

Compressor Report

DERATED RESULTS

Design Document: V:\E-SOS\YPS\294100-2008 IAG-Sandridge Energy\Inquiry\P08-061A Mustang Sand Ridge\Mechanical\Selections (comp,valve,etc.)\P08-061A final flows.xml

Description:

Job Reference:

Customer:

Originator:

Compressor: 555B

Gas compressed: York (R134a)

Analysis Type: Isentropic

Rotational speed (RPM): 3217

DESIGN

StreamIn [25]: Mass Flow	1574.10	lb/min
StreamIn [25]: Temperature	-5.5	°F
StreamIn [25]: Pressure	17.300	psi
StreamIn [64]: Mass Flow	4583.20	lb/min
StreamIn [64]: Temperature	16.6	°F
StreamIn [64]: Pressure	28.200	psi
StreamIn [74]: Mass Flow	1656.70	lb/min
StreamIn [74]: Temperature	66.5	°F
StreamIn [74]: Pressure	59.500	psi
StreamOut [31]: Pressure	126.100	psi

COMPRESSOR

		1	2	3	4	5	Discharge
Pressure (psi)	P	17.30	23.81	35.95	55.77	85.11	128.14/128.10
Temperature (°F)	T	-5.50	15.42	43.83	73.53	104.41	136.07
Sp. volume (ft³/lbm)	V	2.6319	1.9838	1.3748	0.9205	0.6227	0.4235
Enthalpy (Btu/lbm)	H	166.248	169.714	174.504	179.470	184.645	189.869
Saturated Temp (°F)	TP	-8.39	5.09	23.90	45.99	69.53	94.75
Flange dT (°F)	FTPL	0.15	5.18		1.28		0.52
Flg dT given (°F)	FTPL	n/a	6.07		2.79		n/a
Flange dP (psid)	FDP	0.06	2.96		1.36		1.02
Flg dP given (psid)	FDP	n/a	3.50		3.00		n/a
Flg Velocity (ft/s)	FVEL	31.65	125.44		59.96		51.59
Flg Diameter (in)	FDIA	20.00	8.00		6.00		14.00
Number of Flanges	CN	1.00	3.00		2.00		1.00
Mach number	MO	0.7789	0.9059	0.8912	0.8816	0.8760	Overall
Flow coeff	QND	0.1169	0.2099	0.1455	0.1236	0.0836	0.0569
Head coeff	MU	0.4870	0.4689	0.5220	0.5199	0.5173	0.4910
Efficiency	EFF	0.7505	0.7644	0.7506	0.7844	0.7733	0.7009

Head/Efficiency	MU/EFF	0.6489	0.6134	0.6955	0.6628	0.6690	0.7006
Reynolds number	RN	3032521	8969420	9382137	11608147	10903612	
Specific vol ratio	CFMR	1.324	1.443	1.485	1.478	1.471	
Head (Btu/lbm)	DHAD	2.732	3.661	4.076	4.060	4.039	18.568
Head (ft)		2125.8	2849.0	3171.7	3159.2	3143.3	14449.0
Stage power (HP)		135.1	695.5	788.5	953.7	962.5	3535.2
Shaft power (HP)		---	---	---	---	---	3552.9
Vol flow (ft³/min)	CFM	4142.83	12215.11	8465.10	7192.62	4866.13	3308.93
Mass flow (lb/min)	W	1574.1	6157.3	6157.3	7814.0	7814.0	7814.0
Mass flow (% Total)	PW	20.14	58.65	0.00	21.20	0.00	100.00
Impeller size		B3	A8	A6	A4	A1	
Impeller material		Alum	Alum	Alum	Alum	Alum	
Impeller width (in)	WIDTH	1.719	3.406	2.625	2.312	1.562	
Rim Diameter (in)	DIAR	26.700	31.500	31.500	31.500	31.500	
Rim velocity (ft/s)	UR	374.8	442.1	442.1	442.1	442.1	
Blade Diameter (in)	DIAB	26.700	31.500	31.500	31.500	31.500	
Blade velocity (ft/s)	UB	374.8	442.1	442.1	442.1	442.1	
Thrust (lbf)	FORCE	755.6	2437.0	3979.3	4295.7	6299.6	
Thrust area (in²)	TAREA	145.0	251.0	251.0	183.0	183.0	

DERATE INFORMATION

Efficiency derated by 0.0150 - Side Load Flow(s) exceed 25.0% of discharge.

Head Coefficient derated by 0.0100 - Side Load Flow(s) exceed 25.0% of discharge.

DESIGN TEMPERATURE - Estimated Discharge Temp @ Surge: 183.3 °F

COUPLING - Size: 3.000 in (MAX HP: 4375.0)

SEALS REQUIRED: A-4

PROCESS FLOWS								
Stage	Massflow (lb/min)	Temp. of stream (°F)	Line DT (°F)	Pressure of stream (psi)	Line DP (psid)	Flange DP (psid)	Stage Suction Press. (psi)	Available Line DP (psid)
1	1574.10	-5.50	0.00	17.30	0.00	0.06	17.30	n/a
2	4583.20	16.60	0.00	28.20	1.00	2.96	23.81	0.43
4	1656.70	66.50	0.00	59.50	1.00	1.36	55.77	1.37

(Note: First and last stage impeller performance includes suction and discharge flanges pressure losses.)

OIL SYSTEM		
Sump Vented to Stage 3		
Frictional Loss (with tilting pad thrust)	17.7	HP
Frictional Heat Load	44940.1	Btu/h
Sump Heat Load	0.0	Btu/h
Total Heat Load	44940.1	Btu/h

Flow Rate	14.3280	gpm
Max Pressure Drop	9.7	psid
INLET		
Supply Oil Pressure	69.5	psi
Temperature	129.1	°F
OUTLET		
Thrust Oil Pressure	69.5	psi
Temperature	114.1	°F

BALANCE PISTON

Vented to Stage 3		
Material	Aluminum	
Diameter	17.748	in
Area	203.20	in ²
Balance Piston Differential Pressure	83.583	psi
Balance Piston Force	-16984.0	lbf
Total Impeller Axial Forces	17767.1	lbf
Total Miscellaneous Shaft Forces	760.6	lbf
Net Force on Bearing	1543.7	lbf
Net Axial Force on Last Impeller	10684.5	lbf
Tangential Force on Last Impeller	5013.7	lbf
Resultant Force on Last Impeller	11802.3	lbf
Cold Clearance	0.0141	in
Running Clearance	0.0102	in
Inertial Growth	0.0039	in
Temperature Growth	0.0000	in

THRUST BEARING

Selected Type	Tilting Pad	
Design Maximum Force	2419.6	lbf
Net Force on Bearing	1543.7	lbf
Design Minimum Force	604.6	lbf
Load	53.6	psi
Average Rotational Speed	65.0	in/min

SPEEDLINE

Suction (lb/min)	Stage						Overall
		1	2	3	4	5	
1149.9	QND	0.0854	0.1489	0.0985	0.0816	0.0545	
	MU	0.5334	0.5313	0.5605	0.5512	0.5507	0.5297
	EFF	0.7204	0.7438	0.6765	0.6909	0.6827	0.6332
1157.1	QND	0.0859	0.1499	0.0991	0.0822	0.0548	

	MU	0.5330	0.5309	0.5603	0.5511	0.5506	0.5296
	EFF	0.7219	0.7455	0.6784	0.6929	0.6846	0.6351
1173.9	QND	0.0872	0.1521	0.1007	0.0834	0.0557	
	MU	0.5321	0.5299	0.5598	0.5508	0.5503	0.5293
	EFF	0.7251	0.7495	0.6827	0.6975	0.6888	0.6393
1218.0	QND	0.0905	0.1581	0.1048	0.0868	0.0579	
	MU	0.5294	0.5269	0.5583	0.5499	0.5495	0.5282
	EFF	0.7331	0.7591	0.6938	0.7093	0.7000	0.6502
1282.1	QND	0.0952	0.1669	0.1109	0.0920	0.0612	
	MU	0.5250	0.5218	0.5554	0.5479	0.5475	0.5259
	EFF	0.7428	0.7709	0.7090	0.7259	0.7159	0.6650
1349.6	QND	0.1002	0.1762	0.1176	0.0978	0.0651	
	MU	0.5196	0.5153	0.5513	0.5448	0.5445	0.5222
	EFF	0.7506	0.7800	0.7235	0.7426	0.7322	0.6789
1420.6	QND	0.1055	0.1863	0.1251	0.1043	0.0696	
	MU	0.5131	0.5073	0.5456	0.5402	0.5399	0.5169
	EFF	0.7554	0.7848	0.7366	0.7588	0.7485	0.6913
1495.4	QND	0.1111	0.1974	0.1341	0.1126	0.0754	
	MU	0.5031	0.4918	0.5371	0.5328	0.5320	0.5075
	EFF	0.7560	0.7821	0.7474	0.7744	0.7643	0.7006
1574.1	QND	0.1169	0.2099	0.1455	0.1236	0.0836	
	MU	0.4870	0.4689	0.5220	0.5199	0.5173	0.4910
	EFF	0.7505	0.7644	0.7506	0.7844	0.7733	0.7009
1652.8	QND	0.1228	0.2232	0.1598	0.1399	0.0979	
	MU	0.4681	0.4321	0.4871	0.4793	0.4514	0.4502
	EFF	0.7363	0.7176	0.7289	0.7627	0.7192	0.6629
1673.5	QND	0.1243	0.2268	0.1648	0.1464	0.1048	
	MU	0.4623	0.4150	0.4703	0.4538	0.3215	0.4104
	EFF	0.7307	0.6968	0.7102	0.7323	0.6108	0.6193

(**SSSx** refers to Single Stage Surge -- the first stage to surge at the indicated suction mass flow)

(**COMPR** refers to the speedline point calculated using the peak overall head coefficient and the peak overall efficiency)

(**DESIGN** refers to the speedline point at design conditions)

(It is assumed for all speedline points that the compressor pressure rise will be matched by the system.)

(Speedline represents the performance of the compressor with equal change in flows at all suctions.)