

## DOCKETED

<b>Docket Number:</b>	12-AFC-02C
<b>Project Title:</b>	Huntington Beach Energy Project - Compliance
<b>TN #:</b>	210732
<b>Document Title:</b>	Supplemental Information to TN 206858 regarding fin fan cooler data
<b>Description:</b>	N/A
<b>Filer:</b>	Marichka Haws
<b>Organization:</b>	California Energy Commission
<b>Submitter Role:</b>	Commission Staff
<b>Submission Date:</b>	3/15/2016 1:57:05 PM
<b>Docketed Date:</b>	3/15/2016



# API 661 Air-Cooled Heat Exchanger - Specification Sheet

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 Date 2/10/2015  
 Proposal No. \_\_\_\_\_  
 Inquiry No. \_\_\_\_\_

Item No. \_\_\_\_\_  
 By \_\_\_\_\_  
 Revision \_\_\_\_\_  
 Contract No. \_\_\_\_\_  
 Order No. \_\_\_\_\_

Manufacturer	_____	Heat exchanged (Btu/hr)	1.09e+8
Model no.	_____	Surface/Item-Finned tube (ft2)	1569057
Customer	_____	Bare tube (ft2)	73107
Plant location	_____	MTD, Eff. (Deg. F)	13.2
Service	_____	Transfer rate-Finned (Btu/ft2-hr-F)	5.288
Type draft	FORCED	Bare tube, service (Btu/ft2-hr-F)	113.49
Bay size (WxL) (ft)	13.573 x 50.000	Bare tube, clean (Btu/ft2-hr-F)	121.31
No. of bays/Items	14		

## Basic design data

Pressure design code	_____	Structural code	_____
Tube bundle code stamped	_____	Flammable service	_____
Heating coil code stamped	_____	Lethal/toxic service	_____

## Performance Data - Tube Side

Fluid name	20%PG				
Total fluid entering (lb/hr)	3400000	Total flow rate (Liq/Vap) (lb/hr)	In 3400000 / 0.0	Out 3400000 / 0.0	
Dew/bubble point (Deg. F)	/	Water/Steam (lb/hr)	0.0 / 0.0	0.0 / 0.0	
(Deg. F)		Noncondensables (lb/hr)	0.0	0.0	
Latent heat (Btu/lb)		Molecular Wt. (Vap/Non-cond)	/	/	
Inlet pressure (psia)	65.000	Density (Liq/Vap) (lb/ft3)	63.047 /	63.481 /	
Pressure drop (All/Calc) (psi)	13.000 / 4.754	Specific heat (Liq/Vap) (Btu/lb-F)	0.9751 /	0.9707 /	
Velocity (Allow/Calc) (ft/sec)	/ 2.50	Thermal cond. (Liq/Vap) (Btu/hr-ft-F)	0.2949 /	0.2851 /	
Inside fouling resistance (ft2-hr-F/Btu)	0.00050	Viscosity (Liq/Vap) (cP)	1.0764 /	1.7873 /	
	In Out				
Temperature (Deg. F)	105.70	72.80			

## Performance Data - Air Side

Air inlet temperature (Deg. F)	65.80	Face velocity (SFPM)	645.00
Air flow rate/item (SCFM)	6099953	Minimum design ambient temp. (Deg. F)	15.80
Mass velocity (lb/hr-ft2)		Altitude (ft)	20.000
Air outlet temperature (Deg. F)	82.20	Static pressure (inH2O)	0.588
Air flow rate/fan (ACFM)	217467		

## Design, Material, and Construction

Design pressure (psig)	_____	<b>Heating Coil</b>	
Test pressure (psig)	_____	No. of tubes	_____
Design temperature (Deg. F)	_____	Tube outside diameter (inch)	_____
Min. design metal temp. (Deg. F)	_____	Tube material	_____
<b>Tube bundle</b>		Fin material and type	_____
Size (WxL) (ft)	13.510 X 50.000	Fin thickness (inch)	_____
No./Bay	1	ASME Code, Sec. VIII, Div. 1	_____
Number of tube rows	6	Heating fluid	_____
Bundles in parallel	14	Heating fluid flow rate (lb/hr)	_____
Bundles in series	_____	Temperature (In/Out) (Deg. F)	_____ / _____
Structure mounting	_____	Inlet pressure (psia)	_____
Pipe rack beams	_____	Pressure drop (All/Calc) (psi)	_____ / _____
Ladders, walkways, platforms	_____	Design temperature (Deg. F)	_____
Structure surface prep.	_____	Design pressure (psia)	_____
Header surface prep.	_____	Inlet/Outlet nozzle	_____ / _____
<b>Louver</b>		<b>Header</b>	
Material	_____	Type	_____
Action control	_____	Material	_____
Action type	_____	Corrosion Allowance (inch)	_____
		No. of passes	4



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**Design, Material, and Construction (continued)**

<b>Header (continued)</b>				No./Bundle	405
Slope	_____	Length	(ft)	50.000	
Plug material	_____	Pitch	(inch)	2.3750	
Gasket material	_____	Layout		Triangular	
<b>Nozzle</b>	No.	Size, (inch)	Rating/Facing	<b>Fin</b>	
Inlet	1	6.0000	_____	Type	Circular
Outlet	1	6.0000	_____	Material	Aluminum 1060 - H14
Vent	_____	_____	_____	Thickness	(inch) 0.0160
Drain	_____	_____	_____	Selection temp.	(F) _____
Chemical Cleaning	_____	_____	_____	Outside diameter	(inch) 2.2500
Min. Wall Thk.	_____	_____	_____	Fin density	(fin/inch) 10.0
<b>Tube</b>				ASME Code, Sec. VIII, Div. 1	_____
Material	_____	_____	Carbon steel	Customer Specifications	_____
Tube outside diameter	(inch)	_____	1.0000		
Average wall thickness	(inch)	_____	0.0600		

**Mechanical Equipment**

<b>Fan</b>				RPM	_____
Manufacturer	_____	Unknown Manufacturer	_____	Service factor	_____
No./Bay	_____	_____	2	Enclosure	_____
RPM	(Revs/min.)	_____	0.0000	Voltage	_____
Diameter	(ft)	_____	13.000	Phase	_____
No. of blades	_____	_____	_____	Cycle	_____
Angle	(degrees)	_____	_____	Fan noise level	(dB) _____
Pitch adjustment	_____	_____	_____	<b>Speed Reducer</b>	
Blade material	_____	_____	_____	Type	_____
Hub material	_____	_____	_____	Manufacturer	_____
BHP @ design temp	_____	_____	_____	No./Bay	_____
BHP @ min. ambient temp	_____	_____	_____	Service factor	_____
Tip speed	_____	_____	_____	Speed ratio	_____
<b>Driver</b>				Support	_____
Type	_____	_____	_____	Vib. switch	_____
Manufacturer	_____	_____	_____	Enclosure	_____
No./Bay	_____	_____	_____		
Driver	(hp)	_____	34.48		

**Controls - Air Side**

Air recirculation	_____	Louvers	_____
Degree control of outlet process temp.	_____	Positioner	_____
(Max. Cooling), +/-	_____ / _____	Signal air pressure (psia)	_____
Action on control signal failure	_____	From	_____ To _____
Fan pitch	_____	From	_____ To _____
Louvers	_____	Supply air pressure (psia)	_____
Actuator air supply	_____	From	_____ To _____
Fan	_____	From	_____ To _____

**Shipping**

Plot area (WxL)	(ft)	13.573 x 50.000	Total	(lb)	798558
Bundle weight	(lb)	33706	Shipping	(lb)	_____
Bay	(lb)	_____			



# API 661 Air-Cooled Heat Exchanger - Specification Sheet

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 By \_\_\_\_\_  
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Manufacturer	_____	Heat exchanged (Btu/hr)	1.10e+8
Model no.	_____	Surface/Item-Finned tube (ft2)	657889
Customer	_____	Bare tube (ft2)	30653
Plant location	_____	MTD, Eff. (Deg. F)	37.5
Service	_____	Transfer rate-Finned (Btu/ft2-hr-F)	5.244
Type draft	FORCED	Bare tube, service (Btu/ft2-hr-F)	112.54
Bay size (WxL) (ft)	13.573 x 21.400	Bare tube, clean (Btu/ft2-hr-F)	120.23
No. of bays/Items	14		

### Basic design data

Pressure design code	_____	Structural code	_____
Tube bundle code stamped	_____	Flammable service	_____
Heating coil code stamped	_____	Lethal/toxic service	_____

### Performance Data - Tube Side

Fluid name	20%PG						
Total fluid entering (lb/hr)	3400000	Total flow rate (Liq/Vap) (lb/hr)	In 3400000 / 0.0	Out 3400000 / 0.0			
Dew/bubble point (Deg. F)	/	Water/Steam (lb/hr)	0.0 / 0.0	0.0 / 0.0			
(Deg. F)		Noncondensables (lb/hr)	0.0	0.0			
Latent heat (Btu/lb)		Molecular Wt. (Vap/Non-cond)	/	/			
Inlet pressure (psia)	65.000	Density (Liq/Vap) (lb/ft3)	63.044 /	63.481 /			
Pressure drop (All/Calc) (psi)	13.000 / 2.450	Specific heat (Liq/Vap) (Btu/lb-F)	0.9752 /	0.9707 /			
Velocity (Allow/Calc) (ft/sec)	/ 2.50	Thermal cond. (Liq/Vap) (Btu/hr-ft-F)	0.2950 /	0.2851 /			
Inside fouling resistance (ft2-hr-F/Btu)	0.00050	Viscosity (Liq/Vap) (cP)	1.0722 /	1.7873 /			
	In Out						
Temperature (Deg. F)	106.00 72.80						

### Performance Data - Air Side

Air inlet temperature (Deg. F)	32.00	Face velocity (SFPM)	645.00
Air flow rate/item (SCFM)	2610780	Minimum design ambient temp. (Deg. F)	15.80
Mass velocity (lb/hr-ft2)		Altitude (ft)	20.000
Air outlet temperature (Deg. F)	70.85	Static pressure (inH2O)	0.583
Air flow rate/fan (ACFM)	86835		

### Design, Material, and Construction

Design pressure (psig)	_____	<b>Heating Coil</b>	
Test pressure (psig)	_____	No. of tubes	_____
Design temperature (Deg. F)	_____	Tube outside diameter (inch)	_____
Min. design metal temp. (Deg. F)	_____	Tube material	_____
<b>Tube bundle</b>		Fin material and type	_____
Size (WxL) (ft)	13.510 X 21.400	Fin thickness (inch)	_____
No./Bay	1	ASME Code, Sec. VIII, Div. 1	_____
Number of tube rows	6	Heating fluid	_____
Bundles in parallel	14	Heating fluid flow rate (lb/hr)	_____
Bundles in series	_____	Temperature (In/Out) (Deg. F)	_____ / _____
Structure mounting	_____	Inlet pressure (psia)	_____
Pipe rack beams	_____	Pressure drop (All/Calc) (psi)	_____ / _____
Ladders, walkways, platforms	_____	Design temperature (Deg. F)	_____
Structure surface prep.	_____	Design pressure (psia)	_____
Header surface prep.	_____	Inlet/Outlet nozzle	_____ / _____
<b>Louver</b>		<b>Header</b>	
Material	_____	Type	_____
Action control	_____	Material	_____
Action type	_____	Corrosion Allowance (inch)	_____
		No. of passes	4



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**Design, Material, and Construction (continued)**

<b>Header (continued)</b>				No./Bundle	405
Slope	_____	Length	(ft)	21.400	
Plug material	_____	Pitch	(inch)	2.3750	
Gasket material	_____	Layout		Triangular	
<b>Nozzle</b>				<b>Fin</b>	
Inlet	No.	Size, (inch)	Rating/Facing	Type	Circular
Outlet	1	6.0000	_____	Material	Aluminum 1060 - H14
Vent	1	6.0000	_____	Thickness	(inch) 0.0160
Drain	_____	_____	_____	Selection temp.	(F) _____
Chemical Cleaning	_____	_____	_____	Outside diameter	(inch) 2.2500
Min. Wall Thk.	_____	_____	_____	Fin density	(fin/inch) 10.0
<b>Tube</b>				ASME Code, Sec. VIII, Div. 1	_____
Material	_____	_____	Carbon steel	Customer Specifications	_____
Tube outside diameter	(inch)	_____	1.0000	_____	_____
Average wall thickness	(inch)	_____	0.0600	_____	_____

**Mechanical Equipment**

<b>Fan</b>				RPM	_____
Manufacturer	_____	Unknown Manufacturer	_____	Service factor	_____
No./Bay	_____	2	_____	Enclosure	_____
RPM	(Revs/min.)	_____	0.0000	Voltage	_____
Diameter	(ft)	_____	13.000	Phase	_____
No. of blades	_____	_____	_____	Cycle	_____
Angle	(degrees)	_____	_____	Fan noise level	(dB) _____
Pitch adjustment	_____	_____	_____	<b>Speed Reducer</b>	
Blade material	_____	_____	_____	Type	_____
Hub material	_____	_____	_____	Manufacturer	_____
BHP @ design temp	_____	_____	_____	No./Bay	_____
BHP @ min. ambient temp	_____	_____	_____	Service factor	_____
Tip speed	_____	_____	_____	Speed ratio	_____
<b>Driver</b>				Support	_____
Type	_____	_____	_____	Vib. switch	_____
Manufacturer	_____	_____	_____	Enclosure	_____
No./Bay	_____	_____	_____	_____	_____
Driver	(hp)	_____	11.14	_____	_____

**Controls - Air Side**

Air recirculation	_____	Louvers	_____
Degree control of outlet process temp.	_____	Positioner	_____
(Max. Cooling), +/-	_____ / _____	Signal air pressure (psia)	_____
Action on control signal failure	_____	From	_____ To _____
Fan pitch	_____	From	_____ To _____
Louvers	_____	Supply air pressure (psia)	_____
Actuator air supply	_____	From	_____ To _____
Fan	_____	From	_____ To _____

**Shipping**

Plot area (WxL)	(ft)	13.573 x 21.400	Total	(lb)	430864
Bundle weight	(lb)	15950	Shipping	(lb)	_____
Bay	(lb)	_____	_____	_____	_____



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 By \_\_\_\_\_  
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Manufacturer	_____	Heat exchanged (Btu/hr)	<u>1.10e+8</u>
Model no.	_____	Surface/Item-Finned tube (ft2)	<u>1569057</u>
Customer	_____	Bare tube (ft2)	<u>73107</u>
Plant location	_____	MTD, Eff. (Deg. F)	<u>13.3</u>
Service	_____	Transfer rate-Finned (Btu/ft2-hr-F)	<u>5.751</u>
Type draft	<u>FORCED</u>	Bare tube, service (Btu/ft2-hr-F)	<u>123.42</u>
Bay size (WxL) (ft)	<u>13.573 x 50.000</u>	Bare tube, clean (Btu/ft2-hr-F)	<u>132.73</u>
No. of bays/Items	<u>14</u>		

## Basic design data

Pressure design code	_____	Structural code	_____
Tube bundle code stamped	_____	Flammable service	_____
Heating coil code stamped	_____	Lethal/toxic service	_____

## Performance Data - Tube Side

Fluid name	<u>20%PG</u>				
Total fluid entering (lb/hr)	<u>3400000</u>	Total flow rate (Liq/Vap) (lb/hr)	<u>3400000</u> / <u>0.0</u>	<u>3400000</u> / <u>0.0</u>	
Dew/bubble point (Deg. F)	_____ / _____	Water/Steam (lb/hr)	<u>0.0</u> / <u>0.0</u>	<u>0.0</u> / <u>0.0</u>	
Latent heat (Btu/lb)	_____	Noncondensables (lb/hr)	<u>0.0</u>	<u>0.0</u>	
Inlet pressure (psia)	<u>65.000</u>	Molecular Wt. (Vap/Non-cond)	_____ / _____	_____ / _____	
Pressure drop (All/Calc) (psi)	<u>13.000</u> / <u>4.256</u>	Density (Liq/Vap) (lb/ft3)	<u>62.488</u> / _____	<u>62.924</u> / _____	
Velocity (Allow/Calc) (ft/sec)	_____ / <u>2.52</u>	Specific heat (Liq/Vap) (Btu/lb-F)	<u>0.9818</u> / _____	<u>0.9769</u> / _____	
Inside fouling resistance (ft2-hr-F/Btu)	<u>0.00050</u>	Thermal cond. (Liq/Vap) (Btu/hr-ft-F)	<u>0.3084</u> / _____	<u>0.2983</u> / _____	
		Viscosity (Liq/Vap) (cP)	<u>0.6636</u> / _____	<u>0.9339</u> / _____	
Temperature (Deg. F)	In <u>150.00</u> Out <u>117.00</u>				

## Performance Data - Air Side

Air inlet temperature (Deg. F)	<u>110.00</u>	Face velocity (SFPM)	<u>645.00</u>
Air flow rate/item (SCFM)	<u>6099953</u>	Minimum design ambient temp. (Deg. F)	<u>15.80</u>
Mass velocity (lb/hr-ft2)	_____	Altitude (ft)	<u>20.000</u>
Air outlet temperature (Deg. F)	<u>126.26</u>	Static pressure (inH2O)	<u>0.655</u>
Air flow rate/fan (ACFM)	<u>238733</u>		

## Design, Material, and Construction

Design pressure (psig)	_____	<b>Heating Coil</b>	
Test pressure (psig)	_____	No. of tubes	_____
Design temperature (Deg. F)	_____	Tube outside diameter (inch)	_____
Min. design metal temp. (Deg. F)	_____	Tube material	_____
<b>Tube bundle</b>		Fin material and type	_____
Size (WxL) (ft)	<u>13.510 X 50.000</u>	Fin thickness (inch)	_____
No./Bay	<u>1</u>	ASME Code, Sec. VIII, Div. 1	_____
Number of tube rows	<u>6</u>	Heating fluid	_____
Bundles in parallel	<u>14</u>	Heating fluid flow rate (lb/hr)	_____
Bundles in series	_____	Temperature (In/Out) (Deg. F)	_____ / _____
Structure mounting	_____	Inlet pressure (psia)	_____
Pipe rack beams	_____	Pressure drop (All/Calc) (psi)	_____ / _____
Ladders, walkways, platforms	_____	Design temperature (Deg. F)	_____
Structure surface prep.	_____	Design pressure (psia)	_____
Header surface prep.	_____	Inlet/Outlet nozzle	_____ / _____
<b>Louver</b>		<b>Header</b>	
Material	_____	Type	_____
Action control	_____	Material	_____
Action type	_____	Corrosion Allowance (inch)	_____
		No. of passes	<u>4</u>



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**Design, Material, and Construction (continued)**

<b>Header (continued)</b>				No./Bundle	405
Slope	_____	Length	(ft)	50.000	
Plug material	_____	Pitch	(inch)	2.3750	
Gasket material	_____	Layout		Triangular	
<b>Nozzle</b>	No.	Size, (inch)	Rating/Facing	<b>Fin</b>	
Inlet	1	6.0000	_____	Type	Circular
Outlet	1	6.0000	_____	Material	Aluminum 1060 - H14
Vent	_____	_____	_____	Thickness	(inch) 0.0160
Drain	_____	_____	_____	Selection temp.	(F) _____
Chemical Cleaning	_____	_____	_____	Outside diameter	(inch) 2.2500
Min. Wall Thk.	_____	_____	_____	Fin density	(fin/inch) 10.0
<b>Tube</b>				ASME Code, Sec. VIII, Div. 1	_____
Material	_____	_____	Carbon steel	Customer Specifications	_____
Tube outside diameter	(inch)	_____	1.0000		
Average wall thickness	(inch)	_____	0.0600		

**Mechanical Equipment**

<b>Fan</b>				RPM	_____
Manufacturer	_____	Unknown Manufacturer	_____	Service factor	_____
No./Bay	_____	_____	2	Enclosure	_____
RPM	(Revs/min.)	_____	0.0000	Voltage	_____
Diameter	(ft)	_____	13.000	Phase	_____
No. of blades	_____	_____	_____	Cycle	_____
Angle	(degrees)	_____	_____	Fan noise level	(dB) _____
Pitch adjustment	_____	_____	_____	<b>Speed Reducer</b>	
Blade material	_____	_____	_____	Type	_____
Hub material	_____	_____	_____	Manufacturer	_____
BHP @ design temp	_____	_____	_____	No./Bay	_____
BHP @ min. ambient temp	_____	_____	_____	Service factor	_____
Tip speed	_____	_____	_____	Speed ratio	_____
<b>Driver</b>				Support	_____
Type	_____	_____	_____	Vib. switch	_____
Manufacturer	_____	_____	_____	Enclosure	_____
No./Bay	_____	_____	_____		
Driver	(hp)	_____	42.02		

**Controls - Air Side**

Air recirculation	_____	Louvers	_____
Degree control of outlet process temp.	_____	Positioner	_____
(Max. Cooling), +/-	_____ / _____	Signal air pressure (psia)	_____
Action on control signal failure	_____	From	_____ To _____
Fan pitch	_____	From	_____ To _____
Louvers	_____	Supply air pressure (psia)	_____
Actuator air supply	_____	From	_____ To _____
Fan	_____	From	_____ To _____

**Shipping**

Plot area (WxL)	(ft)	13.573 x 50.000	Total	(lb)	799398
Bundle weight	(lb)	33706	Shipping	(lb)	_____
Bay	(lb)	_____			