

REV
#

Energy Exchanger Company

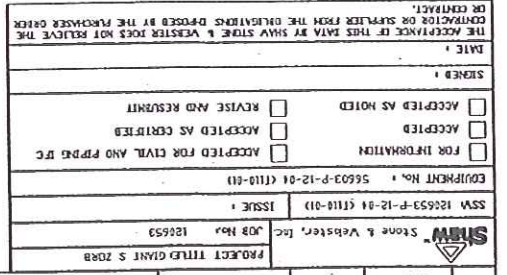
HEAT EXCHANGER SPECIFICATION SHEET

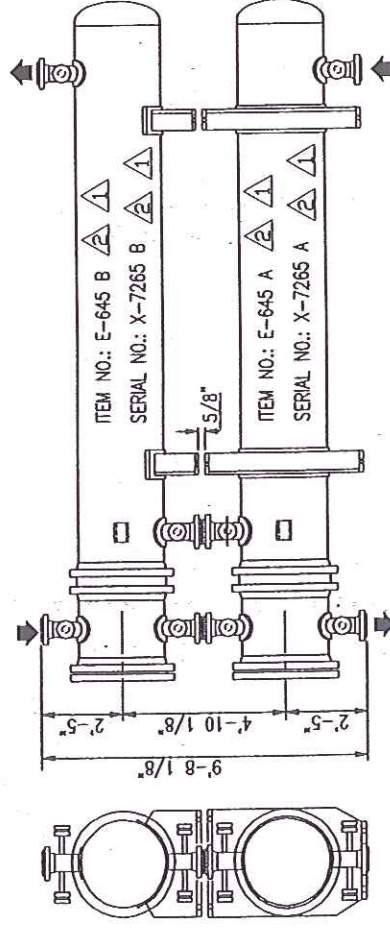
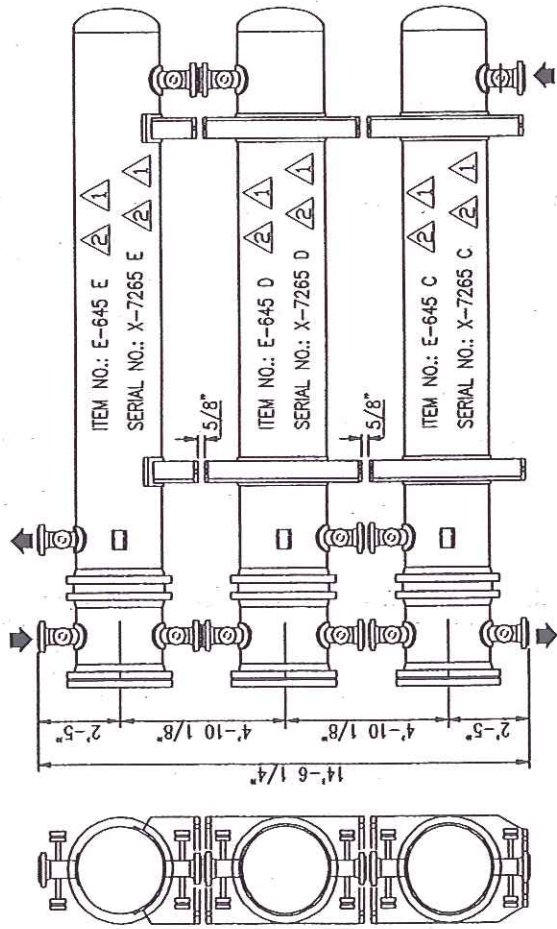


P.O. No.: 56603-P-12-04

REV. 0 AS PURCHASED

1	3	Customer	SHAW STONE & WEBSTER (GIANT)				Job No.: X-7265 "AS BUILT"					
1	4	Address	HOUSTON, TX				Rev.: 1		Date: 3/13/07			
	5	Plant Location	GRAFTON, VA				File:		06-6102			
	6	Service of Unit	DEBUTANIZER FEED/BOTTOMS EXCHANGER				Item: E-645 A/B/C/D/E					
	7	Size	34-240	Type	AEU	Horizontal	Connected In	1	Parallel	5	Series	
	8	Surf./Unit	Gross / ☒ Eff	14164.78 ft ² /Unit		5	Surf./Shell	Gross ☒ Eff.	2832.96 ft ²			
	9	PERFORMANCE OF ONE UNIT										
	10	Fluid Allocation	Shell Side				Tube Side					
	11	Fluid Name	DEBUTANIZER FEED				DEBUTANIZER BOTTOMS					
	12	Fluid Quantity, Total	lb/hr	312999				297443				
	13	Vapor (In/Out)		19071								
	14	Liquid		312999	293928				297443	297443		
	15	Steam										
	16	Water										
	17	Noncondensable										
	18	Temperature (In/Out)	°F	121.	349.0				406.	170.		
	19	Density (Vapor/Liquid)	Lb/Ft ³	42.95	2.3600	34.11	31.47		41.97			
	20	Viscosity	cP	0.331	0.0130	0.124	0.10		0.284			
	21	Molecular Weight										
	22	Molecular Weight, Noncondensable										
	23	Specific Heat	Btu/lb-F	0.5160	0.5930	0.714	0.7960		0.5430			
	24	Thermal Conductivity	Btu/hr-ft-F	0.0660	0.0200	0.047	0.0440		0.0610			
	25	Latent Heat	Btu/lb									
	26	Inlet Pressure	psia	291.7				269.7				
	27	Velocity	ft/sec					3.41				
	28	Pressure Drop, Allow./Calc.	psi	25.00	/	19.00	25.00		/	8.00		
	29	Fouling Resistance (Min.)	Hr-Ft ² -°F/Btu	0.002				0.002				
	30	Heat Exchanged	45260000	Btu/hr; M.T.D. (Corrected)				43.25	°F			
	31	Transfer Rate, Service	73.87	Btu/hr-ft ² -F; Clean				Btu/hr-ft ² -F				
	32	CONSTRUCTION OF ONE SHELL					Sketch (Bundle/Nozzle Orientation)					
	33		Shell Side				Tube Side					
	34	Design/Test Pressure	psig	310/FV/408				300/FV/391				
	35	Design Temperature (Max/Min)	°F	450/366/0				480/366/0				
	36	No. Passes Per Shell		1				2				
	37	Corrosion Allowance	inch	0.125				0.125				
	38	Connections	In	1 - 8" 300RF				1 - 8" 300RF				
	39	Size & Rating	Out	1 - 8" 300RF				1 - 8" 300RF				
	40		Intermediate	(2) 1 - 10" 300RF				1 - 8" 300RF				
	41	Tube No.	365 U'S	OD	0.75	in; Thk.	☒ Min	Avg	0.083	in; Length	20. ft; Pitch	1 in 90°
	42	Tube Type	BARE				Material SA-179					
	43	Shell	SA-516-70	☒ ID	OD	34.	in	Shell Cover	SA-516-70	☒ Integ.	☐ Remov.	
	44	Channel or Bonnet	SA-516-70	Channel Cover				SA-516-70 N	☒ Integ.	☒ Remov.		
	45	Tubesheet-Stationary	SA-516-70 N				Tubesheet - Floating					
	46	Floating Head Cover					Impingement Protection PLATE ON BUNDLE					
	47	Baffles-Cross	16 - SA-516-70	Type	V SEG	% Cut (☒ Dia. ☐ Area)	20.	Spacing c/c	12.94	Inlet	in	
	48	Baffles-Long					Seal Type					
	49	Supports - Tube	SA-516-70	U-Bend	YES	Type				FULL		
	50	Bypass Seal Arrangement					Tube-Tubesheet Joint				ROLLED	
	51	Expansion Joint					Type					
	52	pv ² - Inlet Nozzle	Bundle Entrance				Bundle Exit					
	53	Gaskets - Shell Side	S.I. D.J.F.G.F.				Tube Side				S.I. D.J.F.G.F.	
	54	- Floating Head										
	55	Code Requirements	ASME SECTION VIII, DIV. 1 CODE STAMP				TEMA Class				R	
	56	Weight/Shell	19,000 lb. EACH	Filled With Water	27,550 lb. EACH				Bundle	11,100 lb. EACH		
	57	REMARKS										
	58	(1) DELETED.										
	59	(2) 10" OUTLET ON SHELL "D". 10" INLET AND OUTLET ON SHELL "E"										
	60	(3) 5 ROW PARTIAL SUPPORT AT SHELL NOZZLE CENTERLINES										
	61	(4) PROVIDE (2) 1-1/2" X 300# RFLWN ON EACH OF INLET AND OUTLET (TUBESIDE AND SHELLSIDE) NOZZLES OF EACH INDIVIDUAL SHELL (EXCHANGER).										
	62											
	63	(5) TIE ROD SPACER SLEEVES SHALL BE SCH. 40 PIPE THICKNESS.										
	64	(6) SHELLSIDE SHALL BE DESIGNED FOR HYDROGEN SERVICE.										
	65											





CERTIFIED AS-BUILT
D.D. CARLO 4/24/07

SERIAL NO.: X-7265-A, B, C, D, E
CUSTOMER: D-COK / GIANT INDUSTRIES
P. O. NO.: 56603-P-12-04
ITEM NO.: E-645 A, B, C, D, E
SERVICE: DEBUTANIZER FEED BOTTOMS EXCHANGER
SHIP TO: GRAFTON, VA

Stone & Webster, Inc.		PROJECT TITLE: GIANT S ZORB	
SSN: 120653-P-12-04 (1110-01)	JOB No: 120653	ISSUE 1	
EQUIPMENT No. 1: 56603-P-12-04 (1110-01)			
☐ FOR INFORMATION	☐ ACCEPTED FOR CIVIL AND PIPING IFC		
☐ ACCEPTED	☐ ACCEPTED AS CERTIFIED		
☐ ACCEPTED AS NOTED	☐ REVISE AND RESUBMIT		
SIGNED: _____			
DATE: _____			

THE ACCEPTANCE OF THIS DATA BY SHAW STONE & WEBSTER DOES NOT RELIEVE THE CONTRACTOR OR SUPPLIER FROM THE OBLIGATIONS IMPOSED BY THE PURCHASER ORDER OR CONTRACT.

NOTE:
1) SHIMS, GASKETS & BOLTING FOR STACKING SHALL BE FURNISHED BY ENERGY.
2) HYDROTEST IN THE STACKED POSITION.

STACKING ARRANGEMENTS

DWN. BY	Date	 Energy Exchanger Co. 1844 No. Garrett Rd. • Tulsa, OK 74116
DATE	8/12/06	
CKD. BY	GH	DWG. NO. X-7265-A6
		REV. 2

- 1) MACHINE ALL COVER SURFACES TO .250 AARH, EXCEPT GASKET SURFACES MACHINE TO .125 AARH.
- 2) ALL COVER PASS PLATE GROOVE WIDTHS SHALL BE 1/2".
- 3) ALL COVER PASS PLATE GROOVE JUNCTIONS SHALL BE NOTCHED 3/8" @ 45°.



84 EACH WELD PAD SHALL HAVE A 1/4"-STD. WT. PIPE x 4" LG. INSTALLED AFTER HYDRO TEST. PLUG WITH STIFF GREASE.

NOTES:

- NOTES:
- 1) FOR WELD & BEVEL DETAILS, SEE DWG STD-1.
 - 2) FOR BODY FLANGE DETAILS, SEE DWG. X-7265-M.
 - 3) FOR FABRICATION NOTES, SEE DWG. X-7265-N.
 - 4) MILL PASS PLATES TO 3/8", BOTH ENDS.

CERTIFIED AS-BUILT
D. D. Carro 4/24/05

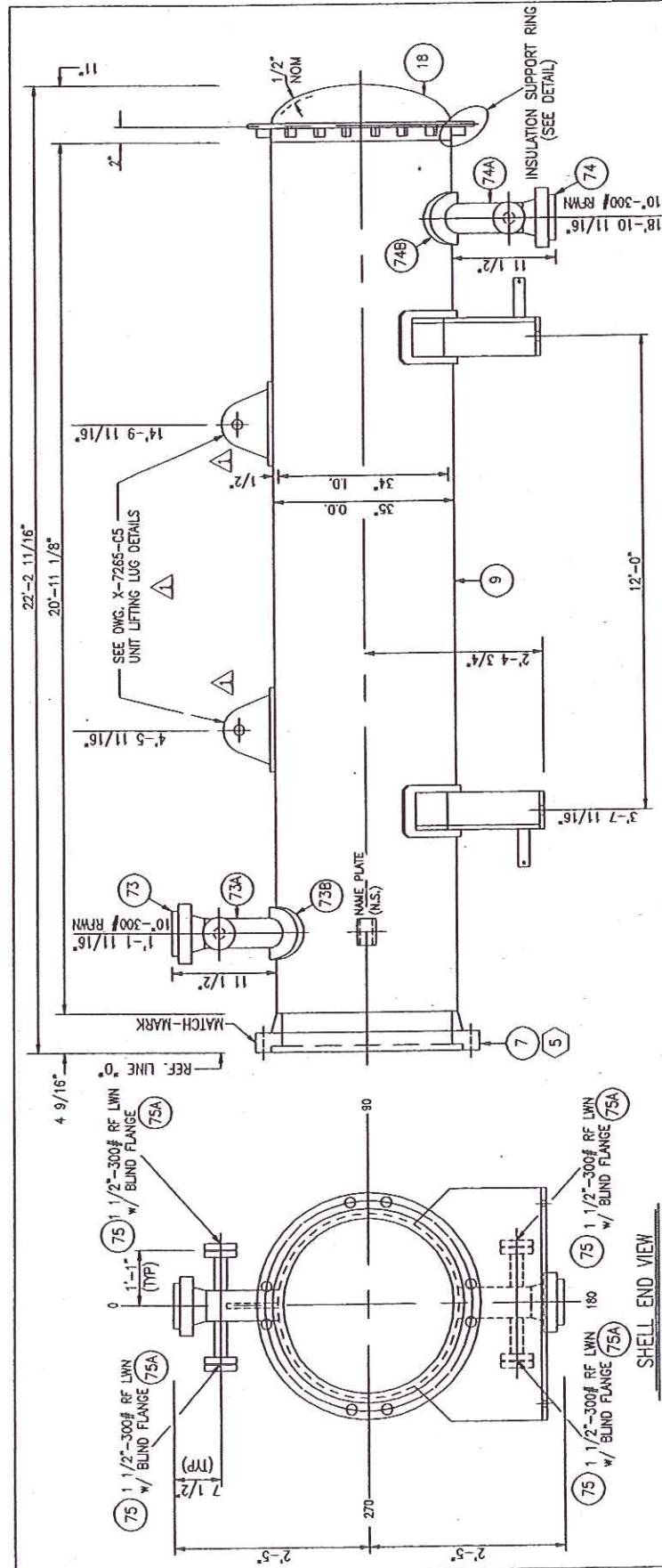
60/20/4

CHANNEL DETAILS

[illegible]

REQUIRED AS SHOWN FOR ONE UNIT;
FIVE-UNITS REQUIRED.

	
Shaw's Stone & Webster, Inc. JOB No. 120653	
PROJECT TITLE: GRANT & ZORA	
SYSTEM: 120653-P-12-04 (1110-01)	1554E
EQUIPMENT No.: 56603-P-12-04 (1110-01)	
☐ FOR INFORMATION	☐ ACCEPTED AS CERTIFIED
☐ ACCEPTED AS NOTED	☐ REVISE AND RESUBMIT
STORED	
DATE:	
ACCEPTANCE OF THIS DATA BY SHAW STONE & WEBSTER DOES NOT RELIEVE THE CONTRACTOR OR SUPERVISOR FROM THE OBLIGATIONS IMPOSED BY THE PURCHASER ORDER OR CONTRACT.	



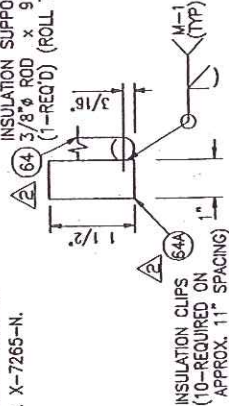
NOTES:

- 1) FOR WELD & BEVEL DETAILS, SEE DWG. STD-1.
- 2) ALL BOLT HOLES TO STRADDLE CENTERLINES.
- 3) FOR SUPPORT DETAILS, SEE DWG. X-7265-D1.
- 4) FOR BODY FLANGE DETAILS, SEE DWG. X-7265-M.
- 5) FOR FABRICATION NOTES, SEE DWG. X-7265-N.

SHOP NOTE:

- 76 EACH WELD PAD SHALL HAVE A 1/4" -STD. WT. PIPE x 3 1/2" LG. INSTALLED AFTER HYDRO TEST. PLUG WITH STIFF GREASE.

64 INSULATION SUPPORT RING
3/8" Ø ROD x 9'-10 1/4" LG.
(1-REQ'D) (ROLL TO 37 1/4" I.D.)



CERTIFIED AS-BUILT
D.D. Chaco 4/24/07


 SERIAL NO.: X-7265-E
 CUSTOMER: D-COK / GIANT INDUSTRIES
 P. O. NO.: 56603-P-12-04
 ITEM NO.: E-645 E
 SERVICE: DEBITANIZER FEED BOTTOMS EXCHANGER
 SHIP TO: GRAFTON, VA

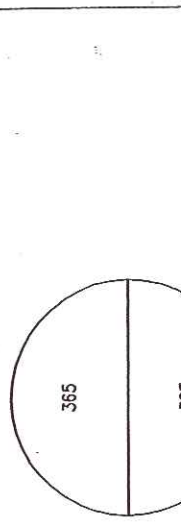
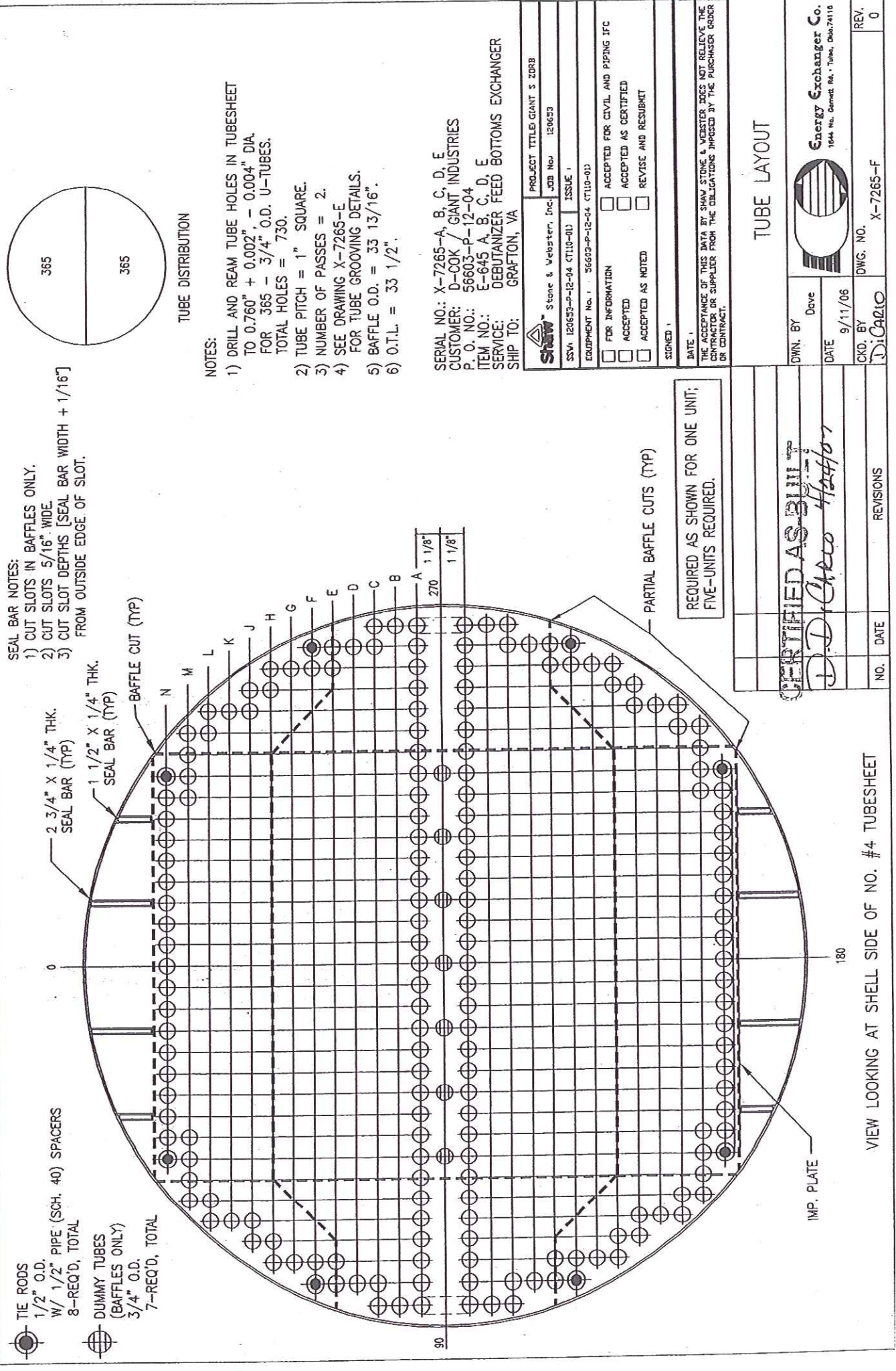
SHELL DETAILS



Energy Exchanger Co.

DWN. BY	Dan
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DATE 10/10/06



TUBE DISTRIBUTION

NOTES:

- 1) DRILL AND REAM TUBE HOLES IN TUBESHEET TO 0.760" + 0.002", - 0.004" DIA. FOR 365 - 3/4" O.D. U-TUBES. TOTAL HOLES = 730.
- 2) TUBE PITCH = 1" SQUARE.
- 3) NUMBER OF PASSES = 2.
- 4) SEE DRAWING X-7265-E FOR TUBE GROOVING DETAILS.
- 5) BAFFLE O.D. = 33 13/16".
- 6) O.T.L. = 33 1/2".

SERIAL NO.: X-7265-A, B, C, D, E
CUSTOMER: D-COK / GIANT INDUSTRIES
P. O. NO.: 56603-P-12-04
ITEM NO.: E-645 A, B, C, D, E
SERVICE: DEBUTANIZER FEED BOTTOMS EXCHANGER
SHIP TO: GRAFTON, VA

Stone & Webster, Inc.		PROJECT TITLE: GIANT S ZOR3
SSN: 120653-P-12-04 (T110-01)	JOB NO: 120653	
ISSUE: 1		
EQUIPMENT No. 1: 56603-P-12-04 (T110-01)		
☐ FOR INFORMATION	☐ ACCEPTED FOR CIVIL AND PIPING IFC	
☐ ACCEPTED	☐ ACCEPTED AS CERTIFIED	
☐ ACCEPTED AS NOTED	☐ REVISE AND RESUBMIT	
SIGNED: _____		
DATE: _____		
THE ACCEPTANCE OF THIS DATA BY SHAW STONE & WEBSTER DOES NOT RELIEVE THE CONTRACTOR OR SUPPLIER FROM THE OBLIGATIONS IMPOSED BY THE PURCHASER ORDER OR CONTRACT.		

TUBE LAYOUT

DWN. BY	Date		REV. 0
DATE	9/11/06		
CKD. BY	D. Carlo	DWG. NO. X-7265-F	

CERTIFIED AS BUILT
D. Carlo

VIEW LOOKING AT SHELL SIDE OF NO. #4 TUBESHEET

FORM U-1 MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1

1. Manufactured and certified by ENERGY EXCHANGER COMPANY, 1844 NORTH GARNETT ROAD, TULSA, OK 74116
 (Name and address of Manufacturer)

Manufactured for D-COK LLC, 3657 BRIAR PARK DRIVE, HOUSTON, TEXAS 77042-5205
 (Name and address of Purchaser)

Location of installation GIANT INDUSTRIES, GRAFTON, VIRGINIA
 (Name and address)

4. Type: HORIZONTAL HEAT EXCHANGER X-7265-E X-7265-A5 REV. 3 5261 2007
 (Horiz., vert., or sphere) (Tank, separator, jkt. vessel, heat exh., etc.) (Mfg's serial No.) (CRN) (Drawing No.) (Nat'l. Bd. No.) (Year built)

5. ASME Code, Section VIII, Div. 1 2004 EDITION, 2005 ADDENDA 2519
 Edition and Addenda (date) Code Case No. Special Service per UG-120(d)

Items 6 - 11 incl. to be completed for single wall vessels, jackets of jacketed vessels, shell of heat exchangers, or chamber of multi-chamber vessels.

6. Shell		(a) No. of course(s):		3		(b) Overall length (ft & in.):		20'-11 1/8"										
Course(s)			Material		Thickness		Long. Joint (Cat. A)			Circum. Joint (Cat. A, B & C)			Heat Treatment					
No.	Diameter, in.	Length (ft & in.)	Spec./Grade or Type		Nom.	Corr.	Type	Full	Spot	None	Eff.	Type	Full	Spot	None	Eff.	Temp.	Time
2	34" I.D.	8'-0"	SA-516-70		1/2"	1/8"	1	SPOT			.85	1	SPOT			.85	---	---
1	34" I.D.	4'-11 1/8"	SA-516-70		1/2"	1/8"	1	SPOT			.85	1	SPOT			.85	---	---

7. Heads: (a) SA-516-70 (b)
 (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)	END	7/16"	1/8"			2:1					X	S	NONE	1.0
(b)														

If removable, bolts used (describe other fastening)
 (Mat'l Spec. No., Grade, size, No.)

8. Type of jacket Jacket closure
 (Describe as ogee & weld, bar, etc.)

If bar, give dimensions If bolted, describe or sketch.

MAWP 314 15 psi at max. temp. 450 366 °F Min. design metal temp. 0 °F at 314 psi.
 (internal) (external) (internal) (external)

Impact test NO; SHELL SIDE DESIGNED PER UCS-66(a)(c)(g) & UG-20(f) at test temperature of --- °F
 (Indicate yes or no and the component(s) impact tested)

11. Hydro., ~~per UG~~, ~~per UCS~~ test press. 408 PSIG Proof test ---

Items 12 and 13 to be completed for tube sections.

12. Tubesheet: SA-516-70N 34 3/4 3" 5/16 BOLTED
 Stationary (Mat'l Spec. No.) Dia., in. (subject to press.) Nom. thk., in. Corr. Allow., in. Attachment (welded or bolted)

Floating (Mat'l Spec. No.) Dia., in. Nom. thk., in. Corr. Allow., in. Attachment

13. Tubes: SA-179 3/4 .083" (MIN) 365 U
 Mat'l Spec. No., Grade or Type O.D., in. Nom. thk., in. or gauge Number Type (Straight or U)

Items 14 - 18 incl. to be completed for inner chambers of jacketed vessels or channels of heat exchangers.

14. Shell		(a) No. of course(s):		1		(b) Overall length (ft & in.):		1'-11"										
Course(s)			Material		Thickness		Long. Joint (Cat. A)			Circum. Joint (Cat. A, B & C)			Heat Treatment					
No.	Diameter, in.	Length (ft & in.)	Spec./Grade or Type		Nom.	Corr.	Type	Full	Spot	None	Eff.	Type	Full	Spot	None	Eff.	Temp.	Time
1	34" I.D.	1'-11"	SA-516-70		1/2"	1/8"	1	SPOT			.85	1	SPOT			.85	...	...

15. Heads: (a) SA-516-70N (b)
 (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full	Spot
(a)	END	3 1/8"	3/16"						34 3/4"					
(b)														

If removable, bolts used (describe other fastening) (a) SA-193-B7, 3/4", 48; CHAN-TO-SHELL: SA-193-B7, 3/4", 48
 (Mat'l Spec. No., Grade, Size, No.)

16. MAWP 301 15 psi at max. temp. 480 366 °F Min. design metal temp. 0 °F at 301 psi.
(internal) (external) (internal) (external)

17. Impact test NO; CHANNEL SIDE DESIGNED PER UCS-66(a)(c)(g) & UG-20(f) at test temperature of ... °F

(Indicate yes or no and the component(s) impact tested)

18. Hydro., ~~burst~~, ~~test~~ press. 391 PSIG Proof test ---

19. Nozzles, inspection, and safety valve openings:

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Flange Type	Material		Nozzle Thickness		Reinforcement Material	How Attached		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
INLET/OUTLET	1/1	8" 300#	RFLWN	SA-106-B	SA-105	.500"	1/8"	SA-516-70	WELDED	WELDED	CHANNEL
T.W.P.G.	2/2	1 1/2" 300#	RFLWN	SA-105	---	.630"	1/8"	WELD	WELDED	---	CH. NOZS.
INLET/OUTLET	1/1	10" 300#	RFLWN	SA-106-B	SA-105	.500"	1/8"	SA-516-70	WELDED	WELDED	SHELL
T.W./P.G.	2/2	1 1/2" 300#	RFLWN	SA-105	---	.630"	1/8"	WELD	WELDED	---	SH. NOZS.

20. Supports: Skirt NO Lugs --- Legs --- Others (2) SADDLES Attached SHELL; WELDED
(Yes or No) (No.) (No.) (Describe) (Where and How)

21. Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report:
(List the name of part, item number, mfg's. name and identifying number)

22. Remarks: SERVICE: DEBUTANIZER FEED BOTTOMS EXCHANGER, P.O. NO: 56603-P-12-04, ITEM NO: E-645 E; SIZE: 34-240, TYPE: AEU

TUBES DESIGNED W/O C.A. PRESSURE RELIEF DEVICES PROVIDED BY OTHERS.

LINES 6-11 INCLUDE (1) 39 1/4 O.D. x 34 I.D. x 4 9/16" THK., SA-105N, RING

LINES 14-18 INCLUDE (2) 39 1/4" O.D. x 34" I.D. x 4 9/16" THK., SA-105N, RING;

CERTIFICATE OF SHOP COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1,

U Certificate of Authorization No. 12370 Expires 9/27/2007

Date 3-12-07 Name ENERGY EXCHANGER COMPANY Signed Edgar Oliver
(Manufacturer) (Representative)

CERTIFICATE OF SHOP INSPECTION

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and the State or Province of OKLAHOMA and employed by OneBeacon America Insurance Company of BOSTON, MASS. have inspected the pressure vessel described in this Manufacturer's Data Report on 3-12-07, and state that, to the best of my knowledge and belief, the

Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 3-12-07 Signed [Signature] Commissions N.B.# 11921 BA OKLA.# 823
(Authorized Inspector) (Nat'l Board incl. endorsement, State, Province and No.)

CERTIFICATE OF FIELD ASSEMBLY COMPLIANCE

We certify that the statements on this report are correct and that the field assembly construction of all parts of this vessel conforms with the requirements of ASME Code, Section VIII, Division 1,

U Certificate of Authorization No. --- Expires ---

Date --- Name --- Signed ---
(Assembler) (Representative)

CERTIFICATE OF FIELD ASSEMBLY INSPECTION

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and the State or Province of --- and employed by --- of --- have compared the statements in this Manufacturer's Data Report with the described pressure vessel and state that parts referred to as data items ---, not included in the certificate of shop inspection, have been inspected by me and to the best of my knowledge and belief, the Manufacturer has constructed and assembled this pressure vessel in accordance with ASME Code, Section VIII, Division 1. The described vessel was inspected and subjected to a hydrostatic test of --- psi. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date --- Signed --- Commissions ---
(Authorized Inspector) (Nat'l Board incl. endorsement, State, Province and No.)

1B 5261

 CERTIFIED BY
Energy Exchanger Company
TULSA, OKLAHOMA

MAWP SHELL	314	PSIG. @	450	OF	408	TEST P.S.I.G.
MAWP TUBE	301	PSIG. @	480	OF	391	TEST P.S.I.G.
MIN. DESIGN METAL TEMP.	SHELL			OF @	314	PSIG.
	TUBE			OF @	301	PSIG.
SERIAL NO.	X-7265 E			YEAR BUILT	2007	
P.O. NO.	66606-P-12-04					
SERVICE	DEBUTANIZER FEED BOTTOMS EXCHANGER					
ITEM	E-645	SIZE	34-240	TYPE	A E U	
MAX. ALLOW. EXT. PRESS. = 15 PSIG @ 366°F						

530
Jack Campbell