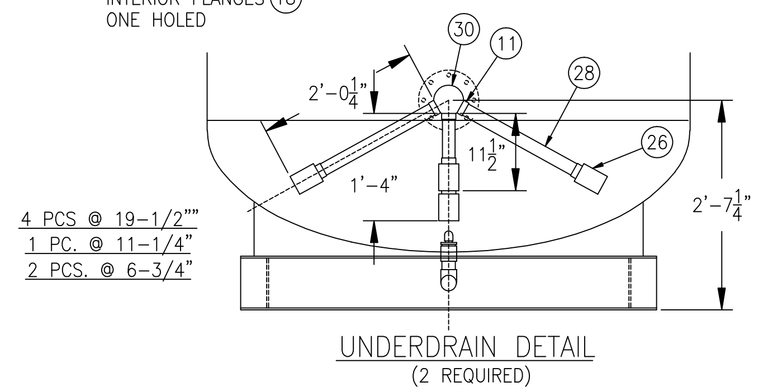
information.water@siemens.com

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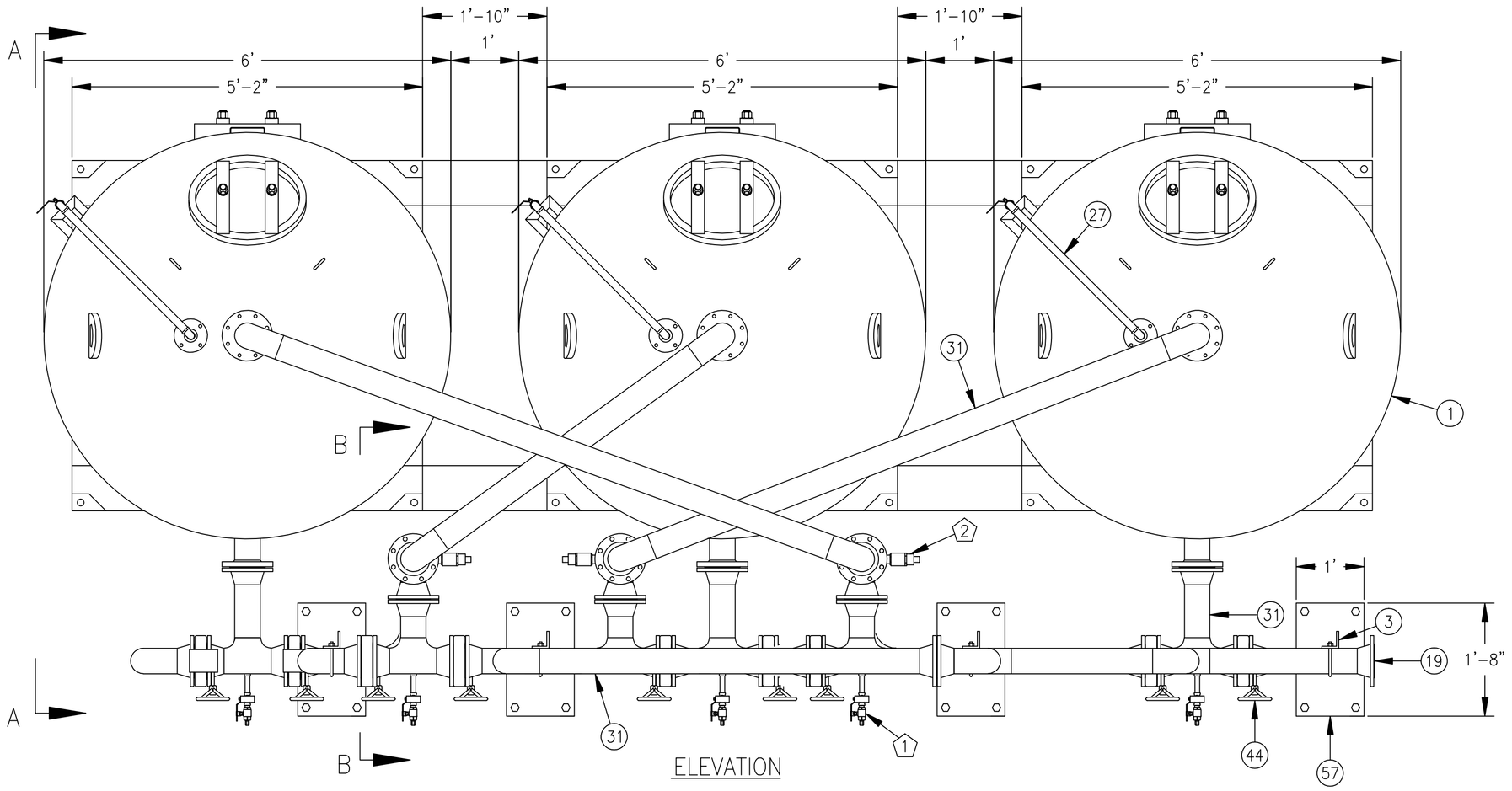
WS-PV1-DS-1206

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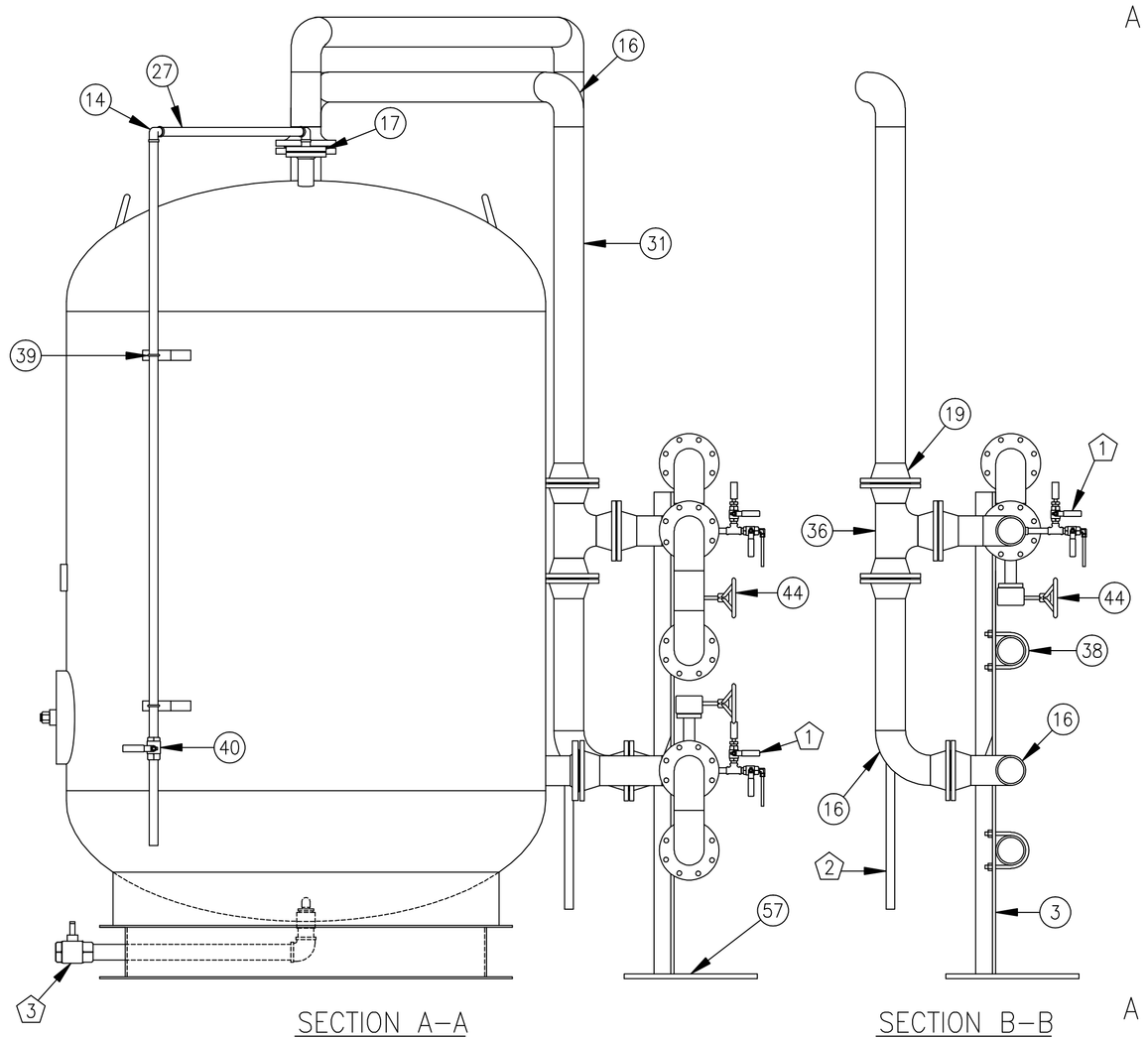


UNDERDRAIN DETAIL
(2 REQUIRED)



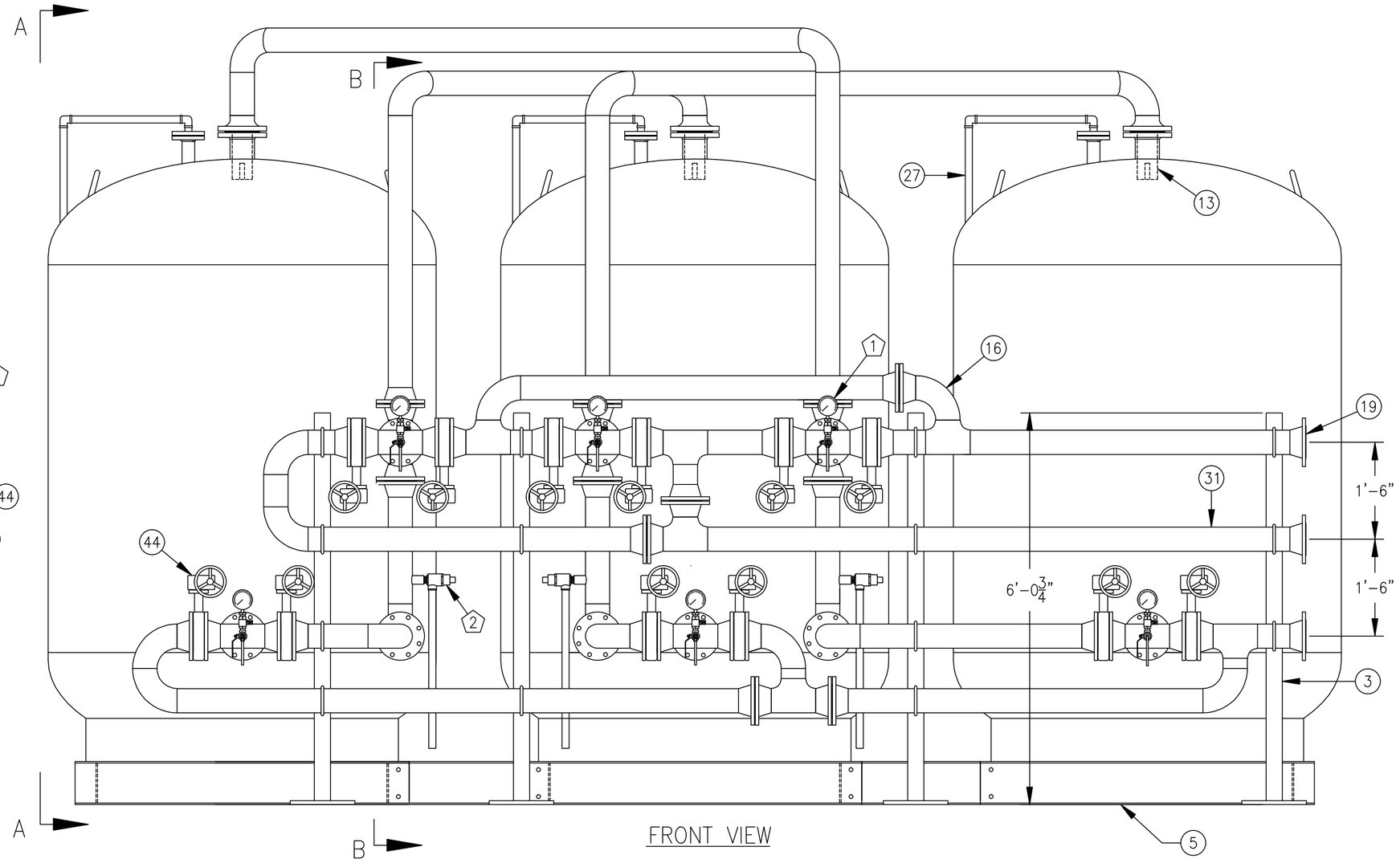
ELEVATION

SCHEDULED MATERIALS			
TAG	DESCRIPTION	QTY	PART NUMBER
1	Vessel: PV 5000 Single Tank	3	PV5000-ST
2	Adaptor: 90 deg BRS 1/2" Comp x 1/2" MPT	6	M3012
3	Angle: 3" x 3" x 3/8" A36	24'	A3X3X3/8
4			
5	Beam: W8 x 31# A36	9'	BW8X31
6	Bushing: 1/2" x 1/4" Galv NPT	6	N/A
7	Bushing: 2" x 1" sch/80 PVC NPT	3	N/A
8			
9	Coupling: 1" A36 3000# Full	3	7006B
10	Coupling: 1/2" A36 3000# Half	6	7002
11	Coupling: 1-1/2" 304 SS sch/40 Half	21	7030B
12	Coupling: 2" 304 SS 3000# Full	3	7024
13	Diffuser: 4" SS	3	M3022
14	Elbow: 1" Galv 90 deg NPT	6	8010
15	Elbow: 2" Galv 90 deg NPT	3	8013
16	Elbow: 4" CS L/R 90 deg Weld	20	2046
17	Flange: 2" x 1" CS THD Reducing	3	2106
18	Flange: 4" 304 SS 150# S/O	6	2015
19	Flange: 4" CS 150# Weld Neck	63	2014
20	Guage: 2-1/2" dia x 1/4" L 0-100 psi	6	M3015
21	Nipple: 1" 316 SS sch/40 Close	3	N/A
22	Nipple: 1/2" 316 SS sch/40 Close	12	N/A
23	Nipple: 1/2" x 4" 316 SS sch/40 NPT	6	N/A
24	Nipple: 2" 316 SS sch/40 Close	3	N/A
25	Nozzle: 1" NPT Polypropylene N8	3	N/A
26	Nozzle: 3" O.D. x 4" Eff 304 SS x 1-1/2" FNPT	21	S1015
27	Pipe: 1" Galv sch/40	48'	P1-GAL-S40
28	Pipe: 1-1/2" 304 SS sch/40	27'	P1-1/2-304-S40
29	Pipe: 2" Galv sch/40	9'	P2-GAL-S40
30	Pipe: 4" 304 SS sch/10	15'	P4-304-S10
31	Pipe: 4" CS sch/40	65'	P4-CS-S40
32	Plate: 4-3/8" dia 304 SS Header Cap	3	N/A
33	Plate: 6" x 6" x 1/4" A36 Skid Plates	6	N/A
34	Plate: 4" x 4" x 3/8" 304 SS	3	N/A
35	Tee: 1/2" Galv NPT	6	8002
36	Tee: 4" CS Std Weld	15	2076
37	Tubing: 1/2" 304 SS .035 Wall	3'	T1/2-304X.035
38	U-Bolt: 4" Hot Dipped Galv	14	N/A
39	U-Bolt: 1" Hot Dipped Galv	6	N/A
40	Valve: 1" Bronze/Chrome Ball	3	1004
41	Valve: 1" Kunkle Pressure Relief 75 psi	3	M3017
42	Valve: 1/2" Bronze/Chrome Ball	12	1002
43	Valve: 2" Bronze/Chrome Ball	3	1005
44	Valve: 4" Alum/Bronze Disk Butterfly Gear Op	12	1020
45	Bolt: 5/8" x 3" 304 SS	24	N/A
46	Bolt: 5/8" x 2" Hot Dipped Galv	32	N/A
47	Bolt: 5/8" x 3" Hot Dipped Galv	172	N/A
48	Bolt: 5/8" x 5" Hot Dipped Galv	96	N/A
49	Nut: 5/8" Hot Dipped Galv Heavy Hex	278	N/A
50	Nut: 5/8" 304 SS Heavy Hex	24	N/A
51	Bolt: 3/4" x 2" 304 SS	3	N/A
52	Nut: 3/4" 304 SS Heavy Hex	3	N/A
53	Washer: 3/4" 304 SS Flat	3	N/A
54	Washer: 5/8" 304 SS Flat	24	N/A
55	Gasket: 2" Red Rubber Ring	3	N/A
56	Gasket: 4" Red Rubber Ring	23	N/A
57	Plate: 12" x 20" x 3/4" Steel	4	N/A
58			

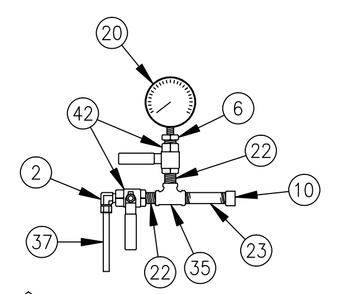


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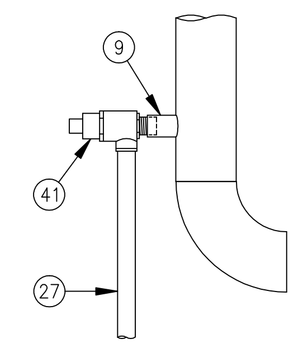
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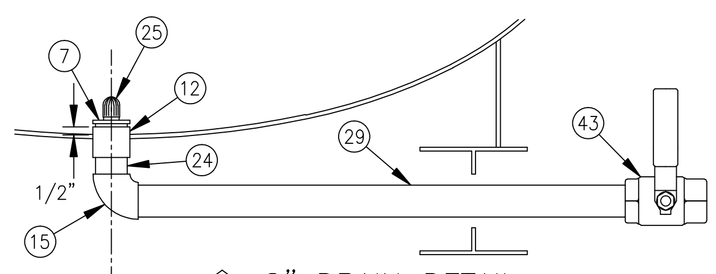
FRONT VIEW



1 1/2" SAMPLE PORT
(4 REQUIRED) NTS



2 KUNKLE VALVE CONNECTION
(2 REQUIRED)



3 2" DRAIN DETAIL
(2 REQUIRED)
1" = 6"

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		DATE
DESIGNER	CAR	7-2-09
CHECKER		DATE
ENGINEER		DATE
MANAGER		DATE
FILE:		
SCALE:	3/4" = 1'	

TITLE 3 PV5000 W/ 12 VALVE MANIFOLD

CLIENT

SIEMENS Water Technologies
RED BLUFF, CA

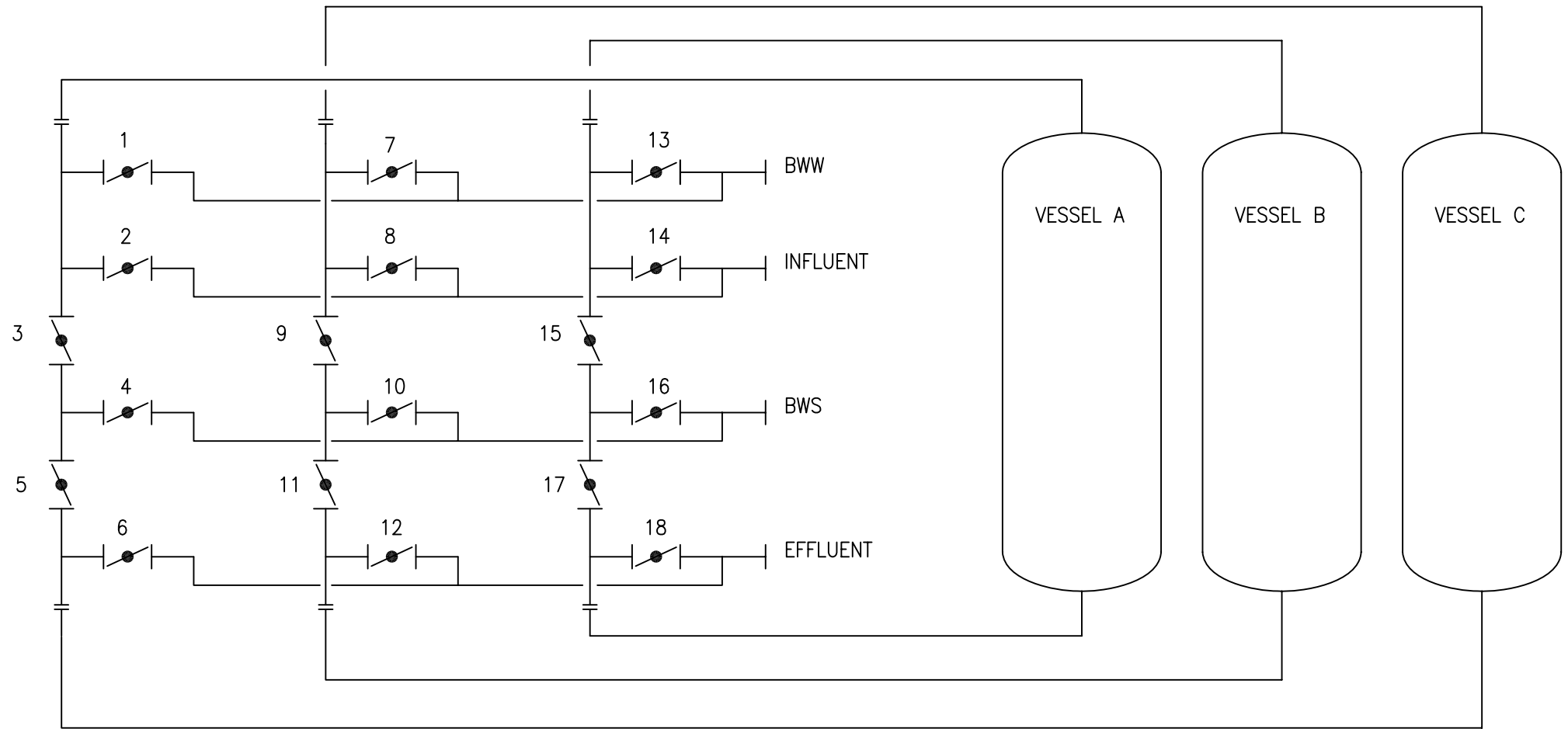
PROJECT	CODE	DRAWING	SHEET	REV
		3PV500012VflatMani	1 OF 1	0

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE

R625-EDC-001213-0

NOTE:
CONNECT AS SHOWN FOR SEQUENCING



FLOW DIAGRAM

OPERATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PARALLEL 'A' & 'B' & 'C'	X	O	X	X	X	O	X	O	X	X	X	O	X	O	X	X	X	O
VESSEL 'A' ONLY	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O
VESSEL 'B' ONLY	X	X	X	X	X	X	X	X	X	X	X	O	X	O	X	X	X	X
VESSEL 'C' ONLY	X	X	X	X	X	O	O	X	X	X	X	X	X	X	X	X	X	X
SERIES FLOW 'A' TO 'B'	X	O	X	X	X	X	X	X	X	X	X	O	X	X	O	X	O	X
SERIES FLOW 'B' TO 'C'	X	X	X	X	X	O	X	X	O	X	O	X	X	O	X	X	X	X
SERIES FLOW 'C' TO 'A'	X	X	O	X	O	X	X	O	X	X	X	X	X	X	X	X	X	O
BACKWASH 'A' RUN 'B' & 'C'	O	X	X	X	X	O	X	X	O	X	O	X	X	O	X	O	O	X
BACKWASH 'B' RUN 'C' & 'A'	X	X	O	X	O	X	X	X	X	O	O	X	O	X	X	X	X	O
BACKWASH C' RUN 'A' & 'B'	X	O	X	O	O	X	O	X	X	X	X	O	X	X	O	X	O	X

VALVE SEQUENCE CHART

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DESIGNER	DATE
LLR	11–14–07
CHECKER	DATE
ENGINEER	DATE
MANAGER	DATE
FILE:	
SCALE:	

TITLE: MANIFOLD FLOW DIAGRAM , 18 VALVES
VALVE SEQUENCE CHART

CLIENT

SIEMENS Water Technologies
RED BLUFF, CA

PROJECT	CODE	DRAWING	SHEET	REV
		18VALVEMANI	OF	

R625-EDC-001213-0

Catalogue and Product Data Sheets

Item	Tag	Description
31	F-420A, F-420B, F-420C, F-420D	GAC Backwash Effluent Bag Filter Canisters

Model 82
Dual Capacity Bag Filter And Basket Strainer

Extra capacity at higher flow rates!

Rosedale dual capacity housings can serve as either basket strainers or bag filters. Covers are easily removed, without tools, and the basket or bag is quickly and easily cleaned or replaced. Rosedale's bag-sized pleated cartridges will provide even greater dirt-holding capacity (see pages 81-84). **Low price, greater dirt holding capacity, and higher flow rates make the Model 82 a very cost-efficient choice!**



Features

- Low pressure drops
- Permanently-piped housings
- Covers are O-ring sealed
- Carbon steel or stainless steel (304 or 316) housings
- Housings are electropolished to resist adhesion of dirt or scale
- Adjustable-height legs
- For flow rates to 440 gpm
- ASME code stamp available
- Large-area, heavy-duty baskets
- Dual stage straining/filtering

Options

- Higher pressure ratings
- Extra-length legs
- Heat jacketing
- Liquid displacers for easier servicing

Basket Data (each basket, two baskets total)

Depth inches (nominal)	Diameter (inches)	Surface Area (sq. ft.)	Volume (cu. in.)	Bag Size No.
15	6.7	2.3	500	1
30	6.7	4.4	1000	2

How To Order

Build an ordering code as shown in the example

Example: Housing: 82- 30- 4F- 1 -150- C - Options: B - S - BM- 200 -D - C

MODEL 82 = **82**

HOUSING SIZE
15 inch = **15**
30 inch = **30**

PIPE SIZE, NPT & FLANGED
2-in. 150 or 300-lb ANSI flange* = **2F**
3-in. 150 or 300-lb ANSI flange* = **3F**
4-in. 150 or 300-lb ANSI flange* = **4F**
6-in. 150 or 300-lb ANSI flange* = **6F**
*Dependent on required pressure rating

OUTLET STYLE
Side = **1**

PRESSURE RATING[1]
150 psi (flanged) = **150**
300 psi (flanged) = **300**

HOUSING MATERIAL
Carbon steel = **C**
304 stainless steel = **S**
316 stainless steel = **S316**

COVER SEAL
Buna N = **B**
Ethylene Propylene = **E**
Viton® Fluoroelastomer = **V**
Teflon® Encapsulated Viton® = **TEV**
Teflon® (solid white) (6 Bolt Cover) = **TSW**

BASKET SEAL
Seal (required) = **S**

BASKET TYPE
Filter bag basket[2] = **PB**
Strainer basket = **P**
Filter bag basket, mesh lined[2] = **BM**
Strainer basket, mesh lined = **M**
Filter bag basket, heavy wire mesh = **HWM**

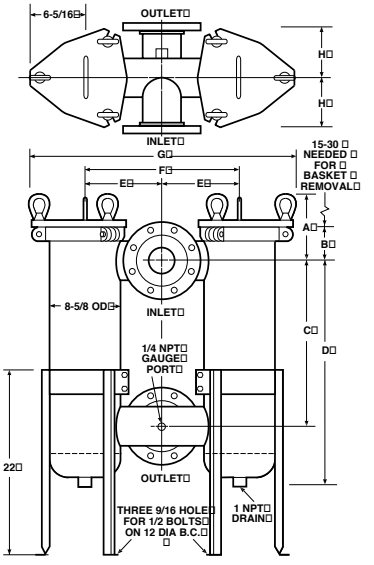
BASKET, MEDIA SIZE, no symbol if type B basket was selected
Type P perforation diameters 1/4, 3/16, 9/64, 3/32, 1/16
Type M and BM mesh sizes 20, 30, 40, 50, 60, 70, 80, 100, 150, 200 = **200**

DISPLACER
Displacer = **D**

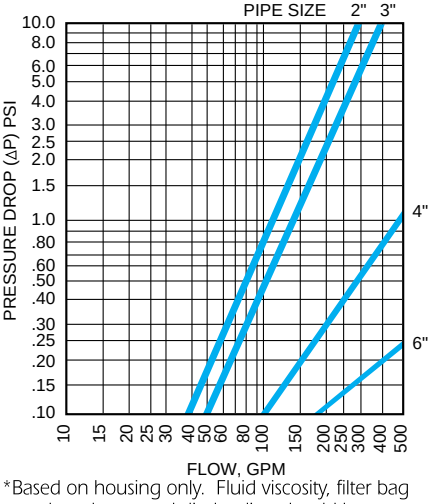
ASME CODE STAMP
Code = **C**

1. Higher pressures are available, consult factory.
2. Filter bags are specified separately. See pages 73-80.
3. Flanges provided with the housing match the pressure rating of the vessel. Housings rated 150 psi have 150 class flanges. Housings rated 300 psi have 300 class flanges.

Dimensions (IN)



Pipe Size	2	3	4	6
A	6-5/8	7-1/2	7-1/2	9
B	2-7/8	3-3/4	3-3/4	5-1/4
C (15 in)	14-1/2	14-1/2	14-1/2	14-1/2
(30 in)	29-1/2	29-1/2	29-1/2	29-1/2
D (15 in)	21-3/16	22-3/32	22-3/32	23-9/16
(30 in)	36-3/16	37-3/32	37-3/32	38-9/16
E	8	8	9	9
F	16	16	18	18
G	28-9/16	28-9/16	30-9/16	30-9/16
H	4-1/2	5-1/2	6-1/2	8



*Based on housing only. Fluid viscosity, filter bag used, and expected dirt loading should be considered when sizing a filter.

Dimensions are reference only and should not be used for hard plumbing. Consult factory for certified drawings.

HOW TO ORDER

HOW TO ORDER PEMF/POMF SERIES FILTER BAGS

Build an ordering code as shown in this example:

Example: PEMF - 3 - 2

MICRO FIBER MATERIAL

Polyester	= PEMF
Polypropylene	= POMF

MICRON RATING (95%)

1.0 micron	= 1
3.0 micron	= 3
8.0 micron	= 8
19.0 micron	= 19

BAG SIZE
(dimensions in inches)

Symbol	Dia.	x	Length
1 =	7-1/16	x	16
2 =	7-1/16	x	32
3 =	4-1/8	x	8
4 =	4-1/8	x	14
7 =	5-5/8	x	15
8 =	5-5/8	x	21
9 =	5-5/8	x	32

*

HOW TO ORDER 500 SERIES GRADED DENSITY BAGS

Build an ordering code as shown in this example:

GD-PO-529-2

EXAMPLE: GD - PO - 523 - 1

Graded Density Bag

MICRO FIBER MATERIAL

Polyester	= PE
Polypropylene	= PO

MICRON RATING (95%)

1.0 micron	= 523
3.0 micron	= 525
8.0 micron	= 527
19.0 micron	= 529

BAG SIZE
(dimensions in inches)

Symbol	Dia.	x	Length
1 =	7-1/16	x	16
2 =	7-1/16	x	32

HOW TO ORDER PLEATED CARTRIDGES

Build an ordering code as shown in this example:

EXAMPLE: PL-PEMF - 1 - P1

MICRO FIBER MATERIAL

Polyester	= PL-PEMF
Polypropylene	= PL-POMF

MICRON RATING (95%)

1.0 micron	= 1
3.0 micron	= 3
8.0 micron	= 8
19.0 micron	= 19

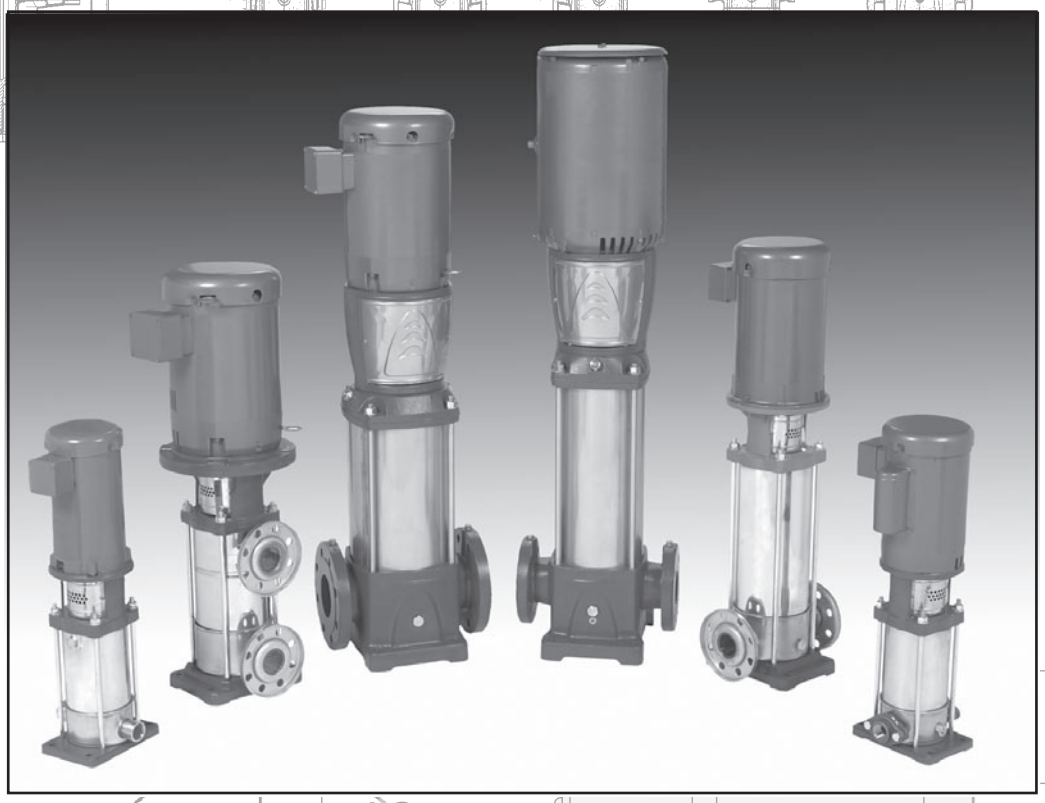
BAG SIZE
(dimensions in inches)

Symbol	Dia.	x	Length
P1 =	7-1/16	x	11-1/8
P2 =	7-1/16	x	26-1/8
P3 =	4-1/8	x	5-1/16
P4 =	4-1/8	x	11-1/16
P7 =	5-5/8	x	10-3/4
P8 =	5-5/8	x	16-1/8
P9 =	5-5/8	x	26-3/4

Catalogue and Product Data Sheets

Item	Tag	Description
35	P-510	On-Facility Injection Well Feed Pump
39	P-640	RO Feed Pump
60	P-1000A, P-1000B	Process Water Pumps

GOULDS PUMPS



G&L Series SSV

TECHNICAL MANUAL

SSV Series Vertical Multi-Stage Pumps

R625-EDC-001213-0

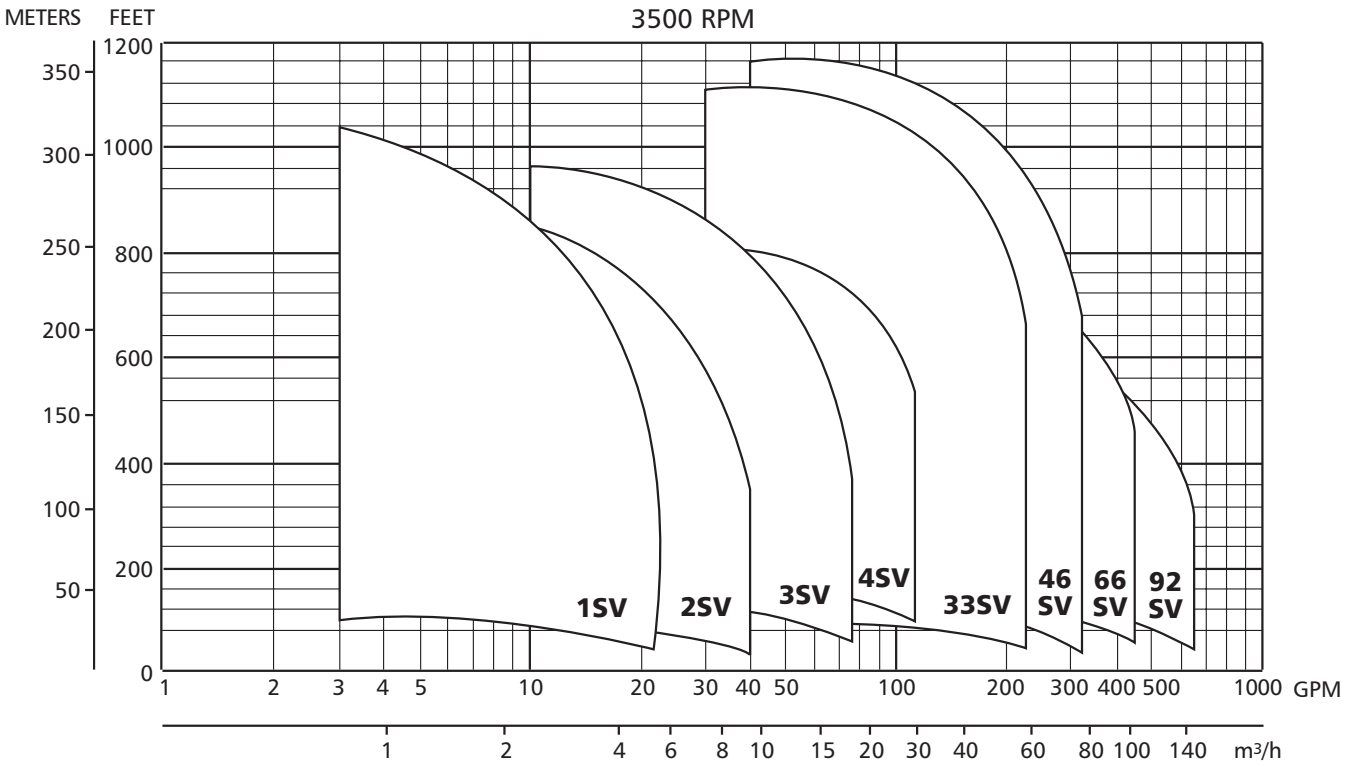
Goulds Pumps

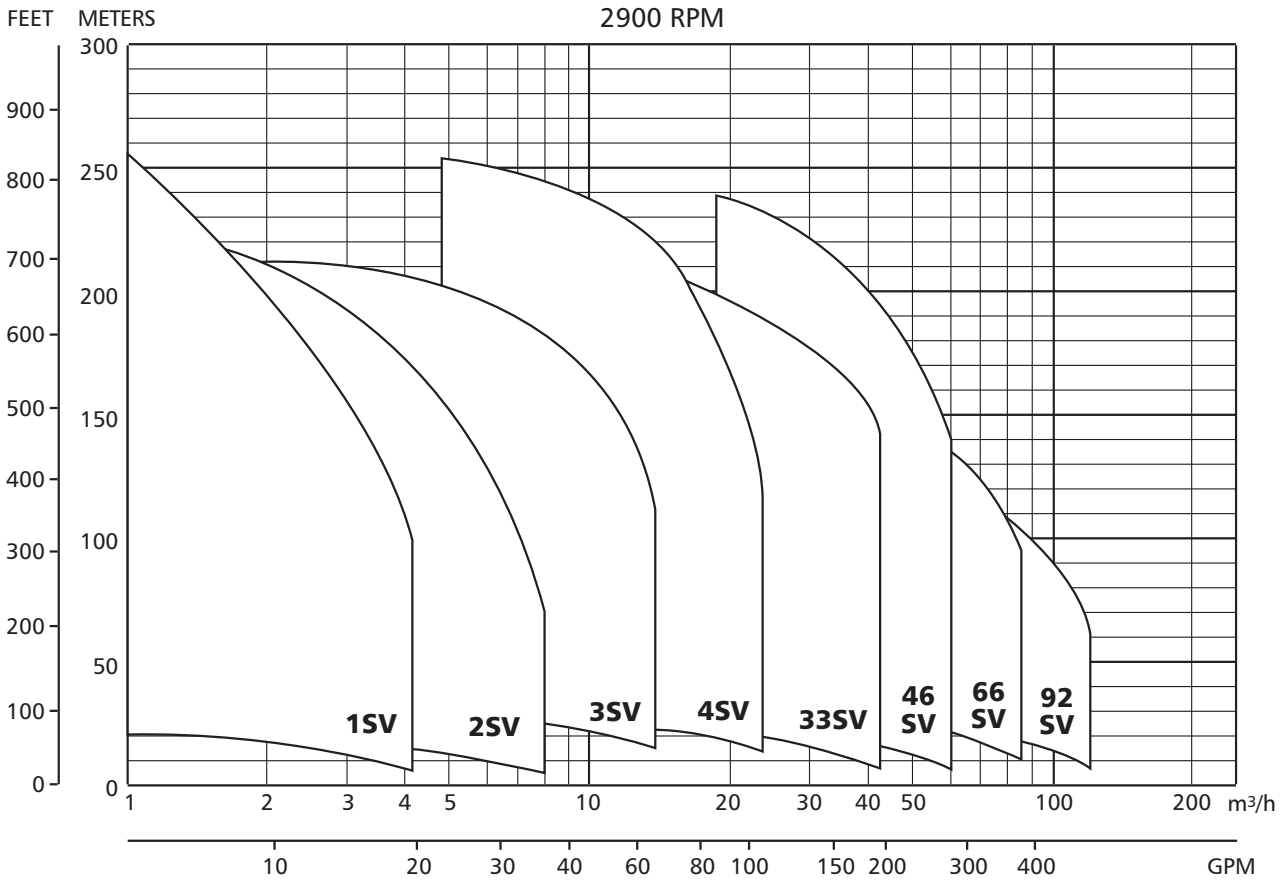
ITT Industries

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SSV Coverage Curve





MUNICIPAL, AGRICULTURAL, LIGHT INDUSTRY, WATER TREATMENT,
HEATING AND AIR CONDITIONING

Applications

- Handling of water, free of suspended solids, in the municipal, industrial and agricultural markets
- Pressure boosting and water supply systems
- Fire fighting jockey pumps
- Irrigation systems
- Wash systems
- Water treatment plants: reverse osmosis
- Handling of moderately aggressive liquids, demineralized water, water and glycol, etc.
- Circulation of hot and cold water for heating, cooling and conditioning systems
- Boiler feed

Specifications

PUMP

The SSV pump is a non-self priming vertical multistage pump coupled to a standard motor.
The liquid end, located between the upper cover and the pump casing, is held in place by tie rods. The pump casing is available with different configurations and connection types.

- Delivery: up to 600 GPM
- Head: up to 1200 feet
- Temperature of pumped liquid:
  -20ºF to 250ºF (-30ºC to 120ºC) standard version
- Maximum operating pressure
  – with oval flanges: 230 PSI (15 bar)
  – with round flanges or Victaulic: 360 PSI (25 bar)
  – SV33, 46: 230, 360 or 575 PSI (16, 25 or 40 bar)*
  – SV 66, 92: 230 or 360 PSI (16 or 25 bar)*
- Direction of rotation: clockwise looking at the pump from the top down (marked with an srrow on the adapter and on the coupling).

MOTOR

- Standard NEMA TC Frame motors in open drip proof or totally enclosed fan cooled.
- 3500 RPM nominal
- Standard voltage:
  - Single phase version: 115-208/230 V, 60 Hz up to 3 HP or 208-230 V for 5 HP
  - Three phase version, 2 pole: 208-230/460 V, 60 Hz up 75 HP

* Based on pump staging

SSV Characteristics

1SV, 2SV, 3SV, 4SV Series

- Vertical multistage centrifugal pump. All metal parts in contact with the pumped liquid are made of stainless steel.
- The following versions are available:

  B – ANSI flanges, in-line delivery and suction ports, AISI 304
  A – Oval flanges (NPT), in-line delivery and suction ports, AISI 304
  C – ANSI flanges, delivery port above the suction port, with four adjustable positions, AISI 304
  D – ANSI flanges, in-line delivery and suction ports, AISI 316
  VIC – Victaulic couplings, in-line delivery and suction ports, AISI 316
- Reduced axial thrusts enable the use of standard NEMA TC motors that are easily found in the market
- Seal housing chamber designed to prevent the accumulation of air in the critical area next to the mechanical seal
- Mechanical seal according to EN 12756 (ex DIN 24960) and ISO 3069
- Versions with ANSI flanges that can be coupled to ANSI raised face counter-flanges
- Threaded oval counter-flanges made of stainless steel are standard supply for the A versions
- Easy maintenance. No special tools required for assembly or disassembly
- Standard version for temperatures ranging from: -20ºF to 250ºF (30ºC to 120ºC)

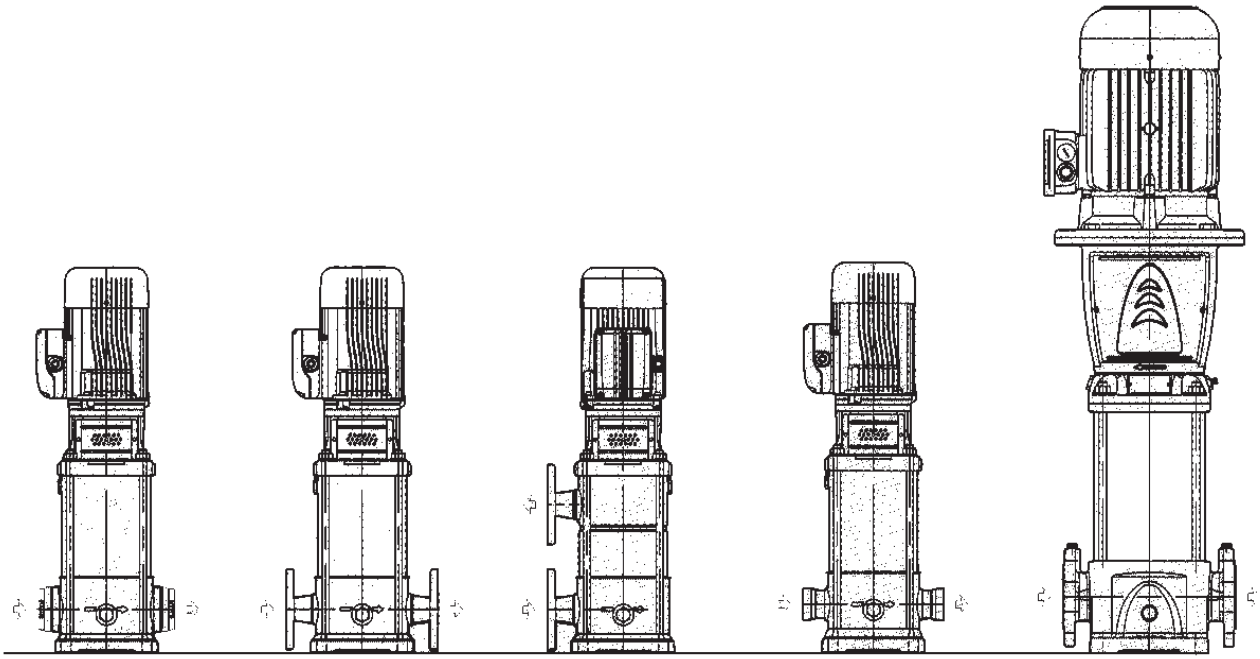
33SV, 46SV, 66SV, 92SV Series

- Vertical multistage centrifugal pump with impellers, diffusers and outer sleeve made entirely of stainless steel, and with pump casing and motor adapter made of cast iron in the standard version
- D version made entirely of AISI 316 stainless steel
- High heads and capacities four sizes: 33SV, 46SV, 66SV, 92SV (replacing the precious models 5SV and 6SV)
- Re-designed liquid end provides improved efficiency and energy savings
- Innovative axial load compensation system on pumps with higher head. This ensures reduced axial thrusts and enables the use of standard NEMA TC motors that are easily found in the market.
- Balanced mechanical seal according to EN 12756 (ex DIN 24960) and ISO 3069, which can be replaced without removing the motor from the pump
- Seal housing chamber designed to prevent the accumulation of air in the critical area next to the mechanical seal
- Standard version for temperature ranging from: -20ºF to 250ºF (-30ºC to 120ºC)
- Pump body fitted with taps for installing pressure gauges on both suction and delivery flanges
- In-line ports with ANSI flanges that can be coupled to counter-flanges, in compliance with ANSI raised face.
- Mechanical sturdiness and easy maintenance. No special tools required for assembly or disassembly.

Optional Features

- Horizontal version.
- Special voltages, 50 Hz frequency.
- Special materials for the mechanical seal, gaskets and elastomers,
- "DPS" sets consisting of two "SV" electric pumps made of AISI 316, connected in series to obtain a total head equal to the sum of the single heads of the two electric pumps.
- Tropicalized motors.
- Premium E and explosion proof motors.
- 1750 RPM, 4 pole motors.

General Characteristics
2-pole



SVA
1SV, 2SV, 3SV

SVB, SVD
1SV, 2SV, 3SV, 4SV

SVC
1SV, 2SV, 3SV, 4SV

VICTAULIC
1SV, 2SV, 3SV, 4SV

SVB, SVD
33SV, 46SV, 66SV, 92SV

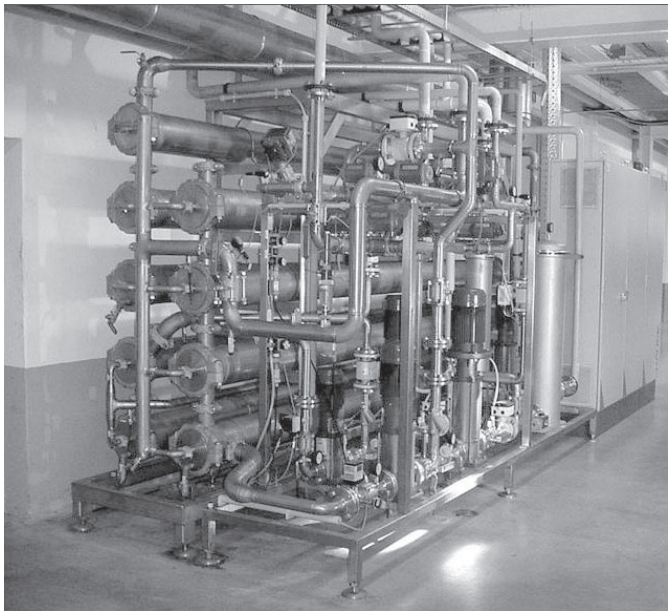
SSV Product Range	1SV	2SV	3SV	4SV	33SV	46SV	66SV	92SV
Nominal Flow (GPM)	15	30	60	85	150	220	350	450
Flow Range (GPM)	2 – 22	6 – 40	11 – 75	17 – 110	30 – 195	45 – 285	70 – 420	90 – 580
Max. Head (Ft)	1100	945	1005	930	1125	1210	850	715
Max. Working Pressure (PSI) ②	360 PSIG ①				360 / 580 PSIG			
Temperature Range	-20ºF to 250ºF (-30ºC to -121ºC)							
Motor Power (HP)	½ – 5 HP	¾ – 5 HP	2 – 15 HP	5 – 20 HP	3 – 60 HP	7½ – 75 HP	10 – 75 HP	15 – 75 HP
Max. Pump Efficiency	44%	58%	64%	67%	76%	78%	78%	80%
Material of Construction								
SVA	AISI 304SS				–	–	–	–
SVB	AISI 304SS				Cast Iron / AISI 316L			
SVC	AISI 304SS				–	–	–	–
SVD	AISI 316LSS				Cast Stainless Steel / AISI 316L			
Connection Sizes								
SVA – Oval NPT	1" NPT (female)	1¼" NPT (female)	1½" NPT (female)	–	–	–	–	–
SVB – Round ANSI Size/Class	1¼" 300#	1¼" 300#	2" 300#	2" 300#	2½" 125/250#	3" 1325/250#	4" 125/250#	4" 125/250#
SVC – Top/Bottom Round ANSI – Size/Class	1¼" 300#	1¼" 300#	2" 300#	2" 300#	–	–	–	–
SVD – Round ANSI Size/Class	1¼" 300#	1¼" 300#	2" 300#	2" 300#	2½" 150/300#	3" 150/300#	4" 150/200#	4" 150/300#
Optional Connections (on request)								
Victaulic (PJE)	1¼" (Victaulic)	1¼" (Victaulic)	2" (Victaulic)	2" (Victaulic)	–	–	–	–

① Some staging may have MAWP of 580 psi (40 bar).

② See pages 53-60 for specific details.

Water Supply and Pressure Boosting

- Pressure boosting in buildings, hotels, residential complexes
- Pressure booster stations, supply of water networks
- Booster packages



Water Treatment

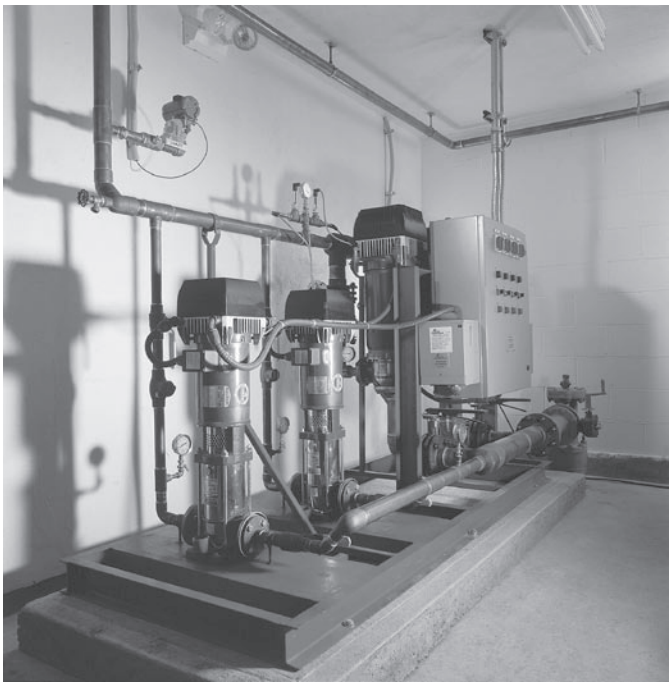
- Ultrafiltration systems
- Reverse osmosis systems
- Water softeners and de-mineralization
- Distillation systems
- Filtration

Light Industry

- Washing and cleaning plants (washing and degreasing of mechanical parts, car and truck wash tunnels, washing of electronic industry circuits)
- Commercial washers
- Firefighting system pumps

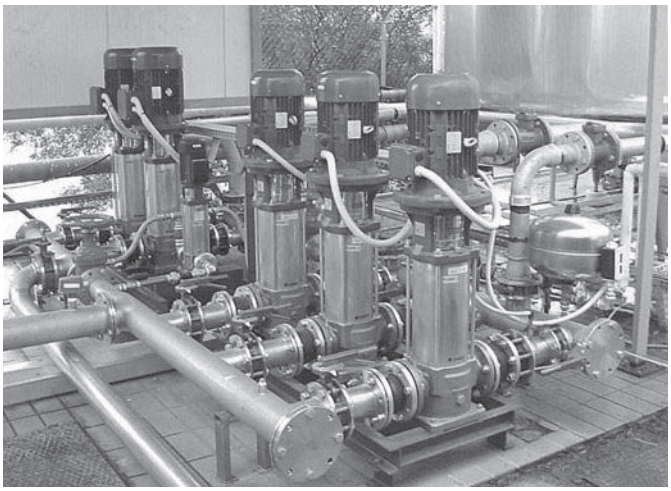
Irrigation and Agriculture

- Greenhouses
- Humidifiers
- Sprinkler irrigation



Heating, Ventilation and Air Conditioning (HVAC)

- Cooling towers and systems
- Temperature control systems
- Refrigerators
- Induction heating
- Heat exchangers
- Boilers
- Water recirculation and heating





SSV Product Line
Numbering System for 1 – 4SV

The various versions of the SSV line are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown below.
Note: Not all combinations are possible. Consult your G&L distributor.

Example Product Code

2 SV A 1 D 2 B 1 H

Options: H = Horizontal mount, **refer to back cover**
VIC = Victaulic connections **(1SVB/D – 4SVB/D only)**

Mechanical Seal Options:

Code No.	Rotary	Stationary	Elastomer	Reference Application
0	High Temp. Carbon	Silicon Carbide Graphite Filled	Viton	General Service
4	Silicon Carbide Graphite Filled			Abrasive
6	High Temp. Carbon		EPR	Boiler Feed

Number of Stages:
B = 2 D = 4 F = 6 H = 8 K = 10 M = 12 P = 14 R = 16 V = 20 Z = 24
C = 3 E = 5 G = 7 J = 9 L = 11 N = 13 Q = 15 T = 18 X = 22

Driver: (50 Hz, no single phase number 0, 1, 4)
1 = 1 PH, ODP 3 = 575V, ODP 5 = 3 PH, TEFC 7 = 3 PH, XP 9 = 3 PH, TEFC with premium efficiency
2 = 3 PH, ODP 4 = 1 PH, TEFC 6 = 575V, TEFC 8 = 575V, XP 0 = 1 PH, XP

HP Rating:
C = ½ E = 1 G = 2 J = 5 L = 10 N = 20
D = ¾ F = 1½ H = 3 K = 7½ M = 15 P = 25

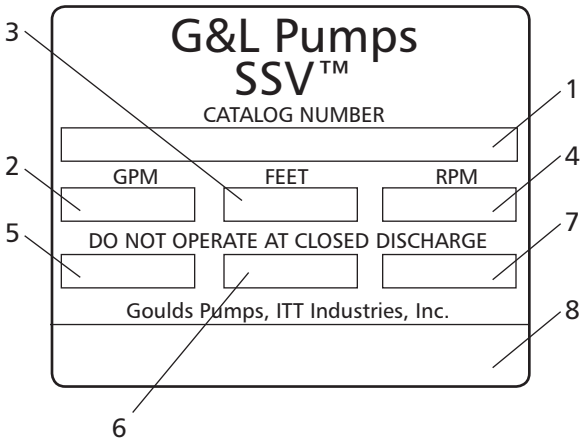
Hertz/RPM:
1 = 60 Hz, 3500 RPM
2 = 50 Hz, 2900 RPM, 190-380 V, (50 Hz motor)
3 = 60 Hz, 3500 RPM, 380 V
4 = 50 Hz, 2900 RPM, 460 V
5 = 60 Hz, 3500 RPM, 220-380 V, D.O.L.
6 = 60 Hz, 3500 RPM, 380 V, Y-DELTA
7 = 60 Hz, 1750 RPM, 208-230, 460 V

Material and Suction/Discharge:
A = 304 stainless steel, in-line NPT threaded oval flange connections (1, 2, 3 only)
B = 304 stainless steel, in-line ANSI flange (1, 2, 3, 4SV)
C = 304 stainless steel, top/bottom ANSI flange connections
D = 316 stainless steel, in-line ANSI flange

Product Line: Stainless Vertical

Nominal Flow: 1 = 15 GPM 2 = 28 GPM 3 = 55 GPM
4 = 86 GPM

Rating Plate 1, 2, 3 and 4SV



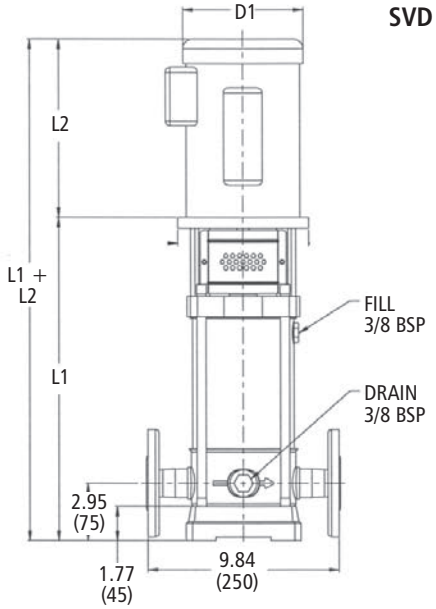
1	Goulds Catalog Number
2	Capacity Range
3	TDH Range
4	Rated Speed
5	Rated Horsepower
6	Maximum Operating Pressure
7	Maximum Operating Temperature
8	Pump Serial Number

3500 RPM, 60Hz

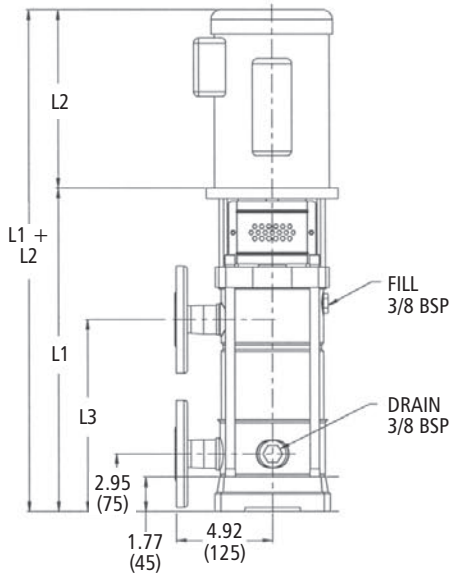
HP	Phase	Enclosure	Nameplate Voltage	NEMA Frame	Goulds PN ②	FLA	SFA	LRA ①	S.F.	Efficiency	Insulation Class
½	1	ODP	115/230	56C	V04721	7/3.6-3.5	7.9/4.06-3.95	21	1.15	66	B
		TEFC	115/230	56C	V04722	7/3.6-3.5	7.9/4.06-3.95	21	1.15	66	B
	3	ODP	230/460	56C	V04741	2.1/2-1	2.52/2.4-1.2	6	1.25	68	B
		TEFC	230/460	56C	V04742	2.1/2-1	2.52/2.4-1.2	6	1.25	68	B
		X-Proof	230/460	56C	V04743	2.1/2-1	NA	6	1	68	B
¾	1	ODP	115/230	56C	V05721	9.4/4.9-4.7	10.8/5.63-5.4	26	1.25	72	B
		TEFC	115/230	56C	V05722	9.6/5-4.8	11.4/5.94-5.7	28	1.25	66	B
	3	ODP	230/460	56C	V05741	2.7-2.6/1.3	3.15-3/1.5	7.6	1.25	74	B
		TEFC	230/460	56C	V05742	2.7-2.6/1.3	3.15-3/1.5	7.6	1.25	74	B
		X-Proof	230/460	56C	V05743	2.7-2.6/1.4	NA	7.6	1	74	B
		Prem. Eff. TEFC	230/460	56C	V05742PE	2.0/1.0	2.3/1.15	7	1.15	82.5	B
1	1	ODP	115/230	56C	V06721	15/7.9-7.5	15.8/8.217.9	48	1.25	65	B
		TEFC	115/230	56C	V06722	11/5.5	13.5/6.75	38.5	1.25	66	B
	3	ODP	230/460	56C	V06741	3.7-3.6/1.8	3.99-3.8/1.9	11	1.25	75.5	B
		TEFC	230/460	56C	V06742	3.7-3.6/1.8	3.99-3.8/1.9	11	1.25	75.5	B
		X-Proof	230/460	56C	V06743	3.7-3.6/1.9	NA	11	1	75.5	B
		Prem. Eff. TEFC	230/460	56C	V06742PE	2.8/1.4	3.12/1.56	12.1	1.25	84.5	B
1½	1	ODP	115/230	56C	V07721	12.8/7-6.4	14.5/7.9-7.3	76	1.15	80	B
		TEFC	115/230	56C	V07722	16/8.4-8	18/10-9	50	1.15	70	B
	3	ODP	230/460	56C	V07741	4.9-4.6/2.3	5.3-5.1/2.54	18.4	1.15	80	B
		TEFC	230/460	56C	V07742	4.9-4.6/2.3	5.3-5.1/2.54	18.4	1.15	80	B
		X-Proof	230/460	56C	V07743	5-4.6/2.3	NA	16	1	75.5	B
		Prem. Eff. ODP	230/460	56C	V07741PE	4.2/2.1	4.6/2.3	16	1.15	85.5	B
		Prem. Eff. TEFC	230/460	56C	V07742PE	4.0/2.0	4.5/2.25	20.1	1.15	85.5	B
2	1	ODP	115/230	56C	V08721	24/12.6-12	28.6/14.3	80	1.15	70	B
		TEFC	115/230	56C	V08722	23/12-11.5	24.2/12.1	78	1.15	74	B
	3	ODP	208-230/460	56C	V08741	6.2-5.8/2.9	7.2-6.52/3.26	22	1.15	80	B
		TEFC	208-230/460	56C	V08742	6.2-5.8/2.9	7.2-6.52/3.26	22	1.15	80	B
		X-Proof	208-230/460	56C	V08743	5.4/2.7	N/A	17.5	1	78.5	B
		Prem. Eff. ODP	208-230/460	56C	V08741PE	5.5-5/2.5	6.2-5.6/2.8	22	1.15	86.5	B
		Prem. Eff. TEFC	208-230/460	56C	V08742PE	5/4.75-2.5	6.4-5.8/2.9	30	1.15	86.5	B
3	1	ODP	230	56C	V09721	14.4/13	16.4-14.8	108	1.15	82.5	B
		TEFC	115/230	56C	V09722	27/13.5	33/18/16.5	11.4	1.15	80	F
	3	ODP	208-230/460	56C	V09741	8.5-8/4	10-9/4.5	30.9	1.15	80	F
		TEFC	208-230/460	56C	V09742	8.1-7.6/3.8	9.5-8.6/4.3	32.9	1.15	82.5	F
		X-Proof	208-230/460	56C	V09743	7.8-7.4/3.7	NA	27	1	82.5	F
		Prem. Eff. ODP	208-230/460	56C	V09741PE	7.4/3.7	9.1-8.2/4.1	29	1.15	87.5	F
		Prem. Eff. TEFC	208-230/460	184TC	V09742PE	6.8/3.4	8.5-7.7/3.8	32	1.15	88.5	F
5	1	ODP	208-230	184TC	V10721A	24-23	30.1-27.2	125	1.15	75	F
		TEFC	208-230	184TC	V10722A	23.5	41.8-37.8	110	1.15	84	F
	3	ODP	208-230/460	184TC	V10741A	13.1-11.5/5.7	15.3-13.8/6.9	48	1.15	84	F
		TEFC	208-230/460	184TC	V10742A	13.2-12/6	15-13.6/6.8	47	1.15	85.5	F
		X-Proof	230/460	184TC	V10743A	13.2-12/6	NA	47	1	85.5	F
		Prem. Eff. ODP	208-230/460	184TC	V10741APE	11.2/5.6	14.4-13/6.5	55	1.15	90.2	B
		Prem. Eff. TEFC	208-230/460	184TC	V10742APE	11.2/5.7	14.4-13/6.5	55	1.15	90.2	F

Dimensions and Weights
1SV Series 3500 RPM

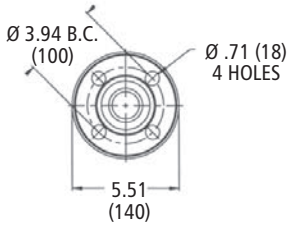
SVB
SVD



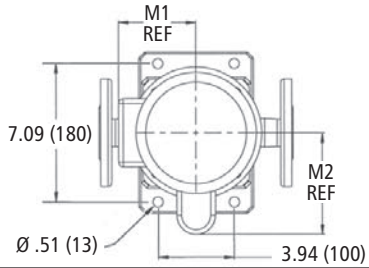
SVC



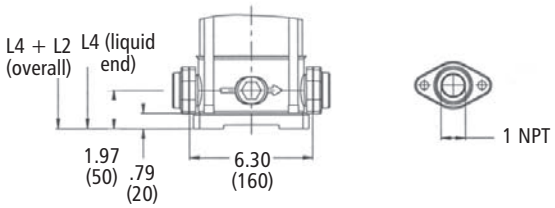
FLANGE



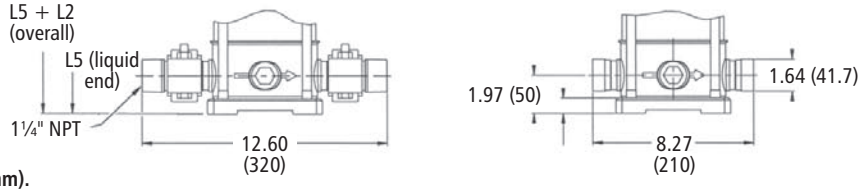
1¼" CLASS 300



SVA



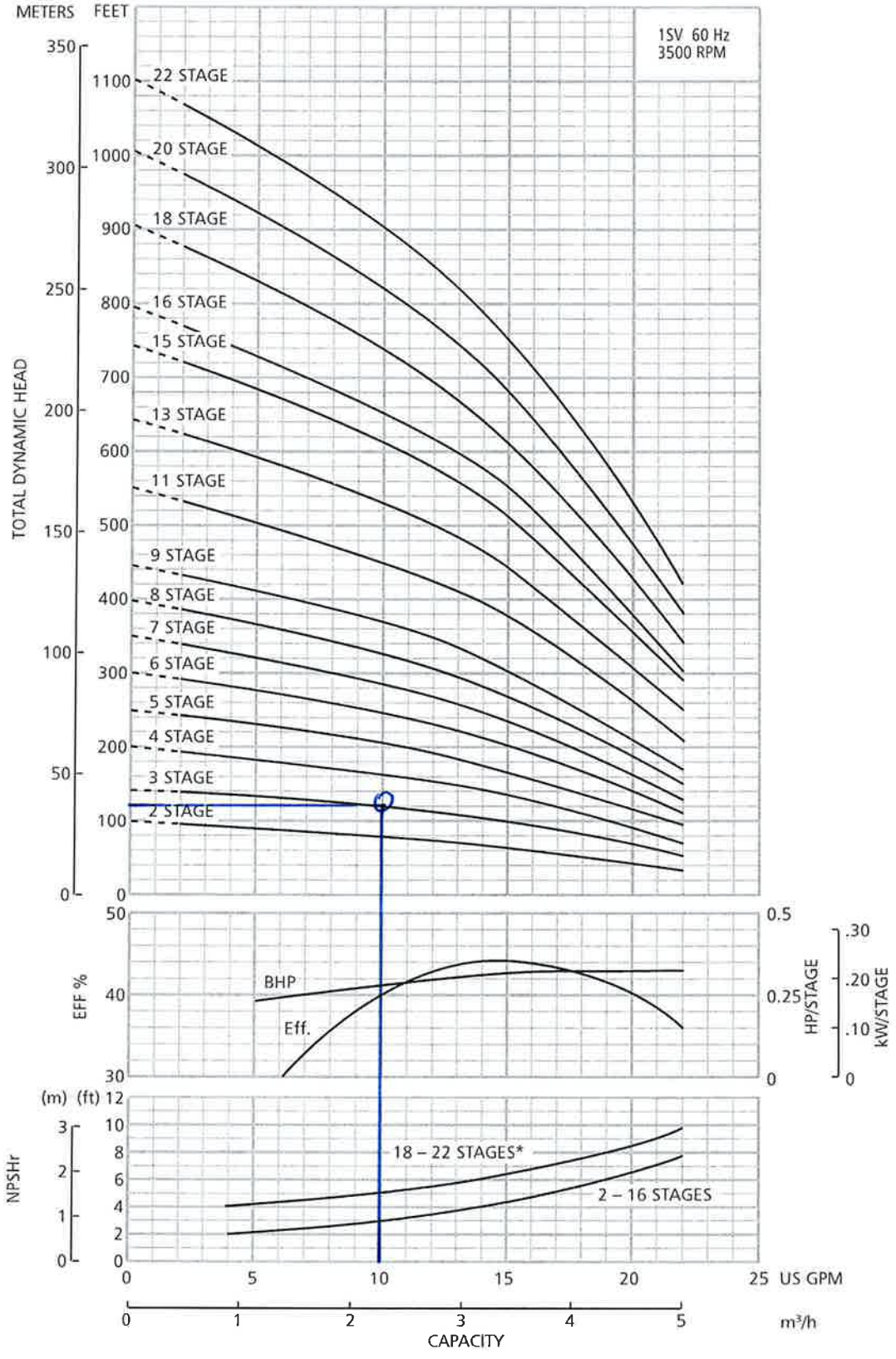
VICTAULIC



All dimensions are in inches (mm).

Stage	Frame (1-Phase)		Frame (3-Phase)				L2							D1 (max.)		Weights (lb)		
	ODP	TEFC	ODP	TEFC	HP	L1	ODP	TEFC	L3	L4	L5	M1 (ref.)	M2 (ref.)	ODP	TEFC	Liquid End	ODP	TEFC
2	56C		56C		½	12.69	9.16	9.29		11.69	11.69	5.06	5.19	6.19	6.19	21	22	22
3					¾	13.63	10.79	9.91		12.69	12.69					22	24	28
4					1	14.63	10.66	11.19		13.63	13.63	5.73	5.55	6.19	7.19	23	32	40
5					1½	15.63	10.67		8.88	14.63	14.63					25	40	43
6					2	16.63	11.19	12.06	9.88	15.63	15.63			7.19		27	43	51
7						17.56	11.19		10.81	16.63	16.63					28		
8					3	18.56	11.57	13.44	11.81	17.56	17.56		5.50	7.16		29	51	56
9						19.56			12.81	18.56	18.56					30		
11						20.50			14.75	20.50	20.50					33		
13	182-4TC		182-4TC		5	23.50	13.93	15.43	16.75		22.50	6.87	6.62	8.50	8.50	35	75	85
15						25.44			18.69		24.44					37		
16						26.44			19.69		25.81					39		
18						28.44					27.50					41		
20	213TC		213TC		7½	30.44					29.50					44	101	124
22						32.44					31.50					46		

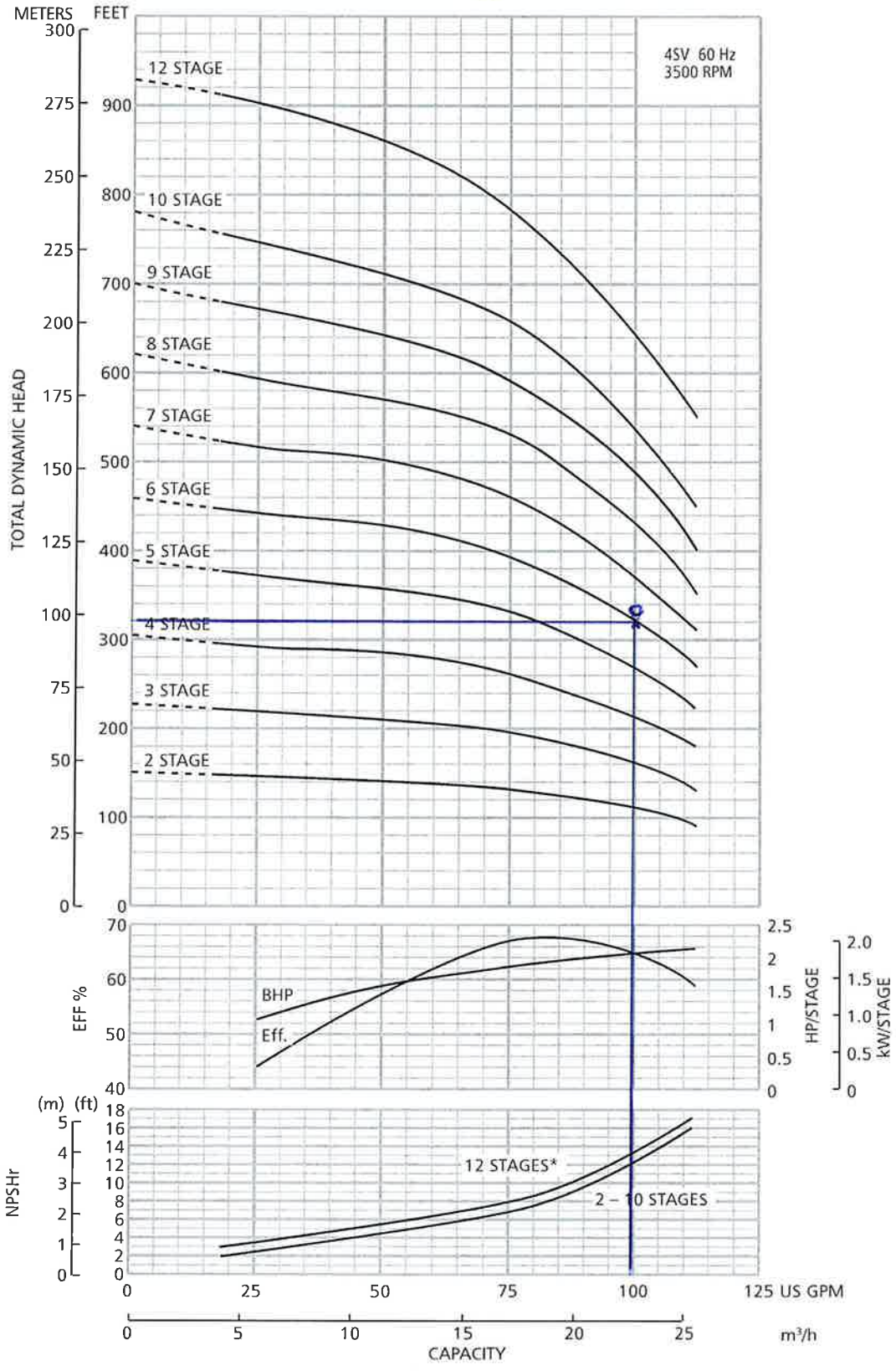
P-510



* For vertical shaft installation only.

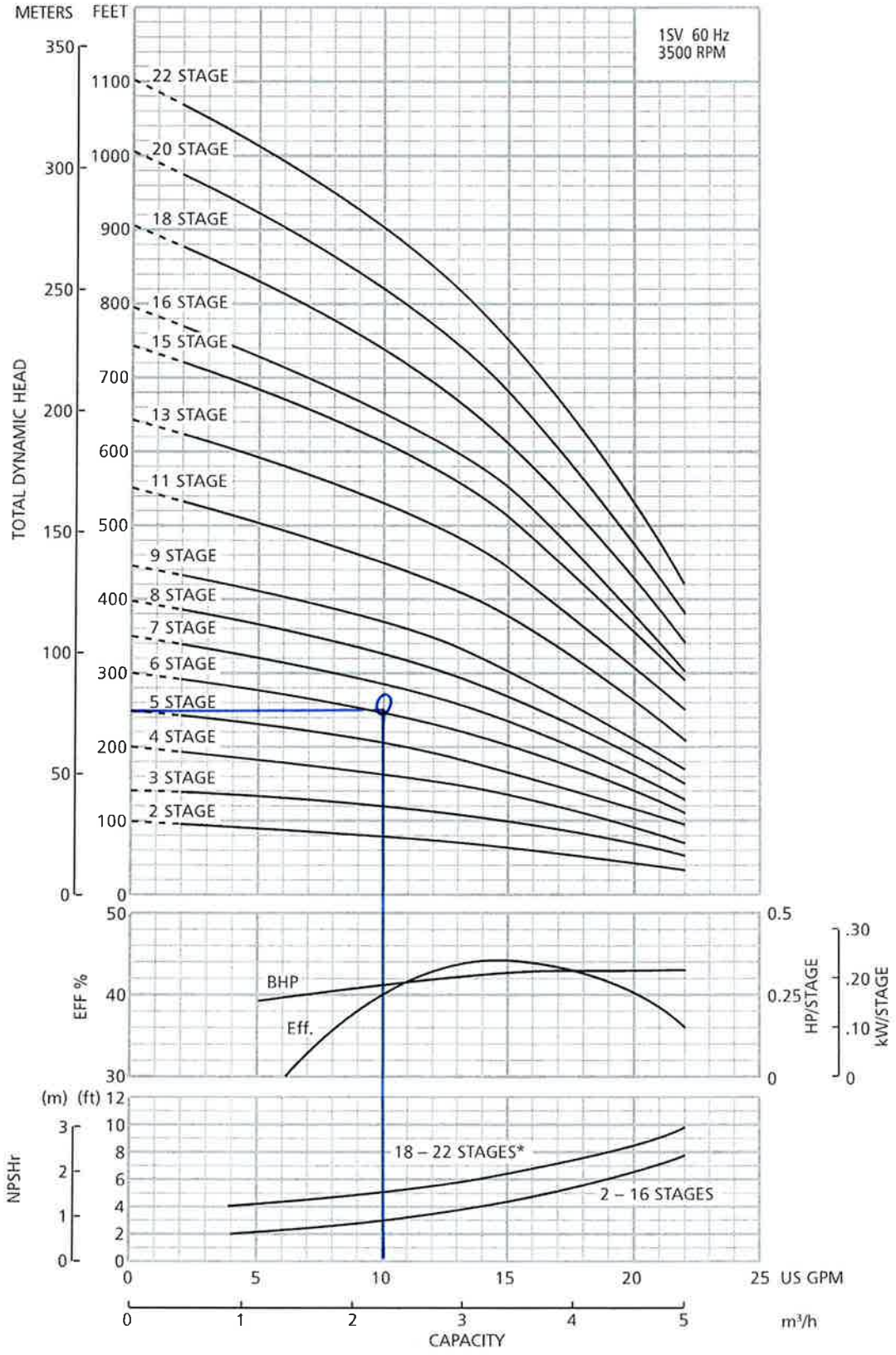
4SV Curve

P- 640
100gpm @ 330ft TDH



* For vertical shaft installation only.

P-1000 A/B



* For vertical shaft installation only.

Catalogue and Product Data Sheets

Item	Tag	Description
36	F-600A, F-600B	Twin Alternating Water Softening System
40	RO-640A/B/C	Reverse Osmosis System

SSZ Sodium Cycle Water Softeners

Crown Solutions

Crown Solutions provides custom-designed softeners for use in boiler rooms, hospitals, industrial plants, RO pretreatment equipment and other installations.

For more than 20 years, Crown Solutions has provided water solutions including water management, custom-engineered equipment, water treatment chemicals and service.

The SSZ Sodium Cycle Water Softeners are fully assembled and factory tested for efficient installation. Softener regeneration can be initiated automatically, plus a number of options are available to meet almost any requirement.

Benefits that Make a Difference

- Engineered hub/radial and header/lateral internal underdrain for equalized distribution.
- Inlet and outlet sample valve and pressure gauge to monitor the performance of the unit.
- Pressure compensating backwash flow controller ensures proper backwash flow rates with varying backwash water pressures.
- Vessels are coated with epoxy, inside and out, for corrosion resistance and long service life.
- Systems are delivered fully assembled and factory tested to minimize installation costs and enable easy start-up.
- Programmable Logic Control (PLC) for higher reliability and greater flexibility.



This heavy duty industrial softener is custom designed for severe plant envionments. It features stainless steel piping, PVC vessel internals, plus resilient seated butterfly valves with position switches and high visibility position indicators. Units are individually skidded with positioning pins for easy installation.

Options

- ASME code tanks
- Online hardness monitor, flow meters and other instrumentation
- Skid mounting
- IntelliFlow™ Programmable Logic Control (PLC) program for regulating flow through multiple vessel systems
- Brine reclaim capability
- PVC galvanized or stainless steel face piping
- Bulk salt storage and brine-making system

VEOLIA WATER
Solutions & Technologies

SSZ Sodium Cycle Water Softeners



HEAVY DUTY INDUSTRIAL SOFTENER

This unit is custom designed for severe plant environments and is an example of how Crown Solutions can accommodate your need to incorporate plant standard components or configurations. It features stainless steel piping and PVC vessel internals. Valves include stainless butterfly valves and 3-piece ball valves with air actuators. Units are individually skidded with positioning pins for easy installation. Includes proximity switches and position indicators, control is via a remote PLC, and vessels are code stamped for 150 psi service. Remote I/O is included on each vessel for easy installation and maintenance. The unit is fully instrumented with pressure and flow transducers at all critical points.



INDUSTRIAL WATER SOFTENER

This unit is typical of our industrial product line and features schedule 80 PVC piping and air operated butterfly valves. Control is supplied via an industrial PLC, which is mounted on the unit. Tanks and piping systems are rated for 100 psi service.

BULK BRINER



Crown Solutions offers bulk salt storage and brine making systems for softening applications that consume large quantities of salt. These systems allow you to purchase salt at a lower bulk rate and eliminate the labor required to move salt and the associated potential for employee injury. The units are available with dry bulk salt capacities of up 63,000 pounds and are constructed of FRP. The brine making section at the bottom is electrically heat traced and insulated, and dust control systems are standard. Crown Solutions can supply numerous types of level controls and pumps for transferring the brine to your softener system.

Crown Solutions

Crown Solutions
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info@crownsolutions.com

R625-EDC-001213-0

Membrane Systems Series 82, 83 and 86

Crown Solutions

Cost-Effective Water Purification

Membrane filtration has been proven to offer cost-effective purification of water for a variety of applications. Creating water solutions for more than 20 years, Crown Solutions offers membrane technology for industrial processes including:

- Purifying process water
- Providing high purity water to utility systems
- Treating wastewater streams for recycling and reuse

Crown Solutions' membrane systems are delivered fully assembled on skids and are factory tested to minimize installation costs and simplify start-up. With three design sizes: Series 82, 83 and 86, the membrane systems are designed for flow rates ranging from 10 gpm to more than 1000 gpm. To further customize the systems, the designs can use a variety of membranes, including ultra filtration, nanofiltration and reverse osmosis membranes.

Ultra Filtration (UF) membranes remove sub-micron sized particles and high molecular weight organics from water streams.
Nanofiltration (NF) membranes remove in excess of 98% of divalent dissolved solids, as well as a significant amount of monovalent species.
Reverse Osmosis (RO) membranes remove 99% or more of all dissolved solids.

Benefits that Make a Difference

- Minimized capital costs with membrane housing that hold six standard 8-inch diameter RO membranes or four standard UF membranes.
- Built-in Clean-In-Place (CIP) provisions for each stage for more effective cleanings.



Series 86 Membrane Systems *treat flow rates from 25 to 1000+ gpm and can be designed using ultra filtration, nanofiltration and reverse osmosis membranes.*

- Pressure indication at all critical points for tracking system performance, which extends the life of system components.
- Industrial Programmable Logic Control (PLC) with operator interface allows for reliable, flexible operation.
- Automatic periodic flushing of system helps maintain optimal membrane performance
- Prefilter housing included on all RO and NF systems for pump and membrane protection.
- True flow control valves ensure stable flows and minimize vibration and noise.

Options

- CIP piping and pump integrated into skid
- Motor starters and electrical disconnects
- External communications
- Single skid for multiple systems
- Two pass designs

VEOLIA WATER
Solutions & Technologies

R625-EDC-001213-0

Membrane Systems
Series 82, 83 and 86

Series 83 Membrane Systems

treat flow rates from 25 to 100+ gpm and can be designed using ultra filtration, nanofiltration, and reverse osmosis membranes.



Series 82 Membrane Systems

treat flow rates from 10 to 25 gpm and can be designed using nanofiltration and reverse osmosis membranes.



Crown Solutions

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R625-EDC-001213-0

Twin Alternating Softener

PFD Tag No. T-600A & B

Functional Description

One Twin Alternating Softener system model number TSSZ-1500-3P by Crown Solutions will be provided. The system will have two (2) Softener vessels operating in an alternating arrangement to remove hardness ions from the feed water.

The Softener system will operate with one vessel in-service and the second one in standby until a preset amount of gallons processed is reached. At that time the second vessel enters service and the first vessel is regenerated. This way the flow of soft water is uninterrupted.

Automatic regeneration cycles shall be controlled by the PLC control system (located on RO). Regeneration cycles shall occur based on totalized flow or manually initiated by the operator. Only one vessel is permitted to regenerate at a time.

General

Quantity	Two (2) Softener vessels
Design Flow, normal	100 gpm @ 10.4 gpm/ft2
Design flow, maximum	100 gpm @ 10.4 gpm/ft2

Pressure Vessel(s)

Dimensions	42”diameter x 60” side shell
Pressure Rating	100 psig Non-Code
Materials of Construction	Carbon steel PVQ
Lining	Epoxy lined
Exterior Finish	Polyurethane coated
Manway, Top	12”x16” oval manway
Media Removal Nozzle	3” Flange Half Spool

Flow distributors

Service Inlet	Four-point distributor, Sch 80 PVC.
Service Outlet	PVC Hub radial with screened laterals, Sch 80 PVC construction

Media

Type	Purolite C100E
Volume per vessel	30 ft^3 per vessel

Manual Valves 3” & larger

Type	Resilient seated butterfly valve, Lug style body, with lever operator.
Material of Construction:	Cast iron body, stainless steel disc & stem, EPDM seat

Manufacturer:	Bray, type 31-169
Function:	Service Inlet isolation Service Outlet isolation

Actuated Valves 2" & smaller (Brine Piping)

Type	True-union PVC ball valve. With air actuated actuator
Material of Construction	PVC body & ball, PTFE seats
Manufacturer	Asahi Type 21
Function	Brine Inlet

Gauge Isolation / Sample Valves (low pressure)

Manufacturer / model	Flow-Tek, Series 5000
Type/Size	Ball valve, Unibody, reduced port, ¼" – ½"
Material of Construction	316 stainless steel, PTFE seats
Actuator	Lever handle

Piping – Water Service

Material of Construction:	3" dia. SCH 80 PVC
Arrangement:	Vessel face piping assembly pre-built and mounted on skid with manual isolation and actuated service control valves

Instrumentation

Pressure Gauges

Quantity:	Two (2)
Manufacturer:	Wika
Model:	Type 233.53
Process Connection:	1/4" MNPT stainless steel
Instrument Location	Softener Inlet /Outlet

Flow meter

Quantity:	One (1)
Manufacturer / type:	Endress+Hauser, Promag 10P80, Magnetic flow transmitter
Materials of construction	Carbon steel body, PTFE liner, 316L SS
Process connection:	electrodes
Features:	3" flanges ANSI 150# Flange
Function:	LCD display, 4-20 mA output, HART protocol Softener Common Outlet

Backwash Flow Controller

Quantity:	Two (2), One per vessel
Manufacturer / type:	Flow Controllet, pressure compensating flow orifice
Materials of construction	PVC

Brine Day Tank T-1100

Quantity:	One (1)
Volume:	360 gallon
Dimensions:	42” diam x 60” ht
Material of Construction:	PE construction, cylindrical open top Complete with brine tank piping assembly Sch 80 PVC and float level controls. The brine tank shall be off-skid.

Brine Eductor

Quantity	One (1)
Manufacturer	Aquamatic
Material of Construction:	PVC

Controls

Quantity	One (1) common to both vessels
Panel	NEMA 4X with terminal strip and solenoids prewired and tubed to valves and instruments

Skid	Carbon steel w/ corrosion resistant urethane coating

Reverse Osmosis System – 75 GPM, Single Pass

PFD Tag No.: RO-100

Functional Description

One (1) single pass Reverse Osmosis (RO) system model number CRO-863-75 by Crown Solutions shall be supplied. The RO is designed to produce 75 gpm of purified water based on the water analysis and temperature information provided.

The RO system shall be supplied as pre-piped, pre-wired, skid-mounted units complete with cartridge prefilter, high pressure booster pump, RO vessels, membranes, instrumentation, piping and PLC control panel.

General

Number of RO machines	One (1)
Number of Passes	One (1)
Design Flow	75 gpm
Overall Recovery	Adjustable, 60 - 75 %
Average Flux	15 gfd

RO Booster Pump

Number	One (1)
Design	100 gpm at 320 ft
Manufacturer and model	Goulds 4SVD1M560H
Material	316 stainless steel
Motor	15 HP, 480/3/60 TEFC Inverter Duty

Motor Starter

Number	One (1) per RO
Manufacturer and model	Allen Bradley
Horsepower	20 HP
Type	IEC Combo Starter/Disconnect

Cartridge Filter Vessel

Number of Units	One (1) per RO machine
Manufacturer and model	Filtrek, S6EF09-007-3-2F-VB-E5
Filter Capacity	7-round x 40”
Material of construction	304 stainless steel
Pressure rating	150 psig
Filter cartridge type	5 micron nominal, 2.5” x 40” DOE

Membrane Vessel(s)

Number of Units	Three (3) per RO machine
Manufacturer and model	CodeLine 80A45
Capacity	Six (6) membranes 8”x40” per vessel
Pressure rating	450 psig
Material of construction	FRP, 316 stainless side ports
Membrane Array	2x1 – 6M

Membranes

Manufacturer and model	Hydranautics, CPA5 – 8'x 40"
Number	Eighteen (18) per RO machine
Rejection	>99% for heavy metals

Automatic Inlet Valve

Manufacturer / model	Bray, Series 31
Type/Size	Butterfly, 3" CI lug body
Material of Construction	CI body, SS disc & stem, EPDM seat
Actuator	Air x Air, 80 psi

Pump Throttle Valve

Manufacturer / model	Bray, Series 41
Type/Size	High Performance Butterfly, 2.5" SS lug body
Material of Construction	316 ss body, 316ss disc & stem
Actuator	Gearwheel manual operator

RO Concentrate Control Valve

Manufacturer / model	Sharpe, Fix. 44836
Type/Size	Globe valve, CL800, 1"
Material of Construction	CF8M stainless steel
Actuator	Manual round handle

Gauge Isolation / Sample Valves (low pressure)

Manufacturer / model	Flow-Tek, Series 5000
Type/Size	Ball valve, Unibody, reduced port, ¼" – ½"
Material of Construction	316 stainless steel, PTFE seats
Actuator	Lever handle

Sample Valves (high pressure)

Manufacturer / model	Conbraco
Type/Size	Globe style needle valve, ¼"
Material of Construction	316 stainless steel, PTFE seats
Actuator	Manual handle

Permeate Check Valve(s)

Manufacturer / model	Asahi / ball-check valve
Type/Size	PVC true-union ball check, SOC, 1"
Material of Construction	PVC

Piping

Low Pressure	Sch80 PVC (3" Feed, 2" RO Permeate & 1-1/2" Concentrate)
High Pressure	Sch10 304 stainless steel (3" Feed & 1-1/2" Concentrate
Arrangement:	Piping assembly pre-built and mounted on skid with manual isolation and actuated service control valves

Instruments

Pressure Gauge(s)	
Manufacturer	Wika, type 233.53
Type/Size	Liquid filled, 2.5” dia
Material	Stainless steel
Locations	RO Feed, Three (3) RO Interstage, One (1) RO Permeate, One (1) RO Concentrate, One (1)
Pressure Switches	
Manufacturer	Barksdale
Type/Size	Adjustable, ¼” NPT
Material	Brass
Locations	RO Booster Pump Suction, One (1) RO Booster Pump Discharge, One (1)
Flow Indicator	
Manufacturer	Endress+Hauser
Type/Size	ProMag 10P80 Magnetic Flow
Material	Carbon steel body, PTFE liner, 316L SS
Locations	RO Concentrate, One (1)
Flow Indicator	
Manufacturer	Endress+Hauser
Type/Size	Vortex 72W50
Material	Carbon steel body, PTFE liner, 316L SS
Locations	RO Permeate, One (1)
pH/ORP Meter	
Manufacturer	Rosemount
Type/Size	Solu. Comp II Analyzer (1056)
Locations	RO Pump Discharge, One (1)

Controls

Panel	NEMA 4X with terminal strip and solenoids prewired and tubed to valves and instruments

Skid Carbon steel w/ corrosion resistant urethane coating

RO Membrane Clean- In -Place (CIP) System

PFD Tag No.: P-670 & T-670

Functional Description

A single CIP system by Crown Solutions shall be supplied as a pre-piped, pre-wired, skid-mounted unit for cleaning the RO membrane system in place. The unit includes a 345 gallon solution tank, cartridge filter, process pump, electric heater, instrumentation and control panel..

The CIP system is manually operated. Flexible hoses with quick disconnect hose couplings are provided for temporary connection of the CIP system to the RO bank during cleaning. The cartridge filter is provided with two sets of filter elements.

General

Number	One (1)

Cleaning System Pump

Number	One (1)
Design	160 gpm at 60 psi (138 ft)
Manufacturer and model	Grundfos CRN 45-1
Material	316 stainless steel
Motor	7.5 HP, 480/3/60 TEFC

Cartridge Filter Vessel

Number of Units	One (1)
Manufacturer and model	Fil-Trek, EF12-012-4-3F-VB
Filter Capacity	12-round x 40”
Material of construction	304 stainless steel
Pressure rating	150 psig @ 250 degF
Filter cartridge type	5 micron nominal, 2.5” x 40” DOE

Cleaning Solution Tank

Manufacturer	Ace Rotomold
Design	Cone bottom, closed top
Capacity	345 gallons nominal
Size	52” D x 58” H
Material	PE

Heater

Type	Flange Immersion In-line Electric Heater
Materials of construction	316L SS flange, Incoloy sheath elements
Power	48 kW, 460/3/60
Heater Installation	304 stainless steel flanged flow-through assembly.

Valves

Manual Valves

Manufacturer	Bray
Type/Style/Size	Butterfly, 3” and up
Material of Construction	Cast Iron Body/SS Disc/EPDM Seat

Instrument Isolation / Sample

Manufacturer	Flow-Tek
Type/Style/Size	Ball, Unibody reduced port, 316ss, ¼” – ½”
Material of Construction	316 SS Body/ Ball, PTFE seats

Piping

Material of Construction	Sch. 80 PVC
Arrangement:	Vessel face piping assembly pre-built and mounted on skid with manual isolation and actuated service control valves

Instruments

Pressure Gauge(s)

Manufacturer	Wika, type 233.53
Type/Size	Liquid filled, 2.5” dia
Material of construction	Stainless steel
Locations	• CIP Pump Outlet • CIP Skid Outlet

Flow Indicator

Manufacturer	Signet
Type/Size	Paddlewheel sensor, 3-inch PVC fitting
Local Indicator	Panel-mounted display
Locations	• CIP Skid Outlet

Temperature Indicator

Manufacturer	Wika
Type/Size	Dial process thermometer, 2.5” face
Local Indicator	316 stainless steel
Locations	• Heater Inlet • Heater Outlet / CIP Skid Outlet

Flow Switch

Manufacturer	Kobold
Type/Size	Paddle flow switch, 1” NPT
Function	• Heater Outlet / Heater Enable function

Control Panel

Panel	NEMA 4X with terminal strip and solenoids prewired and tubed to valves and instruments

Skid Epoxy Painted Carbon Steel

Integrated Control System

Functional Description

One (1) common Main Control Panel (MCP) by Crown Solutions shall be supplied for controlling, monitoring and alarming the Water Softener and RO system. The MCP will be shop assembled, wired and tested before being shipped to the field.

General

Number of Enclosures	One (1)

Equipment Description

Enclosure

Dimensions	60”x38”x12”
Manufacturer	Hoffmann
Model	CP6036
Material	Stainless Steel
Ratings	NEMA 4X

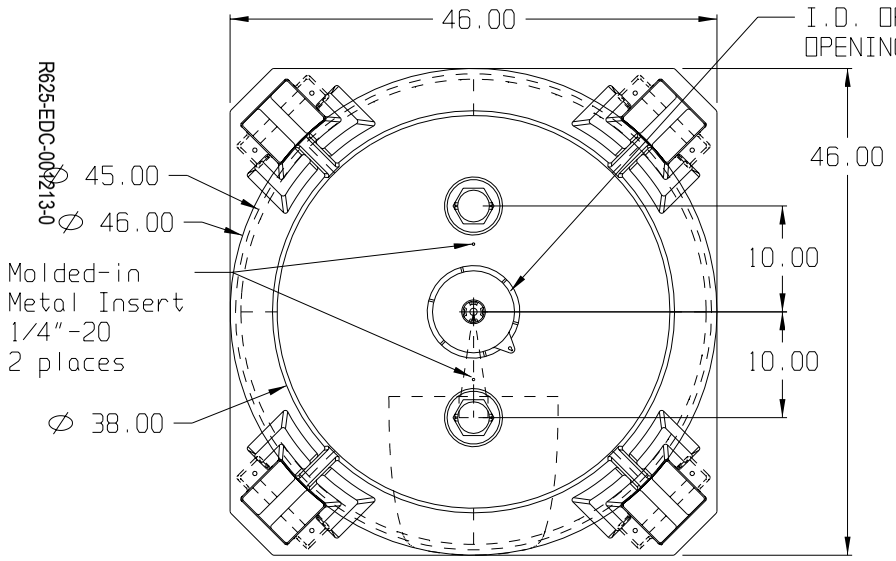
Main Components

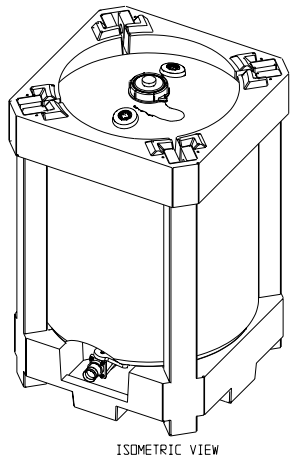
PLC	Allen Bradley CompactLogix
Power Supply	Allen Bradley
Back Panel	Hoffmann
HMI	Allen Bradley PanelView 600+ 5.5-inch Color TFT Display, Ethernet, RS-232 & Modular Communications Interface,
Input and Output Cards	Allen Bradley
Horn	Federal Signal

Catalogue and Product Data Sheets

Item	Tag	Description
42	T-700A, T-700B, T-700C, T-700D, T-710A, T-710B	Chemical Storage Totes

R625-EDC-009213-0

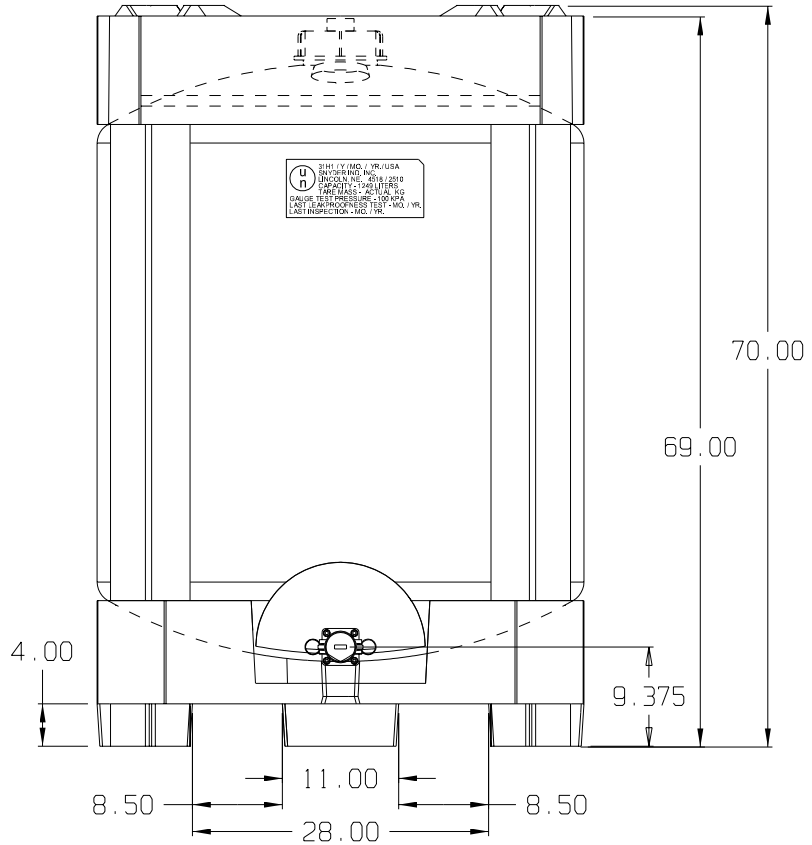




U.N. MARKING ON TANK READS:

un

31H1 / Y / MO. / YR. / USA
SNYDER IND. INC.
LINCOLN, NE. 4518 / 2510
CAPACITY - 1249 LITERS
TARE MASS - ACTUAL KG
GAUGE TEST PRESSURE - 100 KPA
LAST LEAKPROOFNESS TEST - MO. / YR.
LAST INSPECTION - MO. / YR.



FORK OPENING DIMENSIONS ARE THE SAME ON ALL FOUR SIDES OF THE CONTAINER.

330 STANDARD ULTRATAINER "STANDARD PACKAGE OF OPTIONAL EQUIPMENT"

ITEM #	DESCRIPTION	QTY.	PART NUMBER
1	TANK – 2 BUNG TANK WITH 6" HEAVY DUTY CAP AND BOTTOM DRAIN HDPE NATURAL. (WITH CAP LANYARD INSERT AND WITH TAMPER EVIDENCE INSERTS MOLDED IN)	1	68445
2	BASE – BASE 330 STANDARD ULTRATAINER HD/BLUE	1	687179
3	TOP PROTECTOR ULTRA HD/BLUE	1	670179
4	PIN ASSEMBLY PURCHASED PLASTIC W/BOLTS FOR ULTRA.	1	347905
5	S.I.I. PROPRIETARY 2" NPS REPLACEABLE BUNG GLASS FILLED POLYETHYLENE W/VITON O-RING SEAL	2	N/A
6	2" NPS RIEKE POLYETHYLENE BUNG PLUGS WITH EPDM FLAT GASKETS	2	347340
7	6" HEAVY DUTY CAP WITH 2" NPS CENTER OPENING AND EPDM CAP GASKET. EQUIPPED WITH LID TIE	1	347391
8	S.I.I. 2" NPS VACUUM RELIEF VENT WITH EPDM DISK AND FLAT GASKET (AVERAGE GRAVITY FLOW RATE OF 70 GALLONS PER MINUTE)	1	347854
9	2" BANJO STANDARD PORT GLASS FILLED POLYPROPOLENE BOTTOM DRAIN VALVE WITH TEFLON SEATS AND BALL AND 18/8 S.S. BOLTS. INCLUDES DUST CAP AND CAP LANYARD.	1	347718

(all dimensions in inches)
(all dimensions nominal)

SNYDER INDUSTRIES INC.

330 GALLON STANDARD ULTRATAINER W/HD 6" CAP

PART # TANK: 68445

REF#: 0000

08/16/02

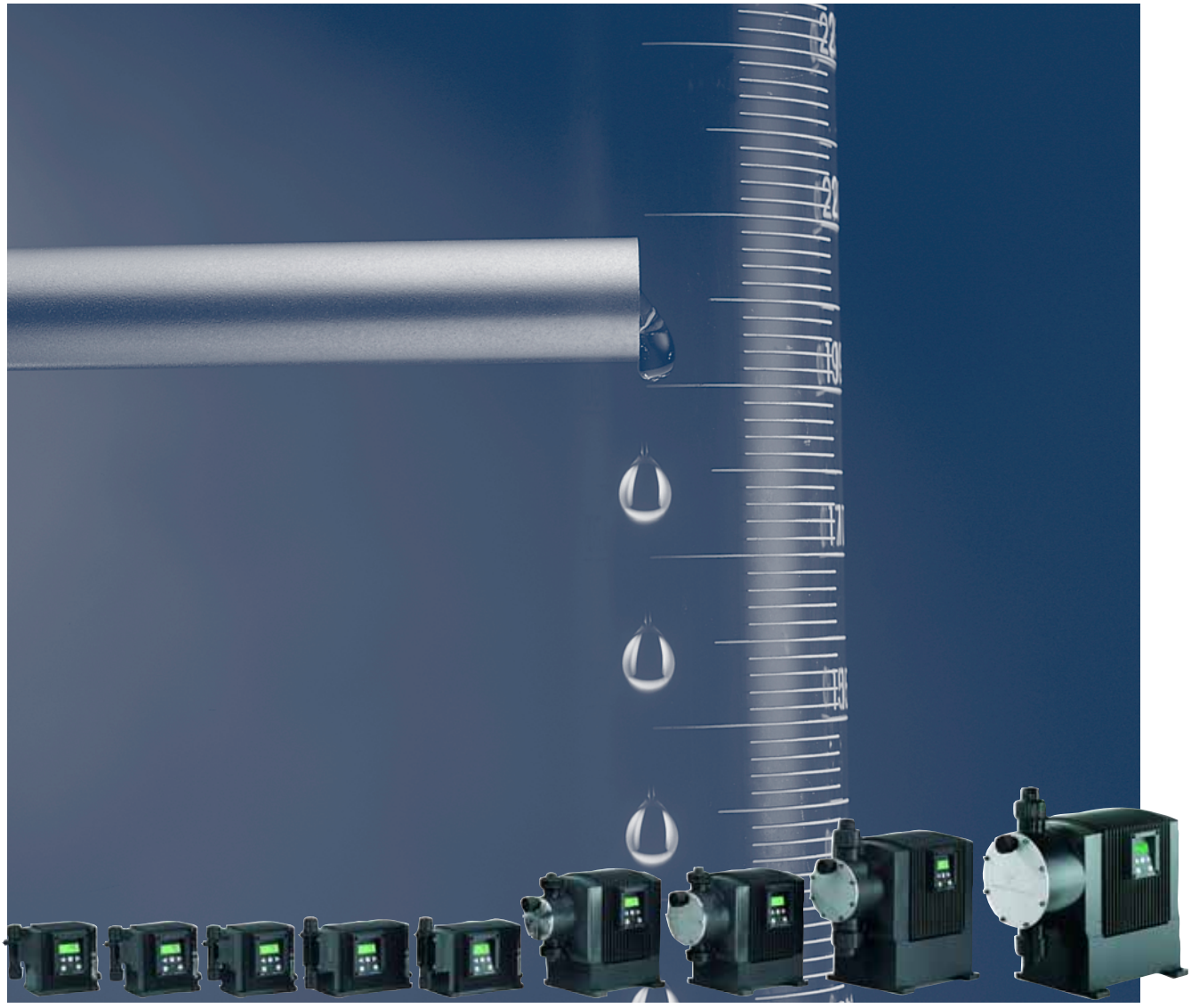
Catalogue and Product Data Sheets

Item	Tag	Description
43	P-700A, P-700B, P-700C, P-700D, P-700E	Sodium Hydroxide Metering Pumps
44	P-710A, P-710B	Sulfuric Acid Metering Pumps
52	P-830A, P-830B	Coagulant Aid Feed Pumps

GRUNDFOS
PRODUCT GUIDE

DME and DMS

Digital Dosing



R625-EDC-001213-0

BE > THINK > INNOVATE >

GRUNDFOS

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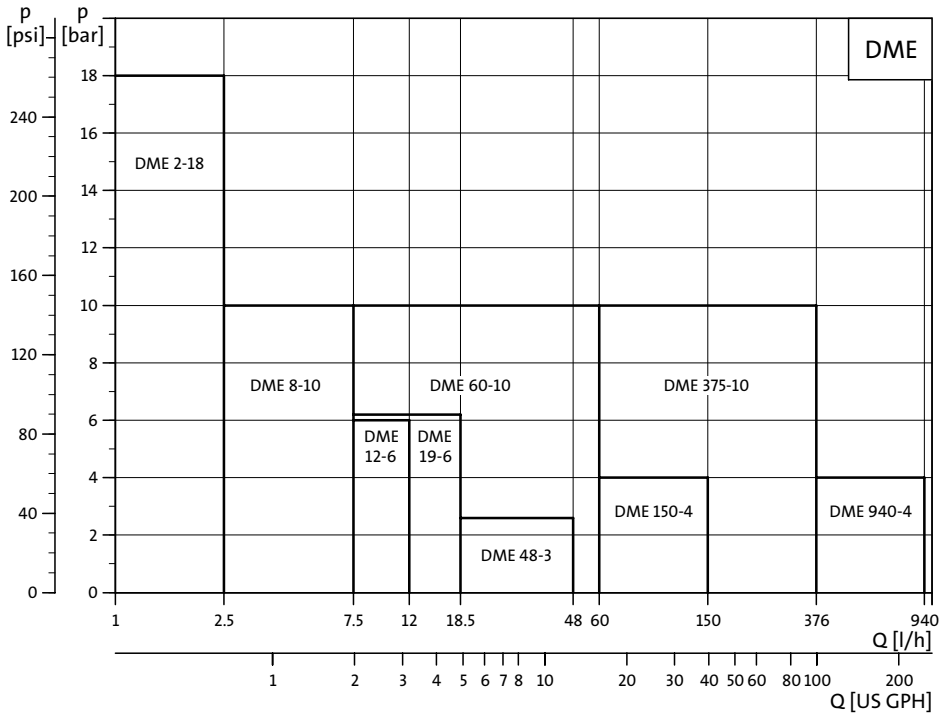
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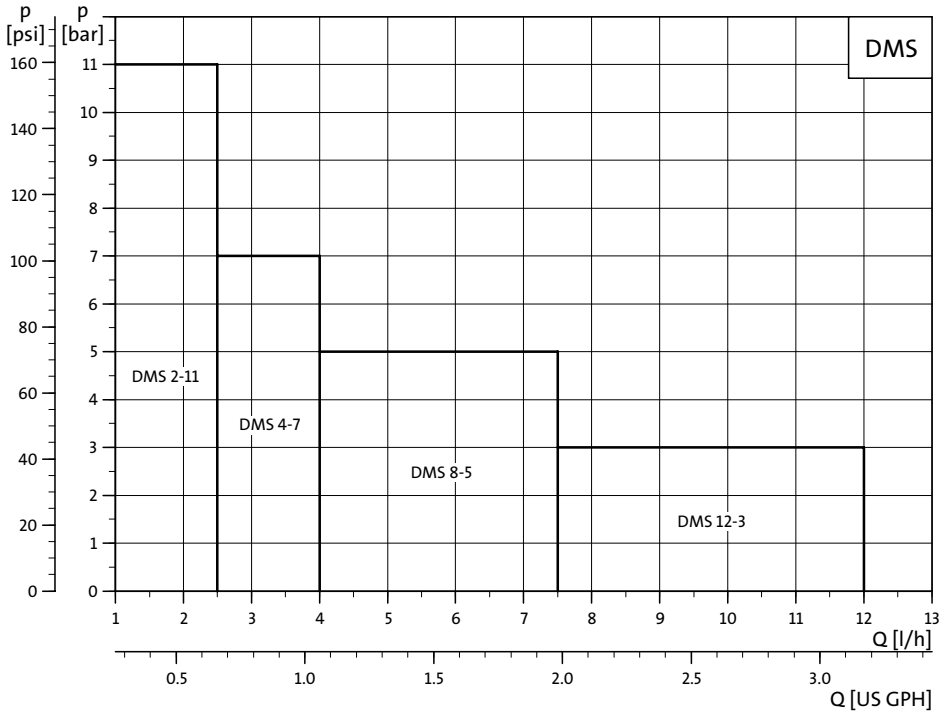
41

Performance range, DME



TM02 9943 4604

Performance range, DMS



TM02 9944 4604

DME and DMS



TM03 0815 0505

Digital Dosing

Digital Dosing represents state-of-the-art technology. This patented Grundfos solution sets new standards, including new principles and methods.

Precise and easy setting

The operator can easily install and set the pump to discharge exactly the quantity of dosing liquid required in the application. Capacity is read on the digital display in GPH, l/h, or ml/h, while icons are used to identify the operation mode.

Unique technology

A unique drive and microprocessor control ensure that dosing liquids are discharged precisely and with low pulsation even when the pump is operating with high viscosity or degassing liquids. Instead of the conventional stroke length adjustment, the capacity of the DME is regulated by automatic ajustment of the motor speed during the discharge stroke and by fixed suction stroke speed, ensuring optimal and uniform mixing. The capacity of the DMS is regulated by automatic regulation of the stroke frequency.

Fewer variants to cover all needs

The powerful variable speed motor, a turn-down ratio of 1:1000/1:800 and a complete control interface including

- full pulse control,
- pulse batch control,
- internal timer batch control,
- analog 0/4-20 mA control,
- level control and
- fieldbus communication module

ensure that nine DME pumps cover the range from 0.00066 to 248.3 gallons per hour, up to 261 psi. The switch mode power supply ensures that the same pump is working precisely, irrespective of the power supply (100-240 V; 50-60 Hz).

The DMS version with synchronous motor and a turn-down ratio of 1:100 (consisting of four pump sizes and two control versions) cover the range from 0.0066 to 3.17 GPH. The DMS-A pumps have external pulse, analog 4-20 mA and level control interface; the DMS-B version is without external control interface. The DMS-D is without control and user interface.

The DME and DMS dosing pumps feature diaphragm dosing head with integrated vent valve, suction and discharge ball valves.

The pumps are also fitted with a power cable and plug.

General data

Type key

Example	DME	2	-	18	-	A	-	PP	/	E	/	C	-	F	-	2	1	RR	B
Type range																			
Maximum capacity [l/h]																			
Maximum pressure [bar]																			
Control variant																			
Dosing head material																			
Gasket material																			
Valve ball material																			
Control panel position																			
Supply voltage																			
Valves																			
Connection suction/ discharge																			
Power plug type																			

Codes

Example	A	-	PP	/	E	/	C	-	2	-	1	R	R	B

Control variant

A	
AG	A + Genibus
AR	A + alarm relay
AP	A + Profibus
B	Basic
D	Only on/off

Dosing head material

PP	Polypropylene
PV	PVDF
SS	Stainless steel

Gasket material

E	EPDM
V	FKM

Valve ball material

C	Ceramic
SS	316 SS
G	Glass
Y	Hastelloy C

Control panel position

F	Front-fitted
S	Side-fitted
X	No control panel

Supply voltage

1	1 x 230 V, 50 Hz
2	1 x 120 V, 60 Hz
3	1 x 100-240 V, 50-60 Hz
6	1 x 110 V, 50 Hz
8	1 x 100 V, 50/60 Hz
9	1 x 200 V, 50/60 Hz

Valves

1	Standard valve
2	Spring-loaded valve

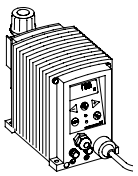
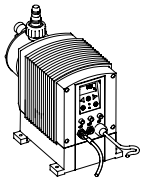
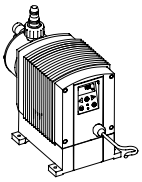
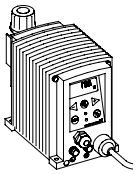
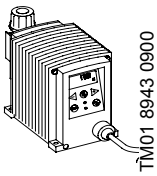
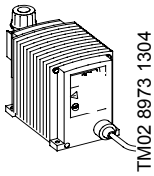
Connection suction/discharge

	Tubing 6/9 mm
1	Tubing 4/6 mm supplied with the pump
	Tubing 6/9 mm
2	Tubing 6/12 + 9/12 mm supplied with the pump
3	Tubing 4/6 mm
4	Tubing 6/9 mm
5	Tubing 6/12 mm
6	Tubing 9/12 mm
T	Tubing 0.17"/0.25"
R	Tubing 0.25"/0.375"
S	Tubing 0.375"/0.5"
A	Threaded Rp 1/4
B	Threaded Rp 3/8
V	Threaded NPT 1/4"
Y	Threaded NPT 3/8"
E	Cementing d.10 mm
F	Cementing d.12 mm
Q	Tubing 19/27 + 25/34
W	Tubing 32/41 + 38/48
A1	Threaded Rp 3/4"
A2	Threaded Rp 1 1/4"
A3	Threaded NPT 3/4”
A4	Threaded NPT 1 1/4”

Power plug

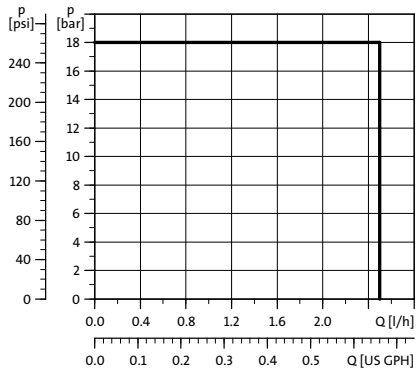
F	EU (Schuko)
B	USA, Canada (120 V)
G	UK
I	Australia
E	Switzerland
J	Japan

Overview of functions

	DME			DMS		
	2 to 48	60 to 940 AR	60 to 940 B	variant A	variant B	variant D
	 TM01 8941 0900	 TM02 8337 4903	 TM02 8338 4903	 TM01 8941 0900	 TM01 8943 0900	 TM02 8973 1304
Capacity control, see page 8						
Internal stroke frequency control	●	●	●	●	●	
Internal stroke speed control	●	●	●			
Control panel, see page 10						
Capacity setting in liters, milliliters or US gallons	●	●	●	●	●	
Display with background light and soft-touch buttons	●	●	●	●	●	
Easy set-up menu with language options	●	●	●	●	●	
On/off button	●	●	●	●	●	
Maximum capacity button (priming)	●	●	●	●	●	
Green indicator light for operating indication	●	●	●	●	●	
Red indicator light for fault indication	●	●	●	●	●	
Control panel lock	●	●	●	●	●	
Side-fitted as an option	●	●	●	●		
Operating modes, see page 13						
Manual control	●	●	●	●	●	
Pulse control	●	●		●		
Analog 0/4-20 mA control	●	●		●		
Timer-based batch control	●	●				
Pulse-based batch control	●	●				
Functions, see page 17						
Dosing monitoring	●	●		●		
Dual-level control	●	●		●		
Calibration of pump to actual installation	●	●	●	●	●	
Anti-cavitation (reduced suction speed)	●	●	●			
Capacity limitation	●	●	●			
Counters for strokes, operating hours and power on/off	●	●	●	●	●	
Fieldbus communication (variants AP and AG)	●	●				
Overload protection		●	●			
Error message in display		●	●			
Leakage sensor		●				
Dosing signal output		●				
Power supply, page 16						
Switch-mode power supply	●	●	●			
Inputs/outputs, see page 19						
Input for pulse control	●	●		●		
Input for analog 0/4-20 mA control	●	●		●		
Input for dual-level control	●	●		●		
Input for external start/stop	●	●		●		
Alarm relay output (variant AR)	●	●		●		
Dosing output		●				
Input for external on/off switch	●	●		●		

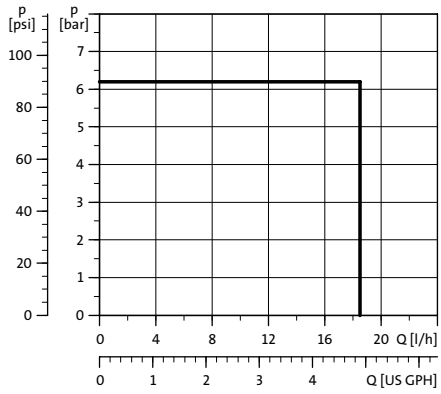
Performance curves

DME 2-18



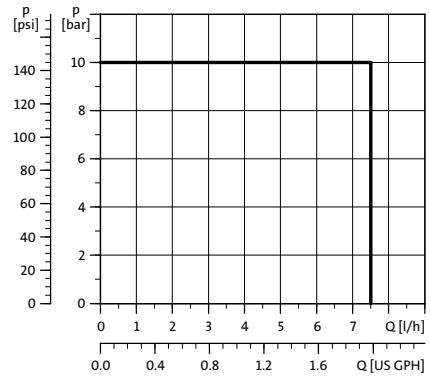
TM02 9946 4604

DME 19-6



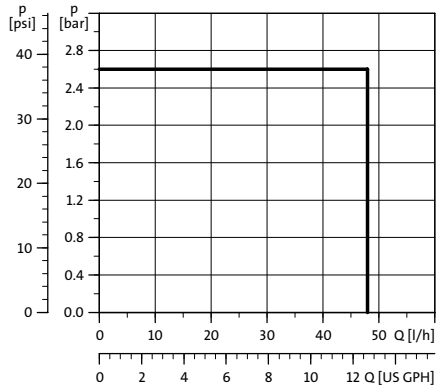
TM02 9946 4604

DME 8-10



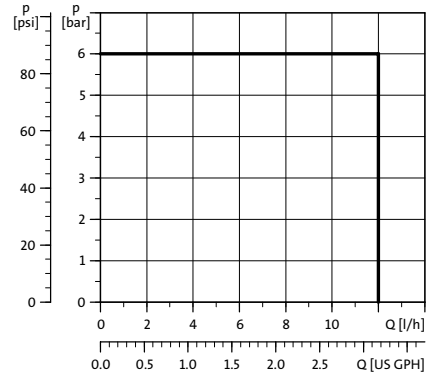
TM02 9947 4604

DME 48-3



TM02 9950 4604

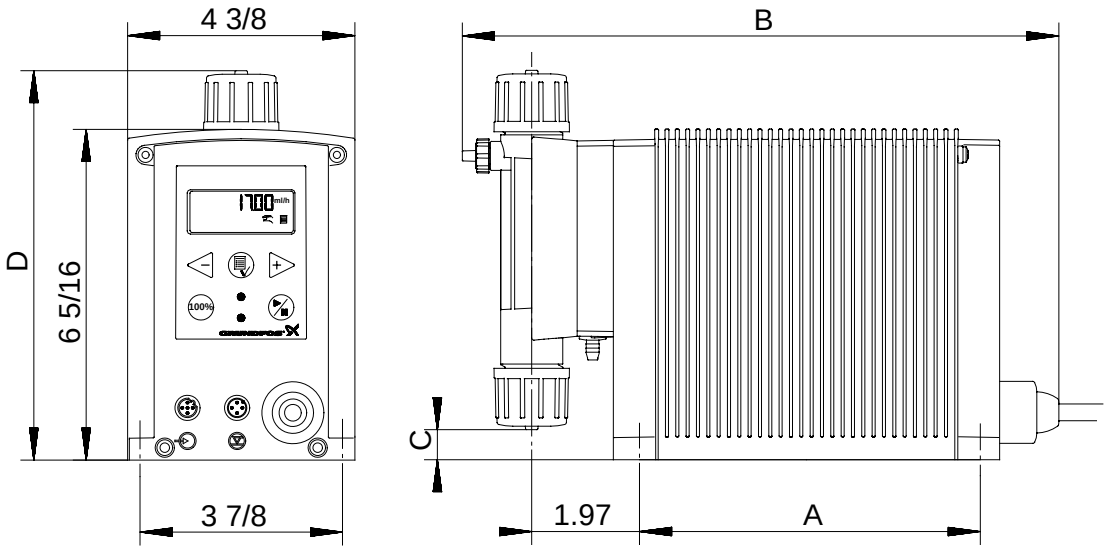
DME 12-6



TM02 9948 4604

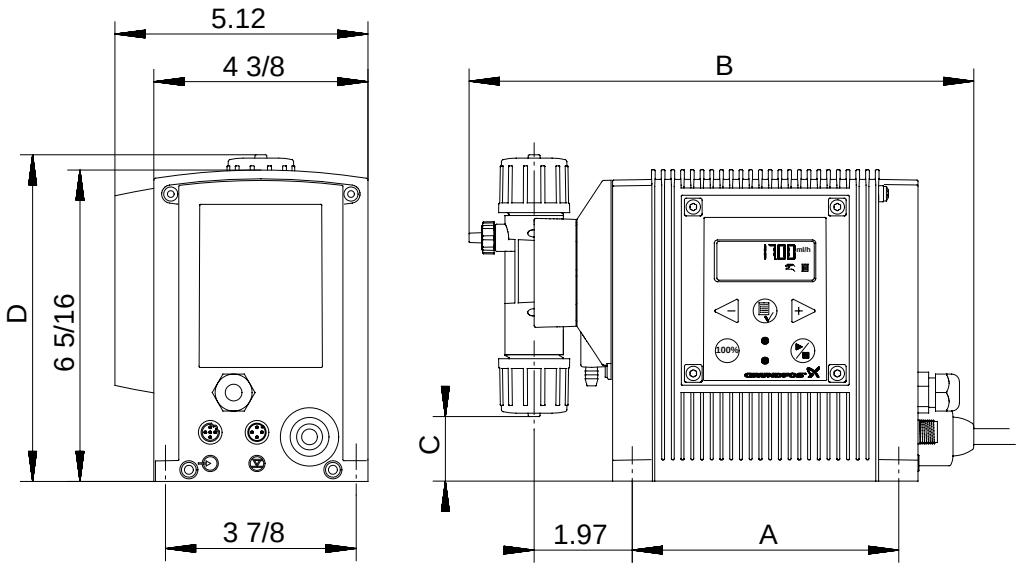
Dimensions

Front-fitted control panel DME 2 to 48, DMS



TM03 0238 4604

Side-fitted control panel DME 2 to 48, DMS



TM03 0239 4604

Dimensions are in inches (mm)

Pump type	DME 2 DMS 2	DMS 4	DME 8 DMS 8	DME 12 DMS 12	DME 19	DME 48
A	5.4 (137)				7.56 (192)	
B	9.4 (239)				11.57 (294)	
C	1.4 (36)				0.59 (15)	
D	6.6 (168)				7.40 (188)	

DME (2 to 48)

Pump			DME 2	DME 8	DME 12	DME 19	DME 48
Mechanical data	Maximum capacity without anti-cavitation ★1	[l/h]	2.5	7.5	12	18.5	48
		[GPH]	0.66	1.98	3.17	4.88	12.68
	Maximum capacity with anti-cavitation ★1	[l/h]	1.8	5.6	9	14.5	37
		[GPH]	0.49	1.48	2.78	3.66	9.51
	Maximum pressure	[bar]	18	10	6	6.2	2.6
		[psi]	261	145	87	90	38
	Maximum stroke frequency ★2 [stroke/min]		180	180	180	151	151
	Maximum wet/primed suction lift [ft (m)]		19.7 (6)				
	Maximum suction lift when priming with wet valves [m]		5.9 (1.8)	9.8 (3)	9.8 (3)	9.8 (3)	9.8 (3)
	Maximum viscosity with spring-loaded valves ★3 [cps]		500	500	500	500	100
	Maximum viscosity without spring-loaded valves ★3 [cps]		200	200	200	200	100
	Maximum liquid temperature [F (°C)]		122 (50)				
	Minimum liquid temperature [F (°C)]		32 (0)				
	Maximum ambient temperature[F (°C)]		113 (45)				
	Minimum ambient temperature[F (°C)]		32 (0)				
	Accuracy of repeatability		±1%				
Weight and size	Weight [lb (kg)]		5 (2.3)	5 (2.3)	5 (2.3)	7.5 (3.4)	7.5 (3.4)
	Diaphragm diameter [in (mm)]		1.1 (28)	1.5 (38)	1.7 (43.5)	2.2 (55)	3.03 (77)
Electrical data	Supply voltage [V]		1 x 100-240 V, 50-60 Hz				
	Maximum current consumption [A]	at 100 V	0.27			0.35	
		at 230 V	0.16			0.26	
	Maximum power consumption P_1 [W]		16.2			22.1	
	Enclosure class		IP 65				
	Insulation class		F				
Signal input	Voltage in level sensor input [VDC]		5				
	Voltage in pulse input [VDC]		5				
	Minimum pulse-repetition period [ms]		3.3				
	Impedance in analog 0/4-20 mA input [Ω]		250				
	Maximum loop resistance in pulse signal circuit [Ω]		350				
	Maximum loop resistance in level signal circuit [Ω]		350				
Signal output	Maximum load of alarm relay output, at ohmic load [A]		2				
	Maximum voltage, alarm relay output [V]		250				
Sound pressure	The sound pressure level of the pump is lower than 70 db(A).						
Approvals			CE, VDE, cUL, UL, METI				

★1 At any back-pressure within the pump's specified range when calibrated to the actual installation.

★2 The maximum stroke frequency varies according to calibration.

★3 Maximum suction lift: 3 ft.

DME 2 to 12 - standard range

DME, 50/60 Hz, 100-240V with US 120V Plug

Pump Head Material	Control Variant	Valve Ball Material	Connections,Suction/ Discharge [in]	Gasket Material	Control Position	Model	Product Number	Ship Weight [lbs]
DME 2-18 0.66 GPH (2.5 l/h) up to 261 psi (18 bar)								
PP	A	Ceramic	1/4 or 3/8*	EPDM	Front	DME2-18 A-PP/E/C-F-21RRB	96470128	5.0
					Side	DME2-18 A-PP/E/C-S-21RRB	96470129	
				FKM	Front	DME2-18 A-PP/V/C-F-21RRB	96470130	
					Side	DME2-18 A-PP/V/C-S-21RRB	96470131	
	AR			EPDM	Front	DME2-18 AR-PP/E/C-F-21RRB	96470135	
					Side	DME2-18 AR-PP/E/C-S-21RRB	96470136	
				FKM	Front	DME2-18 AR-PP/V/C-F-21RRB	96470137	
					Side	DME2-18 AR-PP/V/C-S-21RRB	96470138	
PVDF	A	Ceramic	1/4 or 3/8*	FKM	Front	DME2-18 A-PV/V/C-F-21RRB	96470133	
					Side	DME2-18 A-PV/V/C-S-21RRB	96470134	
	AR				Front	DME2-18 AR-PV/V/C-F-21RRB	96462440	
					Side	DME2-18 AR-PV/V/C-S-21RRB	96470150	
SS	A	SS	1/4" NPT	FKM	Front	DME2-18 A-SS/V/SS-F-21VVB	96470153	
					Side	DME2-18 A-SS/V/SS-S-21VVB	96470154	
	AR				Front	DME2-18 AR-SS/V/SS-F-21VVB	96470151	
					Side	DME2-18 AR-SS/V/SS-S-21VVB	96470152	
DME 8-10 1.98 GPH (7.5 l/h) up to 145 psi (10 bar)								
PP	A	Ceramic	1/4 or 3/8*	EPDM	Front	DME8-10 A-PP/E/C-F-21RRB	96470158	5.0
					Side	DME8-10 A-PP/E/C-S-21RRB	96470159	
				FKM	Front	DME8-10 A-PP/V/C-F-21RRB	96470160	
					Side	DME8-10 A-PP/V/C-S-21RRB	96470161	
	AR			EPDM	Front	DME8-10 AR-PP/E/C-F-21RRB	96470219	
					Side	DME8-10 AR-PP/E/C-S-21RRB	96470224	
				FKM	Front	DME8-10 AR-PP/V/C-F-21RRB	96462441	
					Side	DME8-10 AR-PP/V/C-S-21RRB	96470230	
PVDF	A	Ceramic	1/4 or 3/8*	FKM	Front	DME8-10 A-PV/V/C-F-21RRB	96470217	
					Side	DME8-10 A-PV/V/C-S-21RRB	96470218	
	AR				Front	DME8-10 AR-PV/V/C-F-21RRB	96470243	
					Side	DME8-10 AR-PV/V/C-S-21RRB	96470248	
SS	A	SS	1/4" NPT	FKM	Front	DME8-10 A-SS/V/SS-F-21VVB	96470268	
					Side	DME8-10 A-SS/V/SS-S-21VVB	96470272	
	AR				Front	DME8-10 AR-SS/V/SS-F-21VVB	96470251	
					Side	DME8-10 AR-SS/V/SS-S-21VVB	96470255	
DME 12-6 3.17 GPH (12 l/h) up to 89.9 psi (6.2 bar)								
PP	A	Ceramic	1/4 or 3/8*	EPDM	Front	DME12-6 A-PP/E/C-F-21RRB	96470274	5.0
					Side	DME12-6 A-PP/E/C-S-21RRB	96470275	
				FKM	Front	DME12-6 A-PP/V/C-F-21RRB	96470276	
					Side	DME12-6 A-PP/V/C-S-21RRB	96470279	
	AR			EPDM	Front	DME12-6 AR-PP/E/C-F-21RRB	96470293	
					Side	DME12-6 AR-PP/E/C-S-21RRB	96470294	
				FKM	Front	DME12-6 AR-PP/V/C-F-21RRB	96470296	
					Side	DME12-6 AR-PP/V/C-S-21RRB	96470297	
PVDF	A	Ceramic	1/4 or 3/8*	FKM	Front	DME12-6 A-PV/V/C-F-21RRB	96470284	
					Side	DME12-6 A-PV/V/C-S-21RRB	96470288	
	AR				Front	DME12-6 AR-PV/V/C-F-21RRB	96470328	
					Side	DME12-6 AR-PV/V/C-S-21RRB	96470329	
SS	A	SS	1/4" NPT	FKM	Front	DME12-6 A-SS/V/SS-F-21VVB	96470331	
					Side	DME12-6 A-SS/V/SS-S-21VVB	96470332	
	AR				Front	DME12-6 AR-SS/V/SS-F-21VVB	96470330	
					Side	DME12-6AR-SS/V/SS-S-21VVB	96462476	

WEIGHTS: Shipping weights are approximate.

* 1/4" = 0.17 ID x 0.25 OD; 3/8" = 0.25 ID x 0.375 OD; 1/2" = 0.375 ID x 0.5 OD

List of pumped liquids

The resistance table below is intended as a general guide for material resistance (at room temperature), and does not replace testing of the chemicals and pump materials under specific working conditions.

The data shown are based upon information from various sources available, but many factors (purity, temperature, abrasive particles, etc.) may affect the chemical resistance of a given material. **Note:** Some of the liquids in this table may be toxic, corrosive or hazardous.

Please be careful when handling these liquids.

Pumped liquid 20°C		Concentration %	Materials										
			Pump housing				Gasket					Ball	
			PP	PVDF	316 SS	PVC	FKM	EPDM	CSM	PTFE	Centellen C	Ceramic	Glass
Acetic acid	CH_3COOH	25	●	●	●	●	–	●	❍	●	●	●	●
		60	●	●	●	●	–	❍	–	●	❍	●	●
		85	●	●	●	–	–	–	–	●	❍	●	●
Aluminium chloride	$AlCl_3$	40	●	●	–	●	●	●	●	●	●	●	●
Aluminium sulphate	$Al_2(SO_4)_3$	60	●	●	●	●	●	●	●	●	●	●	●
Ammonia, aqueous	NH_4OH	28	●	●	●	●	–	●	●	●	❍	●	–
Calcium hydroxide★[7]	$Ca(OH)_2$		●	●	●	●	●	●	●	●	●	●	–
Calcium hypochlorite	$Ca(OCl)_2$	20	❍	●	–	●	●	●	●	●	●	●	●
Chromic acid★[5]	H_2CrO_4	10	●	●	●	●	●	●	●	●	●	●	●
		30	–	●	–	●	●	❍	●	●	❍	●	●
		40	–	●	–	●	●	–	●	●	❍	●	●
		50	–	●	–	●	●	–	●	●	❍	●	●
Copper sulphate	$CuSO_4$	30	●	●	●	●	●	●	●	●	●	●	●
Ferric chloride★[3]	$FeCl_3$	100	●	●	–	●	●	●	●	●	●	●	●
Ferric sulphate★[3]	$Fe_2(SO_4)_3$	100	●	●	●	●	●	●	●	●	●	●	●
Ferrous chloride	$FeCl_2$	100	●	●	–	●	●	●	●	●	●	●	●
Ferrous sulphate	$FeSO_4$	50	●	●	●	●	●	●	●	●	●	●	●
Hydrochloric acid	HCl	< 25	●	●	–	●	❍	●	●	●	●	●	●
		25-37	●	●	–	●	–	●	–	●	❍	●	●
Hydrogen peroxide	H_2O_2	30	●	●	●	●	●	●	●	●	●	●	●
Nitric acid	HNO_3	10	●	●	●	●	●	●	●	●	●	●	●
		30	●	●	●	●	●	●	●	●	–	●	●
		40	❍	●	●	●	●	●	–	●	–	●	●
		70	–	●	●	–	●	–	–	●	–	●	●
Peracetic acid	CH_3COOOH	5	●	●	–	●	–	●	●	●	●	●	●
Potassium hydroxide	KOH	50	●	–	●	●	–	●	●	●	❍	●	–
Potassium permanganate	$KMnO_4$	10	●	●	●	●	–	●	●	●	●	●	●
Sodium chlorate	$NaClO_3$	30	●	●	●	●	❍	●	●	●		●	●
Sodium chloride	NaCl	30	●	●	–	●	●	●	●	●	●	●	●
Sodium chlorite	$NaClO_2$	20	●	❍	–	–	●	●	●	●	●	●	●
Sodium hydroxide	NaOH	20	●	❍	●	●	●	●	●	●	❍	●	–
		30	●	–	●	●	●	●	●	●	❍	●	–
		50	●	–	●	●	●	●	●	●	❍	●	–
Sodium hypochlorite	NaOCl	20	❍	●	–	●	●	●	●	●	●	●	●
Sodium sulphide	Na_2S	30	●	●	●	●	●	●	●	●	●	●	–
Sodium sulphite★[6]	Na_2SO_3	20	●	●	●	●	●	●	●	●	●	●	–
Sulphurous acid	H_2SO_3	6	●	●	●	●	●	●	●	●	●	●	❍
Sulphuric acid★[4]	H_2SO_4	< 80	●	●	–	❍	●	❍	●	●	❍	●	❍
		80-98	❍	●	–	–	●	–	–	●	●	●	–

● Suitable.

❍ Limited.

– Not suitable.

★[3] Risk of crystallisation.

★[4] Reacts violently with water and generates much heat. (Pump should be absolutely dry before dosing sulphuric acid.)

★[5] Must be fluoride-free when glass balls are used.

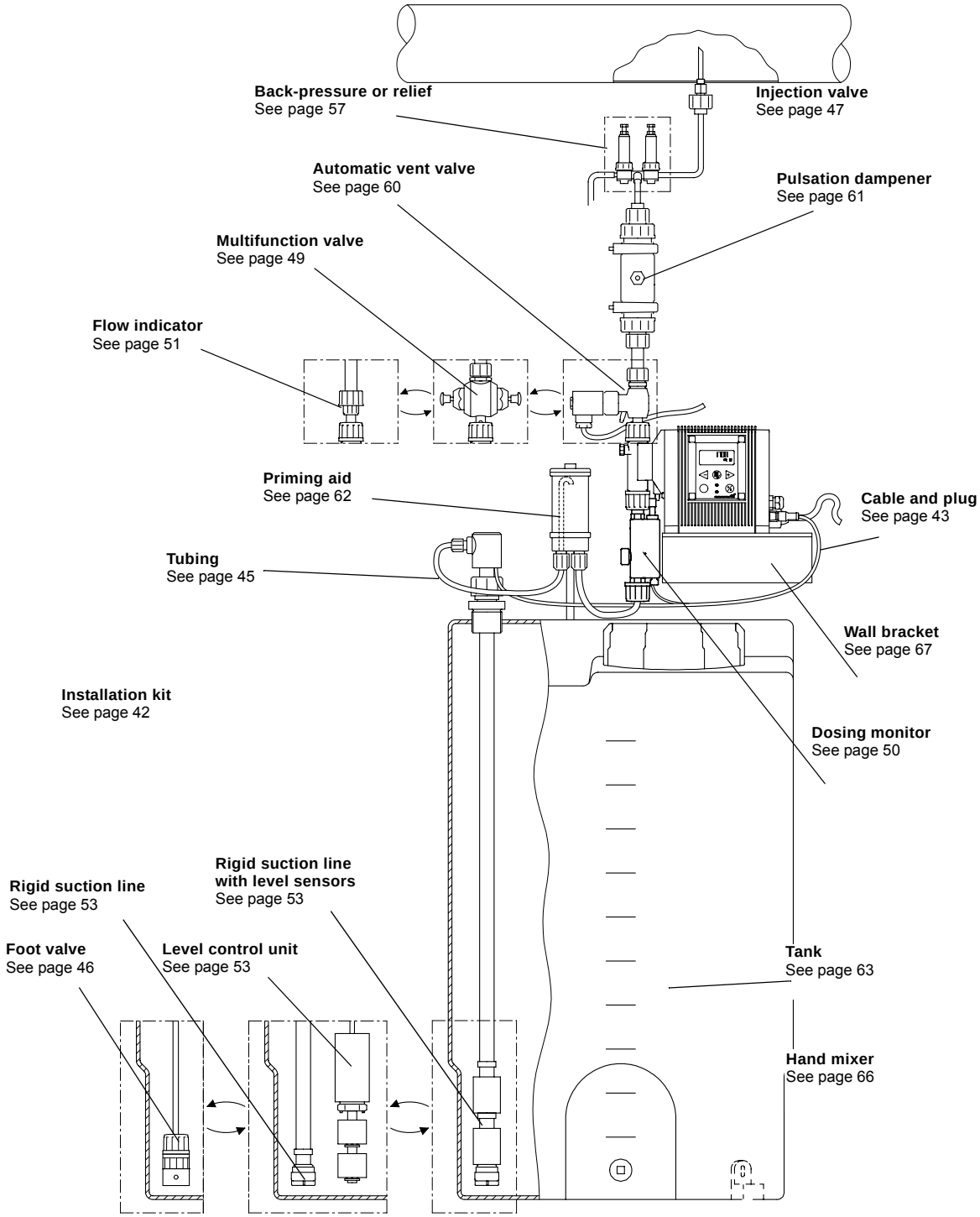
★[6] In neutral solutions.

★[7] Saturated solution 0.1%.

Accessories

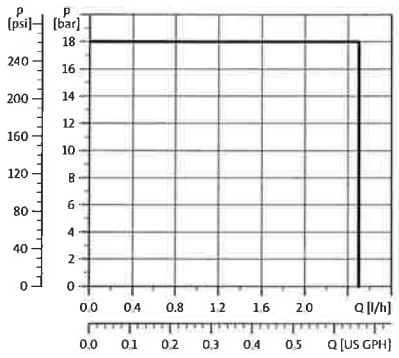
Grundfos offers a comprehensive range of accessories covering every need when dosing with Grundfos dosing pumps.

Overview



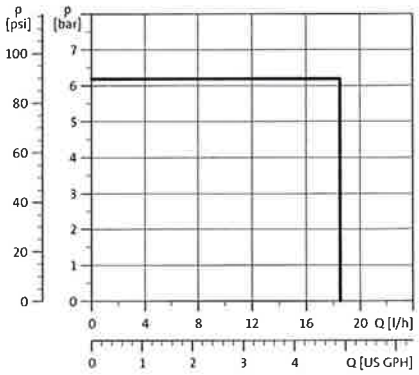
Performance curves

DME 2-18



TM02 9946 4604

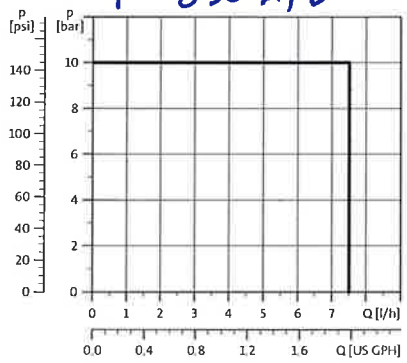
DME 19-6



TM02 9946 4604

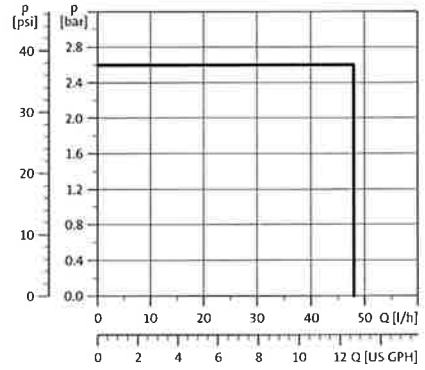
DME 8-10

P-710 A, B
P-830 A, B



TM02 9947 4604

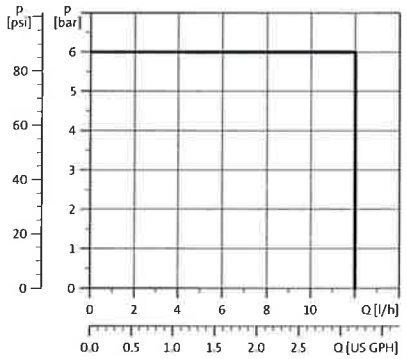
DME 48-3



TM02 9950 4604

DME 12-6

P-700 A-D



TM02 9948 4604

Catalogue and Product Data Sheets

Item	Tag	Description
48	P-810A, P-810B	Filter Press Solids Feed Pumps
55	P-840A, P-840B	Filter Press Solids Feed Pumps

P-810A/B
P-840A/B

WARREN RUPP®

Quality System
ISO9001 Certified

Environmental
Management System
ISO14001 Certified

IECEX



Top Discharge



Bottom Discharge

Ex II 2GD bT5

CE

SANDPIPER®
A WARREN RUPP PUMP BRAND

FLAP-VALVE
SA1-A Type 4
SA25-A Type 4

Air-Powered Double-Diaphragm Pump

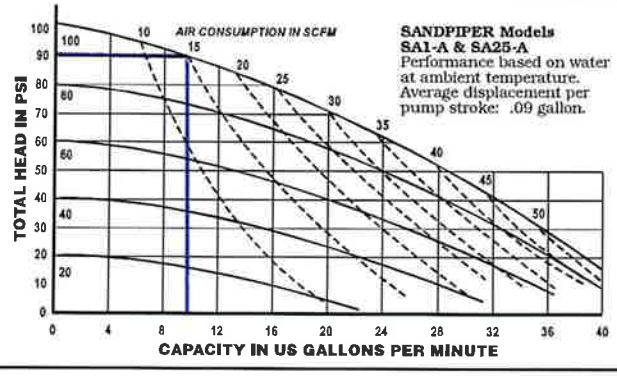
ENGINEERING, PERFORMANCE & CONSTRUCTION DATA

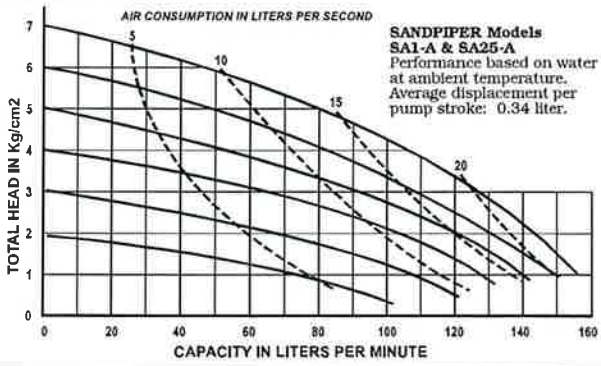
INTAKE/DISCHARGE PIPE SIZE	CAPACITY	AIR VALVE	SOLIDS-HANDLING	HEADS UP TO
SA1-A: 1" *(25mm)* NPT(F) SA25-A: 1" *(25mm)* BSP(F)	0 to 42 gallons per minute *(0 to 159 liters per minute)*	No lube, no-stall design.	Up to nearly 1" *(25mm)*	125 psi or 289 ft. of water *(8.8 Kg/cm² or 88 meters)*

PERFORMANCE CURVES

(SANDPIPER® pumps are designed to be powered only by compressed air)

Temperature Limit: 212°F - 100°C MAXIMUM





MATERIALS OF CONSTRUCTION

Type	Manifold Porting: Top	Side	Bottom	Manifold	Outer Chamber	Inner Chamber	Outer Diaphragm Plate	Inner Diaphragm Plate	Intermediate Housing	Diaphragm Rod	Valve Seat	Hard-ware	Diaphragm	Flap Valve Material	Seat/ Manifold Gasket	Air Valve	Air Valve Cap	Shipping Wt. (lbs)
DB-4-A			X	356-T6AL	AL380DC	AL380DC	PS	PS	AL380DC	416SS	WR-S	PS	B	B	B	PP	AL380DC	31
DI-4-A			X	356-T6AL	AL380DC	AL380DC	PS	PS	AL380DC	416SS	WR-S	PS	I	I	I	PP	AL380DC	31
DN-4-A			X	356-T6AL	AL380DC	AL380DC	PS	PS	AL380DC	416SS	WR-S	PS	N	N	N	PP	AL380DC	31
DV-4-A			X	356-T6AL	AL380DC	AL380DC	PS	PS	AL380DC	416SS	WR-S	PS	V	V	V	PP	AL380DC	31
TB-4-A	X			356-T6AL	AL380DC	AL380DC	PS	PS	AL380DC	416SS	WR-S	PS	B	B	B	PP	AL380DC	31
TI-4-A	X			356-T6AL	AL380DC	AL380DC	PS	PS	AL380DC	416SS	WR-S	PS	I	I	I	PP	AL380DC	31
TN-4-A	X			356-T6AL	AL380DC	AL380DC	PS	PS	AL380DC	416SS	WR-S	PS	N	N	N	PP	AL380DC	31
TV-4-A	X			356-T6AL	AL380DC	AL380DC	PS	PS	AL380DC	416SS	WR-S	PS	V	V	V	PP	AL380DC	31
DB-4-SS			X	WR-S	WR-S	AL380DC	WR-S	PS	AL380DC	416SS	WR-S	PS*	B	B	B	PP	AL380DC	48
DI-4-SS			X	WR-S	WR-S	AL380DC	WR-S	PS	AL380DC	416SS	WR-S	PS*	I	I	I	PP	AL380DC	48
DN-4-SS			X	WR-S	WR-S	AL380DC	WR-S	PS	AL380DC	416SS	WR-S	PS*	N	N	N	PP	AL380DC	48
DV-4-SS			X	WR-S	WR-S	AL380DC	WR-S	PS	AL380DC	416SS	WR-S	PS*	V	V	V	PP	AL380DC	48
TB-4-SS	X			WR-S	WR-S	AL380DC	WR-S	PS	AL380DC	416SS	WR-S	PS*	B	B	B	PP	AL380DC	48
TI-4-SS	X			WR-S	WR-S	AL380DC	WR-S	PS	AL380DC	416SS	WR-S	PS*	I	I	I	PP	AL380DC	48
TN-4-SS	X			WR-S	WR-S	AL380DC	WR-S	PS	AL380DC	416SS	WR-S	PS*	N	N	N	PP	AL380DC	48
TV-4-SS	X			WR-S	WR-S	AL380DC	WR-S	PS	AL380DC	416SS	WR-S	PS*	V	V	V	PP	AL380DC	48
DB-4-SI			X	WR-S	WR-S	CI	WR-S	PS	CI	416SS	WR-S	PS*	B	B	B	PP	PP	63
DI-4-SI			X	WR-S	WR-S	CI	WR-S	PS	CI	416SS	WR-S	PS*	I	I	I	PP	PP	63
DN-4-SI			X	WR-S	WR-S	CI	WR-S	PS	CI	416SS	WR-S	PS*	N	N	N	PP	PP	63
DV-4-SI			X	WR-S	WR-S	CI	WR-S	PS	CI	416SS	WR-S	PS*	V	V	V	PP	PP	63
TB-4-SI	X			WR-S	WR-S	CI	WR-S	PS	CI	416SS	WR-S	PS*	B	B	B	PP	PP	63
TI-4-SI	X			WR-S	WR-S	CI	WR-S	PS	CI	416SS	WR-S	PS*	I	I	I	PP	PP	63
TN-4-SI	X			WR-S	WR-S	CI	WR-S	PS	CI	416SS	WR-S	PS*	N	N	N	PP	PP	63
TV-4-SI	X			WR-S	WR-S	CI	WR-S	PS	CI	416SS	WR-S	PS*	V	V	V	PP	PP	63

Note: For dual-ported unit, add "E" to pump type prefix. (For example: EDB-4-A).

Meanings of Abbreviations:

AL = Aluminum
B = Buna-N
CI = Cast Iron
DC = Die Cast
I = EPDM
N = Neoprene
PP = Polypropylene
PS = Plated Steel
PS* = Plated Steel, except wetted area which is 316SS
SS = Stainless Steel
T = PTFE
V = Viton®
WR-S = Warren Rupp Alloy Type 316SS

®Viton is a registered tradename of E.I. du Pont. ®Warren Rupp and SANDPIPER are registered tradenames of Warren Rupp, Inc.

SA1-A & SA25-A FLAP-VALVE

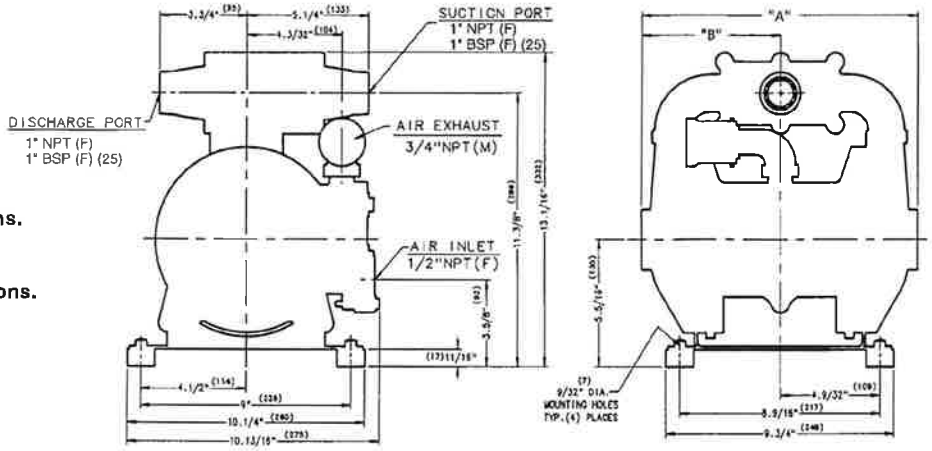
SANDPIPER®
A WARREN RUPP PUMP BRAND

MATERIALS	Operating Temperatures		
	Maximum*	Minimum*	Optimum**
BUNA-N General purpose, oil-resistant. Shows good solvent, oil, water and hydraulic fluid resistance. Should not be used with highly polar solvents like acetone and MEK, ozone, chlorinated hydrocarbons and nitro hydrocarbons.	190°F *88°C*	-10°F *-23°C*	50°F to 140°F *10°C to 60°C*
NEOPRENE All purpose. Resistant to vegetable oils. Generally not affected by moderate chemicals, fats, greases and many oils and solvents. Generally attacked by strong oxidizing acids, ketones, esters, nitro hydrocarbons and chlorinated aromatic hydrocarbons.	170°F *77°C*	-35°F *-37°C*	50°F to 130°F *10°C to 54°C*
VITON® Shows good resistance to a wide range of oils and solvents; especially all aliphatic, aromatic and halogenated hydrocarbons, acids, animal and vegetable oils. Hot water or hot aqueous solutions (over 70° F) will attack Viton®.	212°F+ *100°C+*	+32°F *0°C*	75°F to 212°F *24°C to 100°C*
EPDM Shows very good water and chemical resistance. Has poor resistance to oil and solvents, but is fair in ketones and alcohols.	212°F+ *100°C+*	-10°F *-23°C*	50°F to 212°F *10°C to 100°C*
WR-S Warren Rupp Alloy Type 316 Stainless Steel equal to or exceeding ASTM specification A743 CF-8M for corrosion resistant iron chromium, iron chromium nickel, and nickel based alloy castings for general applications. Commonly referred to as 316 Stainless Steel in the pump industry.			
For specific applications, always consult The Warren Rupp Chemical Resistance Chart.	*Definite reduction in service life. **Minimal reduction in service life at ends of range.		

Dimensions are ± 1/8"
Figures in parenthesis = millimeters

Model SA1-A features NPT threaded connections.

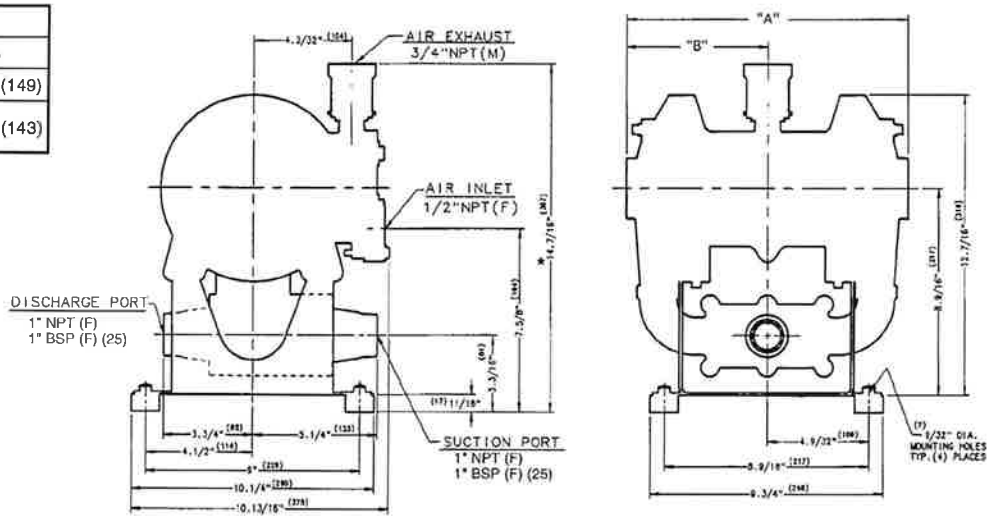
Model SA25-A features British Standard Pipe (BSP) threaded connections.



PUMP TYPES	DIMENSION	
	A	B
XX-XX-A	11 3/4" (298)	5 7/8" (149)
XX-XX-SS XX-XX-SI	11 1/4" (286)	5 5/8" (143)

Note:
Unit furnished with sub-base plate and rubber feet as standard. For stationary bolt down use, rubber feet can be removed.

*** 16 7/16 With Metal Muffler**



SA1-A: 1" NPT(F) SUCTION AND DISCHARGE • ½" NPT (F) AIR INLET PORT • ¾" NPT (F) AIR EXHAUST PORT (NOT SHOWN)
SA25-A: 1" BSP(F) SUCTION AND DISCHARGE • ½" NPT (F) AIR INLET PORT • ¾" NPT (F) AIR EXHAUST PORT (NOT SHOWN)

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Warren Rupp, Inc., A Unit of IDEX Corporation • P.O. Box 1568, Mansfield, Ohio 44901-1568 • (419) 524-8388 • Fax (419) 522-7867

SPSA1A-REV0106

R625-EDC-001213-0

Catalogue and Product Data Sheets

Item	Tag	Description
50	FP-820	Filter Press



J-Press® Sidebar Filter Press

Water Technologies

R625-EDC-001213-0

SIEMENS

J-Press® Filter Press – The Industry Standard



1.5m x 2.0m Fully automatic with automatic cloth washer.

Liquid/Solid Separation Process

The J-Press® sidebar filter press is the cost-effective solution for producing high solids filter cake with extremely high clarity in the liquid effluent. Considered by industry professionals as the premier sidebar filter press, the J-Press® filter press combines rugged construction, precision engineering, ease of operation and a wide range of features and options to tackle the most difficult dewatering problems.

The J-Press® filter press is one of the most versatile dewatering devices on the market, being used in a wide variety of industrial and municipal applications. The J-Press® filter press can be used to recover both solids and liquids from a waste or process stream. With superior materials of construction, the J-Press® filter press is especially useful in the dewatering of aggressive acid and alkali suspensions.

Available in a wide range of sizes and styles, the J-Press® filter press can be configured to provide a dewatering solution to most all process flows from as little as 25 gallons to 1,000,000 gallons per day. It produces consistent results under varying influent conditions.



1500mm fully automatic with automatic cloth washer.

CWB Certification

The Canadian Welding Bureau acknowledges that Siemens Water Technologies is certified to CSA Standard W47.1.

R625-EDC-001213-0



The J-Press® filter press can be configured with highly sophisticated manifolds, controls and cake discharge systems, such as this 2.0m x 2.0m J-Press® filter press built for a prominent municipal wastewater treatment plant.



470mm manual

Siemens sidebar presses are available in sizes ranging from 250mm to 2.0m designs, with working pressure ratings of 100psi (7bar) and 225psi (16bar).

J-Press® Filter Press, The Industry Leader

In 1978, JWI revolutionized the industry with the introduction of the J-Press® filter press. The J-Press® filter press was the first to feature, in a single design, a self compensating air/hydraulic closure system for ease of maintenance, gasketed filter plates for virtually leak free dewatering, semi-automatic plate shifting for labor savings and safety, automatic pump controls for unattended operation and a superior paint system that provided the highest level of protection from corrosion. The J-Press® filter press quickly set the benchmark for filter press performance.

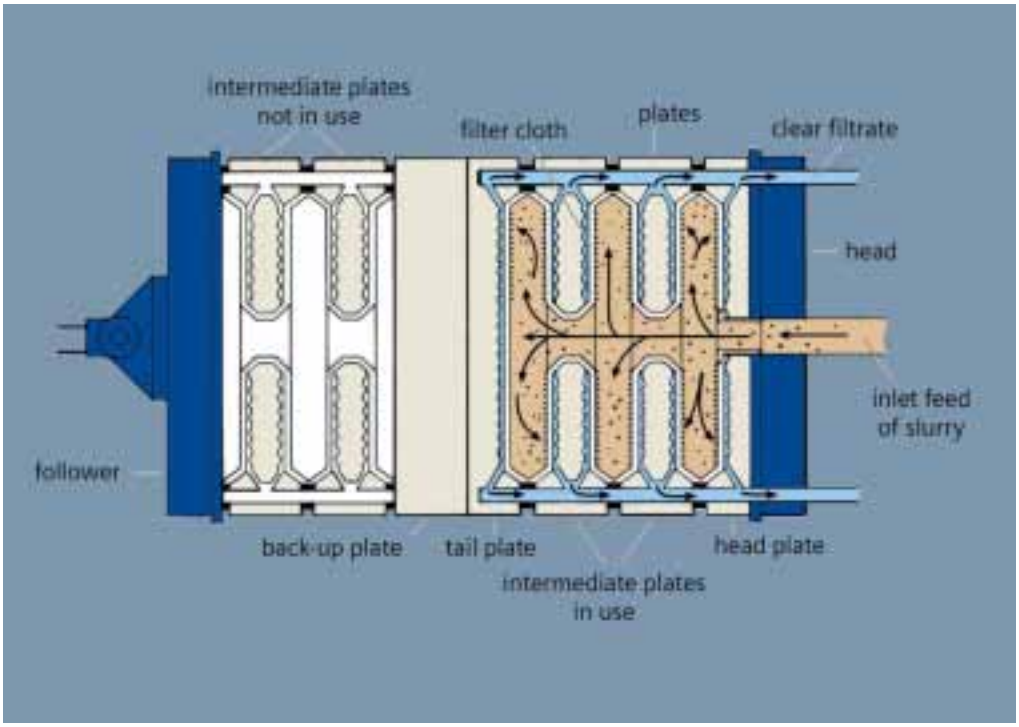
In the ensuing years, the J-Press® filter press evolved, offering options for fully automatic plate shifting, automatic cloth washing, PLC controls and a full complement of ancillary slurry processing and cake handling systems. Being the industry standard, the J-Press® line of filter presses is now the most versatile on the market today, from a manual 250mm pilot press that processes less than 2 lbs of dry solids per batch, to the monster 2.0m fully automatic press that can produce over 10,000 lbs of dry solids per cycle.



630mm semi-automatic

ISO 9001:2000 QMS

The quality management system governing the manufacture of the J-Press® sidebar filter press is ISO 9001:2000 certified.



Because the J-Press® filter press is a batch dewatering system, the press capacity can be easily adjusted by the changing the effective volume of the filter pack. A back-up plate, in conjunction with the tail plate, can be inserted to reduce the number of chambers used during dewatering.

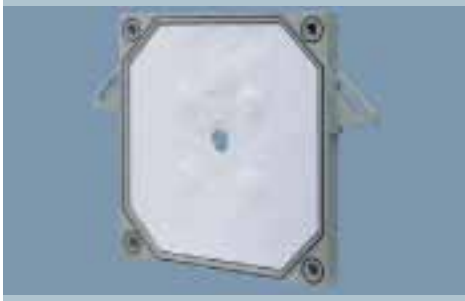
Uniform, Consistent Cake Solids

The J-Press® filter press is simple to operate. A single switch activates the pneumatic or electrically actuated hydraulic system. The plate stack forms a series of chambers, each covered with a filter cloth. With the plate stack clamped tightly in place, a solids-laden slurry is pumped, under pressure, into the plate chambers through a central feed connection.

The plate chambers fill uniformly with solids while the pump pressure and flow keep the solids deposited on the vertical surfaces of the plate chambers. Liquid passes through the filter cloths as clean filtrate flows to the end of the press where it is collected at a common manifold.

The solids continue to fill the plate chambers and are compacted in the press by the feed pump until the chambers are completely full. The feed cycle is discontinued and an air blow down is initiated for 5-15 minutes to remove any freestanding water within the cake and the press. The hydraulic closure of the press is then retracted, the individual filter elements are separated and the solids are discharged as "dry" filter cake to an appropriate receptacle or conveyance system.

The J-Press® filter press may also be equipped with diaphragm (or membrane) squeeze plates that allow for a mechanical compression of the filter cake, yielding higher dry solids before the cake is discharged from the filter press.



Gasketed plates form a tight seal due to o-rings around the recessed chamber and filtrate discharge eyes, allowing for a virtually leak free operation.



Filter clothes are available for all gasketed and non-gasketed plates (above); material and weave pattern are selected for your specific performance requirements.



Diaphragm (or membrane) plates feature flexible drainage surfaces that expand to exert additional pressure on the filter cake, further reducing moisture.

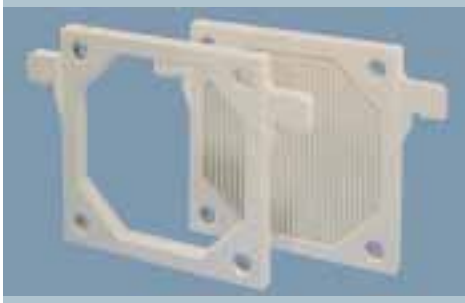


Plate and frame filter packs are available for polishing applications.





J-Press® feed and discharge manifolds are available in a variety of materials from PVC (above right) to stainless steel (above) to suit the application.

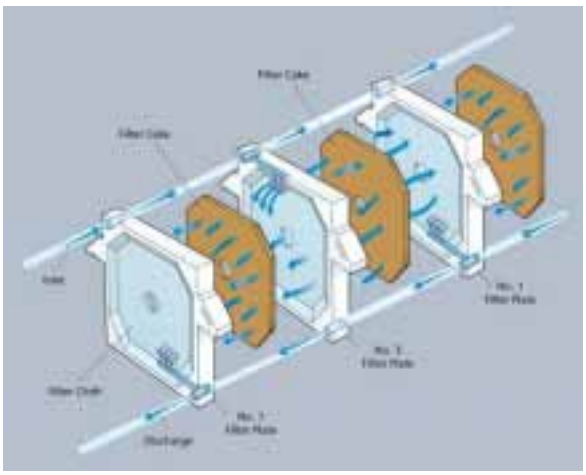
Superior Filter Plate Technology

Adding to the versatility of the J-Press® filter press is the large selection of filter plates available from Siemens. Based upon the process operating demands, filter plates are selected for each specific application. Filter plates are available in corrosion resistant polypropylene, PVDF and nylon. Plates can be configured as gasketed or non-gasketed, diaphragm (membrane) squeeze, or plate and frame designs.

Like the J-Press® filter press itself, the filter plates can be designed to withstand operating pressures up to 225 psi (16 bar).

Cake Wash or Air Blowdown

The inherent flexibility of the J-Press® filter press makes it ideal for recovering solids, liquids or both. In processes where the filter cake may need treatment prior to discharge, the J-Press® cake wash/air blowdown manifold can be used to force wash liquid through the cake. The manifold consists of piping and valves connecting the four corner filtrate ports into a common discharge pipe. By closing the appropriate valves, a wash liquid is pumped through the filter cake, and discharged out the diagonally opposed port. This can be followed by a compressed air blowdown, further removing moisture from the cake and filter plate drainage channels.



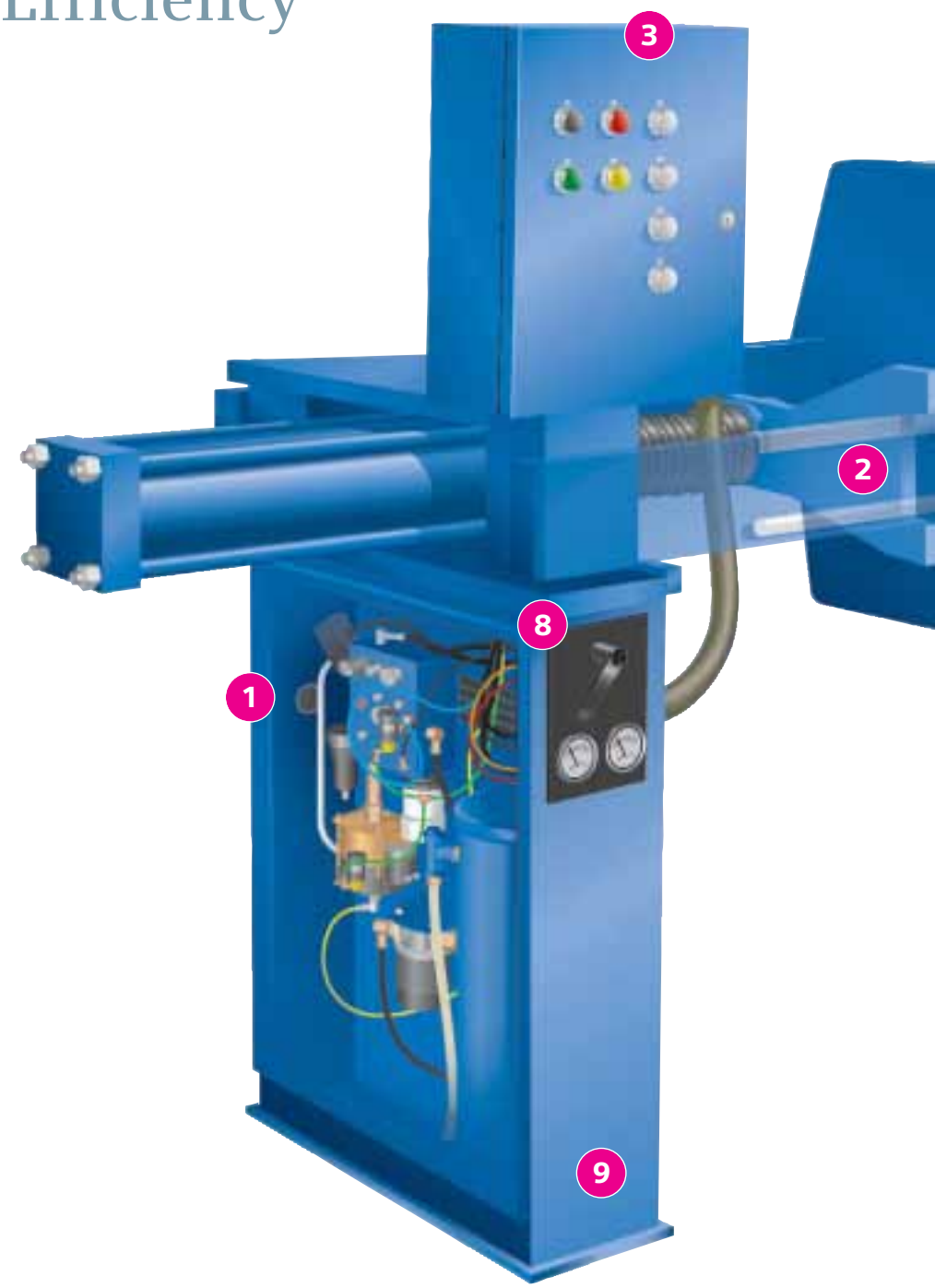
Engineered Performance and Operating Efficiency

1. Modularized Hydraulic Closure Systems — Available with either pneumatic or electric power, the modular power pack delivers up to 5,000 psi of hydraulic pressure to the hydraulic cylinder. The unit automatically compensates for thermal expansion and contraction of the filter pack due to changes in process temperature. Designed to minimize power consumption, the power pack features color coded connections for quick and easy removal and replacement during service and maintenance. The hydraulic pump and associated components are fully enclosed in a steel cabinet for protection from contamination and accidental damage, yet are easily accessible for maintenance through the full width cabinet door.

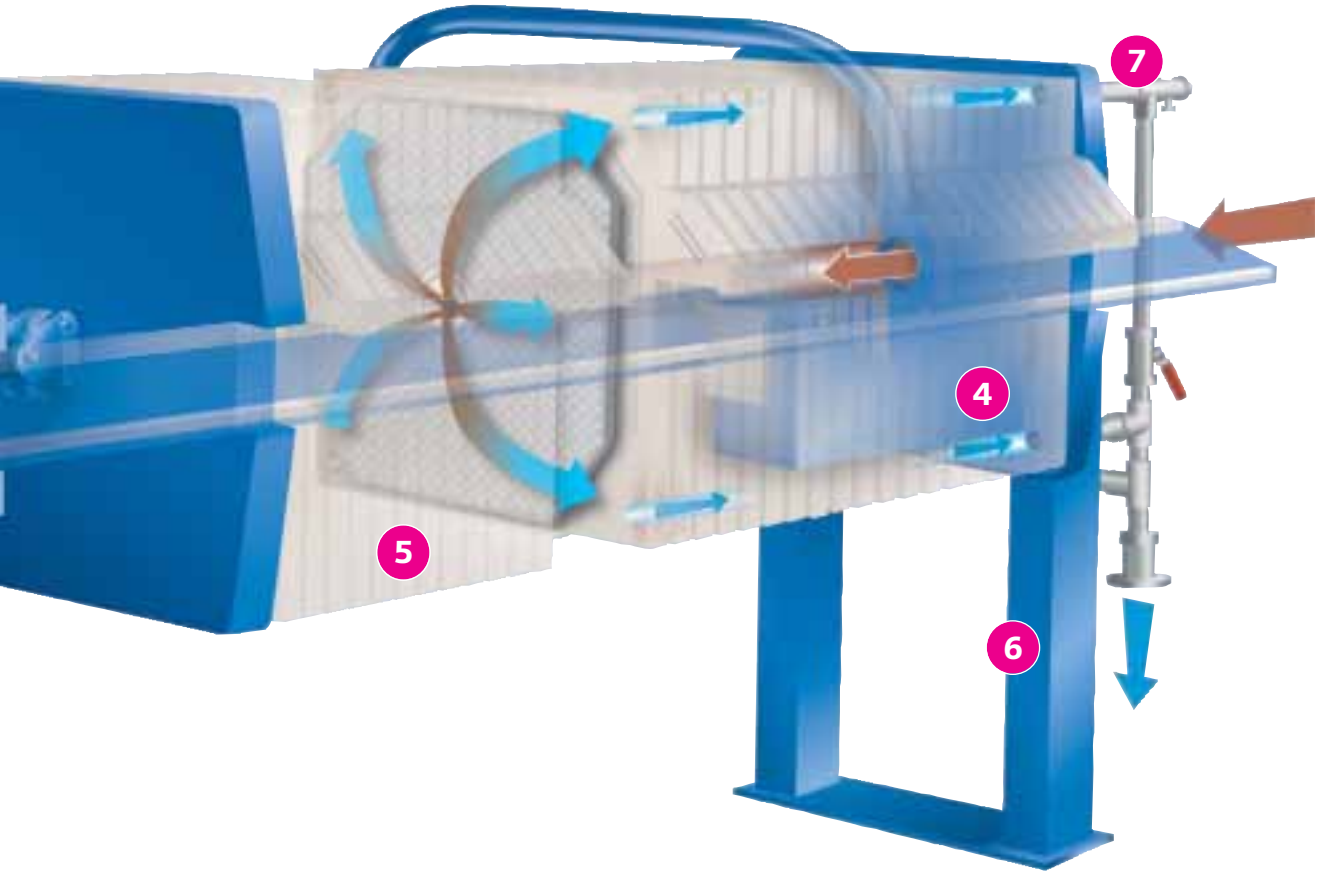
2. Future Expandability — The J-Press® filter press can be equipped with an optional expansion piece for future expansion of operating capacity with no need for costly sidebar replacements or frame exchanges. Expanding the capacity is as easy as adding additional filter plates.

3. Automatic Pump Control System (APCS) — For smaller presses, the APCS automatically controls the filling cycle, gradually increasing the feed pressure of the slurry feed pump to ensure a uniform formation of filter cake in the filter plate chambers. The uniform cake formation enhances the dewaterability of the incoming slurry. The APCS includes a hydraulic pressure safety device that shuts down the feeding cycle if a loss in hydraulic pressure occurs. For larger presses, filter press filling is controlled by a PLC.

4. Plate Shifter/Cloth Washing — The J-Press® filter press is available with either semi-automatic or fully automatic plate shifting systems (depending on size). The semi-automatic plate shifter is an operator driven plate shifting device that reduces manpower requirements during cake discharge. Further reductions in manpower are available with fully automatic shifting systems. The patented Siemens pry, bump and weigh system offers the additional advantage of positive cake discharge from each chamber further reducing the requirement for operator interface with the filter press during cake discharge.



A cloth washing system can also be added to the automatic plate shifting system to provide a periodic high pressure cleaning cycle for the filter cloths. Operating in as little as 20 seconds per plate, the automatic high pressure cloth washing system can restore the porosity of the filter cloths to like new condition. Washing the cloths at regular intervals not only improves performance but prolongs the working life of the cloth as well.



5. Numerous Filter Pack Options — A wide selection of filter plate materials and styles makes the J-Press® filter press one of the most versatile dewatering devices on the market. With materials of construction ranging from polypropylene to PVDF and nylon, the J-Press® filter press can be designed to handle virtually any feed slurry no matter how corrosive or chemically aggressive. Filter plates are available in recessed gasketed, recessed non-gasketed and diaphragm (or membrane) squeeze designs that can dewater everything from the easiest metal hydroxide slurry to difficult organic solids. The J-Press® filter press can readily adapt to changes in product and process applications by simply changing the filter cloths or the filter plates, giving the system great operational flexibility.

6. Robust Frame Construction — The J-Press® filter press is a ruggedly built unit made of fabricated steel plate. Precision alignment and machining of the structural components provide for even distribution of all pressures and stresses generated during operation. Frame strength is based upon the filter press operating pressure of either 100 psi (7 bar) or 225 psi (16 bar).

7. Manifold Piping — Like the filter plates, manifold piping is supplied in a variety of non-metallic and metallic materials suited to meet the rigors of the application. Manifolds can also be configured in a variety of inlet, discharge and valve options to maximize the versatility of the filter press. With the appropriate manifold, a filter press can be designed to perform both pre and post dewatering operations that enhance both the dewaterability of the material and the quality of the final cake.



8. Control Systems — Filter press control can be as simple as a single switch for opening and closing to as complex as a fully integrated PLC with Ethernet or wireless capabilities for remote monitoring and operation. The PLC system provides the most advanced and complete press operation available, from automatic feed pressure adjustment, to cycle frequency, cake discharge, cloth wash and air blowdown.

9. Superior Paint System — Each J-Press® filter press is sandblasted to an SSPC-10 near white finish before being primed and finished with a high quality, single coat aliphatic polyurea, fast clad DTM urethane paint system that results in a durable, chemically resistant finish averaging 6-9 mils in thickness (other paint systems are available on request).

Material Handling Systems



The J-Press® filter press is available with a wide range of material handling solutions for small or large volume cake discharge.

The J-Press® filter press installation can be configured to accommodate a wide range of material handling systems for discharged cake. Dumpsters, equipped with casters and self-dumping forklift mounts are the most common method for smaller presses. The drum disposal system, also for smaller presses, allows easy removal of discharged cake. This system includes a series of chutes that catch the filter cake as it falls from the press and directs it into 55-gallon (200L) drums. The J-Press® filter press is typically mounted on a platform, with catwalks, railings and stairs.

For larger presses, or presses that require transfer to downstream drying systems, Siemens can engineer a belt or screw conveyance as an integrated component of your process configuration. Roll-off container and truck-loading systems are also available. Your Siemens representative works closely with you to design, install and support the most efficient handling system for your specific needs.





Self-dumping dumpsters



Full Range of Features and Options



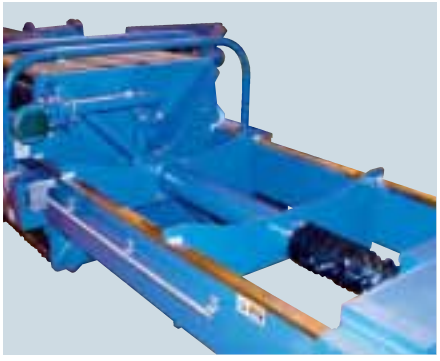
Fully automatic cloth washer



Fully automatic plate shifter



Semi-automatic plate shifter



Optional expansion allows you to build your press to meet future needs, then increase capacity simply by adding additional filter plates.

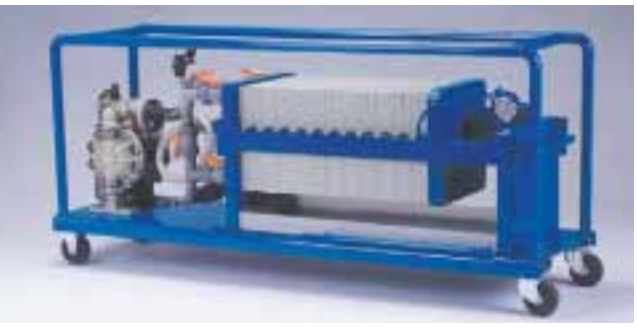


Exclusive integrated hydraulic circuit technology automatically compensates for varying pressures and temperatures. The enclosed steel cabinet and leak-free design minimize maintenance.

Siemens has the expertise and engineering capabilities to manufacture filter presses to meet the demands of your particular operation. Adaptability to applications, processes and capacities is the underlying value of J-Press® filter press. Features include:

- Full range of capacities: 250mm to 2.0m x 2.0m
- Low and high pressure: 100 psi (7 bar), 225 psi (16 bar), higher pressure available – consult factory
- Standard plate packs:
  Non-Gasketed Plates
  Gasketed Plates
  Diaphragm Squeeze Plates
  Plate and Frame
- Stainless Steel Sidebar Covers
- Closure Systems:
  Manual
  Automatic Closure (Air/Hydraulic)
  Automatic Closure (Electric/Hydraulic)
- Control Systems:
  Standard Control Panel
  Automatic Pump Control System
  PLC Control
- Standard Manifolds:
  Air Blow Down Manifold
  Double End Feed Manifold
  Core Blow Down Manifold
  Cake Wash Manifold
  Precoat Manifold (other configurations available — consult factory)
- Expansion options available for future capacity
- Plate Shifting:
  Air Operated Semi-Auto Plate Shifter
  Automatic Pry Shifter
  Automatic Pry Shifter and Bump
  Automatic Pry Shifter, Bump and Weigh (ACDDS)
  Multi-Plate Pull
- Automatic Cloth Washing
- Material handling:
  Filter Cake Dumpster
  Extended Legs and Chute
  Platform, Drum Disposal System
  Platform, Roll-off Container System
- Cake Conveyors
- Drip Trays:
  Manual
  Automatic
- Spread Leg Design:
- Safety:
  Splash Curtain
  Safety Guard
  Safety Light Curtains
  Deadman Control Button
  Safety Tripwire
  Hyd. Clamp Pressure/Feed Pump Interlock
  Hyd. Control System/Press Pressure Interlock
  Hyd. Clamp Pressure/Squeeze System Interlock
- Custom Paint Systems:
  Nicklad® Coating





Portable pilot filter press





Our large parts distribution center ensures that many parts are available for same day shipment.

Laboratory Services — an Informed Decision is the Best Decision

Siemens maintains a fully-staffed, state-of-the-art laboratory for determining the most effective liquid/solids separation techniques for your specific application. Capabilities range from feasibility testing of your materials to providing portable pilot units for on-site testing. This customer-focused resource produces tangible results. We can determine the most effective feed pressures, fill times, filter media and sludge conditioning.

In addition to ensuring a better informed equipment purchase, this valuable service is also available to help you maintain maximum performance of your J-Press® filter press.

An Ongoing Investment in Your Satisfaction

Preventative Maintenance Services We can customize a cost-effective program for your specific equipment, application, and environment that translates into lower maintenance cost and years of worry-free operation.

Parts Repair Service Our professional service staff can quickly and reliably answer your technical questions and troubleshoot your specific requirements, schedule parts shipments, and arrange for an on-site service call. Our factory-trained and qualified service engineers travel throughout the world to help ensure equipment runs efficiently. From basic maintenance to complex Program Logic Control (PLC) interfaces and beyond, we have the experience and capability.

Refurbishment Services We can provide a partial or complete rehabilitation of your equipment to a warranted like-new condition, at your site or ours.

For more information on our Aftermarket Services, call 800.245.3006.

Aftermarket Services

- Factory-based customer service support
- Expert technical consulting
- Same-day shipment on many service and spare parts
- Worldwide repair and preventative maintenance services
- Emergency support services
- Equipment retrofits, upgrades, and refurbishments
- Training
- Testing, evaluative and customized services



Specification/Selection Charts

The following formula may be used for establishing J-Press® filter press volume (ft^3) (L) for most dewatering applications:

$$\text{Total Filter Press Volume } (ft^3)\ (L) = \frac{\text{Total volume of product feed (gallons) (liters)} \times \text{\% solids concentration of product feed*} \times \text{8.34 (lbs per gallon of water) (1kg/L) (density of water)} \times \text{specific gravity of feed slurry}}{\text{Density of wet filter cake** } (lbs/ft^3)(kg/L) \times \text{\% dry solids content of filter cake*}} = \text{lbs (kg) dry solids}$$

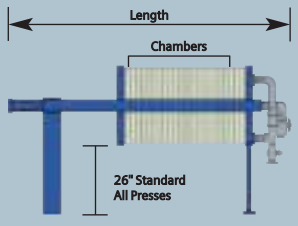
or

$$= \text{cake density } (lbs/ft^3)(kg/L) \times \text{\% cake solids}$$

* % concentration should be expressed in decimal form (e.g. 2% = .02).
**Density of wet filter cake = Specific gravity of wet filter cake x the density of water

For dewatering applications where feed solids are less than 1%, the dewatering area is the controlling parameter rather than volume. For such applications, contact Siemens for size recommendations. Also, for advice on sizing for any application, contact Siemens or our authorized representative.

PRESS	MEASUREMENT	MINIMUM	MAXIMUM
250mm	Volume (ft^3)	0.1	0.4
	Volume (L)	2.8	11.3
Height 15" (381mm)	Length (in)	24.0	38.0
Width 18.5" (470mm)	Length (mm)	607.0	975.0
470mm	Volume (ft^3)	0.5	4.0
	Volume (L)	14.2	113.0
Height 45.8" (1162mm)	Length (in)	41.0	93.0
Width 33.0" (838mm)	Length (mm)	1041.0	2362.0
630mm	Volume (ft^3)	2.0	8.0
	Volume (L)	57.0	227.0
Height 51.0" (1299mm)	Length (in)	85.0	129.0
Width 36.0" (916mm)	Length (mm)	2168.0	3277.0
800mm	Volume (ft^3)	8.0	25.0
	Volume (L)	227.0	708.0
Height 58.0" (1473mm)	Length (in)	122.0	196.0
Width 43.5" (1105mm)	Length (mm)	3099.0	4978.0
1000mm	Volume (ft^3)	25.0	55.0
	Volume (L)	708.0	1558.0
Height 66.5" (1689mm)	Length (in)	175.0	260.0
Width 51.5" (1308mm)	Length (mm)	4445.0	6604.0
1200mm	Volume (ft^3)	50.0	125.0
	Volume (L)	1416.0	3540.0
Height 74.5" (1892mm)	Length (in)	217.0	356.0
Width 60.0" (1524mm)	Length (mm)	5512.0	9042.0
1500mm	Volume (ft^3)	130.0	270.0
	Volume (L)	3682.0	7646.0
Height 95.7" (2432mm)	Length (in)	313.0	500.0
Width 74.9" (1903mm)	Length (mm)	7950.0	12,700.0
1.5 x 2.0M	Volume (ft^3)	275.0	350.0
	Volume (L)	7788.0	9912.0
Height 136.6" (3470mm)	Length (in)	430.0	507.0
Width 79.0" (2007mm)	Length (mm)	10,922.0	14,097.0
2.0 x 2.0M	Volume (ft^3)	300.0	600.0
	Volume (L)	8496.0	16,992.0
Height 106.0" (2692mm)	Length (in)	405.0	562.0
Width 137.0" (3480mm)	Length (mm)	10,287.0	14,275.0



Notes:

- *Based on 32mm cake thickness, 100psi (7bar)*
- *Additional sizes and capacities available — consult factory.*
- *All dimensions are approximate and should only be used for reference.*
- *Dimensions do not include optional equipment such as plate shifters, cloth washers or piping manifolds.*

Nicklad and J-Press are trademarks of Siemens, its subsidiaries or affiliates. CSA ia a trademark of the Canadian Standards Association.

Product is covered by U.S. patent no. 5674384, Canadian patent no. 2235404, German patent no. 69617727.7, and United Kingdom patent no. 0862489.

The information provided in this brochure contains merely general descriptions or characteristics of performance which in actual case of use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

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E10001-WTEPS-A9-V2-4A00
DispoNo.21616 K-No.3936

DW-FPS-1UE-BR-0308

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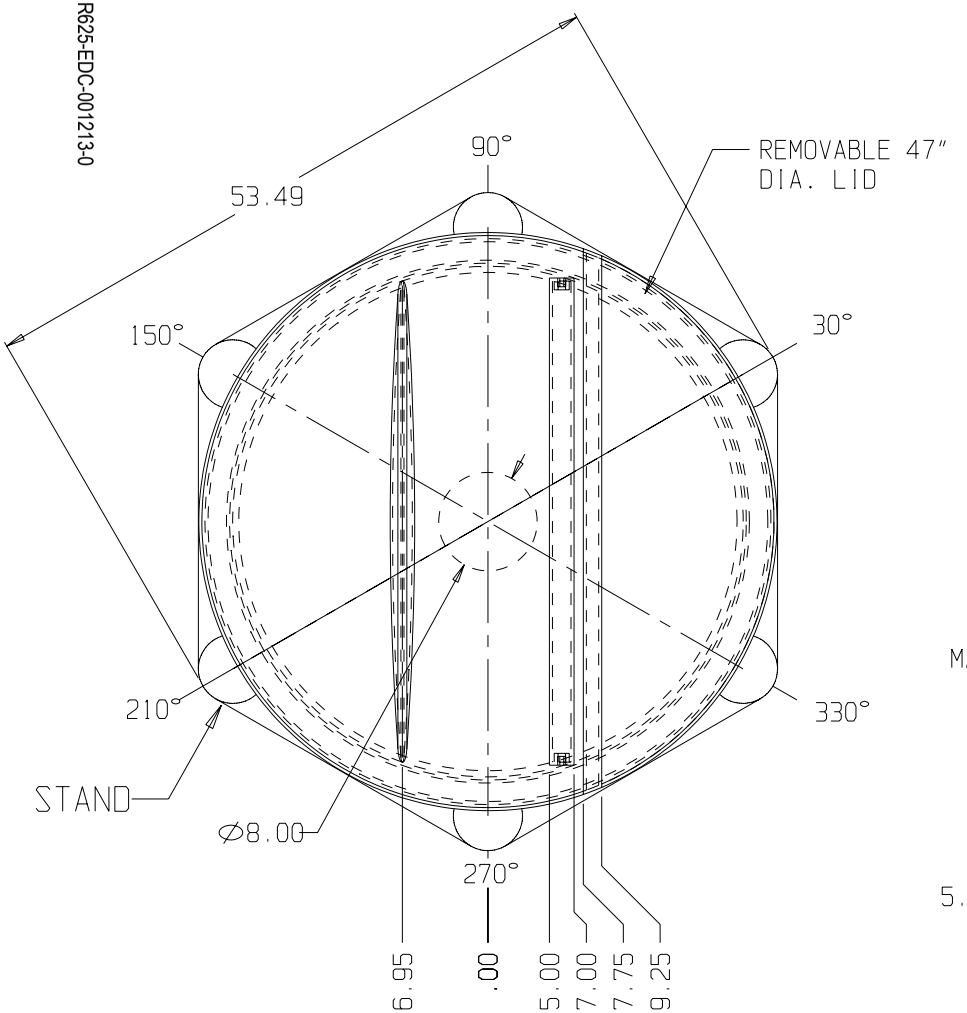
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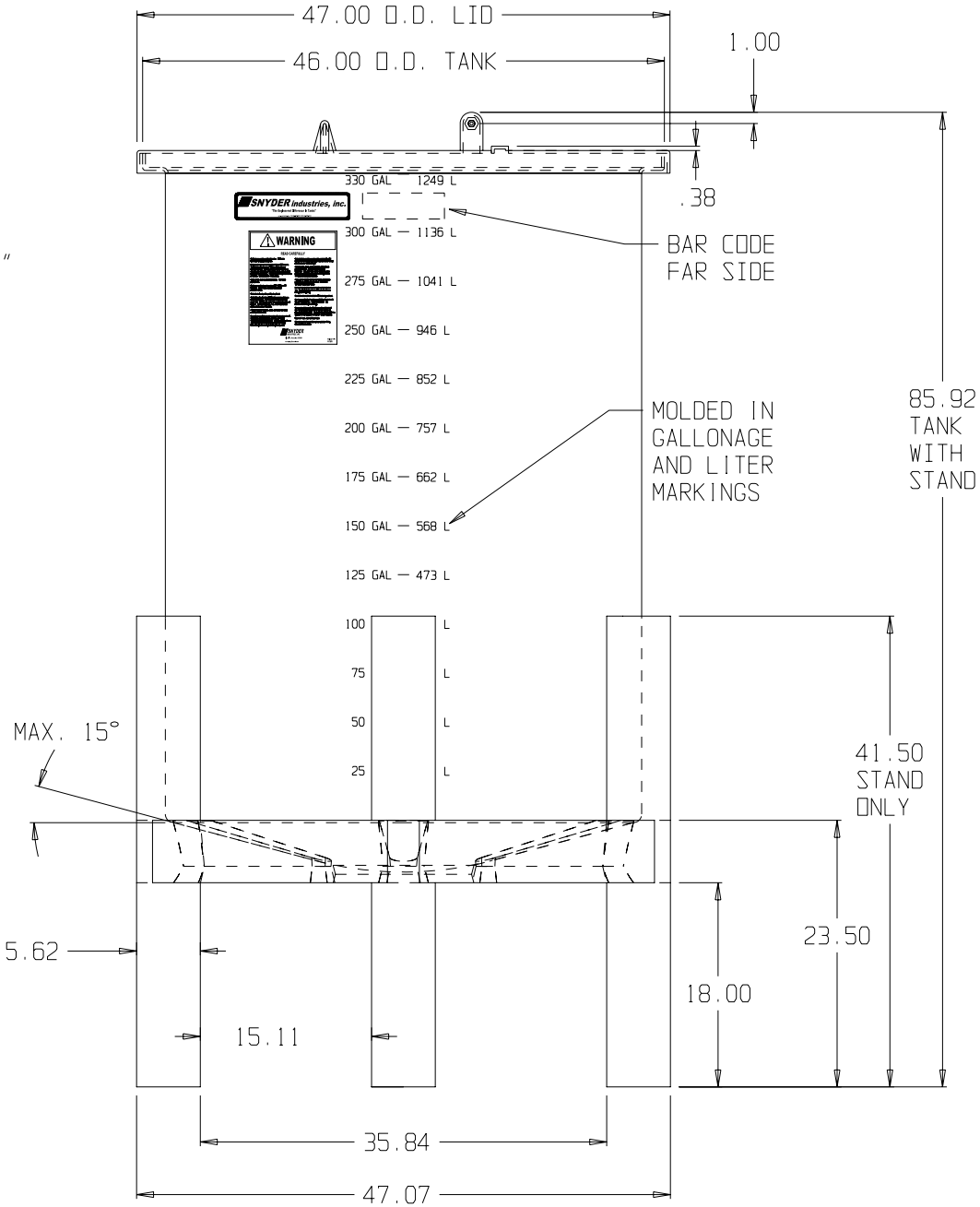


Catalogue and Product Data Sheets

Item	Tag	Description
53	T-840	Pre-Coat Storage Tank

R625-EDC-001213-0





SNYDER INDUSTRIES INC.

* BASE FITTINGS TO BE LEFT INSTALLED AT TIME OF SHIPMENT PER SII PROCEDURE
* Consult Snyder's Guidelines for Use and Installation prior to delivery. Available on-line at www.snydernet.com

PATENT #7,059,575

(all dimensions in inches)

330 GALLON OPEN TOP TOTAL DRAIN TANK W/42"x18" STAND

PART # TANK: 5860000N--L

STAND: 1750001N--L

REF#: 0000 01/06/04

Catalogue and Product Data Sheets

Item	Tag	Description
56	AC-900	Air Compressor
57	AD-900	Air Dryer
58	T-900	Air Receiver Tank

Atlas Copco Air Compressors

SF 1-15

1.5 - 15 kW / 2 - 20 hp oil-free scroll compressors



OIL-FREE
TROUBLE-FREE

Atlas Copco

R625-EDC-001213-0

Atlas Copco scroll compressors, providing you with economical and constantly high quality oil-free compressed air

Atlas Copco has a 100 year history of meeting customer requirements and over 40 years of experience with oil-free Compressor technology. Atlas Copco is able to offer you an unrivalled range of oil-free Compressor technologies: Screw, Tooth, Centrifugal, Reciprocating and Scroll. This range of technologies insures that Atlas Copco can always meet your specific requirement.

The oil-free SF Scroll range of air compressors gives you all of this experience and knowledge in a class leading package, something that you would expect from a company that has such history of providing high quality, cost effective solution to our customer's requirements.

High quality oil-free compressed air is a prerequisite for the continuity and quality of many manufacturing processes. It is our belief that the only way to ensure consistent oil- free air is to prevent oil from entering the compression process in the first place, anything else is a compromise.

SF compressors meet your demands through unrivalled knowledge and experience of your application.



R625-EDC-001213-0

Scroll technology...
innovation in compressed air techniques

Pure oil-free air

Since there is no metal to metal contact between the compression scrolls, there is no need for oil lubrication in the compression chamber.
The scroll compression principle therefore guarantees high quality oil-free air.
The scroll element is belt-driven eliminating the need for a gearbox. As a result, the SF compressor is oil-free in everyway.

Energy efficiency

The SF Scroll compressors are highly energy efficient. Unloaded power consumption is eliminated by using simple start/stop control. The SF 6-15 uses Variable Flow Technology to match the compressed air output to the air demand.

Extremely low noise level

The slow speed of the scroll compression elements insures that the SF scroll compressors are extremely quiet. SF Units are *WorkPlace Air System* compressors making them suitable for installation in all working environments.

Durability and reliability

With the SF scroll compressor, simplicity and reliablity are built in.
The scroll design has a minimal number of moving parts, insuring a long operating life with a minimum number of service interventions

SF 1-4 Skid
Modular structure meets the needs of varying applications







SF-Skid

SF-Skid models are designed with simplicity in mind, making them suitable for installation at point-of-use or integrated into an existing air network.

Skid variants are self contained units equipped with a single scroll element, drive motor, after-cooler and integrated starter, all contained in a modern silenced acoustic canopy.

SF-Skid receiver mounted

Consists of an SF-Skid module mounted on a fully approved 270 litre (80 gallon) air receiver.

All SF air receivers are internally coated to prevent corrosion.

SF-Twin receiver mounted

A tandem installation of SF-Skid modules on a fully approved 500 litre (120 gallon) air receiver.

Each module has its own self contained starter providing the highest level of flexibility when compressed air demands vary.

Both compressors are equipped with a separate pressure switch, allowing each module to operate independently or together as the air demand requires.



SF 1-4
The super silent answer to high quality air





SF 1-4

The SF 1-4 is a complete scroll compressor package. The SF 1-4 includes the compression element, drive motor, after cooler and starter all integrated in a super silent accoustic enclosure.
The SF 1-4 is a true WorkPlace Air System. With noise levels as low as 54 dB(A), the SF 1-4 can be installed directly in the quietest work environment.

SF 1-4 FF (Full Feature)

The SF 1-4 is available as a Full Feature unit. Atlas Copco Full Feature compressors include a refrigerant air dryer integrated in the compressor enclosure. The dryers are prewired to the compressor power supply so only a single power connection is required.

SF 1-4 Receiver Mounted

There are two receiver mounting options available with the SF 1-4. The SF 1-4 can be delivered with an extended canopy that includes two integrated 16 litre galvanized air receivers or it can be delivered mounted on an internally coated 270 litre (120 gallon) horizontal receiver.

Interchangeable top and back canopy panels allow a change in cooling air flow direction, extending the possibilities for installation and integration.

A compact, integrated refrigerant dryer, ensures the delivery of dry quality air.



A sound insulated canopy reduces noise level as low as 54 dB(A).

Totally enclosed air cooled IP 55 class F motor for heavy duty operation.

Air cooled scroll compressor element offering proven durability and reliability in operation.

High efficiency paper cartridge air inlet filter eliminating dust and particles down to 1 μm.

Automatic start/stop when the required working pressure is reached, thus avoiding unnecessary energy costs.

R625-EDC-001213-0

SF 6-15
Total Flexibility with **V**ariable **F**low **T**echnology



Total flexibility.
The SF 6-15 extends oil-free scroll technology up to 15 kW. Between two and four compressor modules are integrated into one canopy, incorporating all the benefits and flexibility of a modular system. SF 6-15 units are available as silenced Pack and Full Feature variants with integrated refrigerant dryer.

Efficiency in operation.
SF 6-15 scroll compressors are equipped with Atlas Copco's Elektronikon® - Multi Scroll Compressor Controller (MSCC). The Elektronikon® continuously monitors the status of each element and starts and stops the compression elements, thereby insuring that the compressed air output matches the air demand.

Elektronikon® monitoring and control system.



Totally enclosed air cooled IP55 class F motor greased for life.

Scroll modules are mounted on a sliding platform for easy servicing.

Fan cooled scroll compressor element.

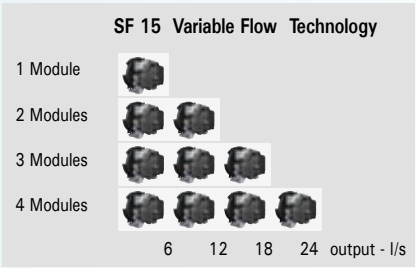
Integrated refrigerant dryer ensuring the delivery of dry high quality air.



High efficiency paper cartridge air inlet filter eliminating dust and particles down to 1 μm.

Elektronikon®: A superior electronic control, monitoring and communication system



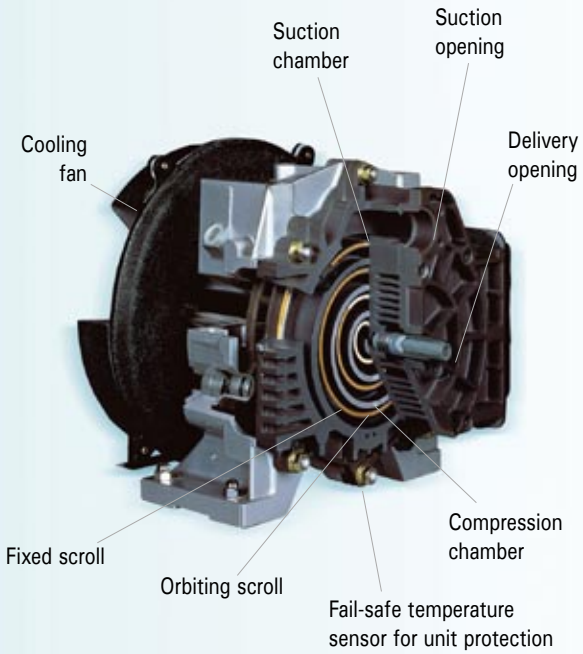


Variable Flow Technology - VFT

All SF 6-15 units are equipped with the unique VFT control system, which provides maximum flexibility of air delivery. The VFT system, included in the Elektronikon controller, automatically starts and stops the scroll elements to exactly match the demands of your compressed air system.

The Elektronikon control algorithm ensures that the system pressure is kept within a very narrow pressure band. This optimizes the efficiency of the compressor and insures a very stable system pressure. The Elektronikon also gives an instant read out of all operational data and continously scans and monitors the operation of the SF compressor.

Innovation in action at the heart of the SF compressors





Air compression is achieved by the interaction of a fixed and an orbiting scroll. Air at inlet pressure enters the compression chamber at the exterior side of the scroll element. Once air is drawn in, the orbiting scroll seals off the inlet port. As the scroll continues to orbit, the air is progressively compressed into an increasingly smaller "pocket".

A continuous flow of compressed air leaves the scroll element through a discharge port in the centre of the fixed scroll. This process is continuously repeated, resulting in the delivery of pulse-free compressed air.

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SF 1-15
WorkPlace Air System™ compressors
The sound of silence

Atlas Copco *WorkPlace Air System*™ compressors are much more than low noise air compressors with integrated air treatment equipment. They are designed to give the most efficient source of compressed air within a production environment.

Compact and space efficient with low noise levels

A low noise level enables the compressor to be installed close to the compressed air application, minimizing the size of the air distribution system and reducing pressure loss and the potential for leakage.

Complete integration of air treatment

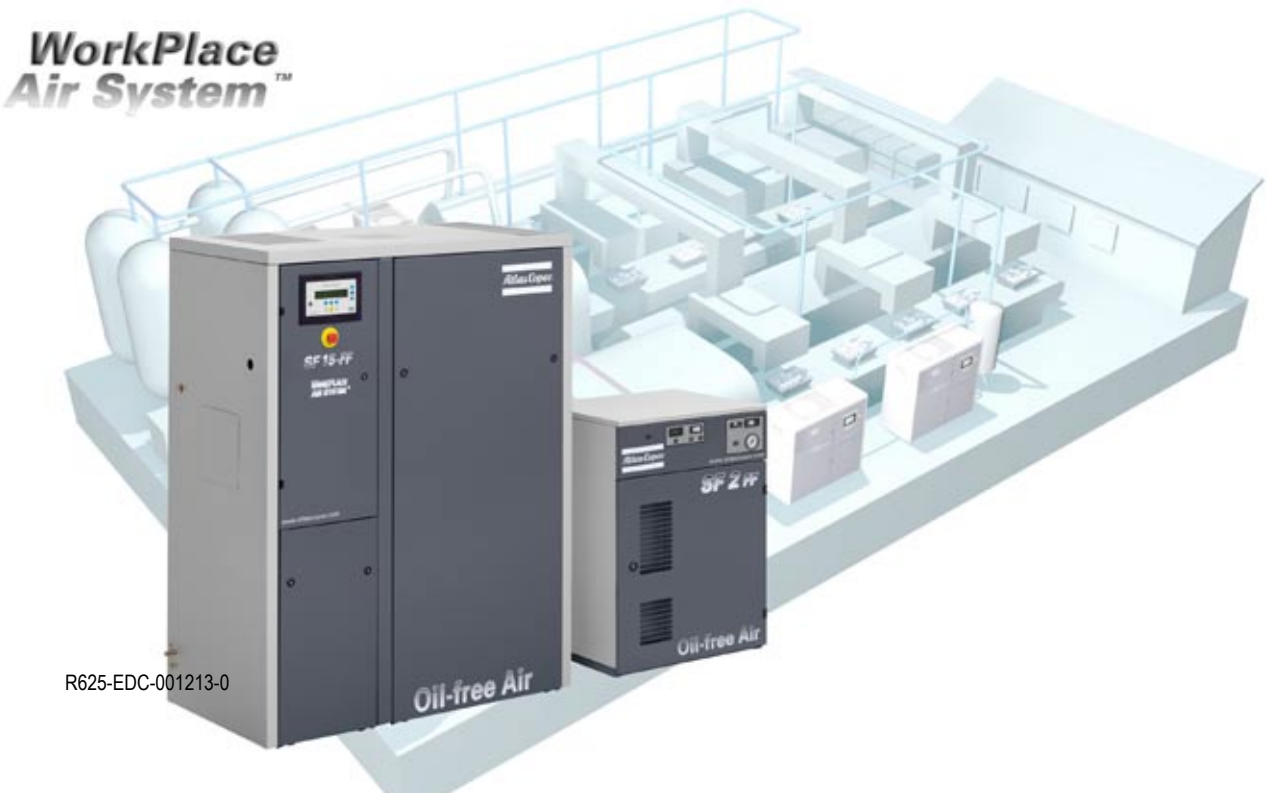
Substantially reduces the installation cost, making multiple compressor installations practical and financially viable.

Correct air quality selection

Because of the broad range of Atlas Copco air treatment technology, it is possible to select the most efficient system to meet individual compressed air requirements.

Efficient regulating systems

To ensure maximum energy efficiency, Atlas Copco offers both traditional on/off regulating systems where the air demand is constant.
Where fluctuating air demand is required, then the unique **VFT** control concept efficiently matches compressed air output air demand.



R625-EDC-001213-0

Technical data and dimensions.

Compressor type 50 Hz / 60 Hz	Max. working pressure		Capacity FAD(*)			Installed motor power		Noise level (**)	Dimensions L x W xH	Weight
	bar(e)	psig	l/s	m³/min	cfm	kW	hp	dB(A)	mm	kg
SF 1	8	116	2.7	0.16	5.7	1.5	2	65		105
	10	145	2.1	0.13	4.4	1.5	2	65		105
SF 2	8	116	4.0	0.24	8.5	2.2	3	67	800 x 600 x 540	110
	10	145	3.4	0.20	7.2	2.2	3	67	(Receiver mounted) 1267 x 600 x 1169	110
SF 4	8	116	6.6	0.4	14.0	3.7	5	68		120
	10	145	5.6	0.3	11.9	3.7	5	68		120
SF 6T	8	116	10.6	0.64	22.5	5.9	8	72		365
	10	145	9.0	0.54	19.1	5.9	8	72		365
SF 8T	8	116	13.2	0.80	28.0	7.4	10	73	2043 x 600 x 1169	375
	10	145	11.2	0.67	23.7	7.4	10	73		375
SF 1	8	116	2.7	0.16	5.7	1.5	2	53		97
	10	145	2.1	0.13	4.4	1.5	2	53		97
SF 2	8	116	4.0	0.24	8.5	2.2	3	55	590 x 600 x 1040	97
	10	145	3.4	0.20	7.2	2.2	3	55		97
SF 4	8	116	6.6	0.40	14.0	3.7	5	57		102
	10	145	5.6	0.34	11.9	3.7	5	57		102
SF 6	8	116	10.4	0.62	22.0	5.9	8	63		340
	10	145	8.8	0.53	18.6	5.9	8	63		340
SF 8	8	116	13.4	0.80	28.4	7.4	10	63		345
	10	145	11.3	0.68	23.9	7.4	10	63		345
SF 11	8	116	20.2	1.21	42.8	11	15	63	1450 x 750 x 1040	480
	10	145	17.0	1.00	36.0	11	15	63		480
SF 15	8	116	26.4	1.58	55.0	15	20	63		560
	10	145	22.8	1.37	48.3	15	20	63		560

(*) Unit performance measured according to ISO 1217, Ed 3, Annex C-1996
Reference conditions:
- absolute inlet pressure 1 bar (14.5 psi)
- intake air temperature 20 °C (68 °F)

(**) Noise level measured at a distance of 1 m according to Pneurop/Cagi PN8NTC2 test code.

Available options

	Integrated refrigerant dryer	Integrated 2 x 16 litre receivers	270 litre (80 gallon) air receiver	Timed air receiver drain	EWD zero loss drain	-40 °C PDP CD Air dryer (1)
SF 1-4 Skid	-	-	●	●	-	●
SF 6-8T Skid Tank mounted	-	-	-	●	-	●
SF 1-4	●	●	●	●	-	●
SF 6-15	●	-	-	-	●	-

(1) CD desiccant air dryers are only available with receiver mounted units.



What sets Atlas Copco apart as a company is our conviction that we can only excel in what we do if we provide the best possible know-how and technology to really help our customers produce, grow and succeed.

There is a unique way of achieving that - we simply call it the Atlas Copco way. It builds on **interaction**, on long-term relationships and involvement in the customers' process, needs and objectives. It means having the flexibility to adapt to the diverse demands of the people we cater for.

It's the **commitment** to our customers' business that drives our effort towards increasing their productivity through better solutions. It starts with fully supporting existing products and continuously doing things better, but it goes much further, creating advances in technology through **innovation**. Not for the sake of technology, but for the sake of our customer's profitability and peace-of-mind.

That is how Atlas Copco will strive to remain the first choice, to succeed in attracting new business and to maintain our position as the industry leader.

Never use compressed air as breathing air without prior purification in accordance with local legislation and standards.



Service competence
Atlas Copco is committed to provide the levels of after-sales care that you require. Our highly trained engineers offer the best possible support and assistance in operating your equipment with the most modern diagnostic tools available.

Global capability
Global capability with local presence means that we can respond rapidly to any situation anywhere in the world. Our world class logistics ensures timely delivery of our range of guaranteed quality spare parts.

ISO 9001
From design to production and delivery, Atlas Copco compressors adhere to the ISO 9001 quality standard.

ISO 14001
Atlas Copco's Environmental Management System forms an integral part of each business process.

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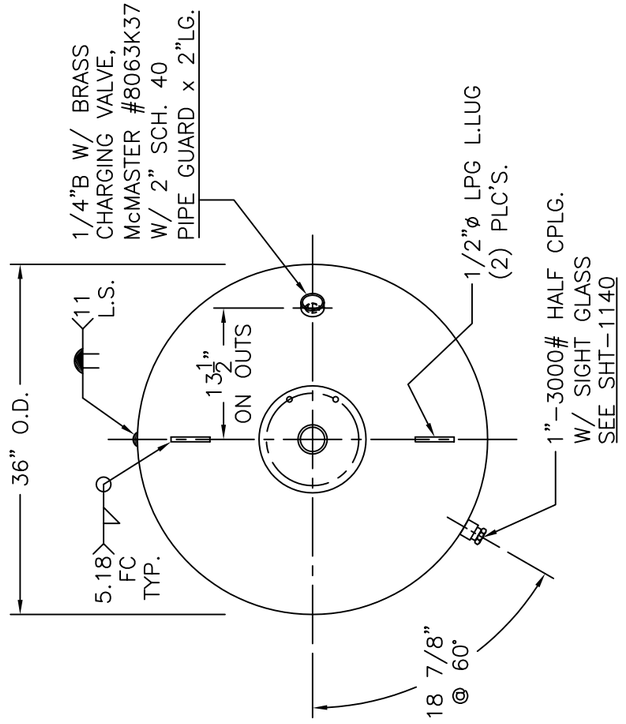
Atlas Copco

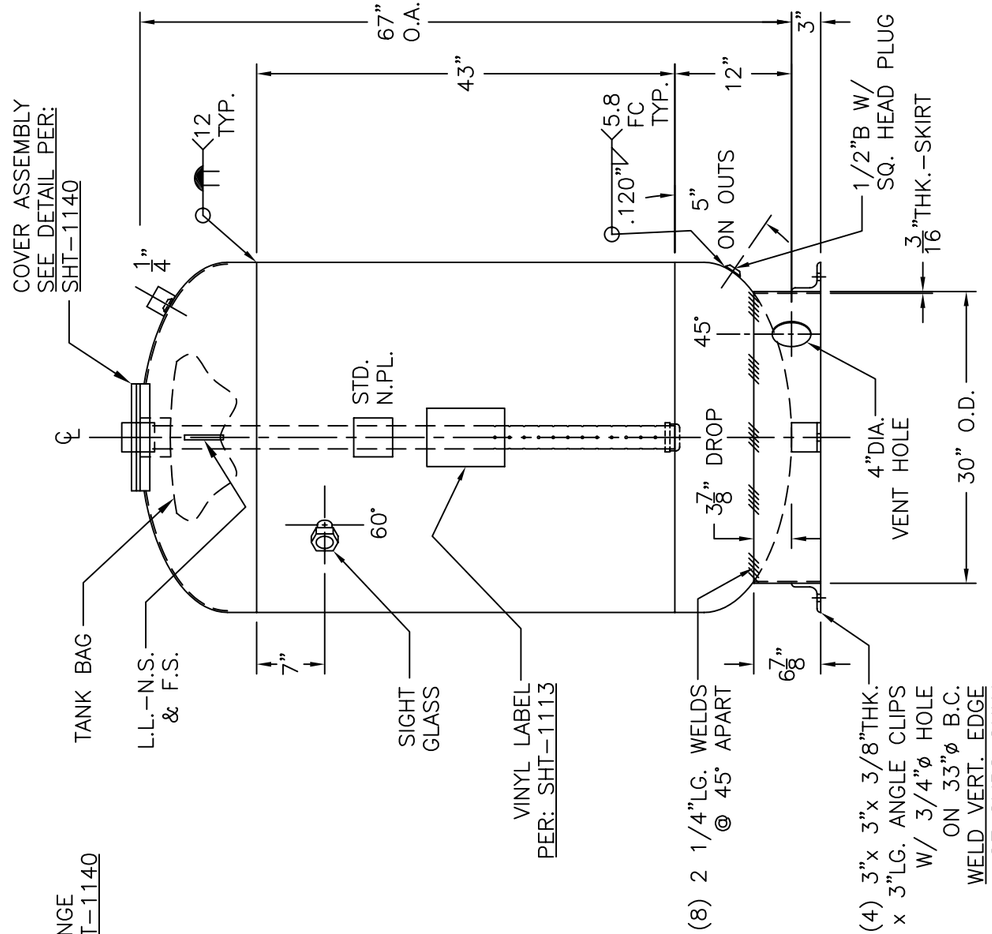
www.atlascopco.com

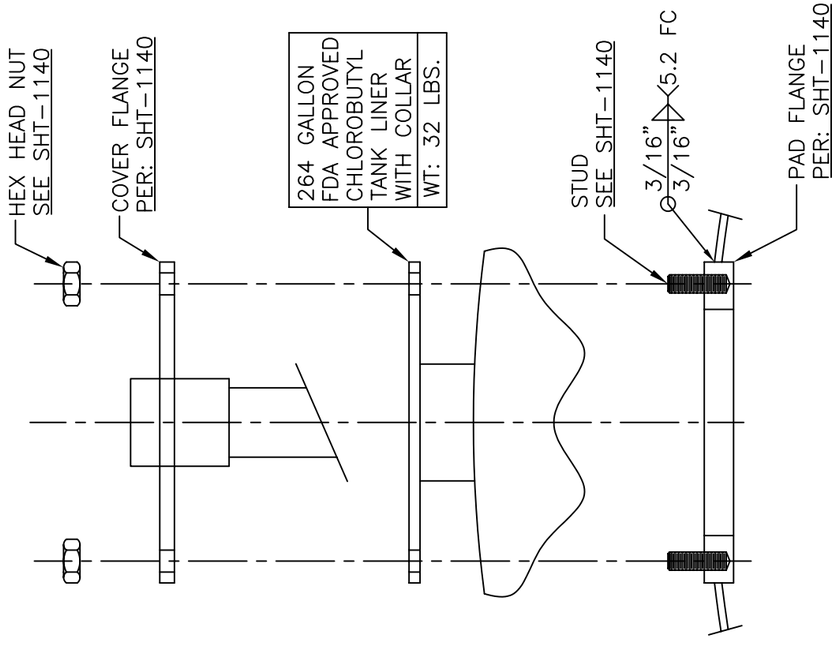
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Catalogue and Product Data Sheets

Item	Tag	Description
59	T-1000	Seal Water Bladder Tank







COVER ASSEMBLY DTL.

2) INSPECTION OPENING, UG 46(f)(6).
NOTE: 1) HYDRO @ 165 PSIG. MIN.

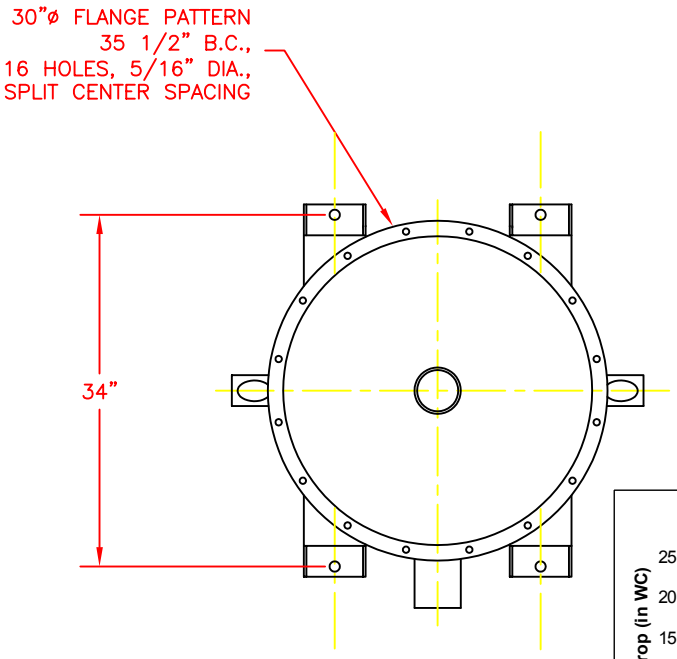
SHELL / HEADS	.182" SA-455 2:1 S.E.	TB-264-R	REV.
	JOGGLE		DATE: 4-1-05
		HANSON STANDARD	
		VERT. BLADDER TANK	
	.164" SA-414-G		
		INSIDE: UNPAINTED	
M.A.W.P. 125 PSIG. @ 240 °F			
M.D.M.T. 32 °F @ 125 PSIG.		OUTSIDE: PRIMER	
ASME. SECTION VIII DIV. 1, 2004 ADD. 2004			
X-RAY: RT-NO		BY: E.S.	SCALE: 3/4"=12"
GALLONS: 264	WT. 559 LBS.	ROY E. HANSON JR. MFG.	
SERIAL NO.		1924 COMPTON AVE.	
N.B.		LOS ANGELES, CA 90011	

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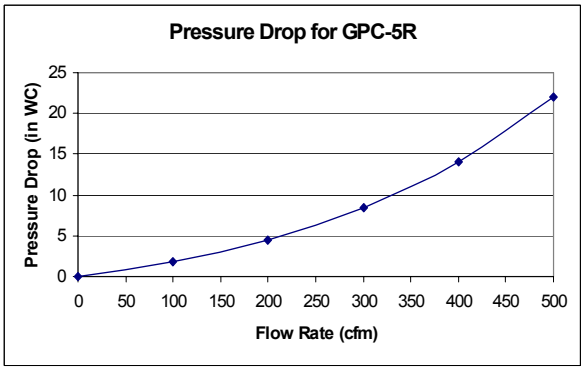
Catalogue and Product Data Sheets

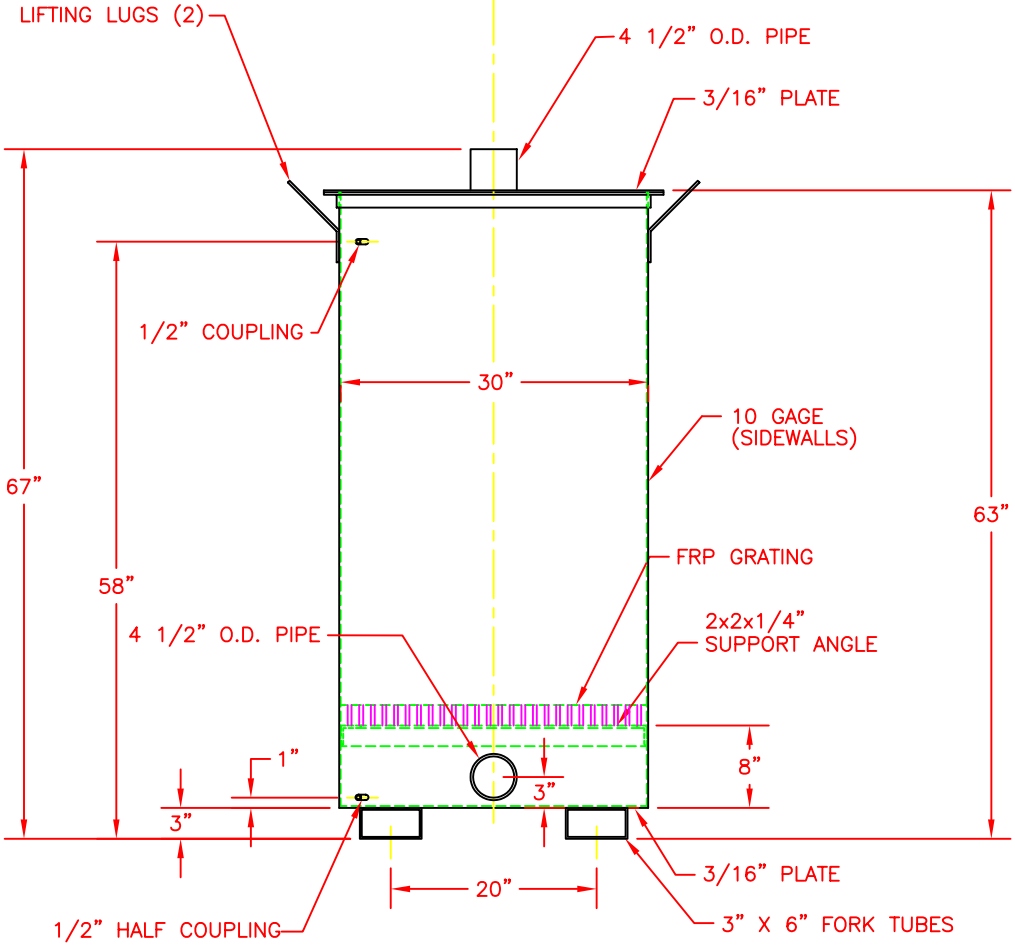
Item	Tag	Description
61	F-1100A, F-1100B	Vapor Phase Granular Activated Carbon Vessels

Carbon Adsorber – Vapor Phase
GPC-5R



PLAN VIEW





ELEVATION

R625-EDC-001213-0

Sales Drawing #155618
03/22/05

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Catalogue and Product Data Sheets

Item	Tag	Description
62	P-1200	Sump Pump

ITT

Wastewater

Goulds Pumps

Model 1DM/2DM

1½" and 2" Submersible Sewage Pump



GOULDS PUMPS

FEATURES

- **Casing:** Corrosion resistant AISI 304 SS designed for long lasting performance.
- **Impeller:** AISI type 304 stainless steel construction; two vane non-clog design for maximum pumping efficiency.
- **Mechanical Seal:** Drive lube silicon carbide sealing faces; all metal components of AISI type 300 stainless steel running in protected oil chamber.
- **Elastomers:** BUNA-N
- **Pump Support Feet; Motor Shell and Lifting Handle:** Constructed of AISI type 304 series stainless steel.
- **Shaft:** AISI type 304 stainless steel high strength pump shaft with keyed and locking cap screw impeller fastening.
- **Discharge:** 1½" and 2" NPT for horizontal connection to rigid, flexible or guide rail piping connection.

NOTE: See accessory section guide rail systems, type A10-20 for simplex or duplex system or base elbow rail systems.

Goulds Pumps is a brand of ITT Corporation.

www.goulds.com

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APPLICATIONS

Non-clog submersible sewage pumps for simplex and duplex installations in small lift stations, drainage systems or raw water applications requiring solids handling capability of 1⅜" and 2" diameter made specifically for:

- Homes and farms
- Mobile home parks and motels
- Schools and hospitals
- Municipal package systems
- Industrial treatment systems
- Dewatering applications

Component	Material
Pump body and motor casing	Stainless steel (AISI 304)
Impeller	Stainless steel (AISI 304)
Lower mechanical seal	Silicon carbide/silicon carbide
Upper lip seal	Nitrile rubber
Motor Shaft	Stainless steel (AISI 304)
Handle	Nylon

SPECIFICATIONS

Pump:

- 1½" discharge on ½ HP.
- 2" discharge on ¾ HP and larger.
- Solid size: 1⅜" solids on ½ HP; 2" solids on ¾ HP and larger.
- Capacities: to 175 U.S. GPM (41 m^3/h).
- Total heads: to 47 feet TDH (14 m).
- Temperature:
  104ºF (40ºC) continuous
  140ºF (60ºC) intermittent.
- Maximum submergence: to 17 feet (5 m).
- AISI 304 SS casing.
- AISI 304 SS impeller.
- Continuous duty rated, non-overloading motor.

Motor:

- Single phase: 60 Hz, 3450 RPM, ½ HP, 115 V; ½ to 1 HP, 230 V.
- Three phase: 60 Hz, 3450 RPM, ½ to 1½ HP, 230 and 460 V.
- Non-overloading.
- Air-filled, class F insulated motor.
- Thermal overload protection: built-in with automatic reset on single phase, 115 V and 230 V models.
- Three phase models require external overload in panel.
- Power cord: 20 feet long.
- Single phase 115 V and 230 V models are supplied with molded NEMA plugs and built-in capacitors.
- Three phase models are supplied with bare leads.
- Float controls: optional, see accessory section for simplex or duplex system requirements.
- Rotation is clockwise when viewed from top.

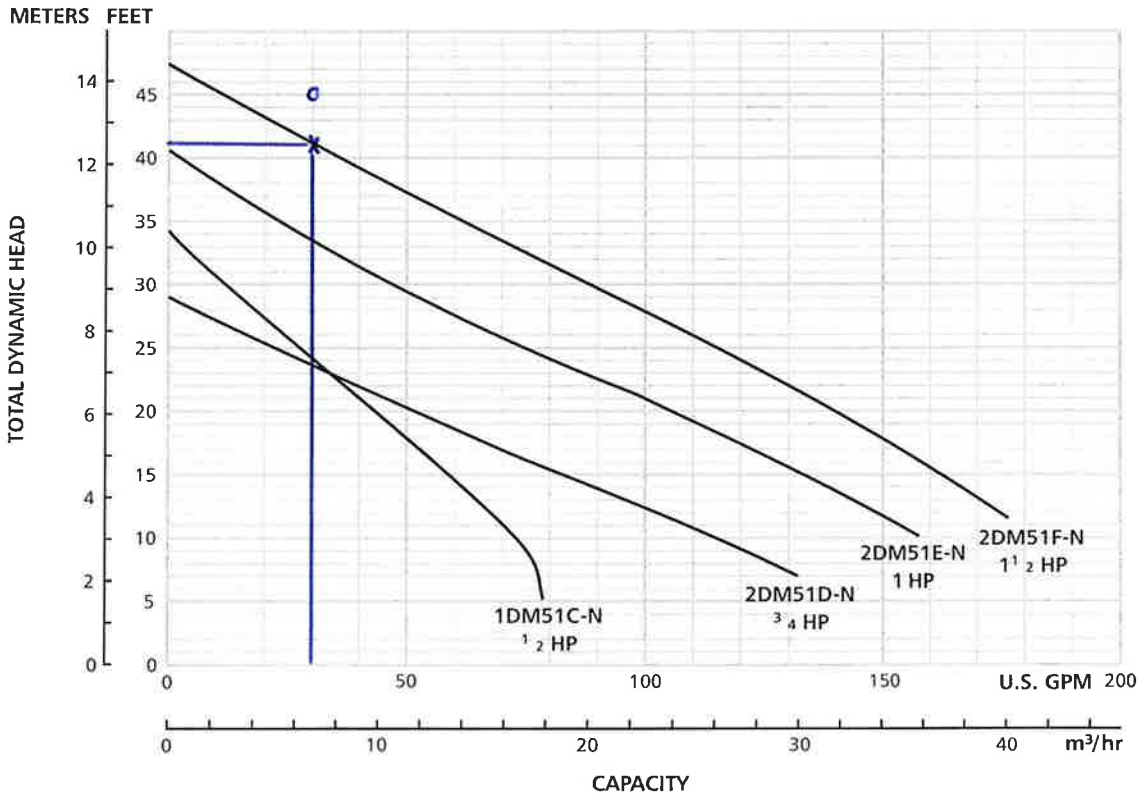
P-1200
30gpm @ 45ft TDH

ITT

GOULDS PUMPS
Wastewater

MODEL INFORMATION

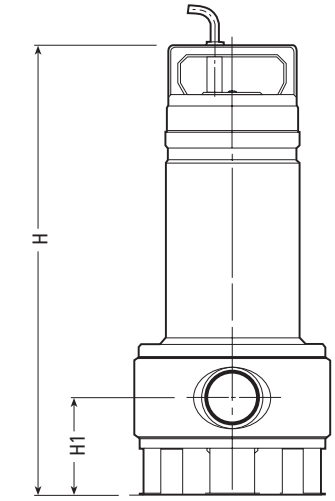
Order Number	HP	Volts	Phase	Maximum Amps	Start Amps	Capacitor uF/V	Resistance Start/ Line-Line	RPM	Cord Length	Discharge Connection	Solids	Weight (lbs.)
1DM51C0NA	½	115	1	9.8	51.0	70/250	1.6 / 0.6	3450	20'	1½"	1⅜"	22
1DM51C1NA		230		4.2	26.3	20/450	5.9 / 2.6					
1DM51C3NA			3	2.3	14.6	NA	NA / 11.7					20
1DM51C4NA		460		1.2	7.5	NA	NA / 14.7					
2DM51D1NA	¾	230	1	5.4	27.2	22/450	4.4 / 1.9			2"	2"	30
2DM51D3NA			3	3.4	24.9	NA	NA / 6.0					25
2DM51D4NA		460		1.7	12.7	NA	NA / 7.8					
2DM51E1NA	1	230	1	7.0	30.6	30/450	4.2 / 1.9					34
2DM51E3NA			3	4.4	29.8	NA	NA / 5.3					30
2DM51E4NA		460		2.2	15.2	NA	NA / 6.6					
2DM51F3NA	1½	230	3	5.6	39.2	NA	NA / 3.7					32
2DM51F4NA		460		2.8	19.9	NA	NA / 4.8					

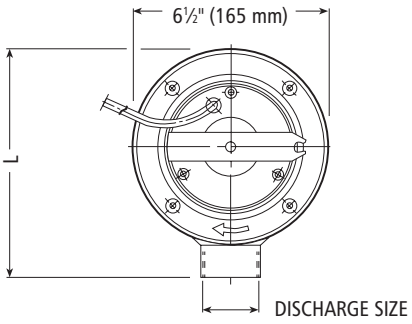


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Wastewater

DIMENSIONS





Series	HP	Phase	Dimensions in inches (mm)			Discharge Size	Wt. (lbs.)
			H	H1	L		
1DM	½	3	15⅜ (391)	3½ (88)	7½ (193)	1½"	20
		1					22
2DM	¾	3	17¼ (438)	4⅜ (111.5)	7¾ (198)	2"	25
		1	18 (458)				30
	1	3					30
		1	18 13/16 (478)				34
	1½	3					32

GOULDS PUMPS

Goulds Pumps and the ITT Engineered Blocks Symbol are registered trademarks and tradenames of ITT Corporation.

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

B1DM/2DM December, 2007

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