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Display ALLS From DS To Phas [PSI]	TREAMS DS To Phas [PSI]	CG-CALC VALVSLIP VAPOR	CLEAN-CG VALVSLIP VAPOR	COOLPRD PD-COOLR COND-I VAPOR	H2S-CG FEEDMIX VAPOR	HP-O2-N2 AIR-HX REGEN VAPOR	IN-COND COND-I VAPOR	IN-COIND COND-I LIQUID	INDESULF DESULF VAPOR	INOSRP DSRP2 SN-EQUIL VAPOR	INREGEN REGEN VAPOR	INRXNTOR DSRP VAPOR	O2-N2 PRESAIR VAPOR	Display ALLS From DS To Phas [PSI]	TREAMS DS To Phas [PSI]
Pressure [PSI]	506.4	274.9	506.4	274.9	482.2	277.3	140	140	506.4	600	772.6	600	13.7	Pressure [PSI]	30 Temperature [PSI]
Mass V/Frac	274.9	1	274.9	1	275	1	0	0	0.865	269.1	0.143	269.1	1	Mass V/Frac	1 Mass S/Frac
Mass S/Frac	0	0	0	0	0	0	0	0	0.135	0	0.857	0	0	Mass S/Frac	0 Mass S/Frac
*** ALL PHAS ES ***															
Mass Flow [LB/HR]	459805.594	456146.75	456146.75	15437.757	447704.125	10927	13544.205	1893.551	531468.188	15437.757	82589.578	15437.803	10927	Mass Flow [LB/HR]	10927 Mass Flow [LB/HR]
Volume Flow [CUFT/HR]	1187320	1177870	1177870	24296.518	1125490	19206.873	13705.025	13.869	1187660	31278.654	26436.727	31051.443	161837.719	Volume Flow [CUFT/HR]	161837.719 Volume Flow [CUFT/HR]
Enthalpy [BTU/HR]	-1.08E+09	-1.08E+09	-1.08E+09	-1.83E+07	-1.07E+09	2.09E+06	-1.99E+07	-1.30E+06	-1.48E+09	-1.63E+07	-3.94E+08	-1.62E+07	2.26E+04	Enthalpy [BTU/HR]	2.26E+04 Enthalpy [BTU/HR]
Density [LB/CUFT]	0.387	0.387	0.387	0.635	0.397	0.569	0.988	136.533	0.447	0.494	3.124	0.497	0.068	Density [LB/CUFT]	0.068 Density [LB/CUFT]
Mass Flow [LB/HR]	15704	15704	15704	15747	15704	15704	15704	0.045	15704	15704	3397.009	515.087		Mass Flow [LB/HR]	Mass Flow [LB/HR]
O2S	14.867	14.749	14.749	20.389	1801.676		20.366	0.033	14.867	20.389		20.389		O2S	O2S
H2O	71265.617	70896.523	70896.523	1374.565	69146.555		1154.749	219.816	71265.617	1374.565		1374.565		H2O	H2O
SZ	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.06 < 0.001	1673.231	1673.231		923.463		SZ	SZ
S6	0.11	0.109	0.109	543.432			0.274	543.188	0.11	0.001		0.001		S6	S6
S8	0.78	0.774	0.774	388.677			0.57	1129.177	0.78	0.006		0.006		S8	S8
CO	213897.828	212195.766	212195.766	0.655	213897.172		0.655	1196.144	213897.828	0.655		0.655		CO	CO
CO2	118728.914	117784.148	117784.148	3618.024	115112.016		3616.834	1.189	118728.914	3618.024		2931.973		CO2	CO2
H2	11535.61	11443.817	11443.817	0.24	11535.37		0.24	11535.61	11535.61	0.24		0.24		H2	H2
O2	2545.084	2545.084	2545.084	8381.916	2545.084		8381.916	0.073	2545.084	8381.916		8381.916		O2	2545.084 O2
N2	44346.063	43993.184	43993.184	35611.336	35611.336		35611.336	0.073	44346.063	8734.794		8734.794		N2	8381.916 N2
CO2S	0.094	0.093	0.093	0.094	0.094		0.094	< 0.001	0.094	0.094		936.6		CO2S	CO2S
ZNO														ZNO	ZNO
ZNS														ZNS	ZNS
AL2O3														AL2O3	AL2O3

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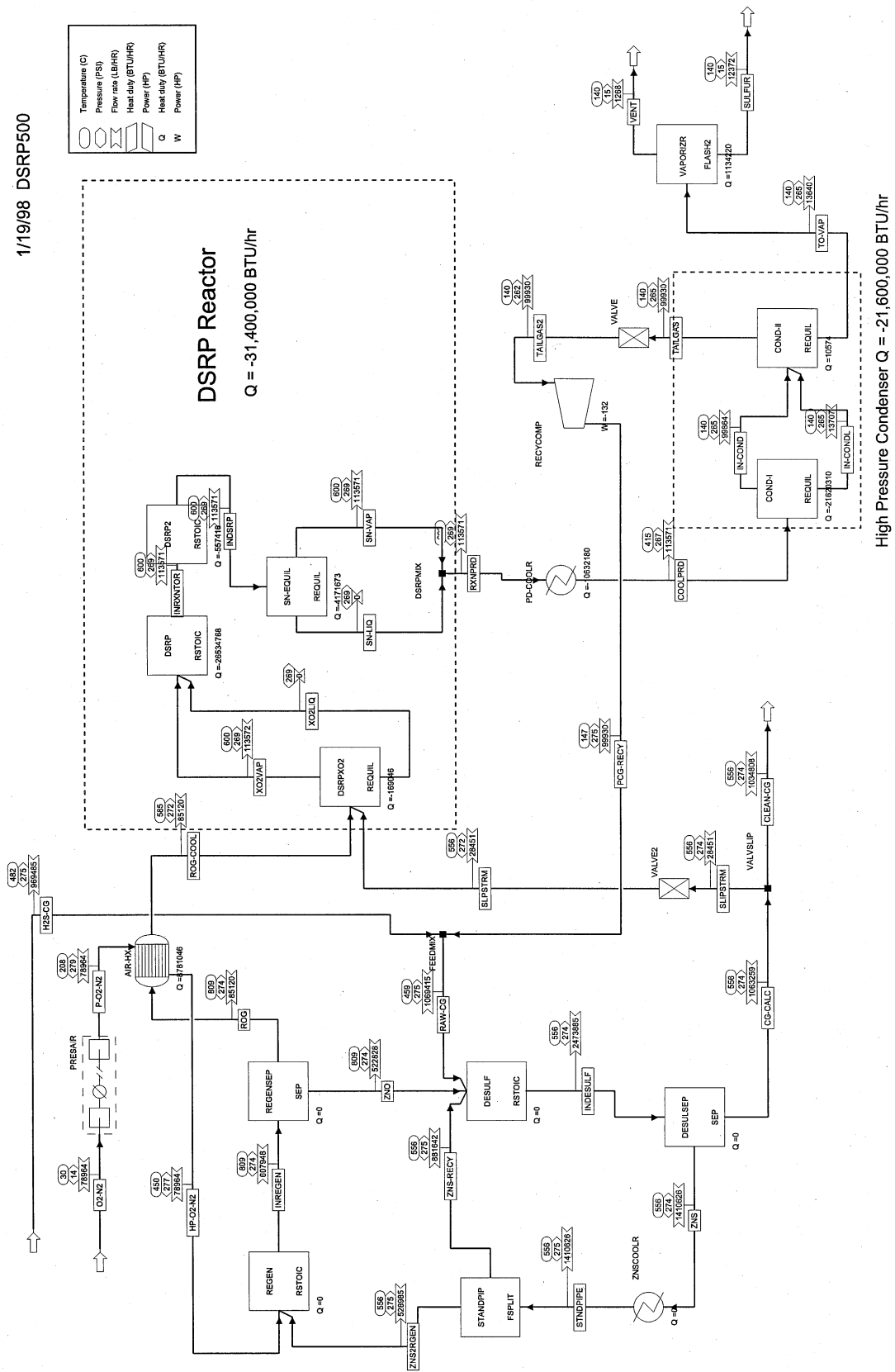
Display ALLS Units: Format: SOLI	TREAMS From DS To Phas	P-O2-N2 PRESAIR AIR-HX VAPOR	PCG-RECY RECYCOMP FEEDMIX VAPOR	RAW-CG FEEDMIX DESULF VAPOR	ROG REGENSEP AIR-HX VAPOR	ROG-COOL AIR-HX DSRPXO2 VAPOR	RXNPRD DSRPMIX PD-COOLR VAPOR	SLIPSTRM VALVSLIP VALVE2 VAPOR	SLPSTRM VALVE2 DSRPXO2 VAPOR	SN-LIQ SN-EQUIL DSRPMIX MISSING	SN-VAP SN-EQUIL DSRPMIX VAPOR	STNDPIPE ZNSCOOLR STANDPIP MISSING	SULFUR VAPORIZR LIQUID	Display ALLS Units: Format: SOLI	TREAMS From DS To Phas
Temperature [C]		207.7	146.8	475.2	772.6	547.5	600	506.4	506.4	506.4	600	506.4	140	Temperature [C]	
Pressure [PSI]		279.3	275	275	274.1	272.1	269.1	274.9	272.1	272.1	269.1	275	14.7	Pressure [PSI]	
Mass SFrac		1	0	0	0	0	0	0	0	0	0	0	0	Mass SFrac	
*** ALL PHAS	ES ***													*** ALL PHAS	ES ***
Mass Flow [LB/HR]		10927	13553.382	460657.5	11778.925	11778.925	15437.757	3656.844	3656.844	0	15437.757	71662.578	1713.577	Mass Flow [LB/HR]	
Volume Flow [CUFT/HR]		12679.411	13452.304	1139190	26095.605	20645.352	30656.066	9447.959	9544.736	0	30656.035	341.12	9.454	Volume Flow [CUFT/HR]	
Enthalpy [BTU/HR]		871552.063	-1.99E+07	-1.09E+09	-2.96E+06	-4.18E+06	-1.68E+07	-8.63E+06	-8.63E+06	0	-1.68E+07	-3.97E+08	-1.30E+05	Enthalpy [BTU/HR]	
Density [LB/CUFT]		0.862	1.007	0.404	0.451	0.571	0.504	0.387	0.383		0.504	210.08	181.246	Density [LB/CUFT]	
Mass Flow [LB/HR]														Mass Flow [LB/HR]	
O2S			15.704	15.704	3397.009	3387.009	15.747	0.125	0.125		15.747		< 0.001	O2S	
H2S			20.368	1822.044			20.399	0.118	0.118		20.399		< 0.001	H2S	
H2O			1163.806	70310.359			1374.565	567.087	567.087		1374.565		41.723	H2O	
S2			< 0.001	< 0.001			741.13	trace	trace		741.13		0.06	S2	
S6			0.11	0.11			543.432	0.001	0.001		543.432		206.281	S6	
S8			0.78	0.78			388.677	0.006	0.006		388.677		1485.512	S8	
CO			0.655	213897.828			0.655	1702.064	1702.064		0.655		CO		
CO2			3616.9	118728.914			3618.024	944.77	944.77		3618.024		0.001	CO2	
H2			0.24	11535.61			0.24	91.793	91.793		0.24		trace	H2	
O2		2545.084											trace	O2	
N2		8381.916	8734.726	44346.063	8381.916	8381.916	8734.794	352.878	352.878		8734.794		trace	N2	
COS			0.094	0.094			0.094	0.001	0.001		0.094		trace	COS	
ZNO													trace	ZNO	
ZNS													15452.001	ZNS	
AL2O3													56210.578	AL2O3	

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Display ALLS Units: Format: SOLI Temperature [C] Pressure [PSI] Mass VFrac	TREAMS From DS To Phas	TAILGAS COND-II VALVE VAPOR	TAILGAS2 VALVE RECYCOMP VAPOR	TO-VAP COND-II VAPORIZER LIQUID	VENT VAPORIZER VAPOR	XO2LIQ DSRPXO2 DSRP MISSING	XO2VAP DSRPXO2 DSRP VAPOR	ZNO REGENSEP DESULF MISSING	ZNS DESULSEP ZNSCOOLR MISSING	ZNS-RECY STANDPIP DESULF MISSING	ZNS2RGEN STANDPIP REGEN MISSING	Display ALLS Units: Format: SOLI Temperature [C] Pressure [PSI] Mass VFrac	TREAMS From DS To Phas
Temperature [C]		140	139.9	140	140	MISSING	600	772.6	506.4	MISSING	506.4	Temperature [C]	
Pressure [PSI]		265.1	262.5	14.7	14.7	0	289.1	274.1	274.9	0	275	Pressure [PSI]	
Mass VFrac		1	1	0	0	0	1	0	0	0	0	Mass VFrac	
*** ALL PHAS ES ***		0	0	0	0	0	0	1	1	1	1	*** ALL PHAS ES ***	
Mass Flow [LB/HR]		13553.382	13553.382	1884.374	170.798	0	15437.86	70810.656	71662.578	0	71662.578	Mass Flow [LB/HR]	
Volume Flow [CUFT/HR]		13719.107	13854.065	13.12	5077.429	33024.156	33024.156	341.12	341.12	0.00E+00	341.12	Volume Flow [CUFT/HR]	
Enthalpy [BTU/HR]		-2.00E+07	-2.00E+07	-1.25E+06	-9.65E+05	0	-1.25E+07	-3.91E+08	-3.97E+08	0.00E+00	-3.97E+08	Enthalpy [BTU/HR]	
Density [LB/CUFT]		0.988	0.978	143.629	0.034	0.0467	0.467	207.583	210.08	210.08	210.08	Density [LB/CUFT]	
Mass Flow [LB/HR]		15.704	15.704	0.043	0.042	0.042	3397.134					Mass Flow [LB/HR]	
O2S		20.368	20.368	0.031	0.031	0.118	0.118					O2S	
H2S		1163.806	1163.806	210.759	169.036	315.4	315.4					H2S	
H2O		< 0.001	< 0.001	0.06	< 0.001	trace	trace					H2O	
S2		0.11	0.11	206.342	0.061	0.001	0.001					S2	
S6		0.78	0.78	1465.947	0.435	0.006	0.006					S6	
S8		0.655	0.655	trace	trace	1310.713	1310.713					S8	
CO		3616.9	3616.9	1.124	1.123	1559.735	1559.735					CO	
CO2		0.24	0.24	trace	trace	119.958	119.958					CO2	
H2		8734.726	8734.726	0.069	0.069	8734.794	8734.794					H2	
O2		0.094	0.094	< 0.001	< 0.001	0.001	0.001					O2	
N2								4315.638				N2	
COS								10284.438				COS	
ZNO								56210.578				ZNO	
ZNS								15452.001			15452.001	ZNS	
AL2O3								56210.578			56210.578	AL2O3	

# DSRP-500 - based Desulfurization

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Display ALLS Units: Format: SOLI Temperature [C]	TREAMS From DS To Phas	CG-CALC DESULSEP VALVSLIP VAPOR	CLEAN-CG VALVSLIP VAPOR	COOLPRD PD-COOLR COND-I VAPOR	H2S-CG FEEDMIX VAPOR	HP-O2-N2 AIR-HX REGEN VAPOR	IN-COOND COND-I COND-II VAPOR	IN-CONDL COND-I COND-II LIQUID	INDESULF DESULF DESULSEP VAPOR	INDSRP DSRP2 SN-EQUIL VAPOR	INREGEN REGEN REGENSEP VAPOR	INRXNTOR DSRP DSRP2 VAPOR	O2-N2 PRESAIR VAPOR	Display ALLS Units: Format: SOLI 30 Temperature [C]	TREAMS From DS To Phas
Pressure [PSI]		556.1	415	266.6	482.2	276.9	140	264.6	556.1	600	808.9	600	13.7	Pressure [PSI]	
Mass VFrac		274.4	266.6	1	275	1	1	0	274.4	268.6	273.6	268.6	1	Mass VFrac	
Mass SFrac		0	0	0	0	0	0	0	0.57	0	0.86	0	0	Mass SFrac	
*** ALL PHAS ES ***															
Mass Flow [LB/HR]		1063260	1034810	113570.906	969485	78963.703	98863.633	13707.267	2.47E+06	113570.898	607948.188	113571.234	78963.703	Mass Flow [LB/HR]	
Volume Flow [CUFT/HR]		2.87E+06	2.80E+06	179490.672	2.43E+06	138997.172	101285.656	100.854	2.88E+06	230823.609	197974.375	229302.5	1169520	Volume Flow [CUFT/HR]	
Enthalpy [BTU/HR]		-2.41E+09	-2.35E+09	-1.35E+09	-2.30E+09	1.51E+07	-1.47E+08	-9.63E+06	-1.02E+10	-1.20E+08	-2.80E+09	-1.20E+08	163338.5	Enthalpy [BTU/HR]	
Density [LB/CUFT]		0.37	0.37	0.633	0.399	0.588	0.986	135.912	0.859	0.492	3.071	0.495	0.068	Density [LB/CUFT]	
Mass Flow [LB/HR]		134.563	130.963	134.922	13202.553		134.543	0.379	134.563	134.922	24548.4	3689.37		Mass Flow [LB/HR]	
O2S		298.899	290.901	156.105	13202.553		155.855	0.25	298.899	156.105	156.105	156.105		O2S	
H2S		164056.219	159668.297	10220.242	148491.516		8597.656	1622.586	164058.219	10220.242	10220.242	10220.242		H2S	
H2O		< 0.001	< 0.001	5421.442	48491.516		< 0.001	0.438	164058.219	10220.242	10220.242	6743.967		H2O	
S2		< 0.001	< 0.001	5421.442	48491.516		< 0.001	0.438	164058.219	10220.242	10220.242	6743.967		S2	
S6		0.803	0.782	3898.438	1.989		1.989	3898.449	0.803	0.021	0.021	0.021		S6	
S8		5.689	5.537	2761.193	4.175		4.175	8178.022	5.689	0.152	0.152	0.152		S8	
CO		459346.656	447055.344	4.665	459341.969		4.665	< 0.001	459346.656	4.665	4.665	4.665		CO	
CO2		273825.563	266498.469	2663.1824	247201.875		26623.211	8.614	273825.563	2663.1824	21748.314	21748.314		CO2	
H2		24773.842	24110.938	1.752	24772.09		1.752	< 0.001	24773.842	1.752	1.752	1.752		H2	
O2		140814.141	137046.203	64339.652	76474.984		64339.125	0.528	140814.141	64339.652	60571.711	60571.711		O2	
N2		0.666	0.649	0.667	0.667		0.666	< 0.001	0.666	0.667	6666.993	6666.993		N2	
COS														COS	
ZNO														ZNO	
ZNS														ZNS	
AL2O3														AL2O3	

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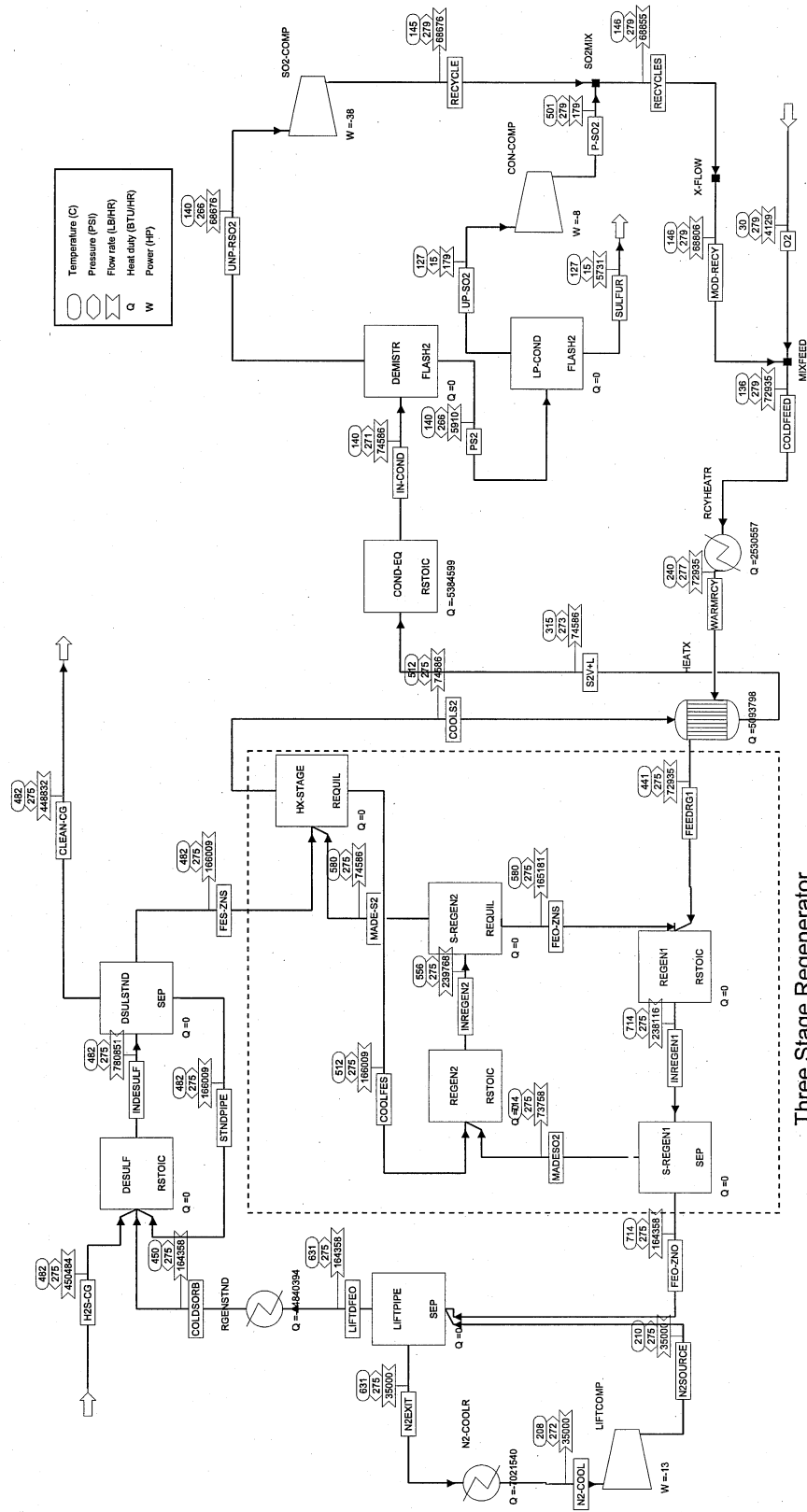
Display ALLS	TREAMS	P-O2-N2	PCG-RECY	RAW-CG	ROG	ROG-COOL	RXNRPD	SLPSTRM	SLPSTRM	SN-LIQ	SN-VAP	STNDPIPE	SULFUR	TREAMS
Units:	From	PRESAIR	RECYCOMP	FEEDMIX	REGENSEP	AIR-HX	DSRPX02	VALVE2	VALVE2	SN-EQUIL	SN-EQUIL	ZNSCOOLR	VAPORIZR	From
Format: SOLI	DS To	AIR-HX	FEEDMIX	DESULF	AIR-HX	DSRPX02	PD-COOLR	VALVE2	VALVE2	DSRPMIX	DSRPMIX	STANDPIP	LIQUID	DS To
Phas	Phas	VAPOR	VAPOR	VAPOR	VAPOR	VAPOR	VAPOR	VAPOR	VAPOR	MISSING	VAPOR	MISSING	LIQUID	Phas
Temperature [C]	[C]	207.6	147.1	459.3	808.9	595.1	600	556.1	556.1	556.1	600	556.1	140	Temperature [C]
Pressure [PSI]	[PSI]	278.9	275	275	273.6	271.6	268.6	274.4	274.4	271.6	268.6	275	14.7	Pressure [PSI]
Mass SFrac	ES ***	0	0	0	0	0	0	0	0	0	0	0	0	Mass SFrac
*** ALL PHAS	ES ***													*** ALL PHAS
Mass Flow [LB/HR]	[LB/HR]	78963.703	99930.422	1069420	85120.109	85120.109	113570.906	28450.951	28450.951	28450.951	113570.906	1410630	12372.203	Mass Flow [LB/HR]
Volume Flow [CUFT/HR]	[CUFT/HR]	91749.711	99302.75	2.53E+06	195456.375	156297.594	226467.672	78921.539	77711.063	77711.063	226467.438	6714.697	66.27	Volume Flow [CUFT/HR]
Enthalpy [BTU/HR]	[BTU/HR]	6.30E+06	-1.47E+08	-2.44E+09	-2.00E+07	-2.88E+07	-1.25E+08	-6.45E+07	-64473000	0.00E+00	-1.25E+08	-7.77E+09	-9.42E+05	Enthalpy [BTU/HR]
Density [LB/CUFT]	[LB/CUFT]	0.861	1.006	0.422	0.435	0.545	0.501	0.37	0.366		0.501	210.08	181.225	Density [LB/CUFT]
Mass Flow [LB/HR]	[LB/HR]													Mass Flow [LB/HR]
O2S	O2S		134.563	134.563	24548.4	24548.4	134.922	3.601	3.601	3.601	134.922		0.002	O2S
H2S	H2S		155.868	13358.421			156.105	7.998	7.998	7.998	156.105		0.001	H2S
H2O	H2O		8663.686	157155.109			10220.242	4389.911	4389.911	4389.911	10220.242		301.303	H2O
S2	S2		< 0.001	< 0.001			5421.442	trace	trace	trace	5421.442		0.437	S2
S6	S6		0.803	0.803			3898.438	0.021	0.021	0.021	3898.438		1493.655	S6
S8	S8		5.689	5.689			2761.193	0.152	0.152	0.152	2761.193		10576.802	S8
CO	CO		4.665	459346.656			4.665	12291.313	12291.313	4.665	4.665	trace	0.005	CO
CO2	CO2		26623.678	273825.663			26631.824	7327.093	7327.093	26631.824	26631.824		0.005	CO2
H2	H2		1.752	24773.842			1.752	662.905	662.905	662.905	1.752		trace	H2
O2	O2	18391.988												O2
N2	N2	60571.711	64339.152	140814.141	60571.711	60571.711	64339.652	3767.94	3767.94	3767.94	64339.652		trace	N2
COS	COS		0.666	0.666			0.667	0.018	0.018	0.018	0.667		trace	COS
ZNO	ZNO													ZNO
ZNS	ZNS													ZNS
AL2O3	AL2O3													AL2O3
												304172		
												1106450		

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Display ALLS	TREAMS From DS To Phas	P-O2-N2 PRESAIR AIR-HX VAPOR	PCG-RECY RECYCOMP FEEDMIX VAPOR	RAW-CG FEEDMIX DESULF VAPOR	ROG REGENSEP AIR-HX VAPOR	ROG-COOL AIR-HX DSRPX02 VAPOR	IRXNPRD DSRPMIX PD-COOLR VAPOR	SLIPSTRM VALVSLIP VALVE2 VAPOR	SLIPSTRM VALVE2 DSRPX02 VAPOR	SN-LIQ SN-EQUIL DSRPMIX MISSING	SN-VAP SN-EQUIL DSRPMIX VAPOR	STNDPIPE ZNSCOOLR STANDPIP MISSING	SULFUR VAPORIZR LIQUID	Display ALLS Units: Format: SOLI DS To Phas	TREAMS From DS To Phas
Temperature [C]	207.6	147.1	459.3	608.9	585.1	600	556.1	556.1	556.1	556.1	288.6	556.1	140	Temperature [C]	
Pressure [PSI]	278.9	275	279	273.6	271.6	266.6	274.4	271.6	271.6	0	14.7	275	14.7	Pressure [PSI]	
Mass VFrac	1	1	1	1	1	1	1	1	1	1	0	1	0	Mass VFrac	
Mass SFrac	0	0	0	0	0	0	0	0	0	0	0	0	0	Mass SFrac	
*** ALL PHAS ES ***														*** ALL PHAS ES ***	
Mass Flow [LB/HR]	78963.703	99830.422	1069420	85120.109	85120.109	113570.906	28450.951	28450.951	28450.951	0	113570.906	1410630	12372.203	Mass Flow [LB/HR]	
Volume Flow [CUFT/HR]	91749.711	99302.75	2.53E+06	195456.375	156297.594	226467.672	76921.539	77711.063	76921.539	0.00E+00	226467.438	6714.897	66.27	Volume Flow [CUFT/HR]	
Enthalpy [BTU/HR]	6.30E+06	-1.47E+08	-2.44E+09	-2.00E+07	-2.88E+07	-1.25E+08	-6.45E+07	-64473000	-6.45E+07	0.00E+00	-1.25E+08	-7.77E+09	-9.42E+05	Enthalpy [BTU/HR]	
Density [LB/CUFT]	0.861	1.006	0.422	0.435	0.545	0.501	0.37	0.366	0.37	0.501	0.501	210.08	181.225	Density [LB/CUFT]	
Mass Flow [LB/HR]		134.563	134.563	24548.4	24548.4	134.922	3.601	3.601	3.601	134.922	134.922		0.002	Mass Flow [LB/HR]	
O2S		155.868	13358.421			156.105	7.998	7.998	7.998	156.105	156.105		0.001	O2S	
H2S		8663.566	157155.109			10220.242	4389.911	4389.911	4389.911	10220.242	10220.242		301.303	H2S	
H2O		< 0.001	< 0.001			5421.442	trace	trace	trace	5421.442	5421.442		0.437	H2O	
S2		0.803	0.803			3898.438	0.021	0.021	0.021	3898.438	3898.438		1493.655	S2	
S8		5.689	5.689			2761.193	0.152	0.152	0.152	2761.193	2761.193		10576.802	S8	
CO		4.665	459346.656			4.665	12291.313	12291.313	12291.313	4.665	4.665		trace	CO	
CO2		26623.678	273825.563			26631.824	7327.093	7327.093	7327.093	26631.824	26631.824		0.005	CO2	
H2		1.752	24773.842			1.752	662.905	662.905	662.905	1.752	1.752		trace	H2	
O2	18391.988													O2	
N2	60571.711			60571.711		60571.711	3767.94	3767.94	3767.94	64339.652	64339.652		trace	N2	
COS		0.666	0.666			0.667	0.018	0.018	0.018	0.667	0.667		trace	COS	
ZNO														ZNO	
ZNS														ZNS	
AL2O3														AL2O3	
															304172
															1106450

# AHGP Advanced Hot Gas Process

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Display ALLS TREAMS Units: From Format: SOLI DS To Phas	CLEAN-CG DSULSTND VAPOR	COLDFEED MIXFEED RCYHEATR MIXED	COLDSORB RGENSTND DESULF MISSING	COOLFES HX-STAGE REGEN2 MISSING	COOLS2 HX-STAGE HEATX VAPOR	FEEDRG1 HEATX REGEN1 VAPOR	FEO-ZNO S-REGEN1 LIFTPIPE MISSING	FEO-ZNS S-REGEN2 REGEN1 MISSING	FES-ZNS DSULSTND HX-STAGE MISSING	H2S-CG DESULF VAPOR	IN-COND COND-EQ DEMISTR MIXED	Display ALLS TREAMS Units: From Format: SOLI DS To Phas
Temperature [C]	482.4	136.5	450	512.3	512.3	440.6	713.9	580.4	482.4	482.2	140	Temperature [C]
Pressure [PSI]	274.7	279.2	275	274.7	274.7	275.2	274.7	274.7	274.7	275	270.7	Pressure [PSI]
Mass VFrac	1	0	0	0	0	0	0	0	0	0	0.921	Mass VFrac
Mass SFrac	< 0.001	0	1	1	1	0	1	1	1	0	0	Mass SFrac
*** ALL PHAS ES ***												
Mass Flow [LB/HR]	448832.344	72935.094	164357.922	166009.453	74566.227	72935.094	164357.922	165181.094	166009.453	450483.875	74566.227	Mass Flow [LB/HR]
Volume Flow [CUFT/HR]	1.13E+06	30858.555	756.208	793.141	60581.492	59761.762	756.208	768.468	793.141	1.13E+06	2.82E+04	Volume Flow [CUFT/HR]
Enthalpy [BTU/HR]	-1.09E+09	-1.35E+08	-1.06E+09	-1.03E+09	-1.25E+08	-1.28E+08	-1.04E+09	-1.04E+09	-1.04E+09	-1.07E+09	-1.35E+08	Enthalpy [BTU/HR]
Density [LB/CUFT]	0.397	2.364	217.345	209.306	1.231	1.22	217.345	214.949	209.306	0.399	2.643	Density [LB/CUFT]
Mass Flow [LB/HR]					68860.266						68860.266	Mass Flow [LB/HR]
O2S		68800				68800						O2S
H2S	23.01											H2S
H2O	73613.648											H2O
S2					519.707							S2
S6		2.397			2171.238		2.397					S6
S8		3.894			3035.012		3.894					S8
CO	213439.25											CO
CO2	114865.578											CO2
H2	11355.747											H2
O2		4128.805										O2
N2	35535.098											N2
COS												COS
ZNO			2084.988				2084.988					ZNO
ZNS				2496.573				2496.573				ZNS
FE2O3			12272.938				12272.938					FE2O3
FEO												FEO
FES	0.001			13512.88				4485.513				FES
AL2O3			150000	150000			150000	150000				AL2O3

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Display ALLS TREAMS Units: From To Format: SOLI DS Phas	INDESULF DESULF DSULSTND VAPOR	INREGEN1 REGEN1 S-REGEN1 VAPOR	INREGEN2 REGEN2 S-REGEN2 VAPOR	LIFTDFEO LIFTPIPE RGENSTND MISSING	MADE-S2 S-REGEN2 HX-STAGE VAPOR	MADES02 S-REGEN2 REGEN2 VAPOR	MOD-RECY X-FLOW MIXFEED VAPOR	N2-COOL LIFTCOMP VAPOR	N2EXIT LIFTPIPE N2-COOL VAPOR	N2SOURCE LIFTPIPE LIFTPIPE VAPOR	O2 MIXFEED VAPOR	Display ALLS TREAMS Units: From To Format: SOLI DS Phas
Temperature [C]	492.4	713.9	556.4	631	580.4	713.9	146.1	208	631	210.1	30	Temperature [C]
Pressure [PSI]	274.7	274.7	274.7	274.7	274.7	274.7	279.2	272	274.7	275	279.2	Pressure [PSI]
Mass VFrac	0.575	0.31	0.311	0	1	1	1	1	1	1	1	Mass VFrac
Mass SFrac	0.425	0.69	0.689	1	0	0	0	0	0	0	0	Mass SFrac
*** ALL PHASES ***												*** ALL PHASES ***
Mass Flow [LB/HR]	780850.875	238116.203	239767.375	164357.922	74586.227	73758.273	68806.289	35000	35000	35000	4128.805	Mass Flow [LB/HR]
Volume Flow [CUFT/HR]	1132710	8.08E+04	68028.672	756.208	66784.258	80083.75	27821.109	43008.844	79802.289	42726.648	2689.199	Volume Flow [CUFT/HR]
Enthalpy [BTU/HR]	-3.16E+09	-1.17E+09	-1.16E+09	-1.09E+09	-1.22E+08	-1.30E+08	-1.35E+08	2866710	9.89E+06	-2899740	-1712.78	Enthalpy [BTU/HR]
Density [LB/CUFT]	0.689	2.946	3.525	217.345	1.117	0.921	2.473	0.814	0.438	0.819	1.547	Density [LB/CUFT]
Mass Flow [LB/HR]		73722.469	68860.266		68860.266	73722.469	68800					Mass Flow [LB/HR]
O2S												O2S
H2S	23.01											H2S
H2O	73613.648											H2O
S2			5726		1563.893							S2
S6					2146.613		2.397					S6
S8					2015.451		3.894					S8
CO	213439.25											CO
CO2	114865.578											CO2
H2	11355.747											H2
O2		35.801				35.801					4128.805	O2
N2	35535.098							35000	35000	35000		N2
CO5												CO5
ZNO		2084.988										ZNO
ZNS		4993.106	2496.573		2084.988							ZNS
FE2O3		12272.938	8199.016	12272.938								FE2O3
FEO												FEO
FES	27025.441		4485.513									FES
AL2O3	300000	150000	150000	150000								AL2O3

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Display ALLS TREAMS From Units: Format: SOLI DS To Phas	P-SO2 CON-COMP SO2MIX VAPOR	PS2 DEMISTR LP-COND LIQUID	RECYCLE SO2-COMP SO2MIX VAPOR	RECYCLES SO2MIX X-FLOW VAPOR	IS2V-L HEATX COND-EQ VAPOR	STNDPIPE DSULSTND DESULF MISSING	SULFUR LP-COND LIQUID	UNP-RSO2 DEMISTR SO2-COMP VAPOR	UP-SO2 LP-COND CON-COMP VAPOR	WARMI RCY HEATR HEATX VAPOR	Display ALLS TREAMS From Units: Format: SOLI DS To Phas
Temperature [C]	500.6	139.6	145.1	146.1	315	482.4	127.1	139.6	127.1	240	Temperature [C]
Pressure [PSI]	279.2	265.7	279.2	279.2	272.7	274.7	14.7	265.7	14.7	277.2	Pressure [PSI]
Mass VFrac	1	0	1	1	1	0	0	1	1	1	Mass VFrac
Mass SFrac	0	0	0	0	0	1	0	0	0	0	Mass SFrac
*** ALL PHAS ES ***											*** ALL PHAS ES ***
Mass Flow [LB/HR]	179.039	5910.173	68676.164	68855.203	74586.227	166009.094	5731.134	66676.133	179.039	72935.094	Mass Flow [LB/HR]
Volume Flow [CUFT/HR]	148.551	33.732	27679.805	27840.887	44448.238	793.139	31.631	28725.764	1460.365	41204.821	Volume Flow [CUFT/HR]
Enthalpy [BTU/HR]	-3.30E+05	120743.211	-1.35E+08	-1.35E+08	-1.30E+08	-1.04E+09	472141.281	-135100000	-357400	-132770000	Enthalpy [BTU/HR]
Density [LB/CUFT]	1.205	175.208	2.481	2.473	1.678	209.307	181.187	2.391	0.123	1.77	Density [LB/CUFT]
Mass Flow [LB/HR]	178.945	190.34	68669.961	68848.906	68860.266		11.396	68669.93	178.945	68800	Mass Flow [LB/HR]
O2S											O2S
H2S											H2S
H2O											H2O
S2					519.707						S2
S6	0.036	2179.265	2.363	2.398	2171.238		2179.229	2.363	0.036	2.397	S6
S8	0.058	3540.567	3.838	3.897	3035.012		3540.509	3.838	0.058	3.894	S8
CO											CO
CO2											CO2
H2											H2
O2										4128.805	O2
N2											N2
CO5											CO5
ZNO											ZNO
ZNS				2496.533							ZNS
FE2O3											FE2O3
FEO											FEO
FES							13512.56				FES
AL2O3							150000				AL2O3



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Display ALLS TREAMS Units: From Format: SOLI DS To Phas	CLEAN-CG DESULSEP VAPOR	COLD-CG MIXFEED RCYHEATR MIXED	COLD-FEED MIXFEED RCYHEATR MIXED	COLD-SORB RGENSTND DESULF MISSING	COOL-FES HX-STAGE HEATX VAPOR	FEED-REG1 HEATX REGEN1 VAPOR	FEO-ZNO S-REGEN1 LIFTPIPE MISSING	FEO-ZNS S-REGEN2 REGEN1 MISSING	FES-ZNS DESULSEP HX-STAGE MISSING	H2S-CG DESULF VAPOR	IN-COND COND-EQ COND MIXED	Display ALLS TREAMS Units: From Format: SOLI DS To Phas
Temperature [C]	482.7	482.7	136.3	450	512.1	421.5	711.6	579.5	482.7	482.2	140	Temperature [C]
Pressure [PSI]	274.1	278.6	278.6	275	274.1	274.6	274.1	274.1	274.1	275	270.1	Pressure [PSI]
Mass V/Frac	1	1	1	0	1	1	0	0	0	0	0.919	Mass V/Frac
Mass S/Frac	0	0	0	1	1	0	1	1	1	0	0	Mass S/Frac
*** ALL PHASES ***												*** ALL PHASES ***
Mass Flow [LB/HR]	463167.313	216585.75	216585.75	493649.531	498669.813	216585.75	493649.531	496152.125	498669.813	468187.563	221603.984	Mass Flow [LB/HR]
Volume Flow [CUF/HR]	1.17E+06	91955.008	91955.008	2270.583	2382.878	173024.047	2270.583	2307.888	2382.878	1.16E+06	8.38E+04	Volume Flow [CUF/HR]
Enthalpy [BTU/HR]	-1.16E+09	-4.01E+08	-4.01E+08	-3.18E+09	-3.10E+09	-3.80E+08	-3.12E+09	-3.19E+09	-3.11E+09	-1.08E+09	-4.00E+08	Enthalpy [BTU/HR]
Density [LB/CUFT]	0.397	2.355	2.355	217.411	209.272	1.252	217.411	214.981	209.272	0.403	2.643	Density [LB/CUFT]
Mass Flow [LB/HR]		204031.219	204031.219		204180.078	204031.219					204180.078	Mass Flow [LB/HR]
O2S												O2S
H2S		23.471								18603.785		H2S
H2O		83842.484								69811.359		H2O
S2					1549.572							S2
S6			7.099		6588.625	7.099						6619.617 S6
S8			11.587		9285.715	11.587						10804.296 S8
CO										215953.672		CO
CO2										116218.758		CO2
H2										11646.276		H2
O2			12535.85									O2
N2			35953.723							35953.723		N2
CO5												CO5
ZNO				6332.866			6332.866					ZNO
ZNS					7583			7583				ZNS
FE2O3				37316.672			37316.672	24919.895				FE2O3
FEO												FEO
FES												FES
AL2O3				450000			450000	450000				AL2O3

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Display ALLS TREAMS Units: From Format: SOLI DS To Phas	INDESULF DESULF DESULSEP VAPOR	INREGEN1 REGEN1 S-REGEN1 VAPOR	INREGEN2 REGEN2 S-REGEN2 VAPOR	LIFTDFEO LIFTPIPE RGENSTND MISSING	MADE-S2 S-REGEN2 HX-STAGE VAPOR	MADES02 S-REGEN1 REGEN2 VAPOR	MOD-RECY X-FLOW MIXFEED VAPOR	N2-COOL N2-COOLR LIFTCOMP VAPOR	N2EXIT LIFTPIPE N2-COOLR VAPOR	N2SOURCE LIFTCOMP LIFTPIPE VAPOR	O2 MIXFEED VAPOR	Display ALLS TREAMS Units: From Format: SOLI DS To Phas
Temperature [C]	482.7	711.6	554.9	649.8	579.5	711.6	146.1	208	649.8	210.1	30	Temperature [C]
Pressure [PSI]	274.1	274.1	274.1	274.1	274.1	274.1	278.6	272	274.1	275	278.6	Pressure [PSI]
Mass VFrac	0.317	0.307	0.309	0	1	1	1	1	1	1	1	Mass VFrac
Mass SFrac	0.683	0.693	0.691	1	0	0	0	0	0	0	0	Mass SFrac
*** ALL PHASES ***												*** ALL PHASES ***
Mass Flow [LB/HR]	1460510	712737.875	717757.063	493849.531	221603.984	219088.344	204049.906	75000	75000	75000	12535.85	Mass Flow [LB/HR]
Volume Flow [CUFT/HR]	1171290	2.40E+05	202161.641	2270.583	198350.969	237827.297	82715.25	92161.805	175148.922	91557.102	8121.884	Volume Flow [CUFT/HR]
Enthalpy [BTU/HR]	-7.37E+09	-3.51E+09	-3.49E+09	-3.13E+09	-3.62E+08	-3.87E+08	-4.01E+08	6142950	2.19E+07	6213730	-5136.922	Enthalpy [BTU/HR]
Density [LB/CUFT]	1.247	2.969	3.55	217.411	1.117	0.921	2.467	0.814	0.428	0.819	1.543	Density [LB/CUFT]
Mass Flow [LB/HR]		219000	204180.953		204180.078	219000	204031.219					Mass Flow [LB/HR]
O2S												O2S
H2S	23.471											H2S
H2O	83842.484											H2O
S2			17423.979		4630.148							S2
S6					6555.111		7.099					S6
S8					6238.653		11.587					S8
CO	215953.672											CO
CO2	116218.758											CO2
H2	11175.208											H2
O2		88.344										O2
N2	35953.723					88.344						N2
CO2												CO2
ZNO		6332.866										ZNO
ZNS	15166		7583									ZNS
FE2O3		37316.672	24919.895	37316.672								FE2O3
FEO												FEO
FES	82173.594		13649.23									FES
AL2O3	900000	450000	450000	450000								AL2O3

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Display ALLS TREAMS Units: Format: SOLI DS To Phas	P-SO2 CON-COMP SO2MIX VAPOR	PS2 COND LP-COND LIQUID	RECYCLE SO2-COMP SO2MIX VAPOR	RECYCLES SO2MIX X-FLOW VAPOR	S2V+L HEATX COND-EQ VAPOR	STANDPIP DESULSEP DESULF MISSING	SULFUR LP-COND LIQUID	UNP-RSO2 COND SO2-COMP VAPOR	UP-SO2 LP-COND CON-COMP VAPOR	WARIMRCY RCYHEATR HEATX VAPOR	Display ALLS TREAMS Units: Format: SOLI DS To Phas
Pressure [PS]	500.4	139.6	145.1	146.1	315	482.7	127.2	139.6	127.2	220	Temperature [C]
Mass VFrac	278.6	265.1	278.6	278.6	272.1	274.1	14.7	265.1	14.7	276.6	Pressure [PS]
Mass SFrac	0	0	0	0	0	0	0	0	0	0	Mass VFrac
*** ALL PHASES ***											*** ALL PHASES ***
Mass Flow [LB/HR]	543.2	17983.422	203620.531	204163.734	221603.984	498669.813	17440.221	203620.938	543.2	216585.75	Mass Flow [LB/HR]
Volume Flow [CUFT/HR]	451.514	102.6	82271.875	82761.391	132180.859	2382.878	96.225	85387.891	4431.133	117188.945	Volume Flow [CUFT/HR]
Enthalpy [BTU/HR]	-1.00E+06	370562.063	-4.00E+08	-401270000	-3.84E+08	-3.11E+09	1436680	-400560000	-1066100	-394990000	Enthalpy [BTU/HR]
Density [LB/CUFT]	1.203	175.276	2.475	2.467	1.677	209.272	181.244	2.385	0.123	1.848	Density [LB/CUFT]
Mass Flow [LB/HR]	542.913	577.553	203602.125	204145.031	204180.078		34.64	203602.531	542.913	204031.219	Mass Flow [LB/HR]
O2S											O2S
H2O											H2O
S2					1549.572						S2
S6	0.109	6612.687	6.994	7.103	6588.625		6612.578	6.994	0.109	7.099	S6
S8	0.178	10793.182	11.415	11.593	9285.715		10793.004	11.415	0.178	11.587	S8
CO											CO
CO2											CO2
H2											H2
O2										12535.85	O2
N2											N2
COS											COS
ZNO											ZNO
ZNS						7583					ZNS
FE2O3											FE2O3
FEO											FEO
FES						41086.797					FES
AL2O3						450000					AL2O3





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Display ALLS TREAMS Units: From Format: SOLI DS To Phas	CLEAN-CG DESULSEP VAPOR	COLDFEED MIXFEED RCYHEATR MIXED	COLDSORB RGENSTND DESULF MISSING	COOLFEES HX-STAGE REGEN2 MISSING	COOLS2 HX-STAGE HEATX VAPOR	FEEDRG1 HEATX REGEN1 VAPOR	FEO-ZNO S-REGEN1 LIFTPIPE MISSING	FEO-ZNS S-REGEN2 REGEN1 MISSING	FES-ZNS DESULSEP HX-STAGE MISSING	H2S-CG DESULF VAPOR	IN-COND COND-EQ DEMISTR MIXED	Display ALLS TREAMS Units: From Format: SOLI DS To Phas
Temperature [C]	482.1	136.9	450	517.8	517.8	441.4	711	594.5	482.1	482.2	140	Temperature [C]
Pressure [PSI]	274.9	279.4	275	274.9	274.9	275.4	275.4	275.4	274.9	275	270.9	Pressure [PSI]
Mass SFrac	1	0	1	0	0	1	0	0	0	1	0.924	Mass SFrac
*** ALL PHASES ***	0	0	1	1	1	0	1	1	1	0	0	*** ALL PHASES ***
Mass Flow [LB/HR]	443898.906	21199.451	48050.277	48507.699	21656.5	21199.451	48050.277	48263.68	48507.699	444356.313	21656.5	Mass Flow [LB/HR]
Volume Flow [CUFT/HR]	1.12E+06	8971.891	221.013	231.696	17760.699	17373.199	221.013	224.428	231.696	1.12E+06	8.21E+03	Volume Flow [CUFT/HR]
Enthalpy [BTU/HR]	-1.07E+09	-3.93E+07	-3.11E+08	-3.03E+08	-3.62E+07	-3.71E+07	-3.05E+08	-3.05E+08	-3.04E+08	-1.06E+09	-3.93E+07	Enthalpy [BTU/HR]
Density [LB/CUFT]	0.397	2.363	217.409	209.559	1.219	1.22	217.409	215.052	209.559	0.397	2.638	Density [LB/CUFT]
Mass Flow [LB/HR]		20002.434			20061.83	20002.434					20061.83	Mass Flow [LB/HR]
O2S												O2S
H2S	65.815									1790.604		H2S
H2O	70033.773									68721.594		H2O
S2					164.784							S2
S6		0.719			612.014	0.719						S6
S8		1.144			817.872	1.144						S8
CO	212582.609									212582.609		CO
CO2	114404.563									114404.563		CO2
H2	11419.664									11464.477		H2
O2		1195.155				1195.155						O2
N2	35392.48									35392.48		N2
CO5												CO5
ZNO			500.379				500.379					ZNO
ZNS				599.156				599.156	599.156			ZNS
FE2O3			3549.896				3549.896		2415.33			FE2O3
FEO												FEO
FES				3908.545					3908.545			FES
AL2O3			44000				44000		44000			AL2O3

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Display ALLS TREAMS From DS To Phas	INDESULF DESULF VAPOR	INREGEN1 REGEN1 S-REGEN1 VAPOR	INREGEN2 REGEN2 S-REGEN2 VAPOR	LIFTFEO LIFTPIPE RGENSTND MISSING	MADES02 S-REGEN1 REGEN2 VAPOR	MOD-RECY X-FLOW MIXFEED VAPOR	N2-COOL N2-COOLR LIFTCOMP VAPOR	N2EXIT LIFTPIPE N2-COOLR VAPOR	N2SOURCE LIFTCOMP LIFTPIPE VAPOR	O2 MIXFEED VAPOR	Display ALLS TREAMS From DS To Phas
Units: Format: SOLI DS To Phas	482.1	711	573.5	651.5	711	146.5	208	651.5	210.1	279.4	30 Temperature [C]
Temperature [C]	274.9	275.4	275.4	275.4	275.4	275.4	272	275	275	279.4	Pressure [PSI]
Mass VFrac	0.82	0.308	0.31	0	1	1	1	1	1	1	1 Mass VFrac
Mass SFrac	0.18	0.692	0.69	1	0	0	0	0	0	0	0 Mass SFrac
*** ALL PHAS ES ***											*** ALL PHAS ES ***
Mass Flow [LB/HR]	541032.563	69463.133	69920.453	48050.277	21656.5	20004.297	7000	7000	7000	1195.155	Mass Flow [LB/HR]
Volume Flow [CUFT/HR]	1119290	2.34E+04	20135.34	221.013	19779.051	8092.941	8601.769	16324.121	8545.33	772.086	Volume Flow [CUFT/HR]
Enthalpy [BTU/HR]	-1.68E+09	-3.42E+08	-3.41E+08	-3.06E+08	-3.76E+07	-3.93E+07	57341.625	2.05E+06	579948.123	-497.809	Enthalpy [BTU/HR]
Density [LB/CUFT]	0.483	2.963	3.473	217.409	1.095	2.472	0.814	0.429	0.819	1.548	Density [LB/CUFT]
Mass Flow [LB/HR]		21310.348	20062.115		20061.83	21310.348					Mass Flow [LB/HR]
O2S											O2S
H2S	65.815										H2S
H2O	70033.773										H2O
S2			1594.662		542.278						S2
S6					569.93	0.719					S6
S8					482.462	1.144					S8
CO	212562.609										CO
CO2	114404.563										CO2
H2	11419.664										H2
O2		102.507				102.507					O2
N2	35392.48						7000	7000	7000		N2
CO2S											CO2S
ZNO		500.379		500.379							ZNO
ZNS	1316.587		599.156								ZNS
FE2O3		3549.896	2415.33	3549.896							FE2O3
FEO											FEO
FES	7617.09		1249.193								FES
AL2O3	88000	44000	44000	44000							AL2O3

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Display ALLS TREAMS Units: From DS To Phas	P-SO2 CON-COMP SO2MIX VAPOR	PS2 DEMISTR LP-COND LIQUID	RECYCLE SO2-COMP SO2MIX VAPOR	RECYCLES SO2MIX X-FLOW VAPOR	SZV-L HEATX COND-EQ VAPOR	STNDPIPE DESULF MISSING	SULFUR LP-COND LIQUID	UNP-RSO2 DEMISTR SO2-COMP VAPOR	UP-SO2 LP-COND CON-COMP VAPOR	WARMRCY RCYHEATR HEATX VAPOR	Display ALLS TREAMS Units: From DS To Phas
Temperature [C]	501.6	140	145.5	146.5	315	492.1	127.7	140	127.7	235	Temperature [C]
Pressure [PSI]	279.4	265.9	279.4	279.4	272.9	274.9	14.7	265.9	14.7	277.4	Pressure [PSI]
Mass VFrac	1	0	1	1	1	0	0	1	1	1	Mass VFrac
*** ALL PHAS ES ***											*** ALL PHAS ES ***
Mass Flow [LB/HR]	49.58	1645.675	20010.68	20060.26	21656.5	48625.977	1596.094	20010.973	49.58	21199.451	Mass Flow [LB/HR]
Volume Flow [CUFT/HR]	41.161	9.405	8070.953	8115.582	12934.794	232.279	6.823	8375.842	404.953	11828.04	Volume Flow [CUFT/HR]
Enthalpy [BTU/HR]	-9.14E+04	34663.465	-3.93E+07	-39425000	-3.78E+07	-3.04E+08	131964.156	-39363000	-97300.727	-38619000	Enthalpy [BTU/HR]
Density [LB/CUFT]	1.205	174.979	2.479	2.472	1.674	209.343	180.904	2.389	0.122	1.792	Density [LB/CUFT]
Mass Flow [LB/HR]	49.553	52.704	20008.838	20058.391	20061.83		3.15	20009.131	49.553	20002.434	Mass Flow [LB/HR]
O2S											O2S
H2S											H2S
H2O											H2O
S2					164.794						S2
S6	0.01	614.651	0.711	0.721	612.074		614.641	0.711	0.01	0.719	S6
S8	0.016	978.32	1.131	1.148	817.872		978.303	1.131	0.016	1.144	S8
CO											CO
CO2											CO2
H2											H2
O2										1195.155	O2
N2											N2
COS											COS
ZNO											ZNO
ZNS					717.431						ZNS
FE2O3											FE2O3
FEO											FEO
FES					3908.545						FES
AL2O3					44000						AL2O3

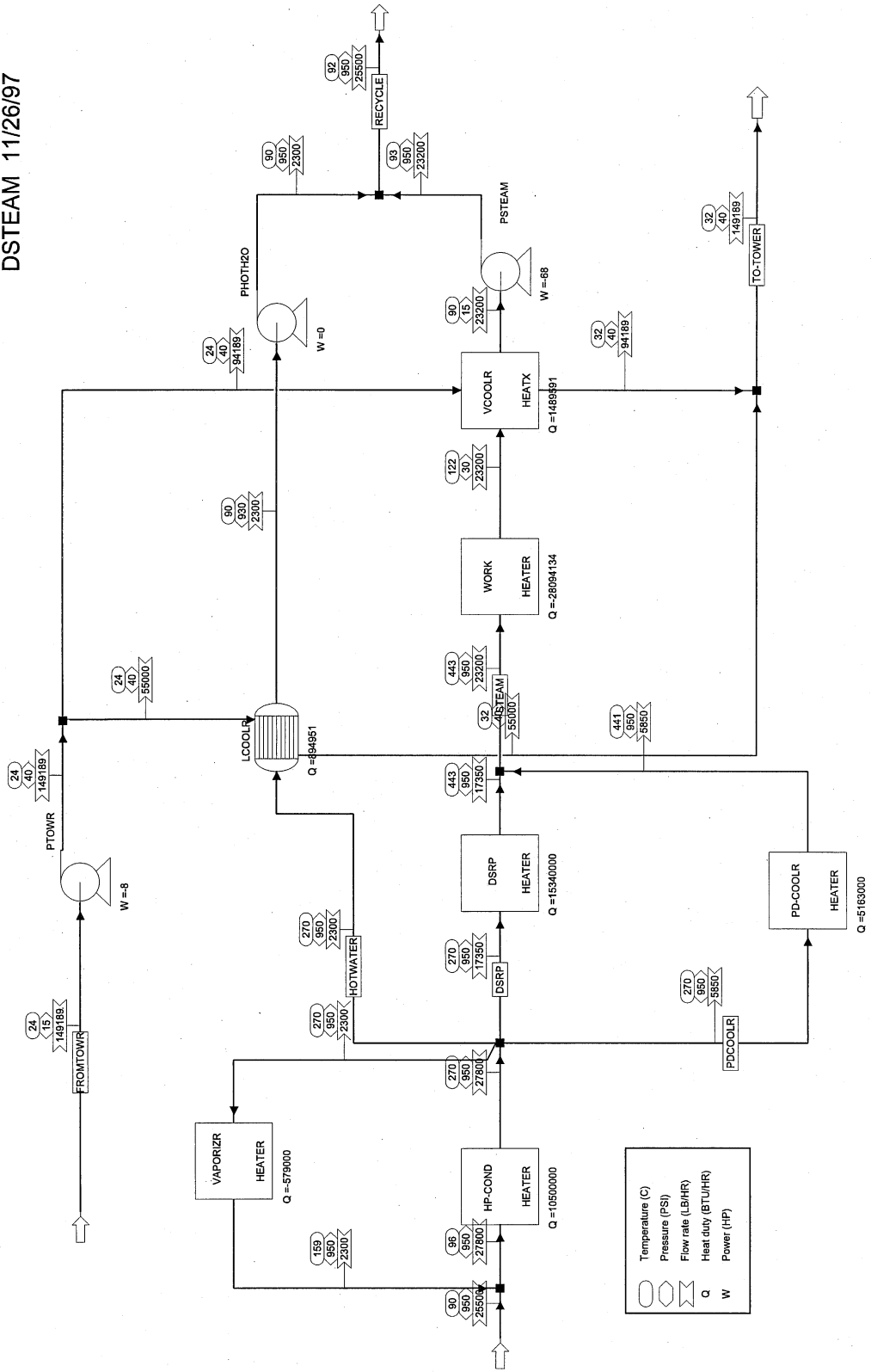
## **Appendix F**

### **Steam Generation Process Flowsheets**

The following flowsheets represent possible design schemes for producing high pressure steam. Desulfurization units that require heat removal are utilized for producing the steam. The steam generated will result in an economic credit for the process. The steam generation simulations will help determine the equipment necessary for cooling the desulfurization process.

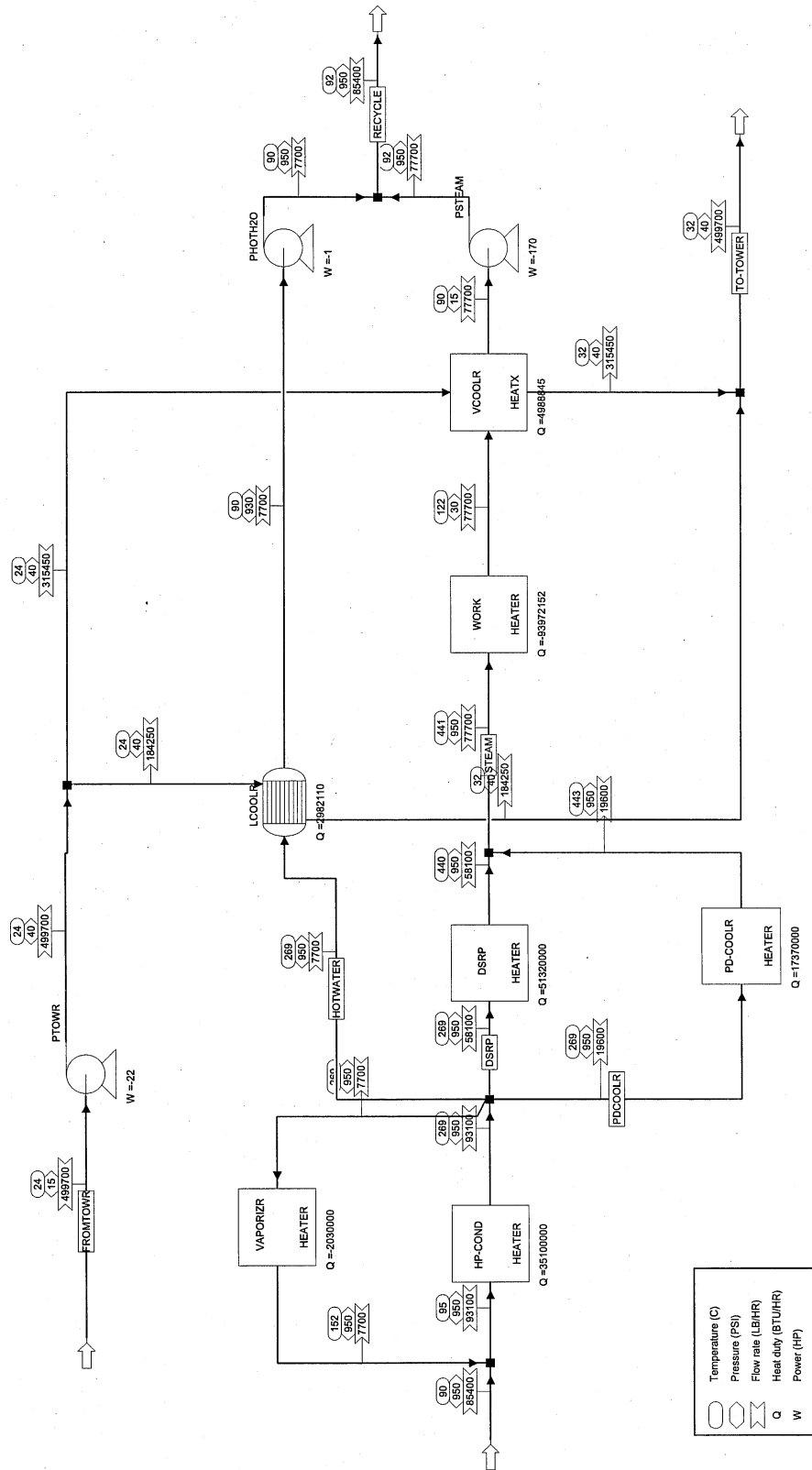
# DSRP Complete Steam Generation Scheme

DSTEAM 11/26/97



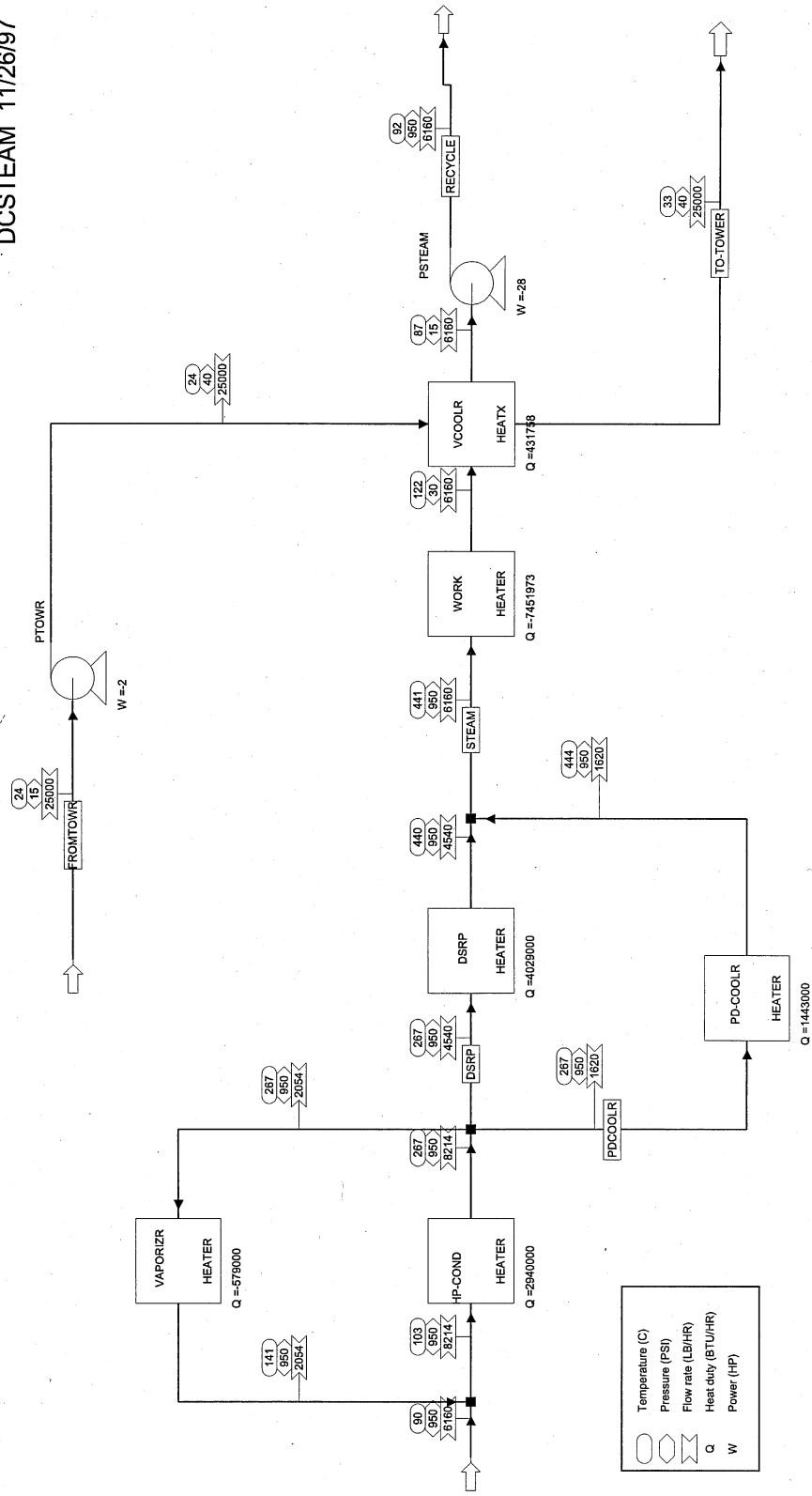
# DSRP-b Complete Steam Generation Scheme

DBSTEAM 11/26/97



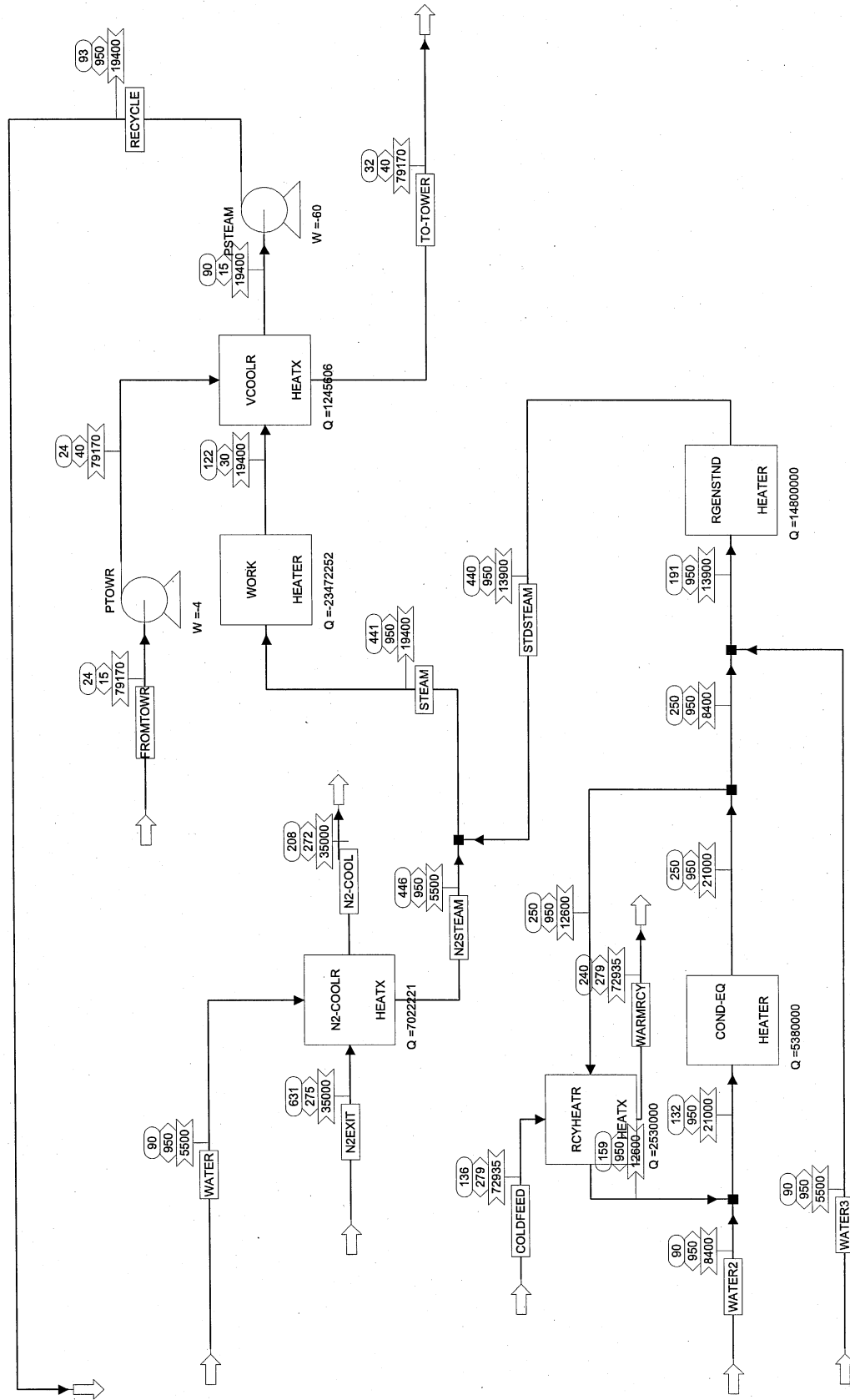
# DSRP-c Complete Steam Generation Scheme

DCSTEAM 11/26/97



# AHGP Complete Steam Generation Scheme

ASTREAM 1/22/98

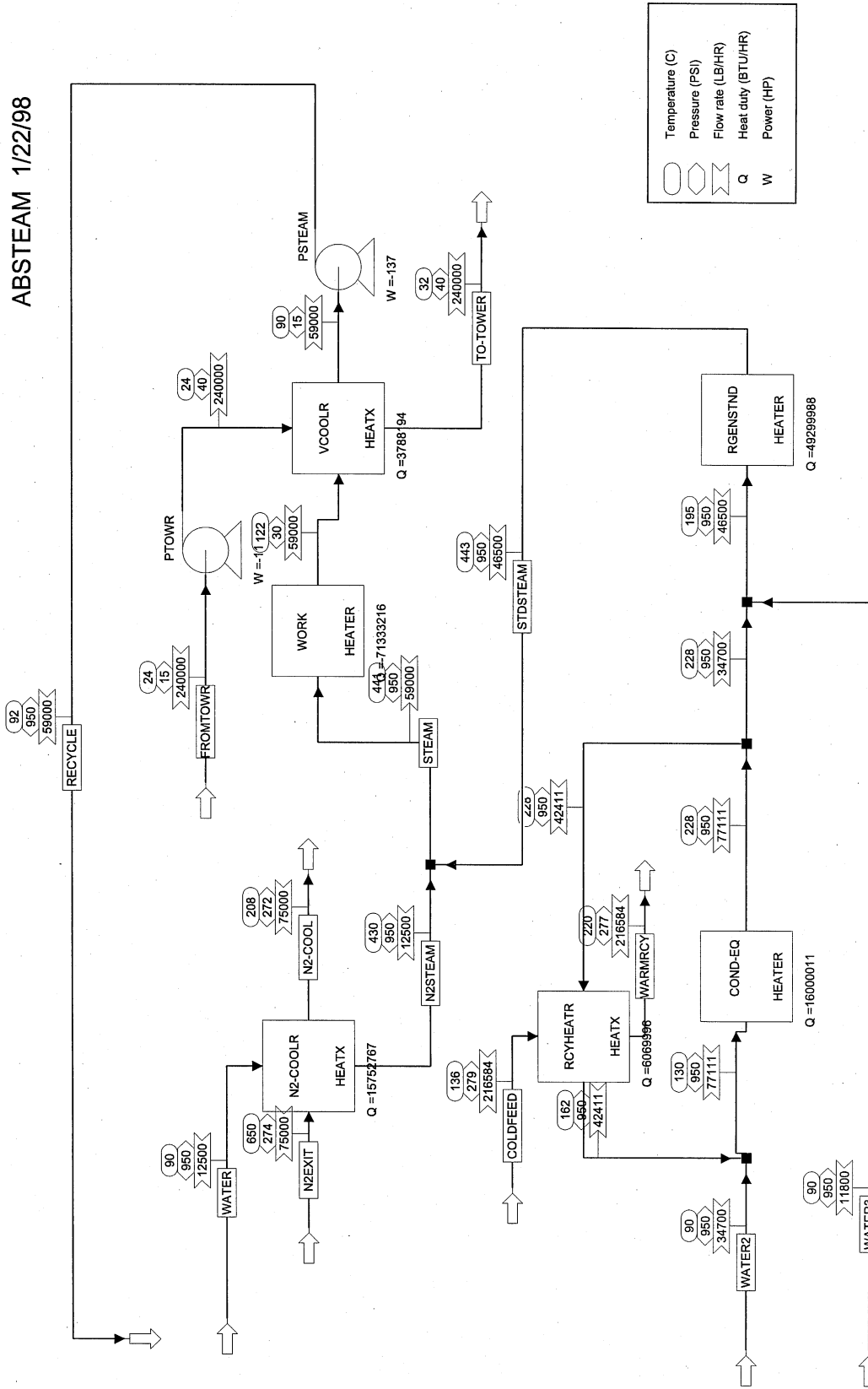


○ Temperature (C)  
 > Pressure (PSI)



# AHGP-b Complete Steam Generation Scheme

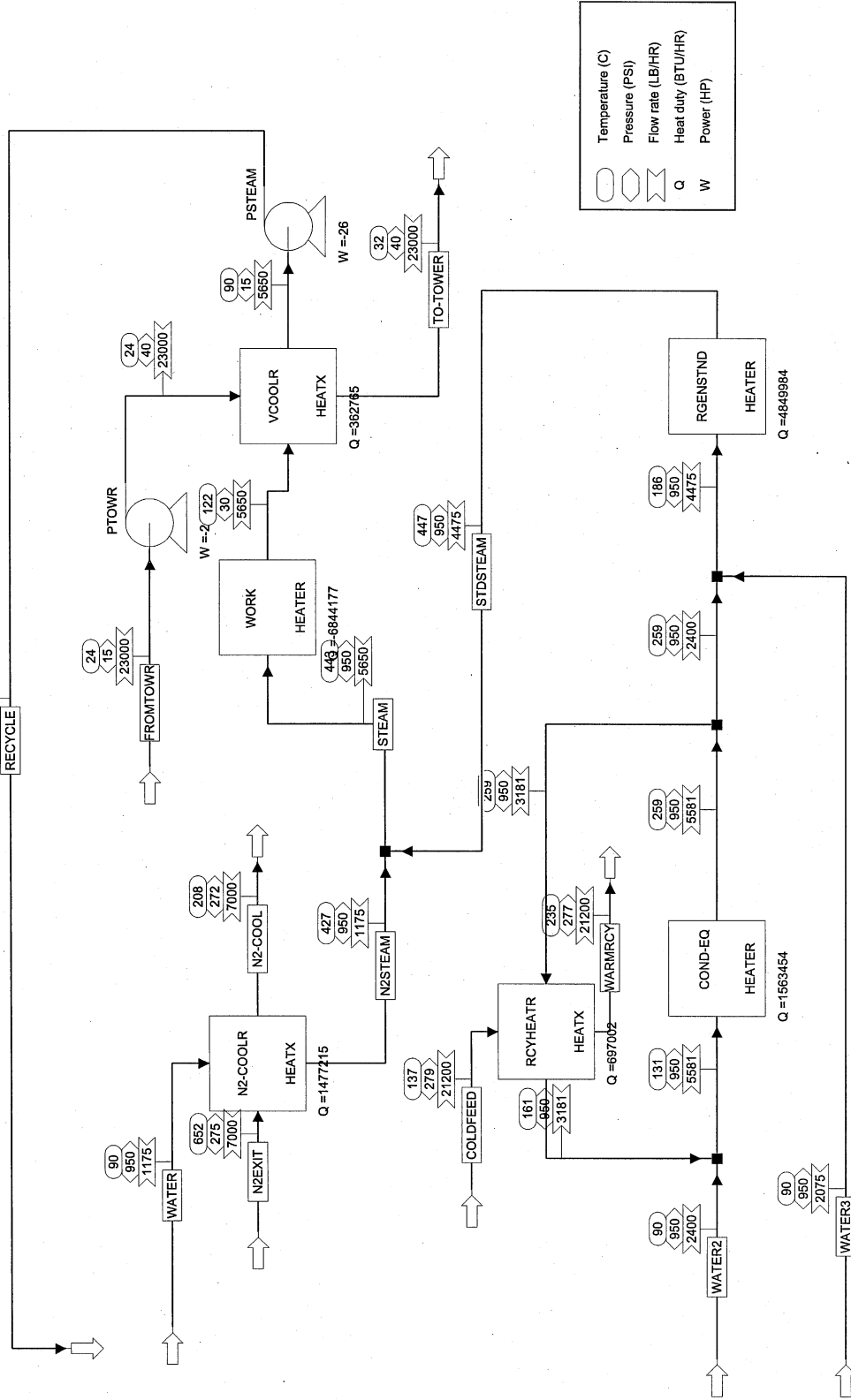
ABSTEAM 1/22/98



○	Temperature (C)
○	Pressure (PSI)
○	Flow rate (LB/HR)
Q	Heat duty (BTU/HR)
W	Power (HP)

# AHGP-c Complete Steam Generation Scheme

ACSTEAM 1/23/98



## Appendix G Calculation of Reactor Size

The reactor's diameter is determined from the average volumetric flow rate and the linear velocity.

$$v = 20 \text{ ft/sec} = 72,000 \text{ ft/hr}$$

$$V = [(\text{gas volume entering}) + (\text{gas volume leaving})]/2 + (\text{sorbent mass flow}) (60 \text{ lb/ft}^3)^{-1}$$

$$\text{Area} = V/v = (\text{Volumetric flow rate ft}^3/\text{hr}) / 72,000 \text{ ft/hr} \quad \{\text{ft}^2\}$$

Calculating the area allows for the calculation of the reactor inside diameter.

$$\text{Area} = \pi (\text{I.D.})^2 / (4 \times 144 \text{ in}^2/\text{ft}^2)$$

$$\text{I.D.} = [(\text{Area}) (4 \times 144) / \pi]^{0.5} \quad \{\text{in}\}$$

The reactor cost will be based on the material of construction costs. The reactor wall thickness and height are necessary for such a calculation. The reactor system cost will be calculated to include installation costs.

The reactor will be cylindrical. The wall and heads will be assumed to have the same thickness. The following equation was used for determining wall thickness (Peters & Timmerhaus, 1991).

$$\text{Thickness} = P (\text{I.D.}) / [2 (\text{Max. allowable working stress psia}) (\text{Efficiency of joints}) - 0.6 P] + C_c$$

$$P = \text{pressure } \{\text{psia}\} \quad C_c = \text{corrosion losses } \{\text{in}\}$$

$$\text{Thickness} = 275 (\text{I.D.}) / [2 (12,000) (0.85) - 0.6 (275)] + 0.125 \quad \{\text{in}\}$$

Taking steel density to be 489 lb/ft<sup>3</sup>, the reactor weight is calculated with the equations below.

$$\text{Weight of shell} = \pi (\text{I.D.}/12) (\text{height}) (\text{Thickness}/12)(489) \quad \{\text{lbs}\}$$

$$\text{Weight of heads} = 2 \pi [12 \text{ I.D.}/2]^2 (\text{Thickness}) (489/12^3) (2) \quad \{\text{lbs}\}$$

$$\text{Total weight} = 1.15 (\text{weight of shell} + \text{weight of heads}) \quad \{\text{lbs}\}$$

The total weight is increased 15% to account of nozzles, manholes, ect.

The cost of carbon steel can be calculated by the equation below.

$$(\text{Cost per lb}) = 80 (\text{total weight})^{-0.34}$$

The equation above is applicable for 800 lb to 100,000 lb vessels (Peters and Timmerhaus 1991). Estimates for weights over 100,000 lbs could not be found. Therefore, in such cases the unit cost for carbon steel was taken as an average of the above equation calculated for 100,000 lb and the above equation calculated for the total weight. The unit cost is expected to continue to decrease at larger quantities but the decrease should become less pronounced.

Unit cost of carbon steel (weight > 100,000 lbs)

$$(\text{Cost per lb}) = 80 [(\text{total weight})^{-0.34} + (100,000)^{-0.34}] / 2$$

The cost of installation will be twice of the cost of the reactor if it were constructed of carbon steel.

$$(\text{Cost of installation}) = 2 (\text{Cost per lb}) (\text{total weight})$$

The total cost of the reactor system includes installation and material costs. Material cost is multiplied by 3.5 to account for using stainless steel 310 instead of carbon steel.

$$(\text{Total cost for reactor}) = (\text{Cost of installation}) + 3.5 (\text{Cost per lb}) (\text{total weight})$$

## **Appendix H**

### **Sizing Reactors for the DSRP**

Copies of the reactor system sizing calculations follow. They include estimates of the reactor system costs. The equations describe in *Appendix G - Calculation of Reactor Size* where used in the spreadsheet.

reactors DSRP

Desulf and Regen transport reactor price calculation

**DSRP**

Regenerator Reactor

v (ft/sec) = 20                      72000 ft/hr  
 V (cfh) = 85,541  
 Area = 1.188 ft<sup>2</sup>  
 I.D. = 15.068 in

thickness= 0.330  
 shell wt.= 5,302 lbs  
 heads wt.= 67 lbs

air volume	<input type="text" value="67,895"/>	cfh	HP-O2-N2
ROG volume	<input type="text" value="94,813"/>	cfh	ROG
regen sorbent flow	<input type="text" value="251,240"/>	lb/hr	ZNS2RGEN
regen sorbent vol.	<input type="text" value="4,187"/>	cfh	

sorbent vol%                      4.90%

Corrosion depth	<input type="text" value="0.125"/>	in
reactor height	<input type="text" value="100"/>	ft

total wt.                      6,174 lbs (includes additional 15% for nozzles, manholes, etc.)

Regenerator Standpipe

total wt.                      6,174 lbs

size vs. regen size

Desulfurization Reactor

v (ft/sec) = 20                      72000 ft/hr  
 V (cfh) = 1,296,166  
 Area = 18.002 ft<sup>2</sup>  
 I.D. = 58.653 in

thickness= 0.922  
 shell wt.= 57,707 lbs  
 heads wt.= 2,821 lbs

coal gas in volume	<input type="text" value="1,200,000"/>	cfh	RAW-CG
cg out volume	<input type="text" value="1,370,000"/>	cfh	CG-CALC
regen sorbent flow	<input type="text" value="669,972"/>	lb/hr	ZNS
regen sorbent vol.	<input type="text" value="11,166"/>	cfh	

sorbent vol%                      0.86%

Corrosion depth	<input type="text" value="0.125"/>	in
reactor height	<input type="text" value="100"/>	ft

total wt.                      69,607 lbs (includes additional 15% for nozzles, manholes, etc.)

Desulfurization Standpipe

total wt.                      69,607 lbs

size vs. desulf size

**total wt.      151,561 lbs**                      weight for desulfurization and regeneration transport reactors

COST

C.S. unit price for quantity needed	1.491 \$/lb	1990 \$	>100,000 lb calc
	1.593 \$/lb	1996 \$	1.490988 1.386
			<100,000 lb calc

Cost of installation                      \$482,917

**Total reactor cost      \$1,328,020** includes cost of installation

DSRP reactor

DSRP Reactor Cost

**DSRP**

DSRP Reactor

v (ft/sec) gas =  10800 ft/hr  
 V (cfh) = 114,923  
 space time -gas 33.33 seconds  
 v (ft/sec) cat = 2.3 8280 ft/hr

Area = 10.782 ft<sup>2</sup>  
 I.D. 45.391 in  
 thickness= 0.742 in  
 shell wt.= 35,930 lbs  
 heads wt.= 1,359 lbs

slipstream	<input type="text" value="37,342"/>	cfh	SLIPSTREAM
ROG volume	<input type="text" value="75,166"/>	cfh	ROG-COOL
reactor effluent	<input type="text" value="107,359"/>	cfh	RXNPRD
DSRP reactor Q	<input type="text" value="-15,340,000"/>	BTU/hr	
catalyst flow	299,381	lb/hr	
catalyst vol.	4,990	cfh	

catalyst vol% 5.59%

Corrosion depth	<input type="text" value="0.125"/>	in
reactor height	<input type="text" value="100"/>	ft

total wt. 42,882 lbs (includes additional 15% for nozzles, manholes, etc.)

DSRP Standpipe

Cyclone (20% of reactor size) 8,576

standpipe height  ft

residence time 10.81 minutes

Area = 10.78 ft<sup>2</sup>  
 I.D. 45.39 in  
 thickness= 0.74 in  
 shell wt.= 14,372 lbs  
 heads wt.= 1,359 lbs

total wt. 26,667 lbs (includes additional 15% on standpipe weight + Cyclone weight)

Heat Exchanger

Heat Exchanger Area (ft<sup>2</sup>)

heat exchanger pipe thickness  in

volume of steel 22

total weight 10,829 lbs

**total wt.** 80,379 lbs weight for DSRP reactor system

COST

C.S. unit price for quantity needed	1.719 \$/lb	1990 \$	>100,000 lb calc
	1.837 \$/lb	1996 \$	1.657735955 1.719
			<100,000 lb calc

Cost of installation \$295,320

**Total reactor cost \$812,129** includes cost of installation