

**R.W. HOLLAND, INC.**

[www.rwholland.com](http://www.rwholland.com)

[sales@rwholland.com](mailto:sales@rwholland.com)

## **DESIGN AND APPLICATION OF HAIRPIN HEAT EXCHANGERS**

**Serving** the Petroleum, Petrochemical,  
**SERVING** Chemical and Power Industries.

### **Advantages of the Hairpin Heat Exchanger**

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#### **Two Types of Hairpin Heat Exchangers**

- Double pipe section with one tube, either finned or bare, within each shell pipe.
- Multi-tube section with multiple smaller tubes, either finned or bare, within each shell pipe.

**Operate in true counter current flow permitting extreme temperature crossing.**

**Due to their modular concept, hairpin heat exchangers are especially adaptable economically to service changes.**

**The hairpin heat exchanger is ideal for wide temperature ranges and differentials.**

**Because of the U-tube construction, expensive expansion joints are not required.**

## The Hairpin Heat Exchanger

### ASME INSPECTED AND CODE STAMPED

- All Holland hairpin heat exchangers are ASME inspected, code stamped and National Board Registered.

### FINTUBES PRODUCED BY ELECTRIC RESISTANCE WELDING METHOD

- Our longitudinal fintubes are produced by electric resistance welding method.
- This assures high heat transfer efficiency throughout the life of the equipment.

### COMPLETELY ASSEMBLED

- Multiple sections are shipped completely assembled and ready for one inlet and outlet process piping connection.

## The Hairpin Heat Exchanger Cont'd

### WIDE RANGE OF SIZES

- Holland hairpin heat exchangers are available in a wide range of sizes to meet most process requirement.

### ECONOMICAL STANDARD DESIGN

- Although we standardize whenever possible, we custom engineer our equipment to meet process or piping requirements.

## The Holland "Petrofin"<sup>®</sup> Closure

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### NO INTERSTREAM LEAKAGE

- The Holland closure has one shellside sealing ring and a separate tubeside gasket, thus, minimizing the possibility of interstream leakage. As an option, the tubes can be welded to the tubesheet to eliminate the possibility of interstream leakage.

### ONE LOCKING SPLIT RING

- There are two reusable split rings on the standard closure and four on the separated head closure which are in full view and are the simplest of all to remove and install.

### CLOSURE FLANGES

- On low pressure designs up through 6" shell sizes, the closure flanges are a square, four bolt design.
- All exchangers with design pressures greater than 500 psig will have circular closure flanges with additional bolting.
- Through bolted closures are not standard in sizes up to 8" shells, but are available upon request.

## The Holland "Petrofin"<sup>®</sup> Closure

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### EASILY REMOVABLE TUBE BUNDLES

- Tube bundles are easily removed and do not require disassembling either the shell piping or mountings. Only four standard interchangeable replacement parts are required for reassembly after routine cleaning and maintenance.
  - One Rear Cover Gasket
  - Two Sealing Rings
  - Two Tube Gaskets
  - Two Nozzle Gaskets (by others)
- Most sizes are stocked for immediate replacement.

## The Holland Separated Head Closure

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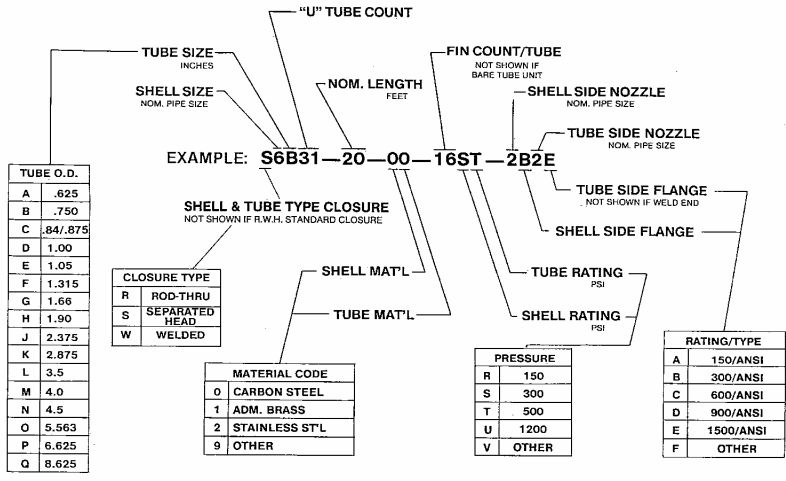
- Has separate flanges and bolting for each sealing surface.
- Recommended for pressures above 2000 psig, cyclic services, low temperature service, extreme temperature differentials, and hard to hold fluids.
- Only four standard interchangeable replacement parts are required for reassembly after routine cleaning and maintenance.
  - One Rear Cover Gasket
  - Two Sealing Rings
  - Two Tube Gaskets
  - Two Nozzle Gaskets (by others)
- Most sizes are stocked for immediate replacement.

R.W. HOLLAND, INC.

R.W. Holland Standard Drawings

# R.W. HOLLAND, INC.

## R. W. HOLLAND, INC. - PETROFIN® HAIRPIN MODEL IDENTIFICATION CODE



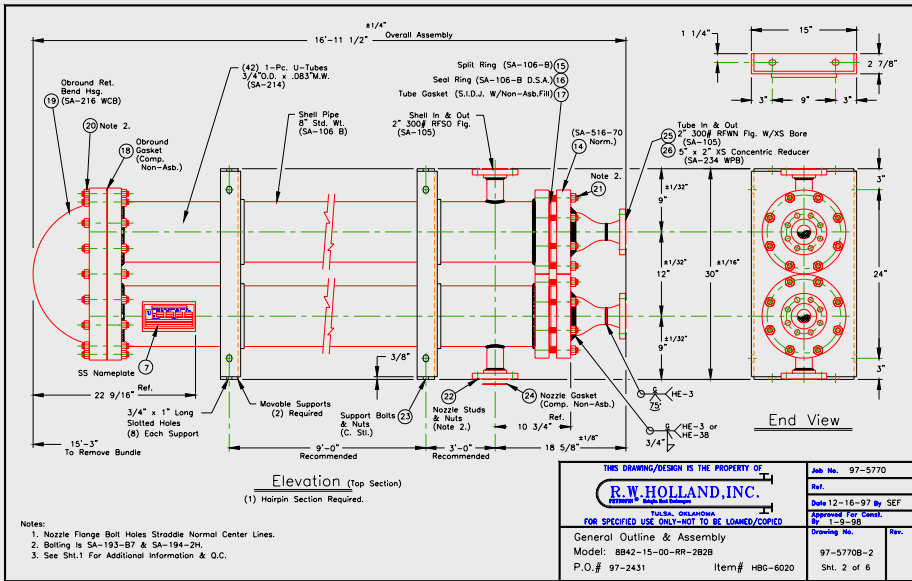
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# R.W. HOLLAND, INC.

CUSTOMER DATA	SPECIAL DATA	TUBE BUNDLE DATA	
CUSTOMER <u>PETREX, INC.</u>	SURFACE PREP. <u>SSPC-SP6</u>	SIZE <u>1"O.D. x .109"Min. Wall</u>	
P.O. NUMBER <u>2675 J0052A</u>	PAINT SPEC. <u>ONE COAT CARBOLINE CARBOZINC 11</u>	COUNT <u>(19) One Pcs. U-Tubes</u>	
TAG ITEM NO. <u>HGB-1500</u>	HEAT TREAT <u>N/R</u>	MATERIAL <u>SA-214</u>	
SERVICE <u>FUEL GAS CROSS HEATER</u>	CUSTOMER INSP. <u>UNKNOWN (SEE BELOW)</u>	FINS/TUBE <u>None</u>	
(1) MODEL: <u>S8D19-06-00-SV-8A3C</u>	NAT'L BRD. NO. <u>N/R</u>	MATERIAL <u>N/A</u>	
MISC. > SEPARATED HEAD CLOSURE. > SEALWELD NON-PRESS. ATTACHMENTS. > FLUOROCARBON POLYMER COATED (PCI-3 or EQ).	CODE STAMP <u>"J" A.S.M.E. Section VIII, Div. 1, A-96</u>	CUT & TWIST <u>N/A</u>	
	RT <u>SPOT TUBESIDE PER A.S.M.E.</u>	> SEALWELD TUBES TO TUBEFITTINGS	
	> A.B.S. INSPECTION REQUIRED. PETREX TO MAKE ARRANGEMENTS FOR THE A.B.S. INSPECTOR & ADVISE PPH OF ANY A.B.S. REQUIREMENTS FOR DATA REVIEW.	SEALWELD PROCED. <u>HE-1</u>	
		"H" SEALWELDS BEFORE AND AFTER TUBE ROLLING	
SHELL ASSY. DATA	SECTION DATA	DESIGN CONDITIONS	
SIZE <u>8" SCH. 40 PIPE</u>	WEIGHT PER SECTION: DRY <u>1,805#</u> WET <u>2,080#</u>	DESIGN PSIG <u>285</u> SHELL TUBE	
MATERIAL <u>SA-106 B/SA-234 WPB (S)</u>	TOTAL UNIT WEIGHTS: DRY <u>-0-</u> WET <u>-0-</u>	TEST PSIG <u>398</u> <u>2070</u>	
CONNECTIONS <u>6"-150# RF, FLG.</u>	SURFACE AREA: PER SECTION <u>67 SQ. FT.</u>	METAL TEMP. <u>170°F</u> <u>170°F</u>	
WELD PROCEDURE <u>HE-3, HE-38</u>	TOTAL <u>-0-</u>	CORROSION <u>.125"</u> <u>.125" tubes</u>	
		MDMT/PSIG <u>30F/285</u> <u>30F/1380</u>	
SECTION ARRANGEMENT			
ITEM NO.	NO. OF SECTIONS	SHELL PARALLEL SERIES	TUBE PARALLEL SERIES
HGB-1500	1	1 1	1 1
REVISIONS:			
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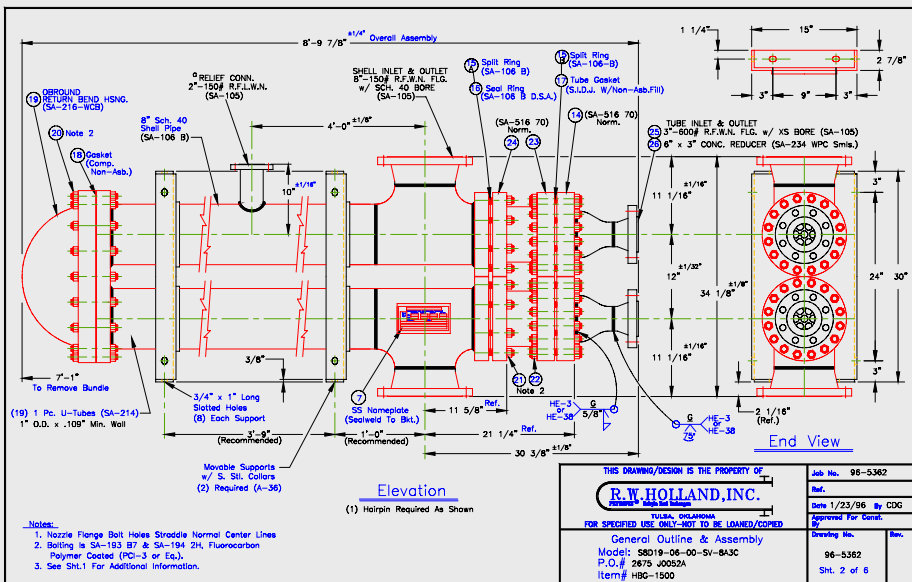
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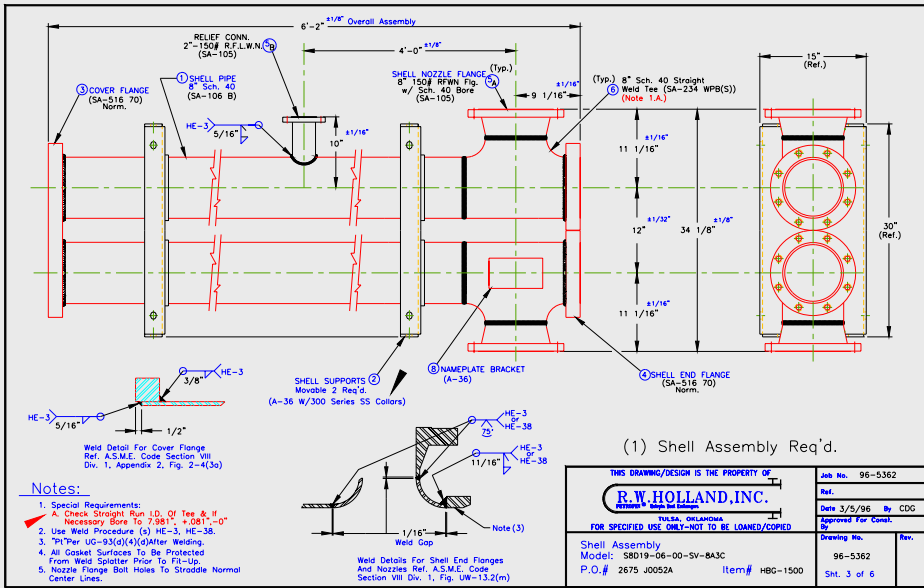
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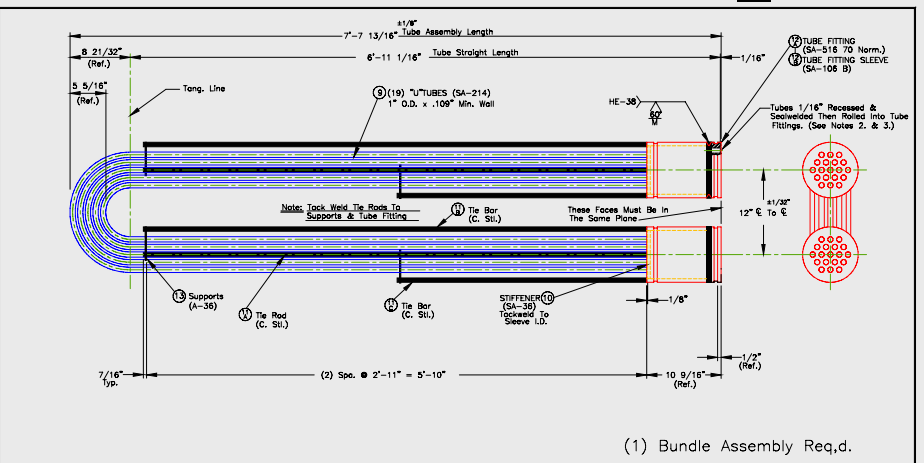


(1) Shell Assembly Req'd.

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TULSA, OKLAHOMA		Approved For Contract
FOR SPECIFIED USE ONLY-NOT TO BE LOANED/COPIED		By
Shell Assembly	Model: S8D19-06-00-SV-B3C	Drawing No. 96-5362
P.O.# 2675 J0052A	Item# HBG-1500	Sht. 3 of 6

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(1) Bundle Assembly Req'd.

**Notes:**

- Protect Gasket Surfaces From Scarring Prior To Installation.
- Tube Holes Are Grooved Per T.E.M.A. RB-7.4.4
- Use WPS HE-1 For Tube Sealwelds, "PT" Sealwelds Before & After Rolling Tubes.

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Tube Bundle Assembly	Model: S8D19-06-00-SV-B3C	Drawing No. 96-5362
P.O.# 2675 J0052A	Item# HBG-1500	Sht. 4 of 6

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# R.W. HOLLAND, INC.

R W HOLLAND, INC

EXCHANGER SPECIFICATION SHEET

CUSTOMER: PETREX, INC.      IND. NO.      QUOTE NO: 95-602  
 LOCATION: TANTAWAN FIELD      DATE: JAN. 19, 1996      ITEM: HBG-1500  
 SERVICE: FUEL GAS CROSS HEATER      PAK. SH./TUBE: 1/1  
 SIZE: MODEL: SB019-06-00-SV-BAC3      SURF./SEC.: 67 SQ FT.  
 TOTAL SURF.: 67 SQ FT.      SEC./UNIT: 1

PERFORMANCE OF ONE UNIT

		SHELLSIDE	TUBESIDE
TOTAL FLOW		FUEL GAS	FUEL GAS
LIQUID IN	LB/HR	20647	20647
LIQUID OUT	LB/HR	0	0
FLUID VAPOR DR COND	LB/HR	0	37
TEMP. IN	DEG F	39.5	125.0
TEMP. OUT	DEG F	66.8	100.0
CP-LIQUID	BTU/LB/F	.000	.550
CP-VAPOR	BTU/LB/F	.452	.570
S.G. IN DR AVG		.000	.000
S.G. OUT		.000	.612
VISC. IN DR AVG	CP	.000	.220
VISC. OUT	CP	.000	.058
K-LIQUID	BTU/HR/FT/DEG F	.000	.014
VISC. GAS	CP	.006	.022
K-GAS	BTU/HR/FT/DEG F	.016	.21.00
MU-IN DR AVG		21.00	82.400
MU-OUT		21.00	925.00
OPER. PRESS.	PSIG	60.00	15.00/1.04
VELOCITY	FT/SEC	82.400	.0010
PRESS. DROP ALLOW/CALC	PSI	5.00/1.11	
FOULING	HR-FT-DEG F/BTU	.0010	
DUTY - BTU/HR	257424	MTD - DEG F	57.7
SERVICE TRANSFER RATE-BTU/HR/FT <sup>2</sup> /DEG F	66.6		

CONSTRUCTION

		IN	EXC. TUBES
CORROSION ALLOWANCE		.125	.125
DESIGN/TEST PRESSURE	PSIG	245	1300
DESIGN TEMP./MDMT	DEG. F.	170/30	170/30

TUBES - MATL.: SA-214      1" O.D. THK.: 109# MW      NO.: 19      LG.: 6 FT.  
 SHELL - MATL.: SA-106 B/SA-234 WPB      8" IPS THK. SCH. 40  
 RETURN BEND HOUSING - MATL.: SA-216 WCB      TYPE: F.F.  
 SHELL FLANGES - MATL.: SA-516 70  
 CHANNELS - MATL.: SA-516 70/SA-234 WPC/SA-105  
 TUBEFITTINGS - MATL.: SA-516 70      TUBE: S.I.D.J. NAF  
 GASKETS - SHELL: COMP. NON-ASB      TUBE: 3"-600# RFWN  
 CONNECTIONS - SIZE & RATING - SHELL: 8"-150# RFWN      TUBE: 3"-600# RFWN  
 CODE REQUIREMENTS: ASME SECTION VIII, DIV.1, w/ STAMP  
 REMARKS: SANDBLAST AND DNE COAT CARBOZINC 11 PRIMER.  
 SEPARATED HEAD CLOSURE.  
 FLOWS & DUTY INCLUDE 10% EXCESS

CERTIFIED BY R.W. HOLLAND, INC. TULSA, OK

U W RT 4	MAWP PSI	TEMP. °F	MDMT °F	AT PSI
	265	170	30	265
	TUBE	1380	170	30
	SERIAL NO.	196-5362	YEAR BUILT	1996

CUST. PETREX, INC.  
 P.O. 2675 J0052A      ITEM HBG-1500

NAMEPLATE FACSIMILE (APPROXIMATELY FULL SCALE)  
 MAT'L.: 300 SERIES S.S.  
 QTY.: (1) NAMEPLATE REQUIRED

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Job No. 96-5362	Rev.
Date 1/23/96 by CDG	
Approved For Issue	
Drawing No. 96-5362	Rev.
Sht. 5 of 6	

EXCHANGER SPECIFICATION SHEET AND  
 NAMEPLATE FACSIMILE

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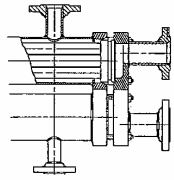
## R.W. Holland Hairpin Closures

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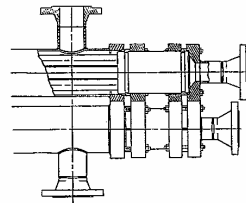


# R.W. HOLLAND, INC.

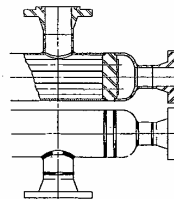
## TUBE END CLOSURES



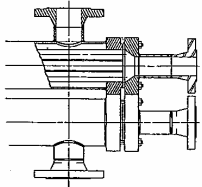
Holland standard closure. Tube nozzles can be offset for venting and draining. ANSI flanges as terminal connections.



Holland separated head closure. Separate flanges and bolting for each gasket surface. Weld neck flanges available.



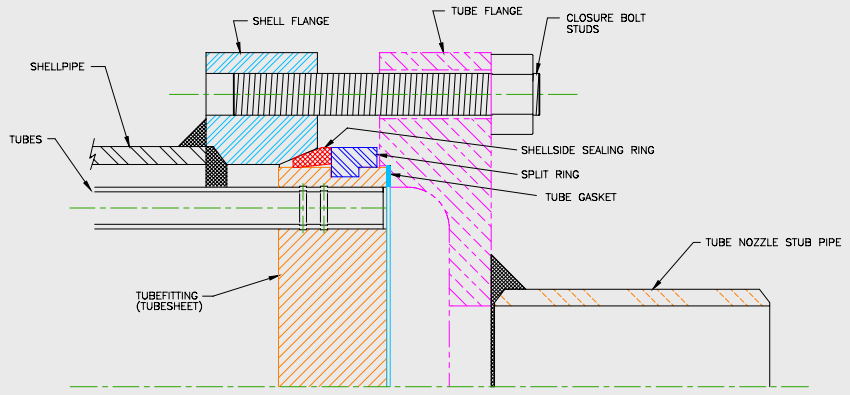
Fixed tubesheet design.



Fixed tubesheet design with removable channel for tube inspection.

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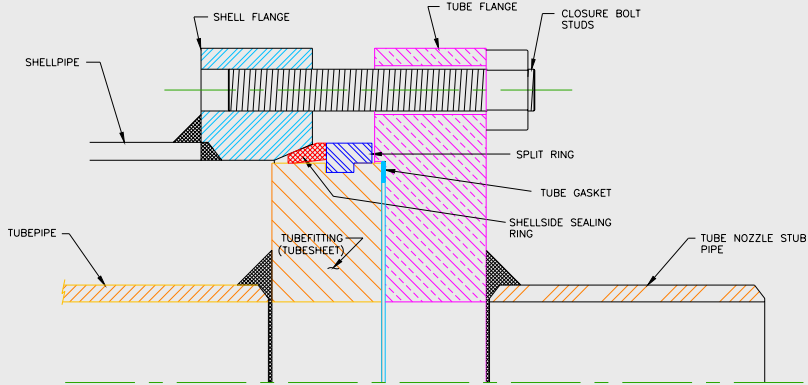


THIS DRAWING/DESIGN IS THE PROPERTY OF		Job No.
<b>R.W. HOLLAND, INC.</b>		Rev.
<small>TUBES, INCLASBMA STANDARD</small>		Date 10/22/90 By GLB
<small>FOR SPECIFIED USE ONLY-NOT TO BE LOANED/COPIED</small>		Approved For Const. By
* STANDARD CLOSURE ASSEMBLY FOR A MULTITUBE HAIRPIN		Drawing No. Rev.
		RWHCLSR1

\* W/ DJ Tube Gasket

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# R.W. HOLLAND, INC.

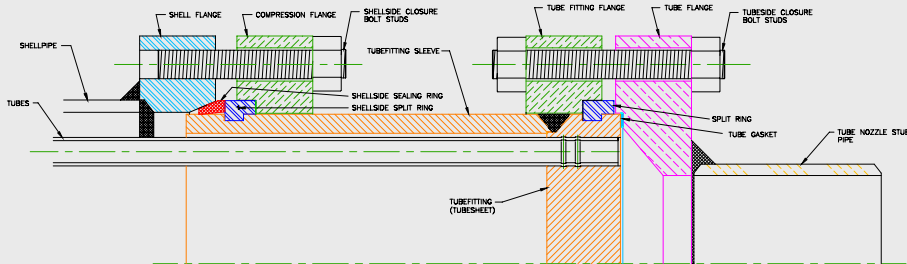


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* STANDARD CLOSURE ASSEMBLY FOR A DOUBLE PIPE HAIRPIN		RWHCLSR2

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\* w/ DJ Tube Gasket

# R.W. HOLLAND, INC.

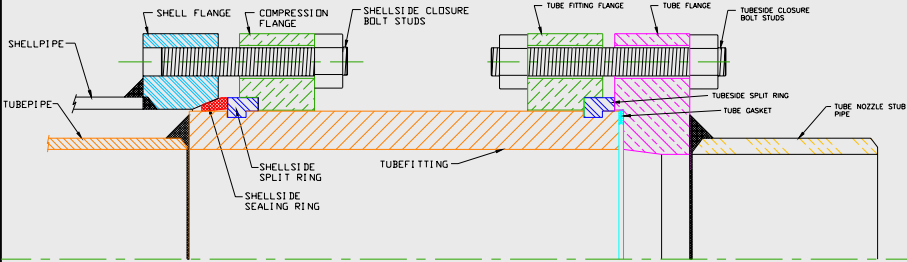


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* SEPARATED HEAD CLOSURE ASSEMBLY FOR A MULTITUBE HAIRPIN		RWHCLSR3

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\* w/ DJ Tube Gasket

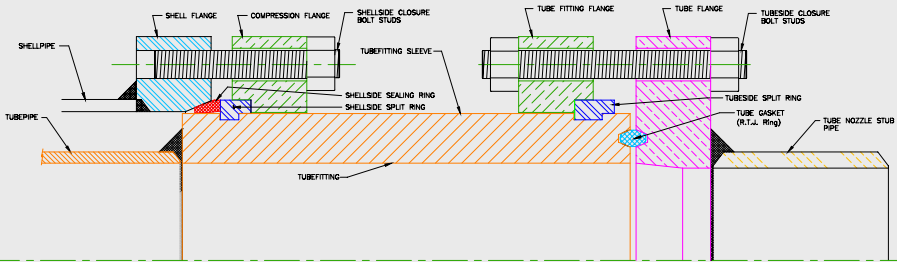
# R.W. HOLLAND, INC.



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<b>R.W. HOLLAND, INC.</b>		Rev.
TULSA, OKLAHOMA FOR SPECIFIED USE ONLY-NOT TO BE LOANED/COPIED		Date 11/03/94 By CLB
*SEPARATED HEAD CLOSURE ASSEMBLY FOR A DOUBLE PIPE HAIRPIN		Approved For Const.
Drawing No.	Rev.	
RWHCLSR7		

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# R.W. HOLLAND, INC.

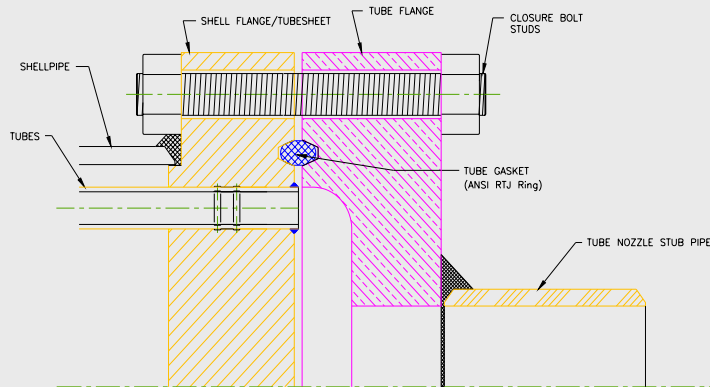


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*SEPARATED HEAD CLOSURE ASSEMBLY FOR A DOUBLE PIPE HAIRPIN		Approved For Const.
Drawing No.	Rev.	
RWHCLSR8		

\* w/ R.T.J. TUBE GASKET

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# R.W. HOLLAND, INC.



**SPECIAL NOTE:**

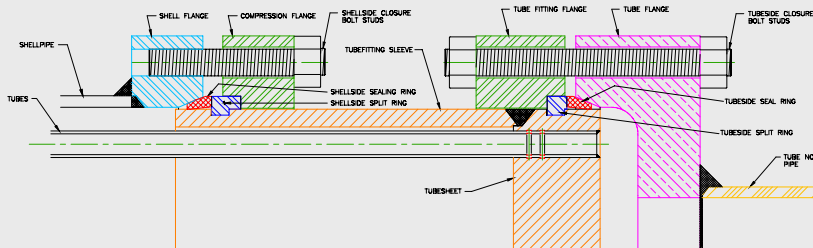
The Intent Of This Drawing Is To Supply GENERAL ORIENTATION & CONFIGURATION INFORMATION. The Design(s) Depicted Are Considered RWH Proprietary "MANUFACTURER'S STANDARD" Information & May Be Covered By One Or More U.S. Patents, Therefore, ONLY Additional Identification Information For Individual Components Can Be Supplied, Such Information Would Be For "RECORDS ONLY" Status.

\*w/ RTJ Tube Gasket

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* ALL WELDED CLOSURE ASSEMBLY w/ REMOVABLE CHANNEL	Drawing No. RWHCLSR13	Rev.

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**SPECIAL NOTE:**

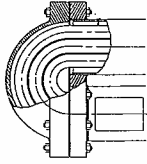
The Intent Of This Drawing Is To Supply GENERAL ORIENTATION & CONFIGURATION INFORMATION. The Design(s) Depicted Are Considered RWH Proprietary "MANUFACTURER'S STANDARD" Information & May Be Covered By One Or More U.S. Patents, Therefore, ONLY Additional Identification Information For Individual Components Can Be Supplied, Such Information Would Be For "RECORDS ONLY" Status.

\* Double Seal Ring Closure

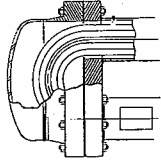
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<b>R.W. HOLLAND, INC.</b>		Ref.
<small>TRADE, MARKS AND SERVICE MARKS</small>		Date 1/22/90 By GLB
<small>FOR SPECIFIED USE ONLY-NOT TO BE LOANED/COPIED</small>		Approved For Const. By
* SEPARATED HEAD CLOSURE ASSEMBLY FOR A MULTITUBE HAIRPIN	Drawing No. RWHCLSR4	Rev.

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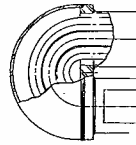
RETURN END CLOSURES



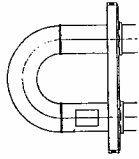
Holland standard closure. When casting is removed, tube returns are completely exposed for inspection.



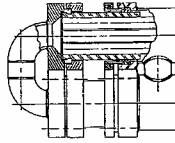
Fabricated closure for high pressure and alloy design where standard closure is not adequate.



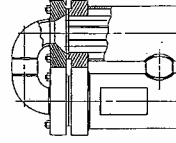
Welded closure for all welded design units using elliptical or hemispherical heads.



Welded closure for all welded design using a 180° return.



Rod thru design with packed joint which allows straight thru cleaning of tubes and removing bundle.



Rod thru design with fixed tubesheets allows straight thru cleaning of tubes. Expansion joints furnished when required.

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Examples

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# R. W. HOLLAND, INC.

R. W. HOLLAND, INC.

EXCHANGER SPECIFICATION SHEET

CUSTOMER: SOUTHERN CO.      INQ. NO: BCC98-035  
 LOCATION:      DATE: FEB. 8, 1999      QUOTE NO: 99-046  
 SERVICE: FUEL GAS HEAT EXCHANGER      ITEM: E-1  
 SIZE: MODEL: 10028-16-02-UU-2C8B      PAR SHL/TUBE 1/1  
 TOT. SURF.: 337 SQ. FT.      SEC./UNIT: 1      SURF./SEC.: 337 SQ. FT.

PERFORMANCE OF ONE UNIT

	UNIT	SHELLSIDE	
		CONDENSATE	NATURAL GAS
TOTAL FLOW	LB/HR	10723.	84500.
VAPOR IN	LB/HR	0.	84500.
LIQUID IN	LB/HR	10723.	0.
FLUID VAP OR COND	LB/HR	0.	0.
TEMP. IN	DEG F	281.0	45.0
TEMP. OUT	DEG F	60.0	100.0
CP-LIQUID	BTU/LB/F	1.010	.000
CP-VAPOR	BTU/LB/F	.000	.515
S.G. IN OR AVG		.928	.000
S.G. OUT		1.000	.000
VISC. IN OR AVG	CP	1.000	.000
VISC. OUT	CP	1.120	.000
K-LIQUID	BTU/HR/FT/DEG F	.365	.000
VISC. GAS	CP	.000	.032
K-GAS	BTU/HR/FT/DEG F	.000	.019
MM-IN OR AVG		.00	17.40
MM-OUT		.00	17.40
OPER. PRESS.	PSIG	655.30	550.36
VELOCITY	FT/SEC	0.400	79.930
PRESS. DROP ALLOW/CALC	PSI	30.00/ 0.34	30.00/ 8.45
FOULING	HR-FT-DEG F/BTU	.0005	.0010

DUTY - BTU/HR 2393463      MTD - DEG F 66.7  
 SERVICE TRANSFER RATE-BTU/HR/FT/DEG F 106.6

CONSTRUCTION

CORROSION ALLOWANCE IN.      .0625      .0625 EX. TUBES  
 DESIGN/TEST PRESSURE PSIG      800./CODE      705./CODE  
 DESIGN TEMPERATURE DEG F      370.      150.

TUBES - MAT'L: SA-249 TP304      1.000" O.D.      TUBE: .0625" NO. 38 LG. 16'  
 SHELL - MAT'L: SA-106 C      10.00" IPS      THK: STD. WT.  
 Baffles MAT'L: C. STL.      TYPE: SEGM      PITCH: 6"  
 RETURN BEND BOWING MAT'L: SA-516 70      TYPE: J.F.F.  
 SHELL FLANGES -      MAT'L: SA-516 70      TUBE: S.I.D.U./NON-ASB  
 TUBESHEET -      MAT'L: SA-240 304      TUBE: 8"-300R RP  
 GASKETS -      SHELL: COMP. NON-ASB      TUBE: S.I.D.U./NON-ASB  
 CONNECTIONS - SIZE & RATING - SHELL: 2"-600R RP      TUBE: 8"-300R RP  
 CODE REQUIREMENTS: ASME SECTION VIII DIV. 1, W/ STAMP.

REMARKS: SANDBLAST AND PRIME W/ CARBOINIC 11.  
 SEAMWELD TUBES TO TUBESHEETS.

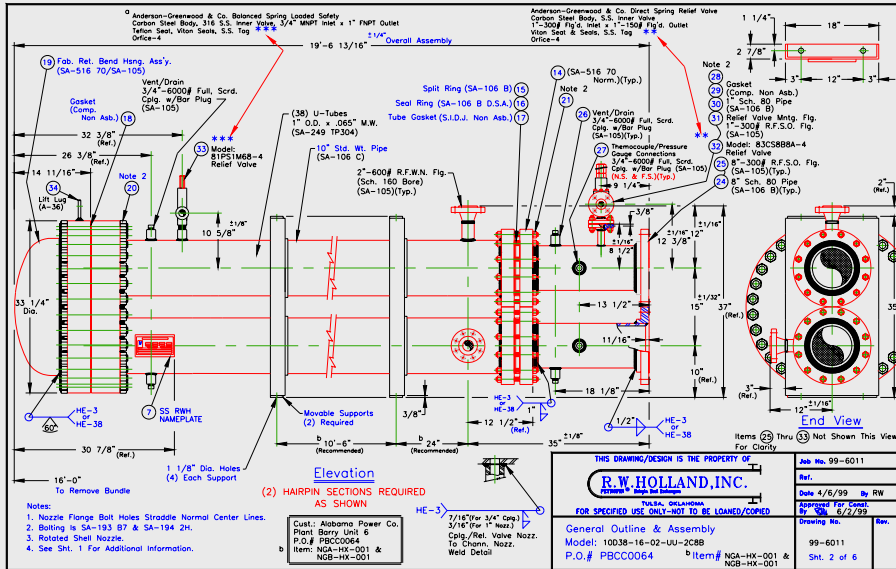
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# R. W. HOLLAND, INC.

CUSTOMER DATA	SPECIAL DATA	TUBE BUNDLE DATA																			
CUSTOMER: SOUTHERN COMPANY For ALABAMA POWER COMPANY LOCATION:      P.O. NUMBER: PBC00064 TAG ITEM NO.: NGA-HX-001 & NGB-HX-001 SERVICE: FUEL GAS HEAT EXCHANGER (2) Models: 10028-16-02-UU-2C8B MISC.: Domestic Mats. Unless Cust. Written OK. Nitrogen Blanket Both Sides. Rotated Shell Nozzle. (For Domestic Shipments)	SURFACE PREP: SSPC SP-8 PAINT SPEC. (See # Below) HEAT TREAT: N/R CUSTOMER INSP.: Yes (5) Working Days Notice B/A Fab. NAT'L BRD. NO.: A.S.M.E. Section VIII, Div. 1, A-98 CODE STAMP: U Div. 1, A-98 RT Ret. Bend Insp. Ass'y/ASME	SIZE: 1" O.D. x .0625" M.W. COUNT: (36) One Piece U-Tubes MATERIAL: SA-249 TP304 FINS/TUBE: None MATERIAL: N/A CUT & TWIST: N/A WELD PROCEDURE: HE-9A *RP TUBE WELDS B/4 & AFTER TUBE ROLLING PROCEDURE.	<p style="text-align: center;">ARRANGEMENT END VIEW SCHEMATIC</p>																		
SHELL ASSY. DATA SIZE: 10" Std. Wt. Pipe MATERIAL: SA-106 C CONNECTIONS: 2"-600R R.F. Flgs. WELD PROCEDURE: HE-3 & HE-38	SECTION DATA WEIGHT PER SECTION: DRY 4930 Lbs.      WET 8021 Lbs. TOTAL UNIT WEIGHTS: DRY _____      WET _____ SURFACE AREA: PER SECTION: 337 Sq. Ft. TOTAL _____	DESIGN CONDITIONS <table border="1" style="width: 100%;"> <thead> <tr> <th></th> <th>SHELL</th> <th>TUBE</th> </tr> </thead> <tbody> <tr> <td>DESIGN PSIG</td> <td>800</td> <td>705</td> </tr> <tr> <td>TEST PSIG</td> <td>1200</td> <td>1058</td> </tr> <tr> <td>DESIGN TEMP</td> <td>370F</td> <td>150F</td> </tr> <tr> <td>CORROSION</td> <td>.0625"</td> <td>.0625" Ex. Tubes</td> </tr> <tr> <td>MDMT/PSIG</td> <td>0F/800</td> <td>0F/705</td> </tr> </tbody> </table> *Hydrotest Water to Contain < 50 PPM Chlorides. #Blow Dry With Shop Air After Hydrotest.		SHELL	TUBE	DESIGN PSIG	800	705	TEST PSIG	1200	1058	DESIGN TEMP	370F	150F	CORROSION	.0625"	.0625" Ex. Tubes	MDMT/PSIG	0F/800	0F/705	
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ITEM NO.			NO. OF SECTIONS	SHELL		TUBE															
	PARALLEL	SERIES		PARALLEL	SERIES																
NGA-HX-001 & NGB-HX-001	* 2	1	1	1	1																
REVISIONS: Rev. a 6/2/99 Rvd./Cust. Marked-Up Approval Dep.			GENERAL DATA																		

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# R.W. HOLLAND, INC.

R. W. HOLLAND, INC.

EXCHANGER SPECIFICATION SHEET (ENGLISH UNITS)

CUSTOMER: BOKFREM CO  
 LOCATION: SMITH/NAMELEY/GOAT ROCK DATE: MAY 2, 2000 QUOTE NO: 00-002-1  
 SERVICE: PURE GAS HEAT EXCHANGER ITEM: A12 2  
 MODEL: W12A158-30-02-VU-6010C PAR SHEL/TUBE 1/ 1  
 ROT. SURF.: 1.612 SQ.FT. SEC./ORIT: 1 SURF./SEC.: 1.612 SQ.FT.

PERFORMANCE OF ONE UNIT

	SHELLSIDE CONDENSATE	TUBESIDE NATURAL GAS
FLUID CIRCULATED		
ROYAL FLOW	LB/HR 75000	84500
VAPOR IN	LB/HR 0	84500
LIQUID IN	LB/HR 75000	0
FLUID VAP OR COND	LB/HR 0	0
TEMP. IN	DEG F 297.0	215.0
TEMP. OUT	DEG F 130.6	280.0
CP-LIQUID	BTU/LB/F 1.010	.000
CP-VAPOR	BTU/LB/F .000	.585
S.G. IN OR AVG	.999	.000
S.G. OUT	.999	.000
VELOC. IN OR AVG	CP 186	.000
VELOC. OUT	CP 500	.000
R-LIQUID	BTU/HR/FT/DEG F .371	.000
VELOC. GAS	CP .000	.012
R-GAS	BTU/HR/FT/DEG F .000	.019
MF-IN OR AVG	.60	17.40
MF-OUT	.60	17.40
OPER. PRESS.	PSIG 655.00	475.00
VELOCITY	FT/SEC 4.100	86.900
PRESS. DROP ALLOW/CALC	PSI 30.00/29.57	30.00/26.75
POOLING	HR-FT/DEG F/BTU .0005	.0010

SERVICE TRANSFER RATE-BTU/HR/FT<sup>2</sup>/DEG F 161.2

CONSTRUCTION

CORROSION ALLOWANCE IN .0625  
 DESIGN/TEST PRESSURE PSIG 1500/CODE 690  
 DESIGN TEMPERATURE DEG F 400

TUBE - MAT'L: SA-249-304 625" O.D. TUBE: 605" W/M NO.158 LG. 30" 0"  
 SHELL - MAT'L: SA-106-C 12.00" I.P.S. THK: SCH 80  
 Baffle MAT'L: C/ST TYPE: SEGMENT PITCH: 7"  
 RETURN BEND HOODING MAT'L: SA-516-70 TYPE: F.F.  
 SHELL FLANGES - MAT'L: SA-516-70  
 TUBESHEET - MAT'L: SA-249-304 CHANNEL MAT'L: C. STL.  
 GASKETS - SHELL: COMP. NON-ASS TUBE: SILDINA SB  
 TUBESIDE A.B.C. - MAT'L: SA-214-WB SIZE: 1/2" TUB. 500"  
 CONNECTIONS - SIZE & RATING - SHELL: 6"-900# RFWN TUBE: 10"-600# RFB0  
 CODE REQUIREMENTS-ASME SECTION VIII DIV. 1, W/ STAMP.  
 REMARKS (HANDWRITING AND PAINT 2-3) MILS CE-11  
 VENTS AND DRAINS  
 PRESSURE AND TEMP. CONNECTIONS ALL NOZZLES  
 WELD TUBES TO TUBESHEET  
 ALL WELDED DESIGN WITH REMOVABLE CHANNELS

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# R.W. HOLLAND, INC.

CUSTOMER DATA	SPECIAL DATA	TUBE BUNDLE DATA	
<b>CUSTOMER</b> GULF POWER COMPANY Pensacola, Florida	<b>SURFACE PREP</b> SSPC-SP 6 <b>PAINT SPEC.</b> Point (3) Coat System As Specified Below.	<b>SIZE</b> 5/8" O.D. x .072" M.W.	<p style="text-align: center;"><u>RECOMMENDED ARRANGEMENT</u> (END VIEW SCHEMATIC)</p>
<b>P.O. NUMBER</b> 5491132-0000	<b>HEAT TREAT</b> N/R	<b>COUNT</b> (158) One P.c. U-Tubes * SA-249 TP304	
<b>TAG ITEM NO.</b> SMITH 3	<b>CUST. INSP.</b> (S) Days Notice to PROJECT DISC. B/A Any Testing	<b>MATERIAL</b> N/A	
<b>SERVICE</b> FUEL GAS HEAT EXCHANGERS (2) Mod# W12A158-30-02-VU-6010C	<b>NATL. BD. NO.</b> N/R	<b>FINS/TUBE</b> None	
<b>MISC.</b> - Foreign Mats. Are Allowed EXCEPT Tubes. - Air-Welded Design w/Removable Chromites. - Insulation (If Any) By Others. - N2 PURGE & BLOWNET Read. - SHELLSIDE & TUBESIDE PSVs Included. - SHELLSIDE & TUBESIDE VENT, DRAIN, PI & TI Connections Included. - 3" NAMEPLATE Projection.	<b>CODE STAMP</b> (U) A.S.M.E. Section VIII, Div. 1, A-99	<b>MATERIAL</b> N/A <b>CUT &amp; TWIST</b> N/A <b>OTHER</b> None	
<b>SHELL ASSY. DATA</b>	<b>WEIGHT &amp; SURFACE</b>	<b>DESIGN CONDITIONS</b>	
<b>SIZE</b> 12" Sch. 80 Pipe	<b>DRY</b> 14900# <b>WET</b> 17440#	<b>SHELL</b> <b>TUBE</b>	
<b>MATERIAL</b> SA-106 C	<b>TOTAL HAIRPIN WEIGHTS:</b>	<b>DESIGN PSIG</b> 1500 690	
<b>CONNECTIONS</b> 6"-800# R.F. Flanges	<b>DRY</b> 29800# <b>WET</b> 34880#	<b>TEST PSIG</b> 2250 1035	
<b>WELD PROCEDURE</b> HE-3 HE-29 & HE-38	<b>SURFACE AREA:</b>	<b>METAL TEMP.</b> 400F. 400F.	
	<b>PER HAIRPIN</b> 1612 Sq. Ft.	<b>CORROSION</b> 0.625" Only 0.625" Only	
	<b>TOTAL</b> 3224 Sq. Ft.	<b>MDMT/PSIG</b> -25 Deg.F./1500 Deg.F./690	
		- Hydrotest w/ Potable Water Containing c. 50 PPM Chlorides. - Blow Dry w/ Shop Air Before N2 Purge & Blanket.	
<b>SECTION ARRANGEMENT</b>			
<b>ITEM NO.</b>	<b>NO. OF SECTIONS</b>	<b>SHELL</b>	<b>TUBE</b>
		<b>PARALLEL</b>	<b>SERIES</b>
		<b>PARALLEL</b>	<b>SERIES</b>
SMITH 3	1	1	1
SMITH 3	1	1	1
<b>REVISIONS:</b> Rev. a 1/05/01 Added P.O. No., Revised Cust. Name (Was SOUTHERN COMPANY) & Revised Point to (3) Coat System Per Cust. (Was Primer Only). Rev. b 4/02/01 Added Color to Paint FINISH COAT Description Per Cust.			
<b>GENERAL DATA</b>			Job No. 00-6232 Ref. Date 9/08/00 by GLB Approved for Issue by C/LB 1/05/01 Drawing No. 00-6232 Rev. SH. 1 of 6

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# R.W. HOLLAND, INC.

<p style="text-align: center;"><b>ELEVATION</b>      <b>END VIEW</b></p>		<p style="text-align: center;"><u>RECOMMENDED ARRANGEMENT</u> (END VIEW SCHEMATIC)</p>	
<p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>Nozzle Flange Bolt Holes Straddle Normal Center Lines</li> <li>Bolting Is SA-193 B7 &amp; SA-194 2H, PTFE Coated @ S.S.</li> <li>See Exp. SH.1 For O.C., Stocking &amp; Additional Info.</li> <li>Item (26) VENT, DRAIN OR PRESSURE CONN. - 3/4"-800# FNPT w/ Bar Plug (SA-105).</li> <li>Item (27) TEMP. GAUGE (Thermowell) CONN. - 1"-600# FNPT w/ Bar Plug (SA-105).</li> <li>Items (28) TUBESIDE PSV CONN. - 2"-600# R.F.S.O. Flg. (SA-106 B/SA-105N)</li> <li>All VENT, DRAIN, PI &amp; TI CONNS. Weld Joints Not Shown Are Full Penetration Config. w/ 3/8" Fillet Weld Size.</li> </ol>			
<b>GENERAL DATA</b>			Job No. 00-6232 Ref. Date 8/03/00 by GLB Approved for Issue by C/LB 1/05/01 Drawing No. 00-6232 Rev. SH. 2 of 6
<b>GENERAL OUTLINE &amp; ASSEMBLY</b>			
Model: W12A158-30-02-VU-6010C P.O.# 5491132-0000      Item# SMITH 3			

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# R. W. HOLLAND, INC.

R. W. HOLLAND, INC.

EXCHANGER SPECIFICATION SHEET (ENGLISH UNITS)

CUSTOMER: PEERLESS MFG. CO.      INQ. NO: D000-01068  
 LOCATION:      DATE: JUN. 21, 2001      QUOTE NO: 00-388-4  
 SERVICE: GAS/WATER EXCHANGER (DESIGN CASE)      ITEM: E-1  
 SIZE: MODEL: 16A258-21-00-UU-10B4C      FAR SHL/TUBE 1/ 1  
 TOT. SURF.: 1905 SQ. FT.      SEC./UNIT: 1      SURF./SEC.: 1905 SQ. FT.

PERFORMANCE OF ONE UNIT

	SHELLSIDE	TUBESIDE
FLUID CIRCULATED	GAS	WATER
TOTAL FLOW	LB/HR 90500	40000
VAPOR IN	LB/HR 90500	0
LIQUID IN	LB/HR 0	40000
FLUID VAP OR COND	LB/HR 0	0
TEMP. IN	DEG F 50.0	466.0
TEMP. OUT	DEG F 351.0	119.1
CP-LIQUID	BTU/LB/F .000	1.107
CP-VAPOR	BTU/LB/F .520	.000
S.G. IN OR AVG	.000	.807
S.G. OUT	.000	.986
VISC. IN OR AVG	CP .000	.111
VISC. OUT	CP .000	.500
K-LIQUID	BTU/HR/FT/DEG F .000	.368
VISC. GAS	CP .014	.000
K-GAS	BTU/HR/FT/DEG F .028	.000
MM-IN OR AVG	16.70	.00
MM-OUT	16.70	.00
OPER. PRESS.	PSIG 430.00	584.00
VELOCITY	FT/SEC 31.800	.500
PRESS. DROP ALLOW/CALC	PSI 3.00/3.14	10.00/13
FOOLING	HR-FT-DEG F/BTU .0010	.0010
DUTY - BTU/HR	14447420, MTD - DEG F 90.1	
SERVICE TRANSFER RATE	BTU/HR/FT/DEG F 83.6	

CONSTRUCTION

CORROSION ALLOWANCE IN. .0625      .0625 EX. TUBES  
 DESIGN/TEST PRESSURE PSIG 550./CODE 990./CODE  
 DESIGN TEMPERATURE DEG F 400      517

TUBES - MAT'L: SA-214      .625" O.D. THK: .065"AW NO.258 LG. 21'  
 SHELL - MAT'L: SA-106 B      16.00" I.P.E THK: STD WT  
 RETURN BEND HOUSING MAT'L: SA-216 WCB      TYPE: F.F.  
 SHELL FLANGES - MAT'L: SA-516 70  
 TUBESHEET - MAT'L: SA-516 70      CHANNEL MAT'L: C. STL.  
 GASKETS - SHELL COMP. NON-ASS      TUBE S.I.D.J./NON-ASS  
 CONNECTIONS-SIZE & RATING-SHELL: 10"-300# RFSSO TUBE: 4"-600# RFSSO  
 CODE REQUIREMENTS:ASME SECTION VIII DIV. 1, W/ STAMP.  
 REMARKS: SANDBLAST AND ONE COAT CARBOZING 11.  
 10% EXCESS SURFACE AREA IN DESIGN.

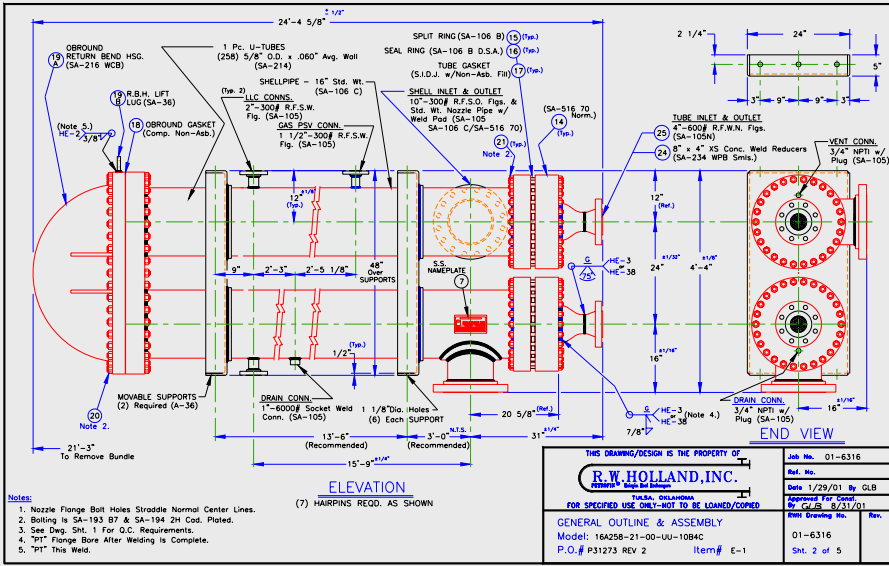
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# R. W. HOLLAND, INC.

CUSTOMER DATA	SPECIAL DATA	TUBE BUNDLE DATA	
CUSTOMER PEERLESS MFG. COMPANY Dallas, Texas	SURFACE PREP. SSPC-SP 10	SIZE 5/8" O.D. x .060" Avg. Wt.	<p style="text-align: center;">RECOMMENDED ARRANGEMENT (END VIEW SCHEMATIC)</p>
P.O. NUMBER P31273 REV 2	PAINT SPEC Prime (1) Coat, 3 to 3.5 Mil DPT. INTERNATIONAL INTERZINC 22 Coat, Green	COUNT (258) One P.c. U-Tubes	
TAG ITEM NO. E-1	HEAT TREAT N/R	MATERIAL SA-214	
SERVICE GAS/WATER EXCHANGER	CUSTOMER INSP. Unknown	FINS/TUBE None	
(7) Mod.# 16A258-21-00-UU-10B4C	NATL. BD. NO. N/A	MATERIAL N/A	
MISC. - Insulation By Others. - 3" NAMEPLATE Projection.	CUSTOMER INSP. ASME, Section VIII, Div. 1, A-00	CUT & TWIST N/A	
	RT None	OTHER None	
	UT None	WELD PROCEDURE N/R (Est. Wt. Of BUNDLE (Dry) = 5200#)	
	MT None		
	PT As Required Per ASME Or RWH.		
SHELL ASSY. DATA	WEIGHT & SURFACE	DESIGN CONDITIONS	
SIZE 16" Std. Wt. Pipe	WEIGHT EACH EXCHANGER: DRY 12355# WET 15955#	DESIGN PSIG 550 SHELL 990 TUBE 990	
MATERIAL SA-106 C	SURFACE EACH EXCHANGER: 1905 Sq. Ft.	TEST PSIG 761 SHELL 1290 TUBE 1290	
CONNECTIONS 10"-300# R.F. Flg.		METAL TEMP. 400F. SHELL 517F. TUBE 517F.	
WELD PROCEDURE HE-3 & HE-38		CORROSION .0625" Exc. .0625" Exc. MDMT/PSIG 32 Deg./550 32 Deg./990	
Additional Connections: 1 1/2"-300# R.F. Flange (PSV) 1"-6000# S.W. Conn. (DRAIN) 2"-300# R.F. Flange (LIC CONN.) 2"-300# R.F. Flange (LIC CONN.)			
SECTION ARRANGEMENT			GENERAL DATA
ITEM NO. E-1	NO. OF SECTIONS 7	SHELL PARALLEL SERIES 1	TUBE PARALLEL SERIES 1
REVISIONS:			THIS DRAWING/DESIGN IS THE PROPERTY OF R.W.HOLLAND, INC. FOR SPECIFIED USE ONLY-NOT TO BE LOANED/COPIED Job No. 01-6318 Date 2/05/01 by CLB Approved For Issue By CAJ/B 8/31/01 Drawing No. 01-6318 SH. 1 of 5

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# R.W. HOLLAND, INC.



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# R.W. HOLLAND, INC.

<p><b>CUSTOMER DATA</b></p> <p>CUSTOMER: PUERTO RICO ELECTRIC POWER AUTHORITY (PREPA) PALO SECO, PUERTO RICO</p> <p>P.O. NUMBER: 0002681</p> <p>TAG ITEM NO., UNIT #1 &amp; UNIT #2:</p> <p>SERVICE: POWER PLANT FUEL OIL HEATER (32) Mod.# 3.5H1-21-00-24UU-2.5C1.5C (2) Identical Installations Of (18) HAIRPINS Each Stacked As Shown On Dwg. SH. 2</p> <p><b>MISC.</b></p> <p>Confirmed Joint @ RETURN BEND HOUSING. Thru Bolted Closure. Shellside &amp; Tubeside Headers Are Included. Continuous Weld External Non-Pressure Attachments. Export Crate.</p>	<p><b>SPECIAL DATA</b></p> <p>SURFACE PREP: SSPC-SP 6</p> <p>PAINT SPEC: Prime (1) Coat</p> <p>CARBONLINE CARBOZINC No. 11 Inorganic Zinc S.S. Loose Pipe Bands</p> <p>HEAT TREAT: Yes Per UCS-56, P-No. 1</p> <p>CUSTOMER INSP: Yes</p> <p>NATL.BRD.NO.: N/R</p> <p>CODE STAMP: <input checked="" type="checkbox"/> A.S.M.E. Section VIII, Div. 1, A-99</p> <p>RT: None</p> <p>LT: None</p> <p>MT: None</p> <p>PT: As Required Per ASME Or RWH.</p>	<p><b>TUBE ELEMENT DATA</b></p> <p>SIZE: 1 1/2" Std. Wt. Pipe</p> <p>COUNT: (1) Welded U-TUBE</p> <p>MATERIAL: SA-108 B</p> <p>FINS/TUBE: (24) 3/4" High x .035" Thk.</p> <p>MATERIAL: C. Stl.</p> <p>CUT &amp; TWIST: N/R</p> <p>WELD PROCEDURE: HE-1</p>																						
<p><b>SHELL ASSY. DATA</b></p> <p>SIZE: 3 1/2" Std. Wt. Pipe</p> <p>MATERIAL: SA-108 B</p> <p>CONNECTIONS: 2 1/2"-600# R.F.S.W.</p> <p>WELD PROCEDURE: HE-3 &amp; HE-38</p>	<p><b>WEIGHT &amp; SURFACE</b></p> <p>WEIGHT/HAIRPIN SECTION: DRY: 900#    WET: 1100#</p> <p>WEIGHT (18) HAIRPIN SECT.: DRY: 15565#    WET: 19865#</p> <p>SURFACE/HAIRPIN SECTION: 143 Sq. Ft.</p> <p>TOTAL UNIT SURFACE: 2288 Sq. Ft.</p>	<p><b>DESIGN CONDITIONS</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>DESIGN PSIG</td> <td>650</td> <td>1000</td> </tr> <tr> <td>TEST PSIG</td> <td>845</td> <td>1300</td> </tr> <tr> <td>METAL TEMP.</td> <td>650F.</td> <td>650F.</td> </tr> <tr> <td>CORROSION</td> <td>.0625"</td> <td>.0625" Exc. Tubes</td> </tr> <tr> <td>MDMT/PSIG</td> <td>0</td> <td>-20</td> </tr> <tr> <td></td> <td>Dep. r./650</td> <td>Dep. r./1000</td> </tr> </table>	DESIGN PSIG	650	1000	TEST PSIG	845	1300	METAL TEMP.	650F.	650F.	CORROSION	.0625"	.0625" Exc. Tubes	MDMT/PSIG	0	-20		Dep. r./650	Dep. r./1000				
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	Dep. r./650	Dep. r./1000																						
<p>SECTION ARRANGEMENT</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">ITEM NO.</th> <th rowspan="2">NO. OF SECTIONS</th> <th colspan="2">SHELL</th> <th colspan="2">TUBE</th> </tr> <tr> <th>PARALLEL</th> <th>SERIES</th> <th>PARALLEL</th> <th>SERIES</th> </tr> </thead> <tbody> <tr> <td>UNIT #1</td> <td>16</td> <td>8</td> <td>2</td> <td>8</td> <td>2</td> </tr> <tr> <td>UNIT #2</td> <td>16</td> <td>8</td> <td>2</td> <td>8</td> <td>2</td> </tr> </tbody> </table>			ITEM NO.	NO. OF SECTIONS	SHELL		TUBE		PARALLEL	SERIES	PARALLEL	SERIES	UNIT #1	16	8	2	8	2	UNIT #2	16	8	2	8	2
ITEM NO.	NO. OF SECTIONS	SHELL			TUBE																			
		PARALLEL	SERIES	PARALLEL	SERIES																			
UNIT #1	16	8	2	8	2																			
UNIT #2	16	8	2	8	2																			
<p><b>REVISIONS:</b></p>																								
<p>THIS DRAWING/DESIGN IS THE PROPERTY OF <b>R.W. HOLLAND, INC.</b></p> <p>FOR SPECIFIED USE ONLY-NOT TO BE LOANED/COPIED</p> <p style="text-align: center;"><b>GENERAL DATA</b></p>																								
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Job No.</td> <td>01-6316</td> </tr> <tr> <td>Ref.</td> <td></td> </tr> <tr> <td>Date</td> <td>11/09/00 By: GLB</td> </tr> <tr> <td>Approved For Issue</td> <td>By: 06-83-8/231/00</td> </tr> <tr> <td>Drawing No.</td> <td>01-6316</td> </tr> <tr> <td>Rev.</td> <td>SH. 1 of 9</td> </tr> </table>			Job No.	01-6316	Ref.		Date	11/09/00 By: GLB	Approved For Issue	By: 06-83-8/231/00	Drawing No.	01-6316	Rev.	SH. 1 of 9										
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# R. W. HOLLAND, INC.

R. W. HOLLAND, INC.  
EXCHANGER SPECIFICATION SHEET (ENGLISH UNITS)

CUSTOMER: PREPA      DATE: MAY 31, 2000      I.N.G. NO: TS-25-99  
 LOCATION: SAN JUAN, PR      QUOTE NO: 00-204  
 SERVICE: POWER PLANT FUEL OIL HEATER      ITEM: 1 BAGS  
 SIZE: MODEL: 3.5H1-21-00-24U0-2.5C1.5C PAR SHL/TUBE 8/8  
 TOP. SURF.: 2356 SQ.FT.      SEC./UNIT: 16      SURF./SEC.: 147 SQ.FT.

PERFORMANCE OF ONE UNIT

	SHELLSIDE	TUBESIDE
FLUID CIRCULATED	FUEL OIL	STEAM
TOTAL FLOW	LB/HR	49200.
VAPOR IN	LB/HR	0.
LIQUID IN	LB/HR	49200.
FLUID VAP OR COND	LB/HR	0.
TEMP. IN	DEG F	130.0
TEMP. OUT	DEG F	230.0
CF-LIQUID	BTU/LB/F	.500
CF-VAPOR	BTU/LB/F	.000
S.G. IN OR AVG		.980
S.G. OUT		.940
VISC. IN OR AVG	CP	460.000
VISC. OUT	CP	45.000
K-LIQUID	BTU/HR/FT/DEG F	.070
VISC. GAS	CP	.000
K-GAS	BTU/HR/FT/DEG F	.000
MW-IN OR AVG.		.00
MW-OUT		18.02
OPER. PRESS.	PSIG	300.00
VELOCITY	FT/SEC	.600
PRESS. DROP ALLOW/CALC	PSI	15.00/ 9.10
FOULING	HR-FT-DEG F/BTU	.0030
DUTY - BTU/HR	2706000.	MTD - DEG F 200.0
SERVICE TRANSFER RATE-BTU/HR/FT2/DEG F		5.7

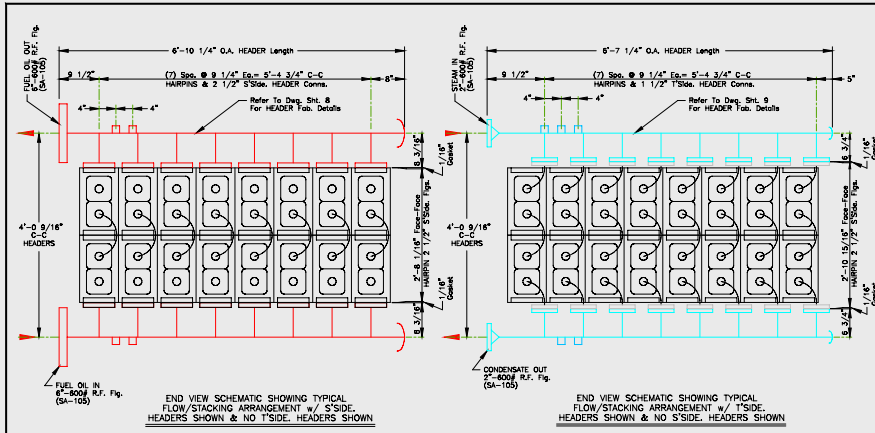
CONSTRUCTION

CORROSION ALLOWANCE IN.      .0625      .0625 EX. TUBES  
 DESIGN/TEST PRESSURE PSIG      650./CODE      1000./CODE  
 DESIGN TEMPERATURE DEG F      650.      650.

TUBES - MAT'LISA-106 B      1.5" IPS      THK: STD. WT. NO. 1      LG. 21'  
 SHELL - MAT'LISA-106 B      3.5" IPS      THK: STD. WT.  
 FINS - MAT'LIC. STL.      .7500" HT.      THK: .035" NO. 24  
 RETURN BEND HOUSING      MAT'L: SA-216 WCB      TYPE: C.J.  
 SHELL FLANGES -      MAT'L: SA-516 70      CHANNEL MAT'LIC. STL.  
 TUBESHEET -      MAT'L: SA-516 70 OR EQ.      TUBE: 1.5"\*\*\*6009 RP  
 GASKETS -      SHELL: COMP. NON-ASS      TUBE: S.W. SS/NON-ASS  
 TUBESIDE R.B.C. -      MAT'L: SA-234 WPS      SIZE: 1.5" IPS  
 CONNECTIONS - SIZE & RATING - SHELL: 2.5"\*\*\*6009 RP      TUBE: 1.5"\*\*\*6009 RP  
 CODE REQUIREMENTS: ASME SECTION VIII DIV. 1, W/ STAMP.  
 REMARKS: SANDBLAST & ONE COAT CARBONLAC CARBONLAC #11 PRIMER.  
 SHELLSIDE (6") & TUBESIDE (2") HEADERS INCLUDED.  
 EXPORT CRATE.  
 \* (2) IDENTICAL INSTALLATIONS OF (16) HAIRPINS EA. ARE REQUIRED.

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- Notes:
- ASSEMBLE AS SHOWN ABOVE FOR HYDROTEST.
  - UNIT #1, REMOVE HEADERS & SHIP LOOSE IN CRATE w/ HAIRPIN STACK. UNIT #2, SHIP AS A N<sub>2</sub> BLANKETED COMPLETE ASSEMBLY IN CRATE.

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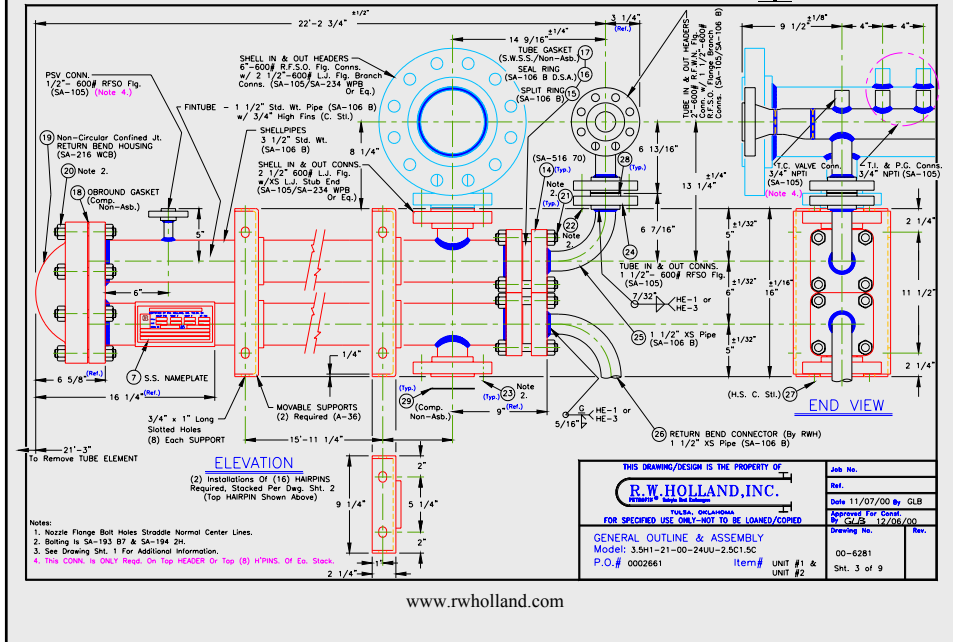
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Job No.	
Date	11/09/00 by GLB
Approved For Issue	12/28/00
Drawing No.	
Flow/Stacking Arrangement	
Model: 3.5H1-21-00-24U0-2.5C1.5C w/ HEADERS	00-6281
P.O.# 0002681      Item#      UNIT #1 & UNIT #2	Sh. 2 of 9

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# R.W. HOLLAND, INC.



# R.W. HOLLAND, INC.

R. W. HOLLAND, INC.

EXCHANGER SPECIFICATION SHEET (ENGLISH UNITS)

CUSTOMER: KITSUI / EXXONMOBIL CHEMICAL INC. NO. 021PR4104  
 LOCATION: BAYCON HOUSE, LA. BATHY TRIC. S. 2001 QUOTE NO: 01-263-2  
 SERVICE: LEAN PHASE COOLER ITEM: 2-53020 A37.1  
 SIZE: MODEL: 180189-25-00-UG-0000 BAR SHEET/TYPE: 3/3  
 TCT. SURF.: 4519 SQ. FT. REC./UNIT: 3 SURF./SEC.: 152.6 SQ. FT.

PERFORMANCE OF ONE UNIT

FLUID CIRCULATED	LEAN PHASE	TUBESIDE
TOTAL FLOW	204705	1193110
VAPOR IN	0	0
LIQUID IN	204705	1193110
LIQUID VAP OR COND	0	0
TEMP. IN	338.5	87.0
TEMP. OUT	98.6	109.5
CP LIQUID	.620	1.000
CP VAPOR	.000	1.000
S.G. LIQ OR AVE	.830	1.000
S.G. OUT	.800	.793
VISC. LIQ OR AVE	.240	.750
VISC. OUT	.057	.335
K-LIQUID	.000	.000
VISC. GAS	.000	.000
K-GAS	.000	.000
VE-IN OR AVE	.00	.00
VE-OUT	.00	.00
OWK. EFFCS	PSIG 598.00	50.00
VELOCITY	PI/SK 2.500	4.300
WESS. DRUP	MTLW/GALC FEET 25.00/13.24	10.00/7.06
FOULING	NO-CT DEG F/DTU .0028	.0020
SERVICE TRANSFER RATE	RTU/HR/FT/DEG F 89.9	

CONSTRUCTION

CONGESTION ALLOWANCE IN: .1250 12NO EX.TUBES  
 DESIGN/INST PRESSURE PSIG: 776/COOR: 515/COOR  
 DESIGN TEMPERATURE DEG F: N/A 150

TUBE: MAT'L: SA-214 1.000 O.D. TRK: 109PM NO.189 LG: .25"  
 SHELL: MAT'L: SA-216 C 7.600 IPS TRK: SCR 63  
 BUFFING: MAT'L: C. STL TYPE: SB24 SPACING: 5"  
 BUNTON BRG: MAT'L: SA-216 72 TRS: C-2  
 SHELL PLATES: MAT'L: SA-216 72 CHANN: MAT'L: C. STL  
 TUBESHEET: MAT'L: SA-216 70 TUBE: S.W. BS/ROK-ASH  
 CARBETS: SHELL: COMP. NON-ASB TUBE: 8" X 8" X 12  
 CONNECTIONS: 6" X 6" GALVING-SUBG. 6" 600# W/NN  
 CURV RECEIVING/LANSE: SPEC'D BY DIV. 1, 0/ STAMP  
 REMARKS: BSEC-RP10 & PAINT WSR C.2.A.  
 SNK (1) SET SPARK DASHES & 10A SPARK HOLDING INCLUDED.  
 THE FOLLOWING MATERIALS, WHICH ARE NOT INCLUDED, ARE REQUIRED FOR FABRICATION:  
 SHALLOW THICK TO TUBESHEETS.

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# R.W. HOLLAND, INC.

CUSTOMER DATA	SPECIAL DATA	TUBE BUNDLE DATA	
<b>CUSTOMER</b> MITSUBISHI ENGINEERING & SHIP-BUILDING CO. LTD. For EXKON/MOBIEL BRPP	<b>SURFACE PREP</b> SSPC-SP 10 (2 to 3 Mil)	<b>SIZE</b> 1" O.D. x .065" Avg. Wall	
<b>P.O. NUMBER</b> H121338	<b>PAINT SPEC.</b> See Below	<b>COUNT</b> (109) 1 P.C. U-Tubes	
<b>TAG ITEM NO.</b> E-5302C	<b>HEAT TREAT</b> N/R	<b>MATERIAL</b> SA-249 TP316	
<b>SERVICE</b> LEAN PHASE COOLER	<b>CUSTOMER INSP.</b> YES (8/4 Feb. Start)	<b>OTHER</b> IMPINGEMENT SLEEVES ON TUBES.	
(3) Mod. 160109-25-02-UT-6C8B	<b>NATL. BRD. NO.</b> YES (Assigned Later)	<b>SPL. TEST(S)</b> 25 PSIG Air/Soap Bubble	<b>NOTE:</b> REFER TO DRAWING SHT. 8 FOR ARRANGEMENT & ASSEMBLY INCLUDING MANIFOLDS.
<b>MANIFOLDS</b> Are included w/ This Equipment.	<b>CODE STAMP</b> (U) A.S.M.E. Section VIII, Div. 1, 2001 Edition	<b>WELD PROCEDURE(S)</b> N/A	
<b>MISC.</b> - Nil. Applies. Any Exceptions Must Be Approved By Cust. In Writing. - Insulation (If Any) By Others. - (1) Set Spare Gaskets & 10% Boiling Inc. Per Each Exchanger. - (1) Ti CONN. is included @ 1" Side & 1" Side. - N2 Purge & Blanket Req'd. For S.S. - Blue PTFE Coated Boiling.	<b>RT</b> 200°C @ 1" Side & 1" Side. Per ASME	<b>TUBE SEALWELD PROCED.</b> HE-14 Note: "T" TUBE Welds B/4 & After Welding.	
<b>SHELL ASSY. DATA</b>	<b>SECTION DATA</b>	<b>DESIGN CONDITIONS</b>	
<b>SIZE</b> 16" XS Pipe	<b>WEIGHT PER SECTION:</b>	<b>DESIGN PSIG</b> 770	<b>SHELL</b> 770
<b>MATERIAL</b> SA-106 C	<b>DRY</b> 16660 lbs. <b>WET</b> 20730 lbs.	<b>TEST PSIG</b> 1390	<b>TUBE</b> 515
<b>CONNECTIONS</b> 6"-600# R.F. Flg.	<b>BUNDLE WEIGHT:</b> 4600 lbs. (Dry)	<b>METAL TEMP.</b> 440°F.	
<b>WELD PROCEDURE</b> HE-3 & HE-38	<b>TOTAL UNIT WEIGHTS:</b>	<b>CORROSION</b> .125" Only	
	<b>DRY</b> 54100 lbs. <b>WET</b> 67850 lbs.	<b>MDMT/PSIG</b> 32F/770	
	<b>SURFACE AREA:</b>	<b>PER SECTION</b> 1516 SQ. FT.	
	<b>TOTAL</b> 4549 SQ. FT.	<b>** Includes All MANIFOLDS.</b>	

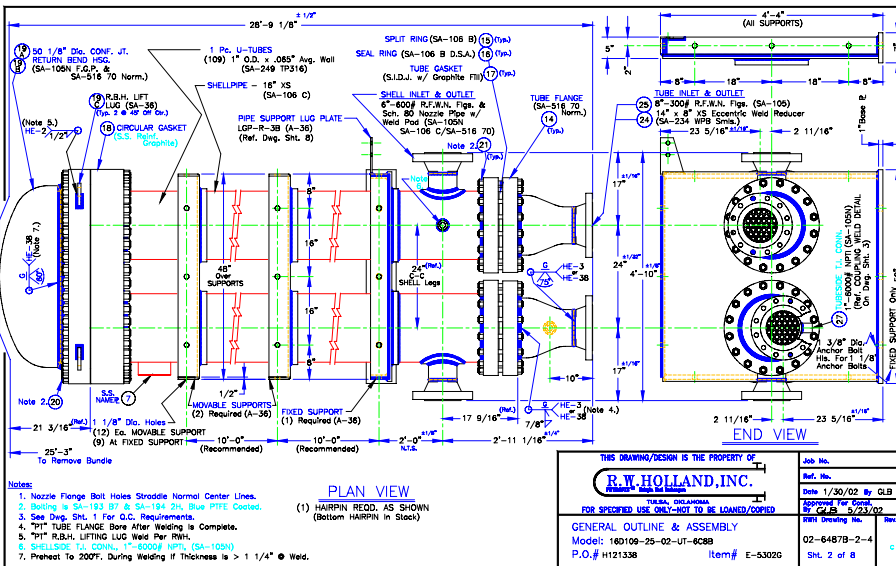
SECTION ARRANGEMENT					
ITEM NO.	NO. OF SECTIONS	SHELL		TUBE	
		PARALLEL	SERIES	PARALLEL	SERIES
E-5302C	3	3	1	3	1

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<small>TULSA, OKLAHOMA</small>		<b>Ref. No.</b>
<small>FOR SPECIFIED USE ONLY-NOT TO BE LOANED/COPIED</small>		<b>Date</b> 3/05/02 <b>By</b> GLB
<b>GENERAL DATA</b>		<b>Approved For Order</b>
		<b>By</b> C.A.B. <b>02/23/02</b>
		<b>Drawing No.</b>
		<b>02-6487B-2-4</b>
		<b>Sh. 1 of 8</b>

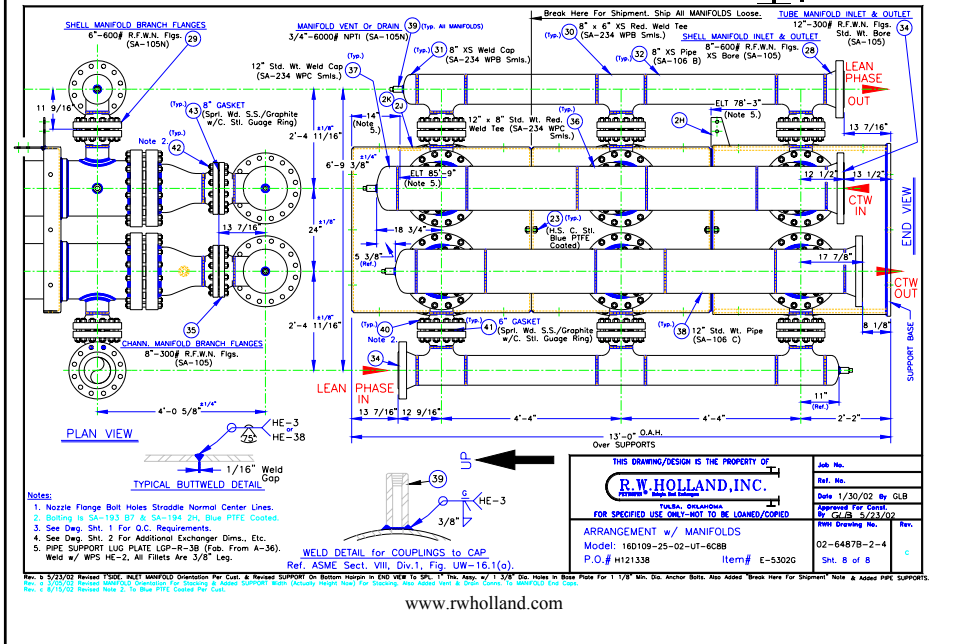
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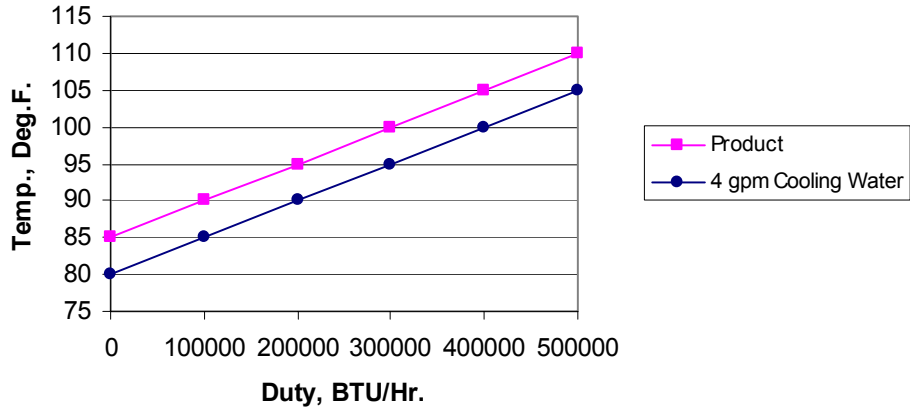
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## LMTD Examples

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LMTD Example - 5 Deg. approach



LMTD Example - 10.8 LMTD

