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REV	DATE	BY	CK	APPROVALS				REMARKS
				SECTION	PROJECT	CLIENT		
A	1/25/07	TJF	GQW	FB				Issued for Quotation
B	6/2/07	GQW	FB	FB				Issued for Purchase
C	2/3/08	GQW	FB	FB				Issued for Purchase - Revised as Noted
D	7/29/08	GQW <i>(initials)</i>	TJF <i>(initials)</i>	<i>GR</i>	<i>OR</i>	<i>RAC</i> <i>9-8-08</i>	<i>RIS</i> <i>9/10</i>	Issued for Purchase - Revised as Noted

<p>BP EXPLORATION (ALASKA) INC. BP GAS PARTIAL PROCESSING (GPP) BP ZPAD FACILITY NORTH SLOPE, ALASKA</p>	<p>DOCUMENT TITLE: AIR COOLED HEAT EXCHANGER DATA SHEET EAC-Z6021 1st STAGE DISCHARGE COOLER</p>
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 <p>WorleyParsons resources & energy</p> <p>DATA SHEET</p>	<p>JOB NUMBER 10741208</p>	<p>EPT NUMBER 36324250</p>	<p>DOCUMENT NUMBER DAS-HT-WPZ-00007-001</p>	<p>SHEET OF 1 5</p>	<p>REV D</p>
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REVISIONS	NO	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO	DATE	BY	CK	APP	DESCRIPTION														
						See sheet 1																					
Service		1st STAGE DISCHARGE COOLER					Item No.	EAC-Z6021																			
Type		Fully Winterized with Header End Recirculation					Req No.	HT-1300-001																			
Mfr Type No. & Size		GEA Rainey Corporation - Model 6-1440T144 Δ					Vendor																				
Plot Area/Bay		13.25' X 61'		Total Plot Area		79.5' X 61'		Induced / Forced Draft			No. of Bays	Six															
Surface per Unit - Finned Tube		504,420					sq ft Bare Tube	26,301 sq ft																			
Heat Exchanged		78,983,966 (Note 14)					Btu/hr	MTD (Eff.)		47.73 Δ		°F															
Transfer Rate - Finned Tube		3.45 Δ		Bare Tube, Service		66.1 Δ		Clean	79.5 Δ		Btu/hr sq ft °F																
PERFORMANCE DATA																											
TUBE SIDE																											
Fluid Circulated		1st Stage Compressor Discharge					Gravity, Liq	(See sheet 3)					LBS / FT ³														
Total Fluid Entering		1,041,632					lb/hr	Hydrate Formation Temp.		61.0 Δ		°F															
Temperature		°F		219.3		OUT		80		Bubble Point		°F		Dew Point °F													
Liquid		lb/hr		Δ		254		Specific Heat (See sht 3)		Btu/lb °F @		°F															
Vapor		lb/hr		MW		1,041,632		21.91		Δ		1,039,540		21.91		Cond (Liq/Vap) (See sht 3)		Btu /hr sq ft °F@		°F							
Noncond		lb/hr		MW						Inlet Pressure		Δ		731.2		psig											
Steam		lb/hr								Allowable Pressure Drop		10		psi													
Water		lb/hr								Calc Pressure Drop		5.7		psi													
Viscosity (Liq/Vap)		cP		-- / 0.015		Δ		1.11 / 0.013		Fouling Resistance, inside		0.002															
AIR SIDE																											
Air Quantity		6,346,000 Δ					(lb/hr) (SCFM)	Altitude		50		ft															
Air Quantity/Fan							ACFM	Temperature In		60		°F															
Static Pressure							in. water	Temperature Out		Δ		114.5															
Face Velocity		530		fpm (Std)		Mass Velocity		lb/hr sq ft		Minimum Ambient Temperature		-50															
DESIGN - MATERIALS - CONSTRUCTION																											
Design Pressure		1,100		psig		Test Pressure		Per Code		psig		Design Temperature Δ		350 / -50 MDMT		°F											
TUBE BUNDLE		HEADER					TUBE																				
Size		13.2' X 40'		No. of Tube Rows		6		Type		Plug		Material				304 Stainless Steel											
No./Bay		One						Material		SA-240-304L		ASME		SA-213			seamless /-welded										
Arrangement -		Bundles		1		In Parallel		1		In Series		Passes - No.		3		Arrangement:		OD		1.25		in.		Min. Thickness		0.109	
Bays		1		In Parallel		1		In Series		Plug - Design		Shoulder		No./Bundle *		342		Length		40			ft				
Bundle Frame		Galvanized					Gasket Material		*					FIN													
MISCELLANEOUS		Corrosion Allowance					0		in.		Type		Extruded														
Structure Mounting		On module roof					Size of Inlet Nozzle		2 - 8"		in.		Material		Aluminum												
Surface Preparation		Prime / Galvanized					Size of Outlet Nozzle		2 - 8"		in.		OD		2.5		in.		Stock Thickness			*					
Louvers		Req'd - Full Winterization					Rating & Facing		900# RTJ		No./in.		10														
Code		ASME VIII, Div.1		Stamp		Yes & Nat. Board Reg.		Specs		SPC-HT-00003 & Latest edition of API 661																	
MECHANICAL EQUIPMENT																											
Fan (Notes 3, 4)		*		Tip Speed		Driver Item No. Δ		MFN-Z6021 A1-A6, B1-B6		Speed Reducer		Flanged Sprocket Belt Driven															
Mfr & Model		Moore 5000-49VT				Motor (Note 10)		Turbine		Type		Gates PowerGrip GT2															
No./Bay		Two		hp/Fan		17.3 Δ		No./Bay		Two		hp/Driver		25		No./Bay		Two									
Diameter		12		ft		rpm		259		rpm		VFD Rated		Model				3850-14MGT-40									
No. Blades		6		Pitch		100% Adj		Man. Auto		Elec. Supply		480 V, 3 phase, 60 Hz		AGMA hp Rating		2.0 Service Factor											
Blade Material		Aluminum		Angle		7 Deg.		Enclosure		TEFC				Ratio		6.76:1											
Hub Material		*					Mfr		Reliance		Mfr		Gates														
Control Action on Air Failure - Fan Pitch		N/A					Min/Max, Louvers		Open/Closed/Remain in last position																		
Notes:														* Give tube count of each pass when irregular.		No. of tube row(s) per pass : 2											
(1) Typical winterization layout and controls are shown on pages 4 & 5.																											
(2) Both motor and fan drive sheaves shall be flanged for belt retention.																											
(3) Each fan shall be equipped with one Bently Nevada Velomiter, BN 190501, CT, velocity transducer. The Vendor shall provide a common junction box for each bay. The Velomiters shall be wired to the junction box with interconnecting cable CB2W100-AXXX. The junction box shall be mounted on the air cooler support structure in an easily accessible location.																											
(4) Limit sound pressure level to 85 dBA (max.), measured at 3 feet below fan guard.																											
(5) Last pass of the tube bundle shall be sloped 0.125 in/ft toward the outlet connection.																											
(6) One Vent and Drain shall be provided on each header. Vent and Drain shall be 1" 900# RTJ LWN.																											
(7) Louvers shall be opposed action type. The louvers for each half bay shall be independently controllable and shall have dedicated actuators for control of plenum temperature. Δ																											
(8) Structural Steel shall be Low Temp. Carbon Steel with impact tests per Spec. requirements of CVN 15 ft-lb @ -50°F, (12 ft-lb min.).																											
(9) Exchanger shall be shoe box design to facilitate shipping and assembly and shall be trial fit at the Vendor's shop.																											
(10) Motor shall be VFD Rated, Class 1, Div 2, Temp T3. Motors will be listed and labeled CSA-US. VFD by others. Δ																											
(11) All instruments shall be NRTL labeled for Class 1, Div 2, Group D Δ																											
(12) Materials in contact with the process fluid shall meet the requirements of NACE MR0175.																											
(13) Two interconnecting walkways shall be provided between the header walkways. One interconnecting walkway shall be located at each end of the unit. Stairway access to the header shall be provided by others.																											
(14) Design basis: Process data sheet DAS-TD-EAC-Z6021, Rev. E Δ																											
* Vendor to specify																											
 WorleyParsons resources & energy Data Sheet		BP EXPLORATION (ALASKA) INC. 1st STAGE DISCHARGE COOLER EAC-Z6021 AIR COOLED HEAT EXCHANGER DATA SHEET						SHEET OF 2 5		JOB NUMBER 10741208																	
		DOCUMENT NUMBER DAS-HT-WPZ-00007-001						REV D																			

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REVISIONS	NO	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO	DATE	BY	CK	APP	DESCRIPTION
								See sheet 1					

HEAT RELEASE CURVE AND PHYSICAL PROPERTIES:

Pressure	Temp.	Heat Flow	Enthalpy	Vapor Fraction	Liquid Fraction
psig	°F	MMBtu/hr	Btu/lb	mass basis	mass basis
731.2	219.3	-2133.4	-2222.2	1.000	---
730.4	201.9	-2142.6	-2231.8	1.000	---
729.5	184.5	-2151.8	-2241.4	1.000	---
728.7	167.1	-2161.0	-2251.0	1.000	---
727.8	149.7	-2170.1	-2260.5	1.000	---
727.0	132.2	-2179.3	-2270.1	1.000	---
726.1	114.8	-2189.0	-2280.2	1.000	0.000
725.3	97.4	-2199.2	-2290.8	0.999	0.001
724.4	80.0	-2209.2	-2301.2	0.998	0.002

Mass Flow Vapor	Enthalpy Vapor	Density Vapor	Specific Heat Vapor	Thermal Cond. Vapor	Viscosity Vapor
lb/hr	BTU/lb	lb/ft ³	Btu/lb °F	Btu / h ft °F	cP
1,041,632	-2,133.4	2.404	0.533	0.025	0.015
1,041,632	-2,142.6	2.484	0.530	0.024	0.015
1,041,632	-2,151.8	2.571	0.529	0.024	0.015
1,041,632	-2,161.0	2.666	0.528	0.023	0.014
1,041,632	-2,170.1	2.770	0.529	0.022	0.014
1,041,632	-2,179.3	2.885	0.530	0.022	0.014
1,041,163	-2,187.0	3.014	0.534	0.021	0.014
1,040,326	-2,193.4	3.159	0.539	0.020	0.013
1,039,540	-2,201.3	3.323	0.548	0.020	0.013

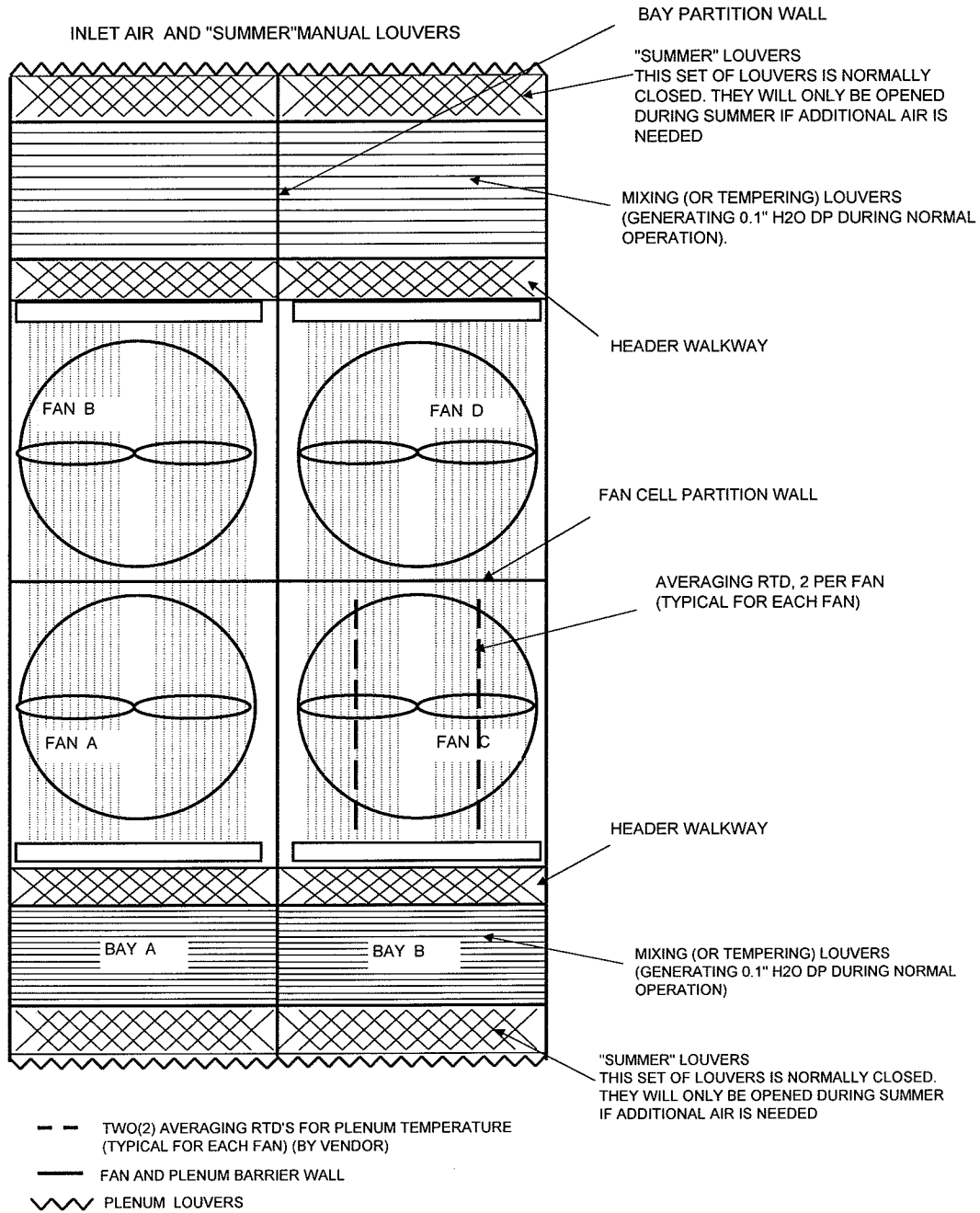
Mass Flow Liquid	Enthalpy Liquid	Density Liquid	Specific Heat Liquid	Thermal Cond. Liquid	Viscosity Liquid
lb/hr	BTU/lb	lb/ft ³	Btu/lb °F	Btu / h ft °F	cP
---	---	---	---	---	---
---	---	---	---	---	---
---	---	---	---	---	---
---	---	---	---	---	---
---	---	---	---	---	---
---	---	---	---	---	---
469.6	-6755.0	62.0	1.000	0.368	0.622
1306.8	-6770.7	62.5	1.004	0.361	0.735
2092.6	-6107.6	60.3	0.973	0.281	1.114

From Process Data Sheet Rev. E, 9/5/08

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REVISIONS	NO	DATE	BY	CK	APP	DESCRIPTION	REVISIONS	NO	DATE	BY	CK	APP	DESCRIPTION
								See sheet 1					

TYPICAL WINTERIZED COOLER WITH AIR FLOW BARRIER WALLS & MIXING PLENUMS



- NOTES:
- 1) Minimum thickness of galvanized steel sheet used in construction of internal 'unexposed' plenums shall be 14 gauge USS per API. Minimum thickness of galvanized steel sheet material used for construction of external exposed plenums shall be 7 gauge USS.
 - 2) Each cooler bay shall have its own independent support structure. No shared columns.
 - 3) Refer to Winterization Scheme - Elevation for end plenum details.



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Data Sheet

BP EXPLORATION (ALASKA) INC.
1st STAGE DISCHARGE COOLER

EAC-Z6021

AIR COOLED HEAT EXCHANGER DATA SHEET

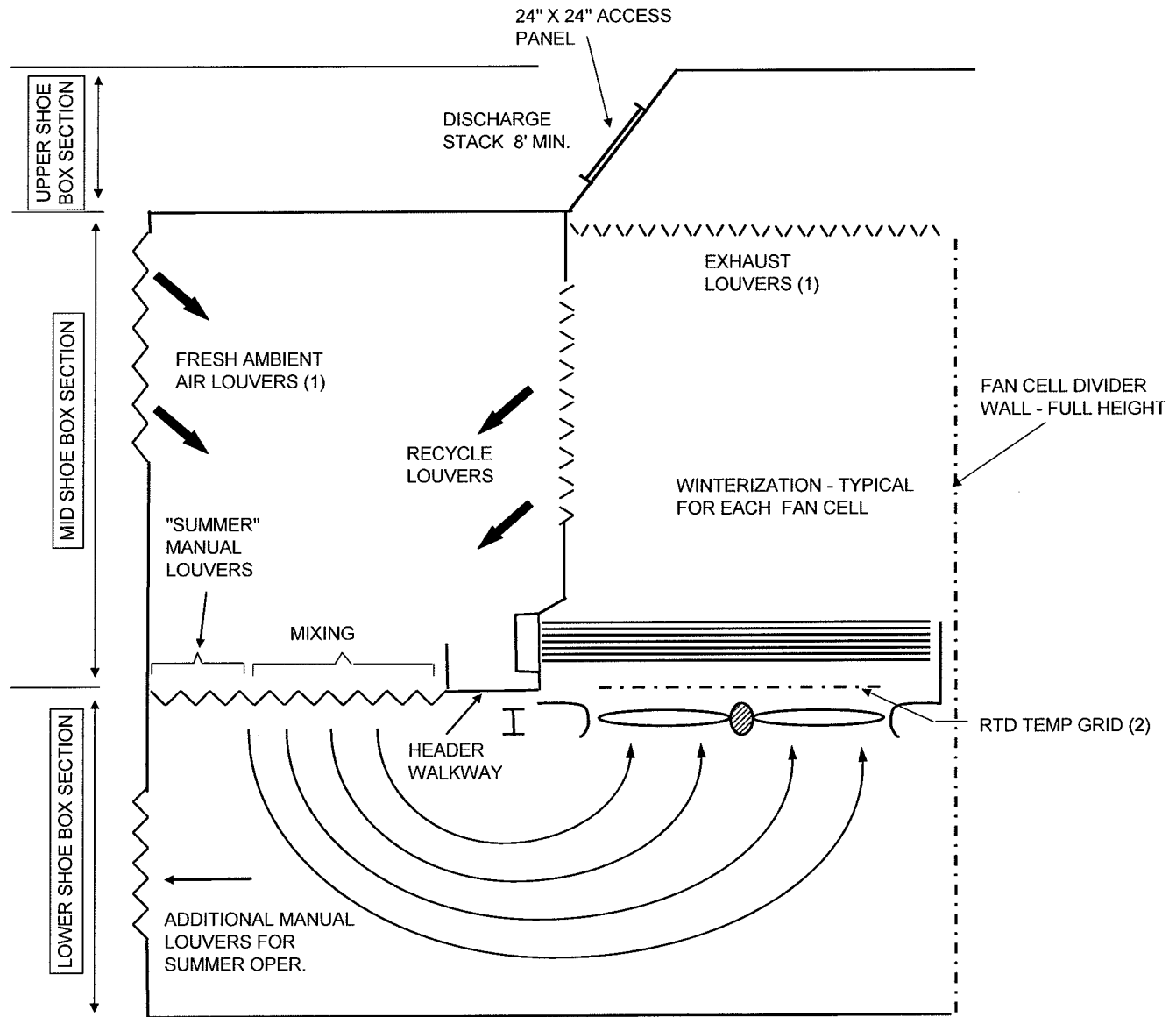
SHEET OF JOB NUMBER
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DOCUMENT NUMBER
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								See sheet 1					



WINTERIZATION - TYPICAL FOR EACH FAN CELL AND END PLENUM

NOTES:

- 1) Louvers control by Fisher 481 piston type actuators with FSDVC6010-100/AC positioners and 377L Series trip valves. All actuators are to be accessible from inside plenums for maintenance. Heat boxes shall be included to maintain 40°F with -50°F ambient temperature.
- 2) The louver actuators shall be fail last. For ease of manual handwheel operation, each piston chamber shall be provided with a 3-way vent valve.
- 3) The exhaust louver actuators shall be provided with open/closed limit switches.
- 4) Provide two(2) 3-wire averaging RTD (AllTemp Sensor model ATS-6309-S1) per fan for air temperature control.
- 5) Full plenum floors of 1/4" checker-plate shall be provided.
- 6) The Shoe box design concept includes sparate shippable "Shoe Box" shaped sections. Three sections are shown to illustrate the general concept, final configuration to be provided by Supplier. The sections are shipped loose and assembled at the destination point to complete the Air Cooled Heat Exchanger. The height of each section shall exceed the maximum shipping height on the route to the module fabrication site. Final assembly to be done by others.
- 7) The exchanger shall be supplied with ladder and platform access to the discharge stacks. Each stack shall be provided with a 24" x 24" access panel.



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Data Sheet

BP EXPLORATION (ALASKA) INC.
1st STAGE DISCHARGE COOLER
EAC-Z6021
AIR COOLED HEAT EXCHANGER DATA SHEET

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DOCUMENT NUMBER			
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