

APV Condenser/Shell and Tube Heat Exchanger

Mfg: APV	Model:
Stock No. 850.PFZ	Serial No.

APV Condenser/Shell and Tube Heat Exchanger. S/N E-2515, The shell side is 316L and the tube side is Titanium. It is 18 foot 10 in. and has a tube surface of 1,752 square feet. There are (2) 16 in, shell side inlets. There are (558) 3/4 in. Tubes, and the shell is 31 in. inside diameter. The way that it was set up the temperature in was 113 °F and the temperature out was 85 °F on the tube side. On the shell side the temperature in was 74 °F and the temperature out was 99 ° F. The heat exchange in btu's per hour was 8,184,000. Dimensions 19 ft. L, 32 in. W, 28 in. H (overall 78 in.), Inlet 28 in. / 1 on bottom at 6 in., 7 in. one on bottom 6 in. Pipe that came with chiller is 7 ft. L, 20 in. Diameter, one on side 12 in. Diameter. 1-1/2 in. outside of pipe.

Killebrew Engr.Corp, now Emfab, INC. House Springs, Mo. 63051

2/20/79 certified 6/6/80

Pfizer, Groton Connecticut

Vapor pounds per hour shell 70 methanol and 7,912 water

Liquid 334,750 pounds per hour

Non condensables 35 pounds per hour air

Size 31-192

Square foot surface 1,752 shell 1,752

Temp in 113 shell 74 tube

Temp out 85 shell 99.2 tube

Operating pressure shell 1.39 psia

No passes per shell crossflow shell 6 tube side

Velocity 5.5 ft/sec tube

Pressure drop .2/.12 shell 10/13 psi tube

Heat exchange btu/hr 8,184,000

Transfer rate surface 210

Design pressure 60+ shell 75 tube

Design temperature 350 350

Tubes titanium 558 3/4

Shell 316 L 31" id





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 * Killebrew Engr. Corp. " Now: " EMFAB, INC. "
 House Springs, Mo. 63051

HEAT EXCHANGER SPECIFICATION SHEET

1	CUSTOMER Pfizer Inc.		JOB NO.
2	ADDRESS Eastern Point Road		REFERENCE NO.
3	PLANT LOCATION Groton, Conn. 06340		PROPOSAL NO.
4	SERVICE OF UNIT Methanol-water Condenser		DATE 2/20/79
5	SIZE 31-192 TYPE Fixed Tubesheet (HORIZ.) (VERT.)		ITEM NO.
* 6	SQ. FT. SURF./UNIT (GROSS) (NET) 1752 SHELLS/UNIT one		CONNECTED IN
* 7	SQ. FT. SURF./SHELL (GROSS) (NET) 1752		
8	PERFORMANCE OF ONE UNIT		
9			
10	FLUID CIRCULATED	SHELL SIDE Methanol-water Vapor	TUBE SIDE Salt Water
11	TOTAL FLUID ENTERING		
12	VAPOR lbs/hr	70 Methanol + 7912 water	
13	LIQUID		
14	STEAM		334,750
15	NON-CONDENSABLES	35 lbs/hr air	
16	FLUID VAPORIZED OR CONDENSED		
17	STEAM CONDENSED		
18	GRAVITY		
19	VISCOSITY		1.03
20	MOLECULAR WEIGHT		
21	SPECIFIC HEAT		
22	THERMAL CONDUCTIVITY	BTU/LB.* F	.97 BTU/LB.* F
23	LATENT HEAT	BTU/HR-FT.* F	BTU/HR-FT.* F
24	TEMPERATURE IN	BTU/LB	BTU/LB
* 25	TEMPERATURE OUT	113 ° F	74 (Max. Summer) ° F
26	OPERATING PRESSURE	1.39 psia	99.2 ° F
* 27	NO. PASSES PER SHELL	Cross flow X	PSIG
* 28	VELOCITY		6
* 29	PRESSURE DROP Max.	.2 / 0.12	5.5 FT/SEC
30	FOULING RESISTANCE (MIN.)	.0005	10 / 13 PSI
* 31	HEAT EXCHANGED-BTU/HR	8,184,000	.001
* 32	TRANSFER RATE-SERVICE	210	MTD CORRECTED.* F 22.2 (WTD) CLEAN
33	CONSTRUCTION OF ONE SHELL		
34	DESIGN PRESSURE	60 + F.V.	
35	TEST PRESSURE	PSI	75 PSI
36	DESIGN TEMPERATURE	350	PSI
* 37	TUBES Ti	NO. 558 O.D. 3/4 DWG 20 LENGTH 16	PITCH 1" Square ° F
* 38	SHELL 316 L S.S.	I.D. 31" O.D.	SHELL COVER (INTÉG) (REMOV)
* 39	CHANNEL OR BONNET Ti or r.l. stl.	5 w/ 4" pitch	CHANNEL COVER
* 40	TUBESHEET-STATIONARY Ti lined on 316 L	Support	TUBESHEET-FLOATING
* 41	BAFFLES-CROSS 316 L TYPE	Support	FLOATING HEAD COVER
* 42	BAFFLES-LONG 316 L TYPE	Perforated	IMPINGEMENT PROTECTION
43	TUBE SUPPORTS		
44	TUBE TO TUBESHEET JOINT		
45	GASKETS		
* 46	CONNECTIONS-SHELL SIDE	IN 2-16" OUT 3-4"	RATING 150# RF
* 47	CHANNEL SIDE	IN 6 OUT 6	RATING 150# RF
48	CORROSION ALLOWANCE-SHELL SIDE	None	TUBE SIDE None
49	CODE REQUIREMENTS	ASME	TEMA CLASS C
50	REMARKS		
51	Shell side materials to be 316 L or titanium. Tube side		
52	materials to be titanium or r.l. stl. Uncondensed vapor leaving		
53	with non-condensibles not to exceed 20.4#/hr.		
54			

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

1. Manufactured by Killebrew Engineering Corporation, Maryland Hgts., Missouri 63043
(Name and address of manufacturer)

2. Manufactured for Chas. Pfizer Inc., New York, NY 10017
(Name and address of purchaser)

3. Location of installation Pfizer Co., Groton, Connecticut
(Name and address)

4. Type horiz. ht. exch. Vessel No. 33708 PB33708A-P
(Horiz. or vert. tank) (Mfr's Serial No.) (Drawing)

3925 Year Built 1980
(Nat'l Brd No.)

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction, and workmanship conform to ASME Rules, Section VIII, Division 1 1977 and Addenda to Summer 1979 and Code Case no. _____
(Year) (Date)

Special service per UG-120(d) _____

Manufacturers' Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: _____

(Name of part, item number, mfr's name and identifying stamp)

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

6. Shell: Material SA240 2161 Nominal Thickness .250 in. Corrosion Allowance _____ in.
(Spec. No., Grade)

Diam. 2 ft 7.500 in. Length 16 ft 0 in.

CERTIFICATE OF 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.

Date 6-6-80 Signed Killebrew Engr. Corp. by Jerry Martin
(Manufacturer) (Representative)

"U" Certificate of Authorization No. 12891 expires July 11, 19 81

CERTIFICATE OF SHOP INSPECTION

Vessel made by Killebrew Engr. Corp. at St. Louis, Missouri

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of Missouri and employed by Commercial Union of 6-6-80 19 _____, 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 the Manufacturers' 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 6-6-80 Signed Orin Harkley Commissions N36163
(Inspector) (Nat'l Board, State, Province and No.)

CERTIFICATE OF COMPLIANCE FOR FIELD WORK

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.

Date _____ Signed _____ (Manufacturer) by _____ (Representative)

"U" Certificate of Authorization No. _____ expires _____, 19 _____

CERTIFICATE OF FIELD ASSEMBLY INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of _____ and employed by _____ of _____ have compared the statements in this Manufacturers' 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 that, 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 Manufacturers' 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, State, Province and No.)

FORM U-1 (BACK)

7. Seams: Longitudinal double butt weld R.T. spot Efficiency 85 %
(Welded, Dbl. Sngl. Lap, Butt) (Spot or Full)
 H.T. Temp _____ F Time _____ Girth double butt weld
(Welded, Dbl. Sngl. Lap, Butt)
 R.T. spot No. of Courses 4
(Spot, Partial, or Full)

8. Heads: (a) Material _____ (Spec. No., Grade) (b) Material _____ (Spec. No., Grade)
 Location (Top, Bottom, Ends) Minimum Thickness Corrosion Allowance Crown Radius Knuckle Radius Elliptical Ratio
 (a) _____
 (b) _____
 Conical Apex Angle Hemispherical Radius Flat Diameter Side to Pressure (Convex or Concave)
 (a) _____
 (b) _____

If removable, bolts used (describe other fastenings) _____ (Material, Spec. No., Gr., Size, No.)

9. Type of Jacket _____ Proof Test _____
 10. Jacket Closure _____ If bar, give dimensions _____
(Describe as open & weld, bar, etc.)

11. Constructed for max. allowable working pressure 60/FV psi at max. temp. 350 F Min. temp. (when less than -20 F) _____ F. Hydrostatic, pneumatic, or combination test pressure 90 psi.

Items 12 and 13 to be completed for tube sections
 12. Tubesheets: Stationary Material SA240 (Spec. No., Gr.) 316L Diam. 35.750 in. (Subject to pressure)
 Nominal Thickness 1.370 in. Corrosion Allowance _____ in. Attachment weld (Welded, Bolted)
 Floating Material _____ (Spec. No., Gr.) Diam. _____ in.
 Nominal Thickness _____ in. Corrosion Allowance _____ in.
 Attachment _____

13. Tubes: Material SB 338 Gr 2 (Spec. No., Gr.) O.D. .750 in. Nominal Thickness 20 in./or gauge
 Number 558 Type straight (Straight or "U")

Items 14-17 incl. to be completed for inner chambers of jacketed vessels or channels of heat exchangers
 14. Shell: Material SA285C (Spec. No., Gr.) Nominal Thickness 3/75 in. Corrosion Allowance _____ in.
 Diam. 2 ft 7.750 in. Length 1 ft 11.500 in.

15. Seams: Longitudinal double butt weld R.T. spot Efficiency 85 %
(Welded, Dbl. Sngl. Lap, Butt) (Spot or Full)
 H.T. Temp _____ F Time _____ Girth double butt weld
(Welded, Dbl. Sngl. Lap, Butt)
 R.T. spot No. of courses 1
(Spot, Partial, or Full)

16. Heads: (a) Material SA516-70 (Spec. No., Grade) (b) Material SA516-70 (Spec. No., Grade)
 Location (Top, Bottom, Ends) Minimum Thickness Corrosion Allowance Crown Radius Knuckle Radius Elliptical Ratio
 (a) end .3125 _____ _____ _____ _____ 2:1
 (b) end _____ _____ _____ _____ _____ _____
 Conical Apex Angle Hemispherical Radius Flat Diameter Side to Pressure (Convex or Concave)
 (a) _____ 32" _____ concave
 (b) _____ _____ _____ _____

If removable, bolts used (describe other fastenings) SA193-B7 SA194-24 (Material, Spec. No., Gr., Size, No.)

17. Constructed for max. allowable working pressure 75 psi at max. temp. 350 F Min. temp. (when less than -20 F) _____ F. Hydrostatic, pneumatic, or combination test pressure 112 psi.

Items below to be completed for all vessels where applicable
 18. Safety Valve Outlets: Number _____ Size _____ Location in piping

19. Nozzles:

Purpose (Inlet, Outlet, Drain)	Number	Diam. or Size	Type	Material	Nominal Thickness	Reinforcement Material	How Attached
<u>inlet</u>	<u>2</u>	<u>16"</u>	<u>flg</u>	<u>316L</u>	<u>.260</u>		<u>welded</u>
<u>inlet/outlet</u>	<u>2</u>	<u>6"</u>	<u>"</u>	<u>c/s</u>	<u>.280</u>		<u>"</u>
<u>outlet</u>	<u>2</u>	<u>4"</u>	<u>"</u>	<u>316L</u>	<u>.120</u>		<u>"</u>

20. Inspection Openings:
 Manholes No. _____ Size _____ Location _____
 Handholes No. _____ Size _____ Location _____
 Threaded No. _____ Size _____ Location _____

21. Supports: Skirt (Yes or no) _____ Lugs (No.) _____ Lags (No.) _____ Other saddles (Describe)
 Attached shell welded (Where and how)

22. Remarks: 31-192-BXM Methanol-water condenser
P.O. No. GW-32943(R)



DESIGN DATA							CONNECTION SCHEDULE		GENERAL NOTES	
DESIGN PRESSURE	SHELL SIDE	TUBE SIDE	MARK	SIZE	RATING	FACING	FACE	SERVICE	1.) ALL BOLT HOLES TO STRADDLE NATURAL CENTER LINES. 2.) ALL NOZZLE FLANGES TO HAVE PROTECTIVE COVERS FOR SHIPMENT. (3/8 THK. PLYWOOD) 3.) ALL THREADED OPENINGS FURNISHED WITH PLUGS. MATERIALS: (IN CONTACT WITH CONTENTS) SHELL SIDE - ALL 316L 3/4 TUBE SIDE - TITANIUM 4/1 EPOXY COATING SURFACE FINISH: (EXTERNAL CARBON STEEL) PREP. - NEAR-WHITE BLAST PER SSPC-SP-10. PAINT - ONE COAT CARBO-ZINC N°11 (1 1/2 TO 3 MILS DFT)	
350 P.S.I.	60 P.S.I.	75 P.S.I.	N1	6"	150°	R.F.	TUBE SIDE INLET			
350 P.S.I.	350 P.S.I.	350 P.S.I.	N2	6"	150°	R.F.	TUBE SIDE OUTLET			
90 P.S.I.	NONE	NONE	N3	16"	150°	R.F.	SHELL SIDE INLET			
NONE	NONE	NONE	N4	4"	150°	R.F.	SHELL SIDE OUTLET			
SPOT (RT-3)	SPOT (RT-3)	SPOT (RT-3)	N5	4"	150°	R.F.	SHELL SIDE INLET			
NONE	NONE	NONE	N6	4"	150°	R.F.	SHELL SIDE OUTLET			
X TYPE	6	6	N7	4"	150°	R.F.	SHELL SIDE OUTLET			
TUBE SURFACE 1752 SQ. FT. (EXTERNAL)										
APPROX. WEIGHT EACH										
EMPTY										
FULL H ₂ O										
REM. BNDL.										
5830*							12000*			
DESIGN & CONSTRUCTION IN ACCORDANCE WITH:										
A.S.M.E. SECT. VIII, DIV. 1, STAMPED										
NATIONAL BOARD REGISTERED										
T.E.M.A. CLASS										
TUBE TO TUBESHEET JOINT										
SEAL W/ WOOD										
SURFACE FINISH: (DONNET INTERIOR)										
PREP: WHITE METAL BLAST PER SSPC-SP-10										
PAINT: ONE COAT CARBOMASTIC # 14.										

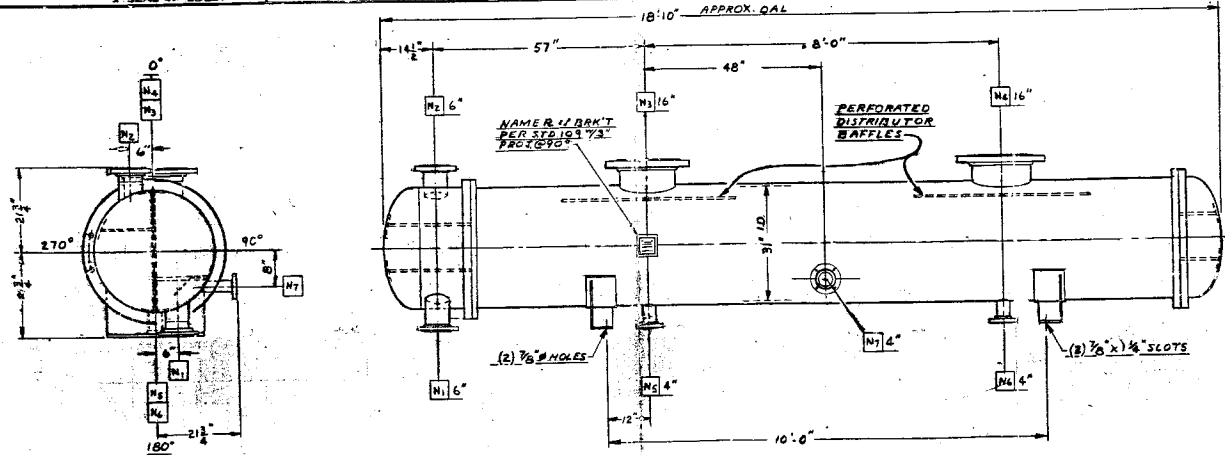
CUSTOMER: CHAS. PFIZER INC.
NEW YORK, NEW YORK 10017

CUST. P.O. NO. GH 32943 (R)

ONE UNIT REQUIRED
TAG: K.E.C. NO. 33708
ITEM NO. _____
P.O. NO. GH 32943 (R)

Q.C. CERTIFIED AS BUILT
Cust Insp Read.

CERTIFIED
CORRECT FOR FABRICATION, BY CEP DATE 9/7/79



KILLEBREW
ENGINEERING CORP.
St. Louis, Missouri

GENERAL ARRANGEMENT
SIZE 31-192 TYPE BXM
METHANOL
EQUIP. NAME - WATER CONDENSER

DR. BY GS	K.E.C. NO. 33708
DATE 6-25-79	DR. NO. PB-33708-A
CHK. BY CEP	REVISION NO.