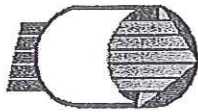


Energy Exchanger Company



HEAT EXCHANGER SPECIFICATION SHEET

105749

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

REV. 0 AS PURCHASED

Customer	SHAW STONE & WEBSTER (GIANT)		Job No.:	X-7263/X-7264 "AS BUILT"	
Address	HOUSTON, TX		Rev.:	1	Date: 3/13/07
Plant Location	GRAFTON, VA		File:	06-6102	
Service of Unit	REACTOR FEED/EFFLUENT EXCHANGER		Item:	E-641 C/D/E/F	
Size	59-264	Type	AFU	Horizontal	Connected In 1 Parallel 4 Series
Surf./Unit	Gross / ☒ Eff	25732. ft ² ; Shells/Unit	4	Surf./Shell	Gross ☒ Eff. 6296/6570 ft ²
PERFORMANCE OF ONE UNIT					
Fluid Allocation		Shell Side		Tube Side	
Fluid Name		REACTOR EFFLUENT		REACTOR FEED	
Fluid Quantity, Total		lb/hr			
Vapor (In/Out)					
Liquid					
Steam					
Water					
Noncondensable					
Temperature (In/Out)		°F			
Density (Vapor/Liquid)		Lb/Ft ³			
Viscosity		cP			
Molecular Weight					
Molecular Weight, Noncondensable					
Specific Heat		Btu/lb-F			
Thermal Conductivity		Btu/hr-ft-F			
Latent Heat		Btu/lb			
Inlet Pressure		psia			
Velocity		ft/sec			
Pressure Drop, Allow./Calc.		psi			
Fouling Resistance (Min.)		Hr-Ft ² -°F/Btu			
Heat Exchanged		Btu/hr; M.T.D. (Corrected)		°F	
Transfer Rate, Service		Btu/hr-ft ² -F; Clean		Btu/hr-ft ² -F	
CONSTRUCTION OF ONE SHELL				Sketch (Bundle/Nozzle Orientation)	
Design/Test Pressure		psig	495/FV/CODE	625/FV/CODE	
Design Temperature (Max/Min)		°F	875/366/0	850/366/0	
No. Passes Per Shell			2	2	
Corrosion Allowance		inch	0.125	0	
Connections		In	1 - 16" 600RF	1 - 16" 600RF	
Size & Rating		Out	1 - 16" 600RF	1 - 16" 600RF	
		Intermediate	1 - 16" 600RF	1 - 16" 600RF	
Tube No. 752 U'S (1)		OD .75 in; Thk. ☒ Min	Avg 0.065 in; Length 22. ft; Pitch 1 in 90°		
Tube Type		PLAIN	Material SA-213-TP321		
Shell		SA-387-11CL2 ☒ ID	OD 59 in; Shell Cover SA-387-11CL2 ☒ Inteq. ☒ Remov.		
Channel or Bonnet		SA-387-11CL2 W/321 OR 347SS OVERLAY	Channel Cover SA-182-F11CL2 W/321 OR 347SS OV ☒ Inteq. ☒ Remov.		
Tubesheet-Stationary		SA-182-F11CL2 W/321 OR 347SS OVE	Tubesheet - Floating		
Floating Head Cover			Impingement Protection Circular Plate ON BUNDLE		
Baffles-Cross		4 - 321SS Type V-N.T.I.W. % Cut (☒ Dia. ☒ Area)	20.6 Spacing c/c 50.7 Inlet in		
Baffles-Long		1.25 CR -0.5 MO	Seal Type LAMIFLEX		
Supports - Tube		321SS U-Bend YES	Type FULL		
Bypass Seal Arrangement			Tube-Tubesheet Joint EXPANDED AND WELDED		
Expansion Joint			Type		
pv ² - Inlet Nozzle		Bundle Entrance	Bundle Exit		
Gaskets - Shell Side		SS DJNAF	Tube Side SS DJNAF		
- Floating Head					
Code Requirements		ASME SECTION VIII, DIV. 1	CODE STAMP	TEMA Class R	
Weight/Shell		76,700 lb. EACH	Filled With Water	109,250 lb. EACH	Bundle 33,250 lb. EACH

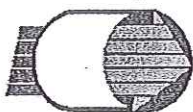
REMARKS

- (1) SHELLS "E" & "F". "C" & "D" HAVE 785U'S
- (2) TUBE SIDE INLET /OUTLET NOZZLES FOR SHELL "C" 12"/16"
- (3) TWO INTERMEDIATE SUPPORTS PER BAFFLE SPACE (4) FOUR ROW PARTIAL SUPPORTS AT SHELL NOZZLE CENTERLINES
- (4) PROVIDE (2) 1-1/2" X 600# RFLWN ON EACH OF INLET AND OUTLET (TUBESIDE AND SHELLSIDE) NOZZLES OF EACH INDIVIDUAL SHELL (EXCHANGER).
- (5) TIE ROD SPACER SLEEVES SHALL BE SCH. 40 PIPE THICKNESS.

105749

Energy Exchanger Company

HEAT EXCHANGER SPECIFICATION SHEET

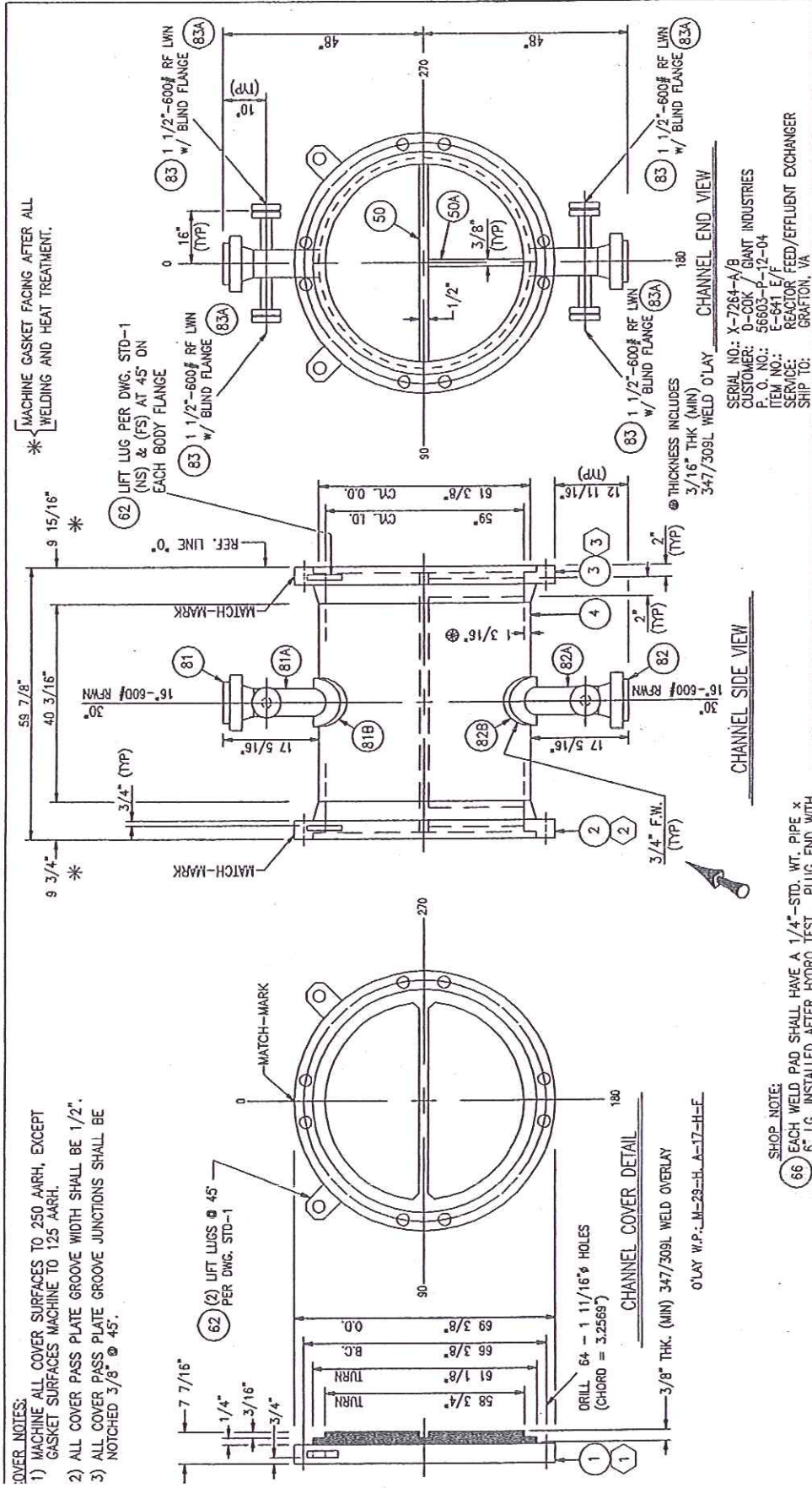


P.O. No.: 56603-P-12-04

REV. 0 AS PURCHASED

0	1	Customer		SHAW STONE & WEBSTER (GIANT)		Job No.: X-7262/X-7263/X-7264 "AS BUILT"	
0	2	Address		HOUSTON, TX		Rev.: 1 Date: 3/13/07	
1	3	Plant Location		GRAFTON, VA		File: 06-6102	
1	4	Service of Unit		REACTOR FEED/EFFLUENT EXCHANGER		Item: E-641 A/B/C/D/E/F	
	5	Size	59-264	Type	AFU	Horizontal	Connected In 1 Parallel 6 Series
	6	Surf./Unit	Gross / ☒ Eff	38872. ft ² /Unit	6	Surf./Shell	Gross ☒ Eff. 6296/6570 ft ²
	7	PERFORMANCE OF ONE UNIT					
	8	Fluid Allocation		Shell Side		Tube Side	
	9	Fluid Name		REACTOR EFFLUENT		REACTOR FEED	
	10	Fluid Quantity, Total		lb/hr		319572	
	11	Vapor (In/Out)		319572		25693	
	12	Liquid				293879	
	13	Steam				312826	
	14	Water					
	15	Noncondensable					
	16	Temperature (In/Out)		°F		799. 235.0 108. 699.	
	17	Density (Vapor/Liquid)		lb/Ft ³		2.0700 0.8700 39.02 0.3300 43.45 2.7600	
	18	Viscosity		cP		0.0220 0.0150 0.199 0.0090 0.353 0.0200	
	19	Molecular Weight					
	20	Molecular Weight, Noncondensable					
	21	Specific Heat		Btu/lb-F		0.7490 0.7620 0.599 1.8410 0.5050 0.7170	
	22	Thermal Conductivity		Btu/hr-ft-F		0.0380 0.0430 0.056 0.0790 0.0680 0.0340	
	23	Latent Heat		Btu/lb			
	24	Inlet Pressure		psia		409.7 498.7	
	25	Velocity		ft/sec		9.68	
	26	Pressure Drop, Allow./Calc.		psi		25.00 / 26.00 25.00 / 13.00	
	27	Fouling Resistance (Min.)		Hr-Ft ² -°F/Btu		0.002 0.005	
	28	Heat Exchanged		148230000		Btu/hr; M.T.D. (Corrected) 80.73 °F	
	29	Transfer Rate, Service		47.23		Btu/hr-ft ² -F; Clean Btu/hr-ft ² -F	
	30	CONSTRUCTION OF ONE SHELL				Sketch (Bundle/Nozzle Orientation)	
	31	Design/Test Pressure		psig			
	32	Design Temperature (Max/Min)		°F			
	33	No. Passes Per Shell					
	34	Corrosion Allowance		inch			
	35	Connections		In			
	36	Size & Rating		Out			
	37			Intermediate			
	38	Tube No.	OD	in; Thk.	Min	Avg	in; Length ft; Pitch in
	39	Tube Type		Material			
	40	Shell	ID	OD	in	Shell Cover	Integ. Remov.
	41	Channel or Bonnet		Channel Cover		Integ. Remov.	
	42	Tubesheet-Stationary		Tubesheet - Floating			
	43	Floating Head Cover		Impingement Protection			
	44	Baffles-Cross	Type	% Cut (	Dia.	Area)	Spacing c/c Inlet in
	45	Baffles-Long		Seal Type			
	46	Supports - Tube	U-Bend	Type			
	47	Bypass Seal Arrangement		Tube-Tubesheet Joint			
	48	Expansion Joint		Type			
	49	pv ² - Inlet Nozzle	Bundle Entrance		Bundle Exit		
	50	Gaskets - Shell Side		Tube Side			
	51	- Floating Head					
	52	Code Requirements		TEMA Class			
	53	Weight/Shell		Filled With Water		Bundle	
	54	REMARKS					
	55	(1) OVERALL PERFORMANCE SHEET FOR SIX EXCHANGERS IN SERIES. SHELLS "E" & "F" HAVE 752U'S TO ALLOW ROOM FOR DERESONATING BAFFLES.					
	56	PLACE DERESONATING BAFFLES IN ALL BAFFLE SPACES BUT INLET AND OUTLET JUST ABOVE AND BELOW THE CENTER OF EACH HALF.					
	57	(2) DESIGN SHELLSIDE AND TUBESIDE TO BE HYDROGEN SERVICE.					
	58						
	59						
	60						
	61						
	62						
	63						
	64						
	65						

	PROJECT TITLE: GALT S 2028	JOB NO: 120653	ISSUE 1	SSW 120653-P-12-01 (1110-01)	EQUIPMENT NO.: S5693-P-12-04 (1110-01)
	Stone & Webster, Inc.				
☐ FOR INFORMATION ☐ ACCEPTED ☐ ACCEPTED AS NOTED ☐ REVISE AND RESUBMIT					
THE ACCEPTANCE OF THIS DATA BY SHAW STONE & WEBSTER DOES NOT RELIEVE THE CONTRACTOR OR SUPPLIER FROM THE OBLIGATIONS IMPOSED BY THE PURCHASER ORDER. ON CONTRACT.					
DATE: _____ SIGNED: _____					



NOTES:

- 1) FOR WELD & BEVEL DETAILS, SEE DWG STD-01.
- 2) FOR BODY FLANGE DETAILS, SEE DWG. X-7264-M.
- 3) FOR FABRICATION NOTES, SEE DWG. X-7264-N.
- 4) MILL PASS PLATES TO 3/8". BOTH ENDS.
- 5) FOR OVERLAY DETAILS, SEE DWG. X-7264-B3.

REQUIRED AS SHOWN FOR ONE UNIT:
TWO-UNITS REQUIRED.

CERTIFIED AS-BUILT

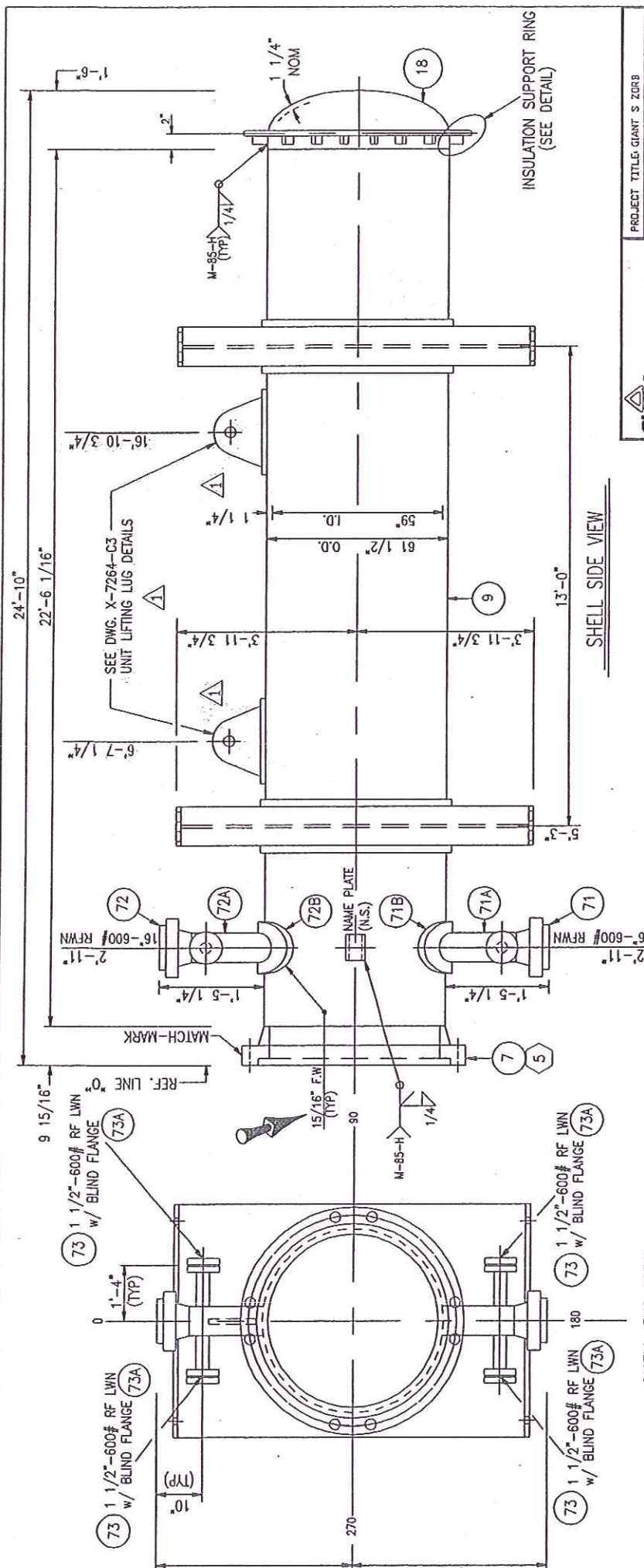
D. D. Calvo

NO.	DATE	RE-ISSUED FOR APPROVAL	REVISIONS
1	12/6/06	Issued	

CHANNEL DETAILS

DWN. BY	Dwn	DATE	CHK. BY	DWG. NO.	REV.
		10/30/06		X-7264-B1	1

Energy Exchanger Co.
1844 New Corporate Blvd., Tulsa, Oklahoma 74118



NOTES:

- 1) FOR WELD & BEVEL DETAILS, SEE DWG. STD-01.
- 2) ALL BOLT HOLES TO STRADDLE CENTERLINES.
- 3) FOR SUPPORT DETAILS, SEE DWG. X-7264-01.
- 4) FOR BODY FLANGE DETAILS, SEE DWG. X-7264-M.
- 5) FOR FABRICATION NOTES, SEE DWG. X-7264-N.

SHELL END VIEW

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

SERIAL NO.: X-7264-A
CUSTOMER: D-COK / GIANT INDUSTRIES
P. O. NO.: 56603-P-12-04
ITEM NO.: E-641 E
SERVICE: REACTOR FEED/EFFLUENT EXCH.
SHIP TO: GRAFTON, VA

105749

CELEST-BIT

① D. D. Ark 5/30/07

SHELL DETAILS

				DWN. BY	Don
				DATE	10/19/06
				GKD. BY	DCarlo
				REV. PER CUSTOMER COMMENTS	Don
				REVISIONS	
				NO.	DATE
				1	12/21/06

	Energy Exchanger Co. 1844 N. Cornett Rd. • Tulsa, Okla. 74116	
	DWG. NO. X-7264-C1	REV. 1

INSULATION SUPPORT RING

DRILL & TAP 3/4" DEEP FOR (20) -1/2" Ø TIE
RODS ON SHELL SIDE OF # 4 TUBESHEET.
DO NOT DRILL THRU !!
(SEE TUBE LAYOUT FOR LOCATIONS)

4'-11"

11/16"

NOTE:
THIS GASKET SHALL BE
INSERTED INTO TUBESHEET
GROOVE BEFORE INSTALLING
LONGITUDINAL BAFFLE.

- 1) MACHINE ALL SURFACES TO 250 AARH, EXCEPT GASKET SURFACES SHALL BE 125 AARH.
- 2) ALL PASS PLATE GROOVES SHALL BE 1/2" WIDE.
- 3) ALL PASS PLATE GROOVE JOINTS SHALL TO BE NOTCHED 3/8" AT 45°.
- 4) TUBESHEET GASKET SURFACES SHALL HAVE A FLATNESS TOLERANCE OF $\pm 1/32"$ (AFTER TUBE WELDING & ROLLING).

SERIAL NO.: X-7264-A/B
 CUSTOMER: D-COK GIANT INDUSTRIES
 P.O. NO.: 56603-P-12-04
 ITEM NO.: E-641 E/F
 SERVICE: REACTOR FEED/EFFLUENT EXCHANGER
 SHIP TO: GRAFTON, VA

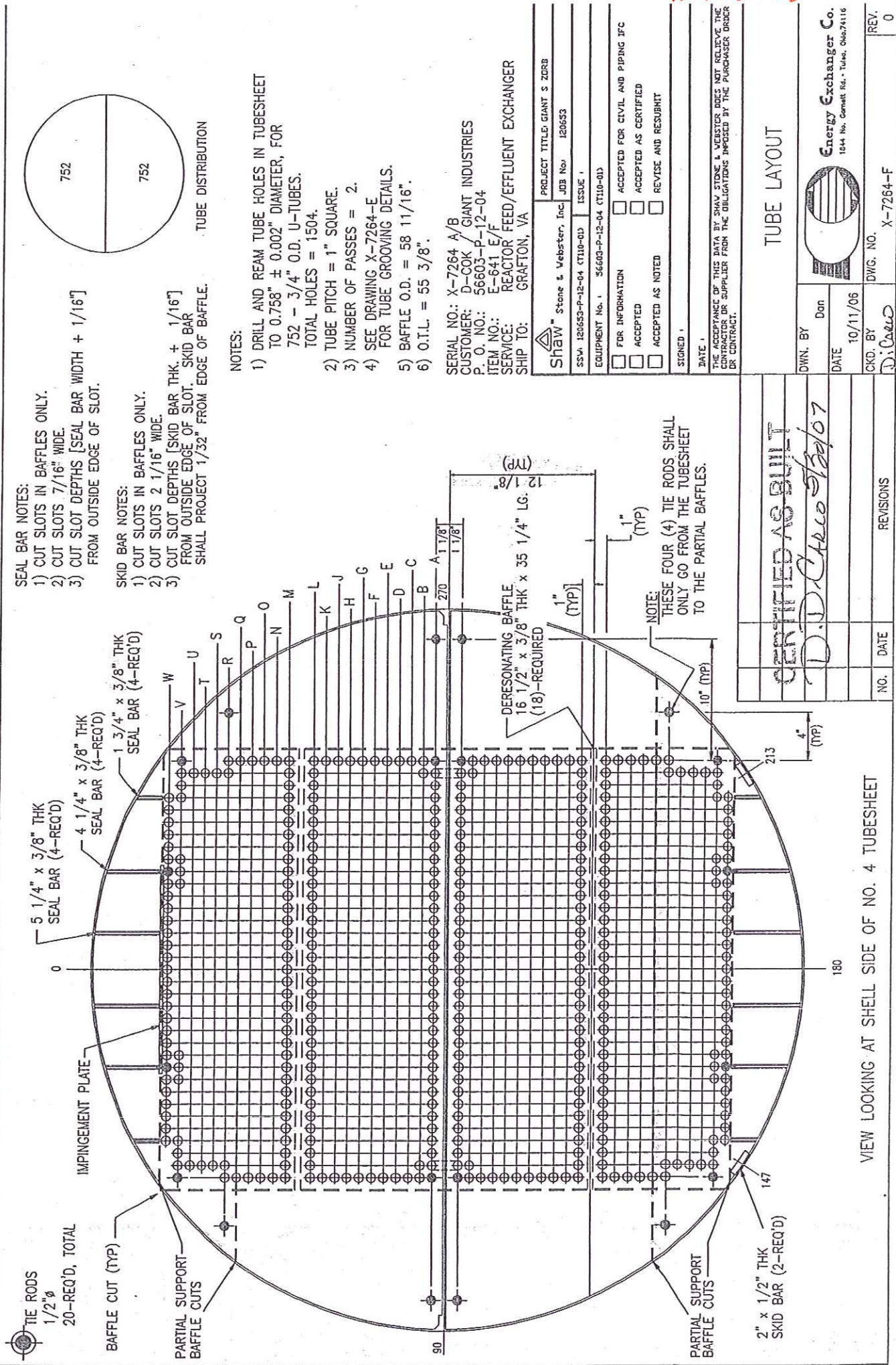
TUBESHEET DETAILS		 Energy Exchanger Co. 1844 New Cornett Rd., Tulsa, Okla. 74118	
DWN. BY		Don	
DATE		10/25/06	
CKD. BY		DiCarlo	
DWC. NO.		X-7264-E	
REV. NO.		2	

TUBESHEET DETAILS

Energy Exchanger Co.
1044 N.W. Cornett Rd. • Tulsa, Okla. 74116

WORKING NO.	REV.
X-7264-E	2

	
Shaw's Stone & Webster, Inc.	
PROJECT TITLE: GALT S ZORR	JOB NO: 120653
ISSUE: 1	
EQUIPMENT NO.: 56693-P-12-04 (1110-0)	
☐ FOR INFORMATION ☐ ACCEPTED FOR CIVIL AND PAVING TFC ☐ ACCEPTED AS CERTIFIED ☐ REVISE AND RESUBMIT	☐ ACCEPTED AS NOTED ☐
SIGNED: _____ DATE: _____	
THE ACCEPTANCE OF THIS PAID BY SHAW STONE & WEBSTER DOES NOT RELIEVE THE CONTRACTOR OR SUPPLIER FROM THE OBLIGATIONS IMPOSED BY THE FOLLOWING ORDER OR CONTRACT:	



- SEAL BAR NOTES:
- 1) CUT SLOTS IN BAFFLES ONLY.
 - 2) CUT SLOTS 7/16" WIDE.
 - 3) CUT SLOT DEPTHS [SEAL BAR WIDTH + 1/16"] FROM OUTSIDE EDGE OF SLOT.
- SKID BAR NOTES:
- 1) CUT SLOTS IN BAFFLES ONLY.
 - 2) CUT SLOTS 2 1/16" WIDE.
 - 3) CUT SLOT DEPTHS [SKID BAR THK. + 1/16"] FROM OUTSIDE EDGE OF SLOT. SKID BAR SHALL PROJECT 1/32" FROM EDGE OF BAFFLE.

NOTES:

- 1) DRILL AND REAM TUBE HOLES IN TUBESHEET TO 0.758" ± 0.002" DIAMETER, FOR 752 - 3/4" O.D. U-TUBES.
- TOTAL HOLES = 1504.
- 2) TUBE PITCH = 1" SQUARE.
- 3) NUMBER OF PASSES = 2.
- 4) SEE DRAWING X-7264-E FOR TUBE GROOVING DETAILS.
- 5) BAFFLE O.D. = 58 11/16".
- 6) O.I.L. = 55 3/8".

SERIAL NO.: X-7264 A/B
CUSTOMER: D-COK / GIANT INDUSTRIES
P. O. NO.: 56603-P-12-04
ITEM NO.: E-641 E/F
SERVICE: REACTOR FEED/EFFLUENT EXCHANGER
SHIP TO: GRAFTON, VA

Shaw Stone & Webster, Inc.		PROJECT TITLE: GIANT S ZORB	
SSW-120653-P-12-04	GT110-03	JOB No.	120653
EQUIPMENT No. 1		56603-P-12-04	GT110-03
☐ 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.

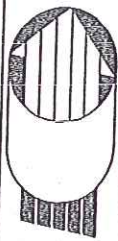
TUBE LAYOUT

OWN. BY	Don		Energy Exchanger Co. 1844 No. Grafton Rd. - Tubes, Grafton, VA 24116
DATE	10/11/06		
CKD. BY	D. Carlo	DWG. NO.	X-7264-F
		REV.	0

CERTIFIED AS BUILT
D.D. Carlo 10/10/07

VIEW LOOKING AT SHELL SIDE OF NO. 4 TUBESHEET

18



CERTIFIED BY
Energy Exchanger Company
TULSA, OKLAHOMA

MAWP SHELL 497 * P.S.I. @ 875 * *F 729 TEST P.S.I.
MAWP TUBE 625 * P.S.I. @ 850 * *F 813 TEST P.S.I.

MIN. DESIGN METAL TEMP. SHELL 0 *F @ 497 * P.S.I.
TUBE 0 *F @ 625 * P.S.I.

SERIAL NO. ① YEAR BUILT 2007

P.D. NO. 56603-P-12-04

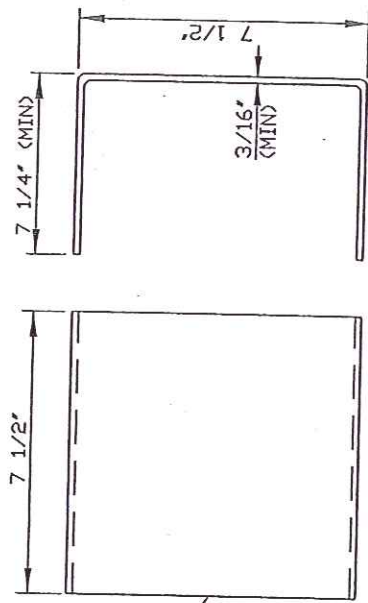
SERVICE REACTOR FEED/EFFLUENT EXCHANGER

ITEM ② SIZE 59-264 TYPE AFU

* MAX. ALLOW. EXT. PRESS. = 15 PSIG @ 366°F.

FIELD TEST PRESS. SHELL 647 PSIG TUBE - 813 PSIG

SHOP TO ASSIGN AT COMPLETION OF FABRICATION



NAME PLATE BRACKET DETAIL
2-REQUIRED

SERIAL NO.: X-7264-A/B
CUSTOMER: D-COK / GIANT INDUSTRIES
P. O. NO.: 56603-P-12-04
ITEM NO.: E-641 E/F
SERVICE: REACTOR FEED/EFFLUENT EXCHANGER
SHIP TO: GRAFTON, VA

Stone & Webster, Inc.		PROJECT TITLE: GIANT S ZORB	
SSW 120653-P-12-04	CT110-01	JOB NO.	120653
EQUIPMENT No. 56603-P-12-04		ISSUE 1	
☐ 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.			
NAME PLATE DETAILS			
DWN. BY	Don		
DATE	10/30/06		
CKD. BY	DiCarlo	DWG. NO.	X-7264-L
NO.	DATE	REV. PER E.E.C.	REVISIONS
1	12/7/06	Don	1

① X-7264 A
X-7264 B

② E-641 E
E-641 F



NAME PLATE DETAIL
2-REQUIRED

CERTIFIED AS-BUILT
D. DiCarlo

NOTE
CLIP CORNERS AND SEAL WELD NAMEPLATE TO BRACKET.



Energy Exchanger Co.
1844 No. Garnett Rd. • Tulsa, OK 74116