

ADDENDUM TO OPERATING MANUAL

GAS RECOVERY UNIT
PLANT 4B

TEXACO INC.
PUGET SOUND PLANT

ESTIMATE 3910

BECHTEL INCORPORATED
HOUSTON, TEXAS
1973

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I. GENERAL
DESCRIPTION

WA-TEX 000757

1 - GENERAL DESCRIPTION

A. INTRODUCTION

This addendum to the Operating Manual for the Gas Recovery Unit at the Puget Sound Works of TEXACO Inc. at Anacortes, Washington, covers the revamp of the Gas Recovery Unit. The major revisions to the Gas Recovery Unit are:

- New and modified heat exchangers
- Replaced and modified pumps
- New trays in the Debutanizer
- Change of service for caustic treaters
- Revision of piping

B. BASIS OF DESIGN

General

The FCC Gas Recovery Unit is to process 15,000 BPSD of FCC fractionator overhead liquid and 20 MMSCFD of FCC fractionator overhead vapor. A small C_2-C_3 stream from the Alkylation Unit is recycled to this unit.

The FCC Gas Recovery Unit recovers a C_3-C_4 stream and light and heavy FCC gasolines. The C_3-C_4 stream flows to the treating section of the Cat Poly Unit. The light FCC gasoline is caustic-treated and directed to storage. The heavy FCC gasoline will, normally, flow hot to the hydrotreater unit, or will be cooled for storage. In either case, the existing caustic treater is bypassed. The heavy FCC gasoline may also be cooled and caustic-treated for storage. A fuel gas stream is recovered from the sponge column. Process flow conditions for the revamped Gas Recovery Unit are shown on the revised process flow diagrams, 4-RA-1 and 4-RA-2.

C. DESCRIPTION OF ADDITIONS AND MODIFICATIONS TO THE UNIT

This section describes only additions and significant modifications to the FCC Gas Recovery Unit. Reference should be made to the Operating Manual for the Gas Recovery Unit for a description of the existing facilities.

Compression and Absorption Section (Ref. P&ID's 4-RA-6 and 4-RA-7)

A new line is added from upstream of the absorption oil cooler, 4B-E3, to upstream of the second stage separator, 4B-C7. The purpose of this line is to permit reduction of the liquid loading in the absorption section of the absorber-deethanizer, 4B-C1, if necessary.

The absorber-deethanizer intercoolers, 4B-E6 and 4B-E7, and their circulating pumps, 4B-G7 and 4B-G8, have been taken out of service. The absorber-deethanizer second intercooler, 4B-E7, is re-used as the light FCC gasoline trim cooler.

Distillation and Treating Section (Reference P&ID 4-RA-8)

New trays are installed in the Debutanizer, 4B-C3. A new splitter reboiler, 4B-E51, is added in series with the existing splitter reboiler, 4B-E13. Reboil heat to the new reboiler is supplied by circulating hot slurry oil from the FCC fractionator.

Feed to the splitter, 4B-C4, is preheated in the new splitter feed-bottom exchanger, 4B-E50. Heavy FCC gasoline from the splitter feed-bottom exchanger, 4B-E50, may be sent directly to the hydrotreater; may be cooled in the heavy FCC gasoline cooler, 4B-E14, and the heavy FCC gasoline aftercooler, 4B-E18, and sent to storage; or may be cooled in the heavy FCC gasoline cooler, 4B-E14, and the heavy FCC gasoline aftercooler, 4B-E18, treated in the heavy FCC gasoline caustic settler, 4B-C11, and sent to storage. Light FCC gasoline is cooled in the light FCC gasoline trim cooler, 4B-E7, treated in the light FCC gasoline settler, 4B-C12, further cooled in the light FCC gasoline aftercooler, 4B-E15, and sent to storage..

Utilities

Utility consumption by new or modified equipment is given in the table on the following page.

<u>Item Number</u>	<u>Service</u>	<u>Consumption</u>
<u>250 psig steam</u>		
4B-GT9A	Absorber-Deethanizer Reboiler Circulation Pump - Spare	5,186 #/Hr.
4B-GT11A	Debutanizer Product Pump - Spare	3,742 #/Hr.
4B-GT30A	Absorption Oil Charge Pump - Spare	8,510 #/Hr.
4B-GT50 & GT50A	Splitter Column Reflux and Product Pump and Spare	3,322 #/Hr.
<u>Cooling Water</u>		
4B-E7	Light FCC Gasoline Cooler	144 GPM
<u>Electrical</u>		
4B-G9	Absorber-Deethanizer Reboiler Circulation Pump	47.2 BHP
4B-G11	Debutanizer Product Pump	51 BHP

2. CONTROL FEATURES

WA-TEX 000761

II - CONTROL FEATURES

A. PRINCIPAL CONTROL FEATURES

The principal control features are not changed by this revamp. Reference should be made to the Operating Manual for the Gas Recovery Unit for a description of the control features.

The following control valve changes are made:

1. The existing 4FRC-11V is replaced with a new 4FV-11.
2. The existing 4FRC-11V is relocated to replace the existing 4FRC-29V.
3. The existing 4FRC-29V is relocated to replace the existing 4LIC-70V.
4. The existing 4LIC-70V is surplus.
5. The existing 4LV-34 is moved from downstream of the heavy FCC gasoline cooler, 4B-E14, to downstream of the feed bottoms exchanger, 4B-E50. This change is necessary so that level control can be maintained when heavy FCC gasoline is sent to hydrotreating.

3. PREPARATION FOR OPERATION

WA-TEX 000763

III - PREPARATIONS FOR STARTUP

Reference should be made to the Operating Manual for the Gas Recovery Unit for a description of preparations for startup.

Blinds should be installed in the intercooler draw and return lines of the absorber-deethanizer column, 4B-C1. These lines will isolate the intercoolers and intercooler circulation pumps that have been taken out of service.

4. STARTUP
PROCEDURE

IV - STARTUP PROCEDURE

Reference should be made to the Operating Manual for the Gas Recovery Unit for a description of the startup procedure. Startup of the revised unit is the same as the existing unit, except the new equipment is integrated into the startup procedure, and some intermediate and product streams are rerouted. Additions and changes to the startup procedure are discussed below.

The following new or relocated exchangers are steam-purged, tightness-tested, and pressured with fuel gas in conjunction with existing equipment and lines:

<u>Exchanger Number</u>	<u>Service</u>
4B-E7	Light FCC Gasoline Cooler
4B-E50	Feed Bottoms Exchanger
4B-E51	Splitter Column Reboiler

The following new lines are steam-purged, tightness-tested, and pressured with fuel gas in conjunction with existing equipment and lines:

<u>Line No.</u>	<u>Service</u>
4B-0-367-3"	Absorption oil bypass to 4B-C7
4B-0-376-2"	Rich sponge oil from 4B-C2
4B-0-350-8"	Splitter feed to 4B-E50
4B-0-351-8"	Splitter feed from 4B-E50
4B-0-363-4"	Slurry oil to 4B-E51
4B-0-364-4"	Slurry oil from 4B-E51
4B-0-365-12"	From 4B-E13 to 4B-E51
4B-0-366-12"	From 4B-E13 to 4B-E51
4B-0-352-4"	Heavy FCC gasoline to 4B-E50
4B-0-353-4"	Heavy FCC gasoline from 4B-E50
4B-0-354-4"	Light FCC gasoline to 4B-E7

<u>Line No.</u>	<u>Service</u>
4B-0-355-4"	Light FCC gasoline from 4B-E7
4B-0-359-4"	Heavy FCC gasoline to 4B-E18
4B-0-357-4"	Light FCC gasoline to 4B-E15
4B-0-361-4"	Heavy FCC gasoline to storage
4B-0-360-4"	Heavy FCC gasoline to 4B-C11
4B-0-362-1"	Gum inhibitor to 4B-0-360-4"
4B-0-356-4"	Light FCC gasoline to 4B-C12

Feed to the splitter column, 4B-C4, is routed through the feed bottoms exchanger, 4B-E50. The new splitter column reboiler, 4B-E51, is started up in parallel with the existing splitter column reboiler, 4B-E13. Splitter bottoms is routed through the feed bottoms exchanger, 4B-E50.

Light FCC gasoline is routed through the light FCC gasoline cooler, 4B-E7, the light FCC gasoline caustic settler, 4B-C12, and the light FCC gasoline cooler, 4B-E15, to storage. Heavy FCC gasoline from the feed bottoms exchanger, 4B-E50, is routed directly to hydrotreating, or is routed through the heavy FCC gasoline cooler, 4B-E14, and the heavy FCC gasoline aftercooler, 4B-E18, to storage, or is routed through the heavy FCC gasoline cooler, 4B-E14, through the heavy FCC gasoline aftercooler, 4B-E18, and through the heavy FCC gasoline caustic settler, 4B-C11, to storage.

5. OPERATING
VARIABLES

V - OPERATING VARIABLES

Reference should be made to the Operating Manual for the Gas Recovery Unit for a description of the operating variables. Operating variables for the revised unit are the same as the operating variables for the existing unit.

6. SHUTDOWN
PROCEDURE

VI - SHUTTING DOWN PROCEDURE

Reference should be made to the Operating Manual for the Gas Recovery Unit for a description of the shutting down procedure. The shutting down procedure for the revised unit is the same as the shutting down procedure for the existing unit.

7. APPENDIX

7. Appendix

7.1 Process and Utility Diagrams

7.2 Vessel Drawings

7.3 Heat Exchangers

7.4 Pump Data and Curves

7.5 Instrument Data

7.6 Tray Loading Data

7.1 PROCESS AND
UTILITY DIAGRAMS

WA-TEX 000774

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SECTION 7.1 PROCESS AND UTILITY DIAGRAMS

Process Flow Diagram	GRU - Compression and Absorption Section	4-RA-1
Process Flow Diagram	GRU - Distillation and Treating Section	4-RA-2
P&ID	GRU - Compression Section	4-RA-6
P&ID	GRU - Absorption Section	4-RA-7
P&ID	GRU - Distillation and Treating Section	4-RA-8
P&ID - Utility	GRU - Gland Oil and Flushing Oil	4-RA-11
Utility Usage Diagram	GRU	4-RA-25



DRAWING STATUS			
DRAWING	ISSUED	DATE	
DEVELOPMENT	1 - 1 - X	5/12/72	
PERMANENT	1 - 1 -	5/15/72	
ENGINEERING			
APPROVED FOR CONSTRUCTION			
			
ISSUED FOR CONSTRUCTION			
			
			

6400 B
APPROVED BY
THE TEXAS CO.



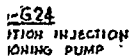
ENTER

ENTER

JOB NO.	REPORT NO.
2525	4-RA-1

WA-TEX 000776

420° 31' 5" 0"



1. CASE "A" IS FOR OPERATION IN WHICH 60 VOLUME % OF THE SPLITTER FLOW IS DISTILLATE PRODUCT.
- CASE "B" IS FOR OPERATION IN WHICH 20 VOLUME % OF THE SPLITTER FLOW IS DISTILLATE PRODUCT.
2. BPSD ARE AT 40°, 60° AND 80° AT OPERATING CONDITIONS.
3. BYPASS LINES ARE PROVIDED FOR OPERATION WHEREBY SPLITTER FLOW IS BYPASSED IN THIS CASE. FLOW OF TOTAL F.R.L. GASOLINE IS CARRIED IN PARALLEL THROUGH THE LIGHT & HEAVY GASOLINE STREAMS.

PROCESS FLOW DIAGRAM, FRACTIONATION THEORET. SECT, FCC UNIT	3-BA
PROCESS FLOW DIAGRAM, COMPRESSION, SECT, GAS RECOVERY UNIT	6-BA
PROCESS FLOW DIAGRAM, P.D. PREP SECT, CAT. POLY UNIT	9-BA

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SAN FRANCISCO

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APPROVED BY
THE TEXAS CO.

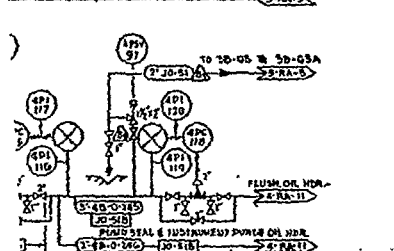


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4-RA-2

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১২	১৩

WA-TEX 000777



ALL OF THESE SYSTEMS ARE DESIGNATED BY THE SYMBOLS SHOWN ABOVE. MINOR REVISIONS ARE CIRCLED AND INCLUDE A TRIANGULAR REVISION MARK.

2. PIPING SERVICE SPECIFICATIONS FOR NEW LINES ARE IN ACCORDANCE WITH GENS J-908 TABLE 7.

3. LINE NUMBER SUFFIXES FOR INSULATION ARE IDENTIFIED AS FOLLOWS:

PP	PERSONNEL PROTECTION
CC	COLD CONSERVATION
PHC	PARTIAL HEAT CONSERVATION
FHC	FULL HEAT CONSERVATION
OTC	OPERATING TEMPERATURE CONTROL
ST	STEAM TRACED AND INSULATED
NI	NO INSULATION

LINE IDENTIFICATION

TEXACO PLANT NUMBER	TEXACO SERVICE SYMBOL	LINE NUMBER	INSULATION REQUIREMENTS	TEXACO PIPING MATERIAL SERVICE SPECIFICATION
1A	Q	422	1	273A-N

BECHTEL
HOUSTON

TEXACO INC.
PUGET SOUND PLANT

PROCESS PIPING & INST DIAGRAM
ABSORPTION SECTION
GAS RECOVERY UNIT

4-RA-7 IGA

WA-TEX 000779

113 SHT. N° 04-1-08

WA-TEX 000780

JOB 2525 4-RA-8 (FORMERLY 4-RA-4)

REFERENCE DRAWINGS	
PROCESS P.I.D. FRACTIONATION SECT.	3-RA-5
UTILITY P.I.D. BLOWDOWN PUMPOUT	3-RA-10
PROCESS P.I.D. DISTILLATION & TREATING	4-RA-8
SCHEDULE OF FLUSHING OIL CONDS.	4-RA-12

APPROVED FOR CONSTRUCTION	DATE	BY	CHKD	DATE	BY	CHKD
ISSUED FOR APPROVAL	DATE	BY	CHKD	DATE	BY	CHKD
REVISIONS	NO.	DATE	BY	CHKD	DATE	BY
NONE						

BECHTEL CORPORATION
SAN FRANCISCO

THE TEXAS COMPANY
PUGET SOUND WORKS

PIPING & INSTRUMENT DIAGRAM
GLAND OIL & FLUSHING OIL
F.C.C.U. & GAS RECOVERY UNIT

6400 APPROVED BY THE TEXAS CO	2525	4-RA-11
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APPROVED FOR CONSTRUCTION	DATE	BY	CHKD	DATE	BY	CHKD
ISSUED FOR APPROVAL	DATE	BY	CHKD	DATE	BY	CHKD
REVISIONS	NO.	DATE	BY	CHKD	DATE	BY
NONE						

BECHTEL
HOUSTON

TEXACO INC.
PUGET SOUND WORKS

UTILITY PIPING & INSTRUMENT DIAGRAM
GLAND OIL & FLUSHING OIL
F.C.C.U. & GAS RECOVERY UNIT

2525	4-RA-11	4A
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5-9-58

WA-TEX 000781

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ALL FIGURES IN 1000#/HR. EXCEPT AS NOTED.

32	16.24
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WA-TEX 000782

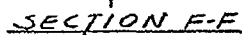
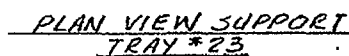
	Job No.		Dwg. No.	No.
BECHTEL - 10086			4-RA-25	0A
TEXACO EST - 3010				

7.2 VESSEL DRAWINGS

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SECTION 7.2 VESSEL DRAWINGS

Debutanizer - 4B-C3 Tray Supports	4-DC-25
Debutanizer - 4B-C3 Trays	4-DC-26



WA-TEX 000785



	7/26/70	REVISED TO AGREE WITH TRAY SUPPLIERS DIMS.		R	R	R	TB	MA	
	7/17/70	ISSUED FOR CONSTR.		R	SM		JAL	MA	
No.	Date	Revisions	By	CHEG	Dwg. Booth	Eng.	Pvt. Eng.	Appr.	
SCALE			DESIGNED ROCKWELL			DRAWN J. HOFFBAUER			
 BECHTEL HOUSTON									
TEXACO INC. PUGET SOUND PLANT									
EXISTING DEBUTANIZER ITEM 4B-C3 NEW TRAYS									
		Job No.		Dwg. No.		Rev.			
		BECHTEL - 10096							
		TEXACO EXT - 3810		4-DC-26		1A			

WA-TEX 000786

7.3 HEAT EXCHANGERS

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SECTION 7.3 HEAT EXCHANGERS

Summary Table 7.3-1 Heat Exchangers

Data Sheets - All Exchangers

TABLE 7.3-1
HEAT EXCHANGER SUMMARY TABLE
GAS RECOVERY UNIT PLANT 4B
ANACORTES, WASHINGTON

CONSTRUCTION DATA					DESIGN				
No.	Material	No. Passes	Shell Data		No. Passes	Shell		Tube	
			Diam. Inches	Material		Temp °F	Press PSIG	Temp °F	Press PSIG
		4			1	580	450	300	75
	C.S.	4	25-1/4	C.S.	1	500	150	650	300
	5CR-1/2Mo	4	26-1/4	C.S.		650	75	720	150

WA-TEX 000789

EXCHANGER SPECIFICATION SHEET

CUSTOMER AND PROJECT LOCATION TEXACO, INC.		EXCHANGER MFR.	
PLANT PUGET SOUND		REQ. NO.	
EXCHANGER NO. 48-E7		ITEM NO.	
SERVICE OF UNIT LIGHT FCC GASOLINE TRIM COOLER			
SIZE 21" X 240"	TYPE	CONNECTED IN	SERIES
SURFACE PER UNIT 1000	EFF. GR.	SHELLS PER UNIT 1	SURFACE PER SHELL 1000
			EFF. GR. 961
PERFORMANCE OF ONE UNIT			
FLUID CIRCULATED		SHELL SIDE	TUBE SIDE
TOTAL FLUID ENTERING 108,047		LIGHT FCC GASOLINE	COOLING WATER
VAPOR			
LIQUID		108,047	72,000
STEAM			
NON-CONDENSIBLES			
FLUID VAPORIZED OR CONDENSED			
STEAM CONDENSED			
GRAVITY-LIQUID		0.655 (IN) / 0.67 (OUT)	
VISCOSITY-LIQUID CP		0.295 (IN) / .32 (OUT)	
MOLECULAR WEIGHT-VAPORS			
SPECIFIC HEAT-LIQUIDS		B.T.U./#	B.T.U./#
LATENT HEAT-VAPORS		B.T.U./#	B.T.U./#
TEMPERATURE IN		130	76
TEMPERATURE OUT		100	100
OPERATING PRESSURE PSIG			
NUMBER OF PASSES		1	4
VELOCITY		FT/SEC	FT/SEC
PRESSURE DROP ALLOW/CALC		3	3
FOULING RESISTANCE MIN.		0.001	.003
HEAT EXCHANGED - BTU/HR 1,730,000		M.T.D. (CORRECTED) 21.6	
TRANSFER RATE - SERVICE 83.4		CLEAN ACTUAL FOULING FACTOR	
CONSTRUCTION			
DESIGN PRESSURE	450	#/SQ IN.	75
TEST PRESSURE		#/SQ IN.	#/SQ IN.
DESIGN TEMPERATURE	580	°F	300
TUBES	NO	O.D.	B.W.G.
SHELL		I.D.	O.D.
SHELL COVER			THICKNESS
CHANNEL			FLOATING HEAD COVER
TUBE SHEETS - STATIONARY			CHANNEL COVER
RAFFLES - CROSS			FLOATING
BAFFLE - LONG			THICKNESS
TUBE SUPPORTS			THICKNESS
GASKETS			THICKNESS
CONNECTIONS - SHELL - IN	6"	OUT	6"
-CHANNEL-IN	4"	OUT	4"
CORROSION ALLOWANCE - SHELL SIDE			TUBE SIDE
CODE REQUIREMENTS		TENSA CLASS	SPEC
WEIGHTS - EACH SHELL		BUNDLE	FULL OF WATER
NOTE INDICATE AFTER EACH PART WHETHER STRESS RELIEVED (S.R.) AND WHETHER RADIOGRAPHED (X-R)			
REMARKS - THIS IS AN EXISTING EXISTING - THE ORIGINAL SERVICE WAS DE-ETHANIZER 2ND CIRCULATING REFLUX COOLER. FOR DATA NOT SHOWN REFER TO DATA SHEET 2525 DS-4-E-7			
REV.		DATE	
ISSUED FOR CONSTRUCTION			
JOB NO.	DRWG NO.	REV.	
10095	DS-4-E-4	0	

EXCHANGER SPECIFICATION SHEET

CUSTOMER AND PROJECT LOCATION		TEXACO, INC. ANACORTES, WASH.		EXCHANGER MFR.	
PLANT		PUGET SOUND PLANT		REQ. NO.	
EXCHANGER NO.		48-E-9 - EXISTING		ITEM NO.	
SERVICE OF UNIT ABSORBER-DIE ETHANIZER STM. REBILDER					
SIZE	TYPE	CONNECTED IN	SERIES	PARALLEL	
SURFACE PER UNIT	1517	EFF. SHELLS PER UNIT	SURFACE PER SHELL		1517
PERFORMANCE OF ONE UNIT					
		SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED	ABSORBER RICH OIL		STEAM		
TOTAL FLUID ENTERING	LBS/HR	409,720	26,000		
VAPOR		45,844			
LIQUID		363,676			
STEAM			26,000		
NON-CONDENSIBLES					
FLUID VAPORIZED OR CONDENSED		109,288	26,000		
STEAM CONDENSED					
GRAVITY-LIQUID					
VISCOSITY-LIQUID					
MOLECULAR WEIGHT-VAPORS			18.0		
SPECIFIC HEAT-LIQUIDS		0.51	BTU/#	BTU/#	
POTENT HEAT-VAPORS		120	BTU/#	BTU/#	
TEMPERATURE IN		260	°F	400	
TEMPERATURE OUT		300	°F	400	
OPERATING PRESSURE	PSIG	293		235	
NUMBER OF PASSES					
VELOCITY			FT/SEC	FT/SEC	
PRESSURE DROP	ALLOW/GALG		#/SQ IN	#/SQ IN	
FOULING RESISTANCE	MIN				
HEAT EXCHANGED - BTU/HR	22.5 X 10 ⁶		M.T.D. (CORRECTED)		
TRANSFER RATE - SERVICE			CLEAN	ACTUAL FOULING FACTOR	
CONSTRUCTION					
DESIGN PRESSURE			#/SQ IN	#/SQ IN	
TEST PRESSURE			#/SQ IN	#/SQ IN	
DESIGN TEMPERATURE			°F	°F	
TUBES	NO	O.D.	BWG	AVG. MIN.	LENGTH
SHELL		I.D. O.D.		THICKNESS	
SHELL COVER			FLOATING HEAD COVER		
CHANNEL			CHANNEL COVER		
TUBE SHEETS - STATIONARY			FLOATING		
BAFFLES - CROSS		TYPE	THICKNESS		
BAFFLE - LONG		TYPE	THICKNESS		
TUBE SUPPORTS			THICKNESS		
GASKETS					
CONNECTIONS - SHELL - IN	2-8"	OUT	10"	RATING	300# RF
-CHANNEL-IN	6"	OUT	6"	RATING	300# RF
CORROSION ALLOWANCE - SHELL SIDE			TUBE SIDE		
CODE REQUIREMENTS		TEMA CLASS	SPEC		
WEIGHTS - EACH SHELL		BUNDLE	FULL OF WATER		
NOTE INDICATE AFTER EACH PART WHETHER STRESS RELIEVED (S.R.) AND WHETHER RADIOGRAPHED (X-R)					
REMARKS - ISSUED TO SHOW OPERATING CONDITIONS PER TEXACO					
EST. 3910 - FOR DESIGN CONDITIONS REFER TO DATA SHEET					
2525 DS-4-E-9 - TOP 3 ROWS OF TUBES REMOVED					
REV.	A	DATE		JOB NO.	DRWG NO.
	A	3/1/73	ISSUED FOR CONSTRUCTION	10095	DS-4-E-3
					REV.
					0

EXCHANGER SPECIFICATION SHEET

1	CUSTOMER AND PROJECT LOCATION	TEXACO INC		EXCHANGER	MFR. HUGHES-ANDERSON	
2	PLANT	PUGET SOUND		REQ. NO.	E-02	
3	EXCHANGER NO.	4B-E50		ITEM NO	1F	
4	SERVICE OF UNIT	SPLITTER FEED - BOTTOMS EXCHANGER				
5	SIZE	25 x 240	TYPE	AES	CONNECTED IN	SERIES PARALLEL
6	SURFACE PER UNIT	1218	EFF. OR	SHELLS PER UNIT	1	SURFACE PER SHELL 1218 EFF. OR
PERFORMANCE OF ONE UNIT						
7	FLUID CIRCULATED	SHELL SIDE		TUBE SIDE		
8	TOTAL FLUID ENTERING LBS/HR	SPLITTER FEED		SPLITTER FEED		
9	VAPOR	188,398		80,351		
10	LIQUID	27,598		20,351		
11	STEAM	160,800		20,351		
12	NON-CONDENSIBLES					
13	FLUID VAPORIZED OR CONDENSED	30,342				
14	STEAM CONDENSED					
15	GRAVITY-LIQUID SP. LIG	0.662(IN) - 0.67(OUT)		API 38.4		
16	VISCOSITY-LIQUID CP	0.215(IN) - 0.222(OUT)		0.165(IN) - 0.25(OUT)		
17	MOLECULAR WEIGHT-VAPORS	86(IN) - 88.8(OUT)				
18	SPECIFIC HEAT-LIQUIDS			B.T.U./#		B.T.U./#
19	LATENT HEAT-VAPORS			B.T.U./#		B.T.U./#
20	TEMPERATURE IN	261 °F		396 °F		°F
21	TEMPERATURE OUT	276 °F		285 °F		°F
22	OPERATING PRESSURE PSIG	51		220		
23	NUMBER OF PASSES	1		4		
24	VELOCITY			FT./SEC.		FT./SEC.
25	PRESSURE DROP ALLOW/CALC.	6.5 / 6.0		#/SQ IN.		3.5 / 3.5 #/SQ IN.
26	FOULING RESISTANCE MIN.	0.001		0.001		
27						
28	HEAT EXCHANGED-B.T.U./HR	5,450,000		M.T.D. (CORRECTED)		53.8
29	TRANSFER RATE-SERVICE	83.2		CLEAN		ACTUAL FOULING FACTOR
CONSTRUCTION						
30	DESIGN PRESSURE	150		#/SQ IN.		300 #/SQ IN.
31	TEST PRESSURE	225		#/SQ IN.		450 #/SQ IN.
32	DESIGN TEMPERATURE	500		°F		650 °F
33	TUBES CARBON STEEL NO. 316	O.D. 3/4"	B.W.G. 0.085	LENGTH	240"	PITCH 1" #120
34	SHELL CARBON STEEL	I.D. 25 1/4"	THICKNESS			
35	SHELL COVER CARBON STEEL			FLOATING HEAD COVER CARBON STEEL		
36	CHANNEL CARBON STEEL			CHANNEL COVER CARBON STEEL		
37	TUBE SHEETS-STATIONARY CARBON STEEL			FLOATING CARBON STEEL		
38	BAFFLES-CROSS CARBON STEEL	TYPE SEGMENTAL		THICKNESS		
39	BAFFLE-LONG	TYPE		THICKNESS		
40	TUBE SUPPORTS			THICKNESS		
41	GASKETS	METAL JACKETED ASBESTOS				
42	CONNECTIONS-SHELL-IN	10"	OUT 12"	RATING 150# RF		
43	-CHANNEL-IN	4"	OUT 4"	RATING 300# RF		
44	CORROSION ALLOWANCE-SHELL SIDE	1/8"		TUBE SIDE		1/8"
45	CODE REQUIREMENTS ASME SECTION VIII	TEMA CLASS R		SPEC.		
46	WEIGHTS-EACH SHELL	BUNDLE		FULL OF WATER		
47	NOTE	INDICATE AFTER EACH PART WHETHER STRESS RELIEVED (S.R.) AND WHETHER RADIOGRAPHED (X-R)				
48	REMARKS	(1) BAFFLE CUT 44%. 10-BAFFLES @ 21 1/16" SPACING. (2) THIS EXCHANGER TO STACK ONLY OVER EXISTING EXCHANGER 3B-E7				
51						

REV.	DATE	REVISION	TR	JOB NO.	DRWG. NO.	REV.
1	1-24-72	REVISED, ISSUED FOR CONST.	TR	10095	DS-A-E-1	1
2	10-12-72	ISSUED FOR PURCHASE	TR			

WA-TEX 000792

EXCHANGER SPECIFICATION SHEET

CUSTOMER AND PROJECT LOCATION		TEXACO INC		EXCHANGER MFR. HUGHES-ANDERSON	
PLANT		PUGET SOUND		REQ. NO. E-02	
EXCHANGER NO.		4B-E51		ITEM NO 12	
SERVICE OF UNIT SPLITTER REBOILER					
SIZE	26 x 240	TYPE	AHT	CONNECTED IN	SERIES
SURFACE PER UNIT	1222	EFF. SHELLS PER UNIT	1	SURFACE PER SHELL	1222
PERFORMANCE OF ONE UNIT:					
		SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED		GASOLINE SPLITTER BTMS		FCCU BTMS. QUENCH	
TOTAL FLUID ENTERING	LBS/HR	282,400		122,300	
VAPOR		56,500			
LIQUID		225,900		122,300	
STEAM					
NON-CONDENSIBLES					
FLUID VAPORIZED OR CONDENSED		56,500			
STEAM CONDENSED					
GRAVITY-LIQUID		0.66		API 15.6	
VISCOSITY-LIQUID	CP	0.0079 (VAP) / 0.16 (LIQ)		0.40 (IN) - 0.65 (OUT)	
MOLECULAR WEIGHT-VAPORS		123.6			
SPECIFIC HEAT-LIQUIDS				B.T.U./#	
LATENT HEAT-VAPORS				B.T.U./#	
TEMPERATURE IN		387 °F		660 °F	
TEMPERATURE OUT		396 °F		545 °F	
OPERATING PRESSURE	PSIG	30			
NUMBER OF PASSES		DOUBLE SPLIT FLOW		4	
VELOCITY		FT / SEC.		4.8 FT / SEC	
PRESSURE DROP	ALLOW / CALC.	1.0 / 0.50		7.0 / 8.0	
FOULING RESISTANCE	MIN.	0.004		0.003	
HEAT EXCHANGED - BTU / HR		8,000,000		M.T.D. (CORRECTED) 206	
TRANSFER RATE - SERVICE	31.8	CLEAN		ACTUAL FOULING FACTOR	
CONSTRUCTION					
DESIGN PRESSURE		75		150	
TEST PRESSURE		115		225	
DESIGN TEMPERATURE		650		720	
TUBES	5%CR - 1/2% Mo NO. 316	O.D. 3/4"	BWG. 14	LENGTH	240"
SHELL	CARBON STEEL	I.D. 26 1/4"	THICKNESS		
SHELL COVER	5%CR - 1/2% Mo	FLOATING HEAD COVER		5%CR - 1/2% Mo	
CHANNEL	5%CR - 1/2% Mo	CHANNEL COVER		C.STEEL W/5CR LINER	
TUBE SHEETS - STATIONARY	5%CR - 1/2% Mo	FLOATING		5%CR - 1/2% Mo	
BAFFLES - CROSS	CARBON STEEL TYPE SOLID	THICKNESS			
BAFFLE - LONG	CARBON STEEL TYPE MULTILEAF	THICKNESS			
TUBE SUPPORTS		THICKNESS			
GASKETS	METAL JACKETED ASBESTOS				
CONNECTIONS - SHELL - IN	2 - 12"	OUT	2 - 12"	RATING	150# RF
- CHANNEL - IN	4"	OUT	4"	RATING	300# RF
CORROSION ALLOWANCE - SHELL SIDE	1/8" ON C.S.	TUBE SIDE	1/8" ON C.S.		
CODE REQUIREMENTS	ASME SECTION VIII D1	TEMA CLASS	R	SPEC. E1M7	
WEIGHTS - EACH SHELL	BUNDLE	FULL OF WATER			
NOTE INDICATE AFTER EACH PART WHETHER STRESS RELIEVED (S.R.) AND WHETHER RADIOGRAPHED (X-R)					
REMARKS - THIS REBOILER STACKS OVER 4B-E13 (EXISTING)					
REV.	DATE	REVISION		JOB NO	DRWG NO
1	1-24-77	REVISED, ISSUED FOR CONST		10095	DS-4-E-2
2	10-12-72	ISSUED FOR PURCHASE			1

7.4 PUMP DATA AND
CURVES

WA-TEX 000794

TABLE OF CONTENTS
SECTION 7.4 PUMP DATA AND CURVES

Summary Table 7.4-1

Data Sheets - All Pumps

Pump Curves - All Pumps

TABLE 7.4-1
CENTRIFUGAL PUMP SUMMARY SHEET
GAS RECOVERY UNIT PLANT 4B
ANACORTES, WASHINGTON

ia. Max.	Number of Stages	Shaft Seal	DRIVER DATA			Full Load Amps
			RPM	H.P.	Type	
7			3600	7-1/2	Motor Turbine	10
1-1/2		Mech	3600	100	Motor Turbine Turbine	
3-7/8		Mech			Turbine	
1-1/2		Mech			Turbine	

WA-TEX 000796

CENTRIFUGAL PUMP DATA SHEET

APPLICABLE TO: PROPOSALS ☐ PURCHASE ☐ AS BUILT ☐
 NOTE: () INDICATES INFORMATION TO BE COMPLETED BY PURCHASER;
☐ BY MANUFACTURER

EXISTING PUMP & DRIVERS

JOB NO. 10095 ITEM NO. 4B-G5 & G5A
 PURCHASE ORDER NO. 10095-605 A
 REQUISITION NO. _____
 INQUIRY NO. _____
 DATE _____ REVISION _____

FOR TEXACO INC SITE PUGET SOUND
 UNIT CRUDE EXPANSION SERVICE 2.25 STAGE SEPARATOR LIQUID
 NO. PUMPS REQ'D 2 NO. MOTORS REQ'D 1 ITEM NO. 4B-G5 PROVIDED BY EXISTING MTD BY EXISTING
 NO. TURBINES REQ'D 1 ITEM NO. 4B-G5 PROVIDED BY EXISTING MTD BY EXISTING
 PUMP MFR UNITED SIZE AND TYPE 2" RT-AA SERIAL NO. 74425426

OPERATING CONDITIONS, EACH PUMP				PERFORMANCE	
LIQUID <u>LIGHT HC</u>	U.S. GPM at PT, HOR.	RATED	<u>235</u>	PROPOSAL CURVE NO.	<u>51T 570A</u>
	DISCH. PRESS. PSIG		<u>322.4</u>	RPM	<u>3525</u> NPSHR (WATER)
PT. F. HOR. <u>100°F</u> MAX	SUCT. PRESS. PSIG MAX		<u>288.2</u>	EFF.	<u>66%</u> BHP RATED
SP. GR. at PT <u>0.564</u>	DIFF. PRESS. PSI		<u>34.2</u>	MAX. BHP RATED IMP	<u>7.4</u>
VAP. PRESS. at PT, PSIA <u>300</u>	DIFF. HEAD, FT		<u>140</u>	MAX. HEAD RATED IMP	<u>190</u>
VIS. at PT, <u>0.23 CS</u> CP	NPSHA, FT		<u>7.8</u>	MIN. CONTINUOUS GPM	<u>30</u>
CORR/EROS. CAUSED BY _____	HYD. HP		<u>4.7</u>	ROTATION (VIEWED FROM CPLG END)	<u>CCW</u>

CONSTRUCTION					SHOP TESTS	
NOZZLES	SIZE	RATING	FACING	LOCATION	☐ NON-WIT. PERF	☐ WIT. PERF.
SUCTION	<u>4"</u>	<u>300</u>	<u>RT</u>	<u>END</u>	☐ NON-WIT. HYDRO	☐ WIT. HYDRO
DISCHARGE	<u>2"</u>	<u>300</u>	<u>RT</u>	<u>TOP</u>	☐ NPSH REQ'D	☐ WIT. NPSH

CASE MOUNT: ☒ CENTERLINE ☐ FOOT ☐ BRACKET ☐ VERT. (TYPE) _____
 SPLIT: ☐ AXIAL ☒ RAD: TYPE VOLUTE ☒ SGL ☐ DBL ☐ DIFFUSER
 PRESS: ☐ MAX. ALLOW. 533 PSIG ☐ F: ☐ HYDRO TEST 800 PSIG
 CONNECT: ☐ VENT ☐ DRAIN ☐ GAGE
 IMPELLER DIA: ☐ RATED 6 3/4 ☐ MAX. 7" ☐ TYPE CLOSED
 MOUNT: ☐ BETWEEN BRGS ☒ OVERHUNG ☐ WEAR. RG. DIAM./CLRNC.
 BEARINGS TYPE: ☐ RADIAL BALL ☐ THRUST BALL
 LUBE: ☐ RING OIL ☒ FLOOD ☐ OIL MIST ☐ FLINGER ☐ PRESSURE
 COUPLING: ☐ MRF FALK ☐ MODEL SPACER TYPE
 DRIVER HALF MTD BY: ☐ PUMP MFR ☐ DRIVER MFR ☐ PURCHASER
 PACKING: ☐ MFR & TYPE _____ ☐ SIZE/NO. OF RINGS _____
 MECH. SEAL: ☒ MFR & MODEL CRANE 1B API CLASS. CODE _____
 MFR CODE BF-191

AUXILIARY PIPING				VERTICAL PUMPS	
☐ C.W. PIPE PLAN	☐ C.W. O.S.S.	☐ TUBING	☐ PIPE	PIT OR SUMP DEPTH	☐ MIN. SUBMERGENCE REQ'D
☐ TOTAL COOLING WATER REQ'D, GPM	☐ SIGHT FL. REQ'D			COLUMN PIPE: ☐ FLANGED ☐ THREADED	
☐ PACKING COOLING INJECTION REQ'D: ☐ TOTAL GPM ☐ PSIG				LINE SHAFT: ☐ OPEN ☐ ENCLOSED	
☐ SEAL FLUSH PIPE PLAN	☐ C.S. O.S.S.	☐ TUBING	☐ PIPE	BRGS: ☐ BOWL ☐ LINE SHAFT	
☐ EXTERNAL SEAL FLUSH FLUID	☐ GPM		☐ PSIG	BRG. LUBE ☐ WATER ☐ OIL ☐ GREASE	
☐ AUXILIARY SEAL PLAN	☐ C.S. O.S.S.	☐ TUBING	☐ PIPE	FLOAT & ROD ☐ C.S. ☐ O.S.S. ☐ BRZ ☐ NONE	
☐ AUX. SEAL QUENCH FLUID				FLOAT SWITCH ☐	
				PUMP THRUST, LB ☐ UP ☐ DOWN	

EXISTING MOTOR DRIVER
 HP 7 1/2 RPM 3600 FRAME 215 VOLTS/PHASE/CYCLES 460/3/60
 MFR GE BEARINGS BALL LUBE GREASE
 TYPE SK315GG3A INSUL A FULL LOAD AMPS 10
 ENC XP TEMP RISE 55 LOCKED ROTOR AMPS 60
 OVHS ☐ OVSS ☐ VERT. THRUST CAP. LB _____ SERVICE FACTOR _____
 APPROX. WT. PUMP & BASE _____ MOTOR _____ TURBINE _____

API STANDARD 870 GOVERNS UNLESS OTHERWISE NOTED DRIVER FOR 4B-G5A - DEAN HILL TORINE DH-10-1
 VENDOR TO QUOTE NEW IMPELLER AND WEAR RINGS FOR
 OPERATING CONDITIONS SHOWN. A FOR DATA NOT SHOWN SEE
 DATA SHEET 7575 DS-4-G-2



NO	DATE	DESCRIPTION	BY	DATE	JOB NO.	DRAWING NO.	REV.
2	11/4/73	AS BUILT - ISSUED FOR CONST.					
1	7-6-73	ISSUED FOR CONSTRUCTION	DU	11/8/66	10095	DS-4-G-7	1
0	3-12-73	ISSUED FOR QUOTATION	DR	6/2/72			

CENTRIFUGAL PUMP DATA SHEET

APPLICABLE TO: PROPOSALS ☐ PURCHASE ☐ AS BUILT ☐
 NOTE: () INDICATES INFORMATION TO BE COMPLETED BY PURCHASER:
☐ BY MANUFACTURER

EXISTING PUMPS

JOB NO. 10095 ITEM NO. 4B-G-9-69A
 PURCHASE ORDER NO. 10095-G-050-012
 REQUISITION NO. 10095-G-050-012
 INQUIRY NO. _____
 DATE _____ REVISION _____

FOR TEXACO, INC. SITE PUGET SOUND
 UNIT GAS RECOVERY UNIT SERVICE ABSORBER DEMETH. REBOILER
 NO. PUMPS REQ'D _____ NO. MOTORS REQ'D _____ ITEM NO. _____ PROVIDED BY _____ MTD BY _____
 NO. TURBINES REQ'D _____ ITEM NO. _____ PROVIDED BY _____ MTD BY _____
 PUMP MFR UNITED SIZE AND TYPE 6" TC-C SERIAL NO. 74427/74428

OPERATING CONDITIONS, EACH PUMP				PERFORMANCE	
LIQUID <u>LIGHT</u>	U.S. GPM at PT. NOR. <u>1565</u>	RATED <u>1800</u>		PROPOSAL CURVE NO. <u>TC-727-2</u>	
<u>H.C.</u>	DISCH. PRESS. PSIG <u>326</u>			RPM <u>1750</u> NPSHR (WATER) <u>0.12</u>	
PT. F. NOR. <u>238</u> MAX.	SUCT. PRESS. PSIG MAX. <u>37</u>	RATED <u>289</u>		EFF. <u>82.5%</u> BHP RATED <u>47.5</u>	
SP. GR. at PT. <u>0.523</u>	DIFF. PRESS. PSI <u>165</u>			MAX. BHP RATED IMP <u>57.6</u>	
VAP. PRESS. at PT. PSIA <u>300</u>	DIFF. HEAD. FT. <u>13' CORRECTED</u>			MAX. HEAD RATED IMP <u>188'</u>	
VIS. at PT. Sct. <u>2.30</u> CP	NPSHA FT. <u>13' CORRECTED</u>			MIN. CONTINUOUS GPM _____	
CORR./EROS. CAUSED BY _____	HYD. HP <u>38.8</u>			ROTATION (VIEWED FROM CPLG END) _____	

CONSTRUCTION					SHOP TESTS	
NOZZLES	SIZE	RATING	FACING	LOCATION	☐ NON-WIT. PERF.	☐ WIT. PERF.
SUCTION	<u>8"</u>	<u>300#</u>	<u>RF</u>	<u>TOP</u>	☐ NON-WIT. HYDRO	☐ WIT. HYDRO
DISCHARGE	<u>6"</u>	<u>300#</u>	<u>RF</u>	<u>TOP</u>	☐ NPSH REQ'D	☐ WIT. NPSH

CASE-MOUNT: ☒ CENTERLINE ☐ FOOT ☐ BRACKET ☐ VERT. (TYPE) _____
 SPLIT: ☐ AXIAL ☒ RAD. TYPE VOLUTE ☐ SGL ☒ DBL ☐ DIFFUSER
 PRESS: ☐ MAX. ALLOW. 400 60° F. ☐ HYDRO TEST 600 PSIG
 CONNECT: ☒ VENT ☒ FRAIN ☐ GAGE
 IMPELLER DIA. 13 7/16" ☐ MAX ☐ TYPE CLOSED
 MOUNT: ☐ BETWEEN BRGS ☒ OVERHUNG ☐ WEAR. RG. DIAM./CLINC.
 BEARINGS-TYPE: ☒ RADIAL BALL ☒ THRUST BALL
 LUBE: ☒ RING OIL ☐ FLOOD ☐ OIL MIST ☐ FLINGER ☐ PRESSURE
 COUPLING: ☒ MRF FALK ☒ MODEL SPACER TYPE
 DRIVER HALF MTD BY: ☐ PUMP MFR ☐ DRIVER MFR ☐ PURCHASER
 PACKING: ☐ MFR & TYPE ☐ SIZE/NO. OF RINGS
 MECH. SEAL: ☒ MFR & MODEL CRAIG-9B API CLASS CODE _____
☒ MFR CODE QP-191

AUXILIARY PIPING				VERTICAL PUMPS	
☐ C.W. PIPE PLAN	☐ CU. O.S.S.	☐ TUBING	☐ PIPE	PIT OR SUMP DEPTH _____	
☐ TOTAL COOLING WATER REQ'D. GPM _____	☐ SIGHT FL. REQ'D _____			MIN. SUBMERGENCE REQ'D ☐ _____	
☐ PACKING COOLING INJECTION REQ'D: ☐ TOTAL GPM ☐ PSIG				COLUMN PIPE: ☐ FLANGED ☐ THREADED	
☐ SEAL FLUSH PIPE PLAN _____	☐ C.S. ☐ O.S.S. ☐ TUBING ☐ PIPE			LINE SHAFT: ☐ OPEN ☐ ENCLOSED	
☐ EXTERNAL SEAL FLUSH FLUID _____	☐ GPM _____	☐ PSIG _____		BRGS: ☐ BOWL ☐ LINE SHAFT	
☐ AUXILIARY SEAL PLAN _____	☐ C.S. ☐ O.S.S. ☐ TUBING ☐ PIPE			BRG. LUBE ☐ WATER ☐ OIL ☐ GREASE	
☐ AUX. SEAL QUENCH FLUID _____				FLOAT & ROD ☐ C.S. ☐ O.S.S. ☐ BRZ ☐ NONE	
				FLOAT SWITCH ☐ _____	
				PUMP THRUST, LB ☐ UP ☐ DOWN	

MOTOR DRIVER
 HP 100 RPM 1776 FRAME 40ST VOLTS/PHASE/CYCLES 460/3/60
 MFR AC BEARINGS BALL LUBE GRS
 TYPE HORIZ. INSUL B FULL LOAD AMPS 113
 ENC TEFC TEMP RISE C _____ LOCKED MOTOR AMPS 725
☐ VHS ☐ VSS VERT. THRUST CAP. LB _____ SERVICE FACTOR 1.0

API STANDARD 610 GOVERNS UNLESS OTHERWISE NOTED FOR DATA NOT SHOWN SEE
DATA SHEET 252S DS-4-G-2
1 AT NORMAL FLOW 1565 GPM 512' HEAD 2 AT DESIGN FLOW 1800-15' REQ'D



NO.	DATE	ISSUED FOR	JDN	TR	WSE	JOB NO.	DRAWING NO.	REV.
3	11/14/73	AS BUILT - ISSUED FOR CORRECTION						
2	7-6-73	ISSUED FOR CONSTRUCTION	JDN	TR	WSE			
1	2-27-73	ISSUED FOR PURCHASE	JDN	TR	WSE			
0	1-4-73	ISSUED FOR QUOTATION	JDN	TR	WSE			
						10095	DS-4-G-3	2

CENTRIFUGAL PUMP DATA SHEET

APPLICABLE TO: PROPOSALS ☐ PURCHASE ☐ AS BUILT ☐
 NOTE: () INDICATES INFORMATION TO BE COMPLETED BY PURCHASER;
☐ BY MANUFACTURER

JOB NO. 10095 ITEM NO. 4B-G11/A
 PURCHASE ORDER NO.
 REQUISITION NO. 10095 - G-D1A
 INQUIRY NO.
 DATE REVISION

FOR TEXACO, INC. SITE PUGET SOUND
 UNIT GAS RECOVERY UNIT SERVICE DERUTANIZER PRODUCT
 NO. PUMPS REQ'D 2 NO. MOTORS REQ'D 1 ITEM NO. 4B-G11 PROVIDED BY PUMP MFG. MTD BY PUMP MFG. A
 NO. TURBINES REQ'D 1 ITEM NO. 4B-G11A PROVIDED BY EXISTING MTD BY PURCHASER
 PUMP MFR BINGHAM SIZE AND TYPE SERIAL NO. 33070/77 A

OPERATING CONDITIONS, EACH PUMP				PERFORMANCE	
LIQUID LIGHT	U.S. GPM at PT. NOR.	RATED	210 A	PROPOSAL CURVE NO.	1983-1
HYDROCARBON	DISCH. PRESS. PSIG		331	RPM	3550 NPSHR (WATER) 14 A
PT. F. NOR. 110 MAX.	SUCT. PRESS. PSIG MAX.	RATED	144	EFF.	58.5 BHP RATED 42
SP. GR. at PT. 0.52	DIFF. PRESS. PSI		187	MAX. BHP RATED IMP	80.1
VAP. PRESS. at PT. PSIA 156	DIFF. HEAD. FT.		780 A	MAX. HEAD RATED IMP	860 A
VIS. at PT. SUCT. < 30	NPSHA. FT.		10 (CORR)	MIN. CONTINUOUS GPM	60
CORR/EROS. CAUSED BY	HYD. HP		30.0	ROTATION (VIEWED FROM CPLG END)	CLW

CONSTRUCTION					SHOP TESTS	
NOZZLES	SIZE	RATING	FACING	LOCATION	NON-WIT PERF	WIT. PERF.
SUCTION	4	300	RF	TOP	NON-WIT HYDRO	WIT. HYDRO
DISCHARGE	3	300	RF	TOP	NPSH REQ'D	WIT. NPSH

CASE MOUNT: ☒ CENTERLINE ☐ FOOT ☐ BRACKET ☐ VERT. (TYPE)
 - SPLIT: ☐ AXIAL ☒ RAD. TYPE VOLUTE ☐ SGL ☒ DBL ☐ DIFFUSER
 - PRESS: ☐ MAX. ALLOW. 800 PSIG ☒ 600 PSIG F. ☐ HYDRO TEST 1700 PSIG
 - CONNECT: ☐ VENT ☐ FRAIN ☐ GAGE
 IMPELLER DIA. ☒ RATED 10 1/2 ☐ MAX 11 1/2 ☐ TYPE CLOSED
 MOUNT: ☐ BETWEEN BRGS ☒ OVERHUNG ☐ WEAR. RG. DIAM./CLINC.
 BEARINGS TYPE: ☐ RADIAL ☒ BALL ☐ THRUST DR. BALL
 LUBE: ☒ RING OIL ☐ FLOOD ☐ OIL MIST ☐ FLINGER ☐ PRESSURE
 COUPLING: ☐ MRF ☒ FAST ☐ MODEL B
 DRIVER HALF MTD BY: ☐ PUMP MFR ☐ DRIVER MFR ☐ PURCHASER
 PACKING: ☐ MFR & TYPE ☐ SIZE/NO. OF RINGS
 MECH. SEAL: ☐ MFR & MODEL BWL QB API CLASS. CODE BSTGM A
☐ MFR CODE QB-2500 5D.7N A

MATERIALS
 API CASE/TRIM CLASSO
 GEMS P-2M7
 GEMS P-2A1
 CASE - STEEL

BASEPLATE: ☐ FS-DR
 VERTICAL PUMPS

AUXILIARY PIPING
☐ C.W. PIPE PLAN "B" ☐ CU: ☐ S.S.: ☐ TUBING: ☐ PIPE
☐ TOTAL COOLING WATER REQ'D. GPM ☐ SIGHT FL. REQ'D.
☒ PACKING COOLING INJECTION REQ'D: ☐ TOTAL GPM ☐ PSIG
☒ SEAL FLUSH PIPE PLAN 12 O.C.S. O.S.S. ☐ TUBING ☒ PIPE SCH. 80 SOKLET
☐ EXTERNAL SEAL FLUSH FLUID ☐ GPM ☐ PSIG
☐ AUXILIARY SEAL PLAN O.C.S. O.S.S. ☐ TUBING ☐ PIPE
☐ AUX. SEAL QUENCH FLUID

PIT OR SUMP DEPTH
 MIN. SUBMERGENCE REQ'D.
 COLUMN PIPE: ☐ FLANGED ☐ THREADED
 LINE SHAFT: ☐ OPEN ☐ ENCLOSED
 BRGS: ☐ BOWL ☐ LINE SHAFT
 BRG. LUBE ☐ WATER ☐ OIL ☐ GREASE
 FLOAT & ROD ☐ C.S. ☐ S.S. ☐ BRZ ☐ NONE
 FLOAT SWITCH
 PUMP THRUST. LB ☐ UP ☐ DOWN

MOTOR DRIVER
 HP 100 RPM 3600 FRAME 405TS VOLTS/PHASE/CYCLES 460/3/60
 MFR AC BEARINGS BALL LUBE GRS
 TYPE HORIZ INSUL B FULL LOAD AMPS 61
 ENC. T.E.F.C. TEMP RISE C 55 LOCKED ROTOR AMPS
 OVHS ☐ VSS VERT. THRUST CAP. LB SERVICE FACTOR 1.0

APPROX. WT. PUMP & BASE 1840
 MOTOR 1777A TURBINE

API STANDARD 610 GOVERNS UNLESS OTHERWISE NOTED. SOCKET WELD VENT & DRAIN CONNECTIONS

READ ON JOBSITE BEFORE 9/1/73 3/11/73 AS BUILT - ISSUED
 EXISTING TURBINE DEAN HILL - DN-20.2 FOR CONSTRUCTION



NO.	DATE	ISSUED FOR	JOB NO.	DRAWING NO.	REV.
2	3-6-73	ISSUED FOR PURCHASE	10095	DS-4-G-4	2
1	2-2-73	ISSUED FOR RE-QUOTE			
3	3-16-73	CHG'D SEAL - ADD MTL DRIVER			

CENTRIFUGAL PUMP DATA SHEET

EXISTING PUMP

JOB NO. 10095 ITEM NO. 4B-G3D

PURCHASE ORDER NO.

REQUISITION NO. LA-87737-F-PSP-171

INQUIRY NO.

DATE

REVISION

APPLICABLE TO: PROPOSALS ☐ PURCHASE ☐ AS BUILT ☐

NOTE: () INDICATES INFORMATION TO BE COMPLETED BY PURCHASER;

☐ BY MANUFACTURERFOR: TEKACO, INCSITE: PUG SOUNDUNIT: GAS RECOVERYSERVICE: ABSORPTION OIL CHARGE PUMP

NO. PUMPS REQ'D

NO. MOTORS REQ'D

ITEM NO.

PROVIDED BY

MTD BY

NO. TURBINES REQ'D

ITEM NO.

PROVIDED BY: PURCHASER MTD BY: FIELDPUMP MFR: INGERSOLL-RANDSIZE AND TYPE: 2 1/2" CNTA8-GSERIAL NO. B67245

OPERATING CONDITIONS, EACH PUMP

LIQUID: ABSORPTION OIL U.S. GPM at PT. MOR. 475 RATED 475
DISCH. PRESS. PSIG 384
PT. F. MOR. 100 MAX. SUCT. PRESS. PSIG MAX. 3 RATED 3
SP. GR. at PT. 0.755 DIFF. PRESS. PSI 381
VAP. PRESS. at PT. PSIA 16.2 DIFF. HEAD. FT. 1165
VIS. at PT. 30.5 cP NPSHA. FT. 29
CORR./EROS. CAUSED BY: HYD. HP 105.5

PERFORMANCE

PROPOSAL CURVE NO. 40131
RPM 3550 NPSHR (WATER) 18 1/2'
EFF. 73% BHP RATED 148
MAX. BHP RATED IMP. 185
MAX. HEAD RATED IMP. 1560
MIN. CONTINUOUS GPM
ROTATION (VIEWED FROM CPLG END) CCW

CONSTRUCTION

NOZZLES SIZE RATING FACING LOCATION
SUCTION 4" 400# RF RF SIDE
DISCHARGE 2 1/2" 900# RF SIDE
CASE MOUNT: ☐ CENTERLINE ☒ FOOT ☐ BRACKET ☐ VERT. (TYPE)
- SPLIT: ☒ AXIAL ☐ RAD. TYPE VOLUTE ☐ SGL ☐ DBL ☒ DIFFUSER
- PRESS. ☐ MAX ALLOW. PSIG ☐ F. ☐ HYDRO TEST PSIG
- CONNECT: ☐ VENT ☐ FRAIN ☐ GAGE
IMPELLER DIA: ☐ RATED ☐ MAX. ☐ TYPE: CLOSED
MOUNT: ☒ BETWEEN BRGS ☐ OVERHUNG ☐ WEAR. RG. DIAM./CLRNC.
BEARINGS-TYPE: ☐ RADIAL ☐ THRUST
LUBE: ☐ RING OIL ☐ FLOOD ☐ OIL MIST ☐ FLINGER ☐ PRESSURE
COUPLING: ☐ MRF WALDRON LIMITED ☐ MODEL 3A -5 1/8" SPACER
DRIVER HALF MTD BY: ☐ PUMP MFR ☐ DRIVER MFR ☐ PURCHASER
PACKING: ☐ MFR & TYPE ☐ SIZE/NO. OF RINGS
MECH. SEAL: ☐ MFR & MODEL ☐ API CLASS. CODE
☐ MFR CODE

SHOP TESTS

☐ NON-WIT PERF ☐ WIT. PERF.
☐ NON-WIT HYDRO ☐ WIT. HYDRO
☐ NPSH REQ'D ☐ WIT. NPSH
☐ SHOP INSPECTION
☐ DISMANT. & INSP. AFTER TEST
☐ OTHER

MATERIALS

API CASE/TRIM CLASS 0
BASEPLATE ☐ FSDE

VERTICAL PUMPS

PIT OR SUMP DEPTH 0
MIN. SUBMERGENCE REQ'D ☐
COLUMN PIPE: ☐ FLANGED ☐ THREADED
LINE SHAFT: ☐ OPEN ☐ ENCLOSED
BRGS: ☐ BOWL ☐ LINE SHAFT
BRG. LUBE ☐ WATER ☐ OIL ☐ GREASE
FLOAT & ROD ☐ CS ☐ SS ☐ BRZ ☐ NONE
FLOAT SWITCH ☐
PUMP THRUST, LB ☐ UP ☐ DOWN

AUXILIARY PIPING

☐ C.W. PIPE PLAN ☐ CU. ☐ S.S. ☐ TUBING ☐ PIPE
☐ TOTAL COOLING WATER REQ'D, GPM ☐ SIGHT FL. REQ'D
☐ PACKING COOLING INJECTION REQ'D: ☐ TOTAL GPM ☐ PSIG
☐ SEAL FLUSH PIPE PLAN ☐ C.S. ☐ S.S. ☐ TUBING ☐ PIPE
☐ EXTERNAL SEAL FLUSH FLUID ☐ GPM ☐ PSIG
☐ AUXILIARY SEAL PLAN ☐ C.S. ☐ S.S. ☐ TUBING ☐ PIPE
☐ AUX. SEAL QUENCH FLUID

EXISTING MOTOR DRIVER - TO BE REMOVED

HP. 150 105 RPM 3500 FRAME 6338Y5 VOLTS/PHASE/CYCLES
MFR. GE BEARINGS WEG NIG DUC 591C587
TYPE INSUL FULL LOAD AMPS
ENC. TEMP RISE C LOCKED ROTOR AMPS
OVNS OVSS VENT. THRUST CAP. LB. SERVICE FACTOR

DIM DWG V-258 CNTA 86X33
APPROX. WT. PUMP & BASE 3600
MOTOR TURBINE

API STANDARD 810 GOVERNS UNLESS OTHERWISE NOTED. PUMP: ORIG 8 STAGES - 2 STAGES REMOVED
IMP PATTERN 25 CNTA CEC/D WITH 8 3/8 SHROUD & 8 1/8 VANE
MOTOR REPLACED WITH A WORTHINGTON 203HM STEAM TURBINE - 105HP

FORM NO 130 REVISED APRIL 71



NO.	DATE	REVISION	JOB NO.	DRAWING NO.	REV.
0	11/14/73	AS BUILT - ISSUED FOR CONST.	10095	DS-4-G-5	0
0		APPROVED FOR CONSTRUCTION			
				SHEET <u>L</u> OF <u>1</u>	

WA-TEX 000800

CENTRIFUGAL PUMP DATA SHEET

APPLICABLE TO: PROPOSALS ☐ PURCHASE ☐ AS BUILT ☐
 NOTE: () INDICATES INFORMATION TO BE COMPLETED BY PURCHASER:
☐ BY MANUFACTURER

JOB NO. 10095 ITEM NO. 4B-G30A
 PURCHASE ORDER NO. 10095-G01
 REQUISITION NO. 10095-G01
 INQUIRY NO. _____
 DATE _____ REVISION _____

FOR TEXACO, INC. SITE PUGET SOUND
 UNIT GAS RECOVERY SERVICE ABSORPTION OIL CHARGE
 NO. PUMPS REQ'D 1 NO. MOTORS REQ'D _____ ITEM NO. _____ PROVIDED BY _____ MTD BY _____
 NO. TURBINES REQ'D 1 ITEM NO. 4B-G30A PROVIDED BY OTHERS MTD BY OTHERS
 PUMP MFR BYRON JACKSON SIZE AND TYPE 4X6X14 G53H SERIAL NO. _____

OPERATING CONDITIONS, EACH PUMP				PERFORMANCE	
LIQUID <u>LIGHT H.C.</u>	U.S. GPM at PT. NOR. <u>452</u>	RATED <u>500</u>	PROPOSAL CURVE NO. <u>2643-2</u>		
PT. F. NOR. <u>100</u> MAX.	DISCH. PRESS. PSIG <u>384</u>	RATED <u>3</u>	RPM <u>3650</u> NPSH (WATER) <u>10</u>		
SP GR. at PT. <u>0.76</u>	SUCT. PRESS. PSIG MAX. _____		EFF. <u>56%</u> BHP RATED <u>200</u>		
VAP. PRESS. at PT. PSIA <u>16.2</u>	DIFF. PRESS. PSI <u>381</u>		MAX. BHP RATED IMP <u>337</u>		
VIS. at PT. Sec <u>30.5</u> CP	DIFF. HEAD. FT. <u>116.5</u>		MAX. HEAD RATED IMP <u>1200</u>		
CORR./EROS. CAUSED BY _____	NPSHA. FT. <u>10.6</u>		MIN. CONTINUOUS GPM <u>120</u>		
			ROTATION (VIEWED FROM CPLG END) <u>CCW</u>		

CONSTRUCTION					SHOP TESTS	
NOZZLES	SIZE	RATING	FACING	LOCATION	☒ NON-WIT. PERF.	☐ WIT. PERF.
SUCTION	<u>6</u>	<u>300#</u>	<u>RF</u>	<u>TOP</u>	☐ NON-WIT. HYDRO	☒ WIT. HYDRO
DISCHARGE	<u>4</u>	<u>300</u>	<u>RF</u>	<u>TOP</u>	☐ NPSH REQ'D	☐ WIT. NPSH
CASE-MOUNT: ☒ CENTERLINE ☐ FOOT ☐ BRACKET ☐ VERT. (TYPE) _____					☒ SHOP INSPECTION	
-SPLIT: ☐ AXIAL ☐ RAD. TYPE VOLUTE ☐ SGL ☒ DBL ☐ DIFFUSER					☐ DISMANT. & INSP. AFTER TEST	
-PRESS: ☐ MAX. ALLOW. <u>200</u> PSIG <u>60</u> F. ☐ HYDRO TEST <u>1200</u> PSIG					☐ OTHER _____	
-CONNECT: ☒ VENT ☒ BRAIN ☐ GAGE						
IMPELLER DIA. ☐ RATED <u>11 3/8</u> ☐ MAX. <u>13 3/8</u> ☐ TYPE: <u>CLOSED</u>						
MOUNT: ☒ BETWEEN BRGS ☐ OVERHUNG ☐ WEAR RG. DIAM./CLING.						
BEARINGS-TYPE: ☐ RADIAL <u>BALL</u> ☐ THRU <u>DR BALL</u>						
LUBE: ☐ RING OIL ☐ FLOOD ☐ OIL MIST ☐ FLINGER ☐ PRESSURE						
COUPLING: ☐ MRF <u>FAST</u> ☐ MODEL <u>B</u>						
DRIVER HALF MTD BY: ☒ PUMP MFR ☒ DRIVER MFR ☐ PURCHASER						
PACKING: ☐ MFR & TYPE _____ ☐ SIZE/NO. OF RINGS _____						
MECH. SEAL: ☐ MFR & MODEL <u>BW-QB</u> API CLASS. CODE <u>B5TFJ</u>						
☐ MFR CODE <u>QB-2625-5D4K</u>						

AUXILIARY PIPING		MATERIALS	
☐ C.W. PIPE PLAN <u>NOT REQ'D</u> CU: ☐ S.S.: ☐ TUBING: ☐ PIPE _____		API CASE/TRIM CLASS <u>GEMS P-2M7</u>	
☐ TOTAL COOLING WATER REQ'D. GPM _____	☐ SIGHT F.I. REQ'D _____	<u>GEMS P-2A1</u>	
☐ PACKING COOLING INJECTION REQ'D: ☐ TOTAL GPM _____ ☐ PSIG _____		<u>CASE-STEEL</u>	
☐ SEAL FLUSH PIPE PLAN <u>12</u> O.C.S. ☐ S.S. ☐ TUBING ☒ PIPE <u>SCH 80 Sock Weld</u>		BASEPLATE ☐ <u>ES-DR</u>	
☐ EXTERNAL SEAL FLUSH FLUID _____ ☐ GPM _____ ☐ PSIG _____		VERTICAL PUMPS	
☐ AUXILIARY SEAL PLAN _____ O.C.S. ☐ S.S. ☐ TUBING ☐ PIPE _____		PIT OR SUMP DEPTH _____	
☐ AUX. SEAL QUENCH FLUID <u>WATER QUENCH CONN REQ'D</u>		MIN. SUBMERGENCE REQ'D. ☐ _____	
MOTOR DRIVER		COLUMN PIPE: ☐ FLANGED ☐ THREADED	
HP _____ RPM _____ FRAME _____ VOLTS/PHASE/CYCLES _____		LINE SHAFT: ☐ OPEN ☐ ENCLOSED	
MFR _____ BEARINGS _____ LUBE _____		BRGS: ☐ BOWL ☐ LINE SHAFT	
TYPE _____ INSUL. _____ FULL LOAD AMPS _____		BRG. LUBE ☐ WATER ☐ OIL ☐ GREASE	
ENC _____ TEMP. RISE C. _____ LOCKED ROTOR AMPS _____		FLOAT & ROD ☐ S.S. ☐ BRZ ☐ NONE	
☐ VHS ☐ VSS _____ VERT. THRUST CAP. LB. _____ SERVICE FACTOR _____		FLOAT SWITCH ☐ _____	
APPROX. WT. PUMP & BASE <u>3800</u>		PUMP THRUST, LB ☐ UP ☐ DOWN	
MOTOR <u>NONE</u> TURBINE <u>2860</u>			

API STANDARD 610 GOVERNS UNLESS OTHERWISE NOTED. TURBINE DRIVER - WORTHINGTON 282M

FORM NO 130 (REVISED APRIL 71)

NO.	DATE	REVISION	JOB NO.	DRAWING NO.	REV.
2	11/13/72	AS BUILT - ISSUED FOR CONST.			
1	7/4/72	ISSUED FOR PURCHASE			
0	11-7-72	ISSUED FOR QUOTATION			
			10095	DS-4B-G2	1
				SHEET 1 OF 1	

WA-TEX 000801

JOB NO. 10095 ITEM NO. 4B-G50/A

PURCHASE ORDER NO. _____
REQUISITION NO. 10095.-G-01
INQUIRY NO. _____
DATE _____ REVISION _____

OPERATING CONDITIONS, EACH PUMP				PERFORMANCE	
LIQUID <u>LIGHT GASOLINE</u>		S. GPM at PT. NOR <u>395</u> RATED <u>425</u>		PROPOSAL CURVE NO. <u>CA-807</u>	
DISCH. PRESS. PSIG <u>142</u>				RPM <u>3560</u> NPSHR (WATER) <u>10</u>	
PT. F. NOR. <u>130</u> MAX		SUCT. PRESS. PSIG MAX <u>23</u> RATED <u>23</u>		EFF. <u>65.5%</u> BHP RATED <u>45</u>	
SP GR. at FT. <u>0.66</u>		DIFF. PRESS. PSI <u>119</u>		MAX. BHP RATED IMP <u>50.2</u>	
VAP. PRESS. at PT. PSIA <u>?</u>		DIFF. HEAD. FT. <u>412</u>		MAX. HEAD RATED IMP <u>4.85</u>	
VIS. at PT. Sec <u>130</u> CP		NPSHA, FT. <u>10</u>		MIN. CONTINUOUS GPM <u>100</u>	
CORR/EROS. CAUSED BY		HYD. HP <u>29.5</u>		ROTATION (VIEWED FROM CPLG END) <u>ccw</u>	

SHOP TESTS

☒ NON-WIT. PERF. ☐ WIT. PERF.
☐ NON-WIT HYDRO ☒ WIT. HYDRO
☐ NPSH REQ'D. ☐ WIT. NPSH
☒ SHOP INSPECTION
☐ DISMANT. & INSP. AFTER TEST
☐ OTHER " "

MATERIALS

API CASE/TRIM CLASS ☐ GEMS P-2M7
GEMS P-2A1
CASE-STEEL

VERTICAL PUMPS

PIT OR SUMP DEPTH _____
MIN. SUBMERGENCE REQ'D. ☐ _____
COLUMN PIPE: ☐ FLANGED ☐ THREADED
LINE SHAFT: ☐ OPEN ☐ ENCLOSED
DRGS: ☐ BOWL _____ ☐ LINE SHAFT _____
BRG. LUBE ☐ WATER ☐ OIL ☐ GREASE
FLOAT & ROD () C.S. () S.S. () BRZ () NONE
FLOAT SWITCH _____
PUMP THRUST. LB ☐ UP _____ ☐ DOWN _____

MOTOR DRIVER

APPROX. WT. PUMP & BASE 850
MOTOR _____ TURBINE _____

FORM NO. 130 (REVISED APRIL 71)



EQUIP. NO. 4B-G 5/A

ALVE
1-7-54

DATE

INPUT	Z
-------	---

3500
RPM

UNITED CENTRIFUGAL PUMPS
DIVISION OF
UNITED IRON WORKS

PUMP SIZE & TYPE
2" RT-AA

☐ (1) approved - subject to final AEC, Navy proposal.

☐ (2) approved - subject to final AEC, Navy proposal.

☐ (3) approved except as noted - Rules change and sublimit final award - AEC may proceed as approved.

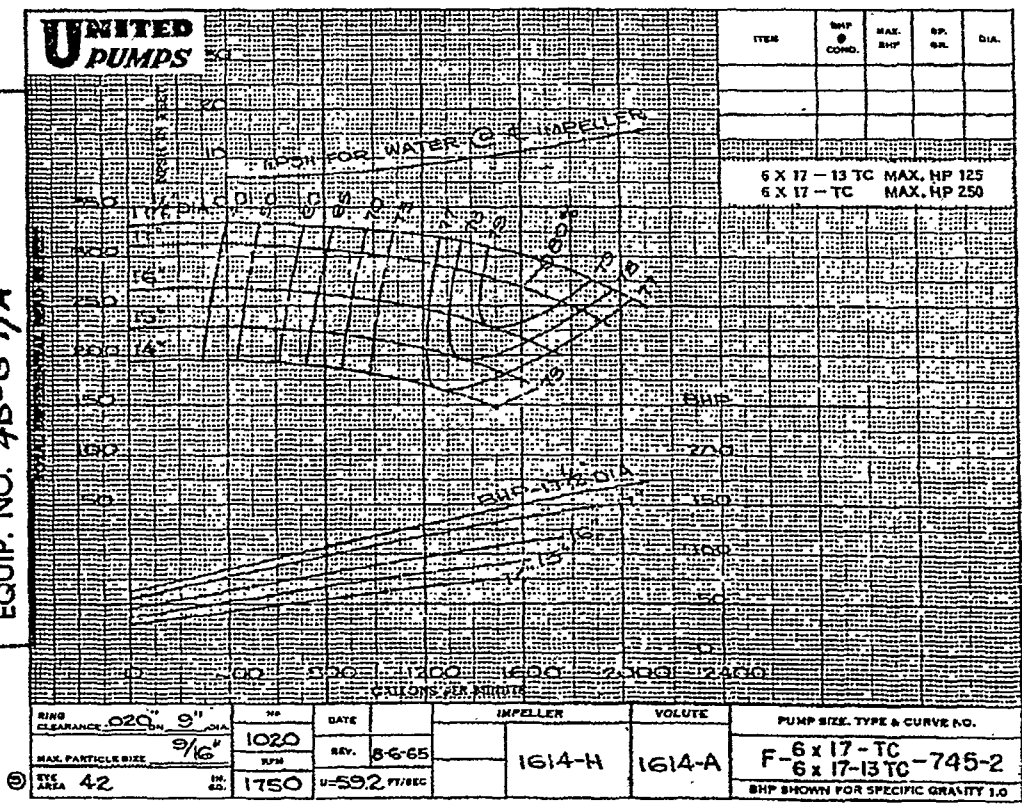
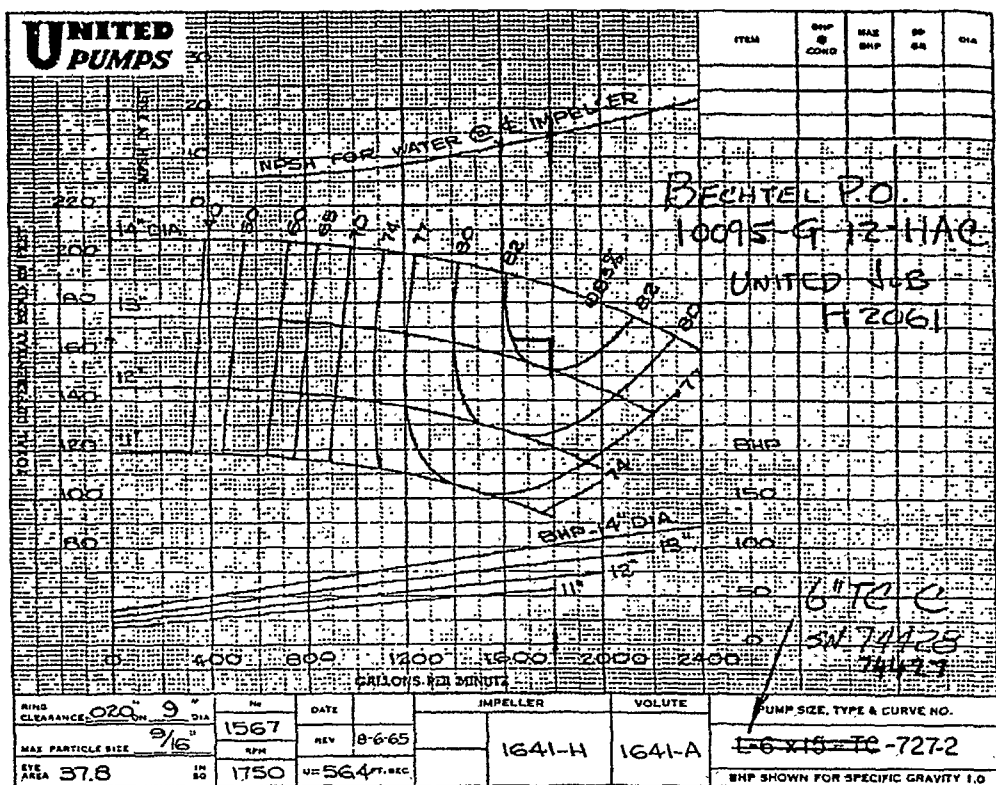
Standard Inside Ring Diameter 0.915" an O.D. Master,
 Working Ring Diameter 4 5/8"
3/8" Maxium Dia. where it pass through smaller

WA-TEX 000803

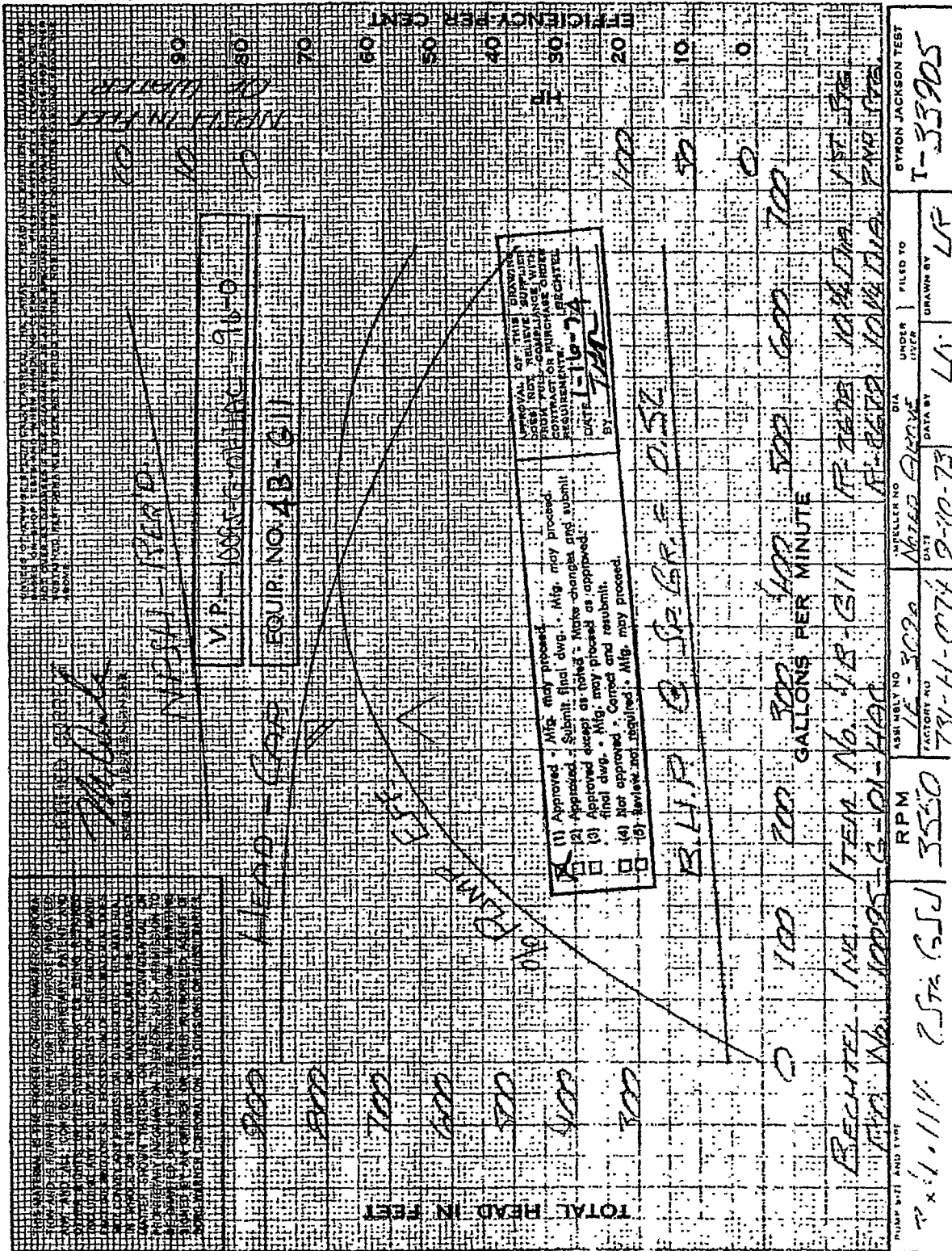
APPROVAL OF THIS DRAWING
DOES NOT RELIEVE SUPPLIER
FROM FULL COMPLIANCE WITH
CONTRACT OR PURCHASE ORDER
REQUIREMENTS. BECHTEL
DATE 11-13-73 BY *[Signature]*

- (1) Approved - Mfg. may proceed.
- (2) Approved - Submit final. Mfg. may proceed.
- (3) Approved except as no. Make changes and submit final dwg. - Mfg. may proceed as approved.
- (4) Not approved - Correct and resubmit.
- (5) Review not required - Mfg. may proceed.

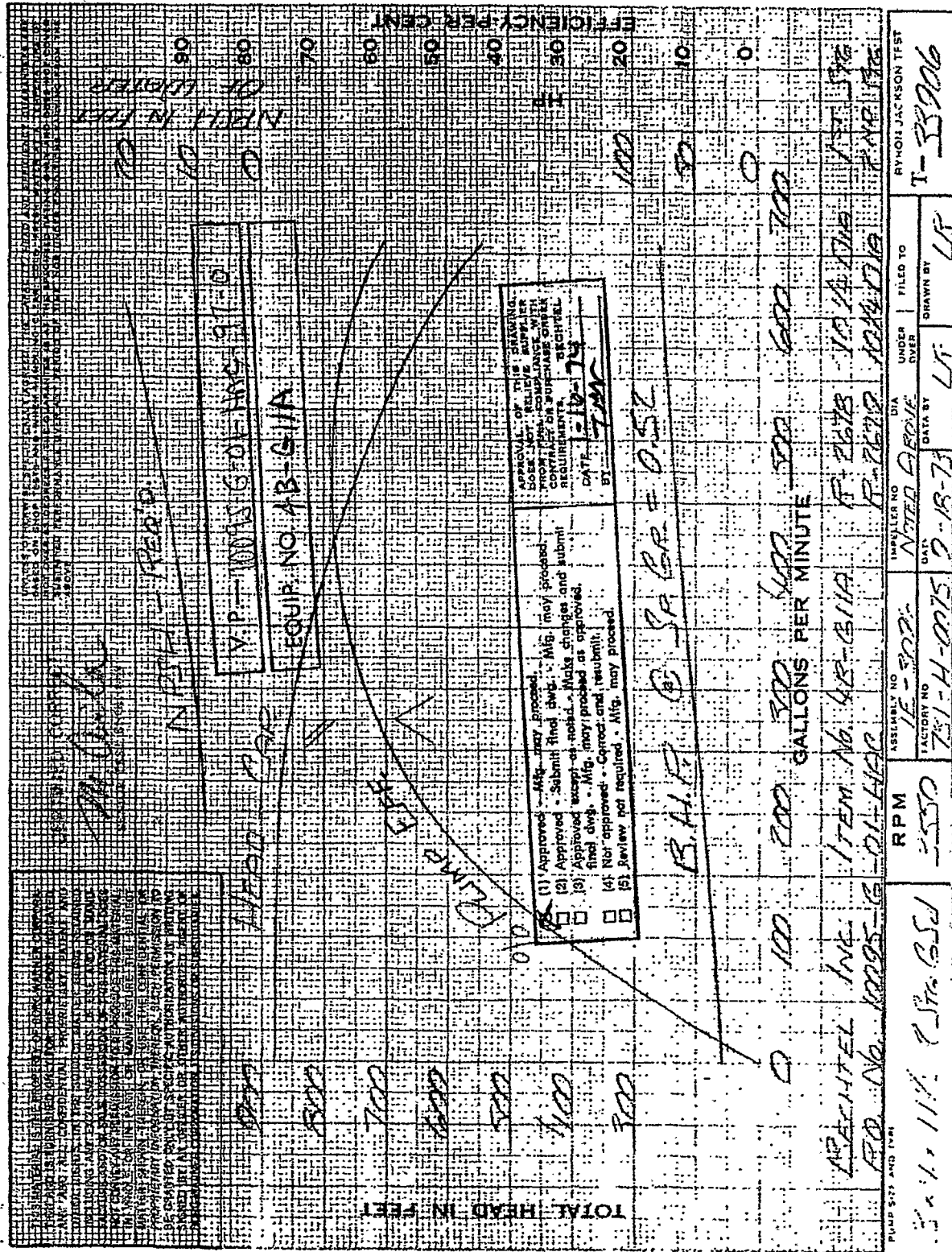
V.P. 10095-G-12-114C-1-0
EQUIP. NO. 4B-G-9/A



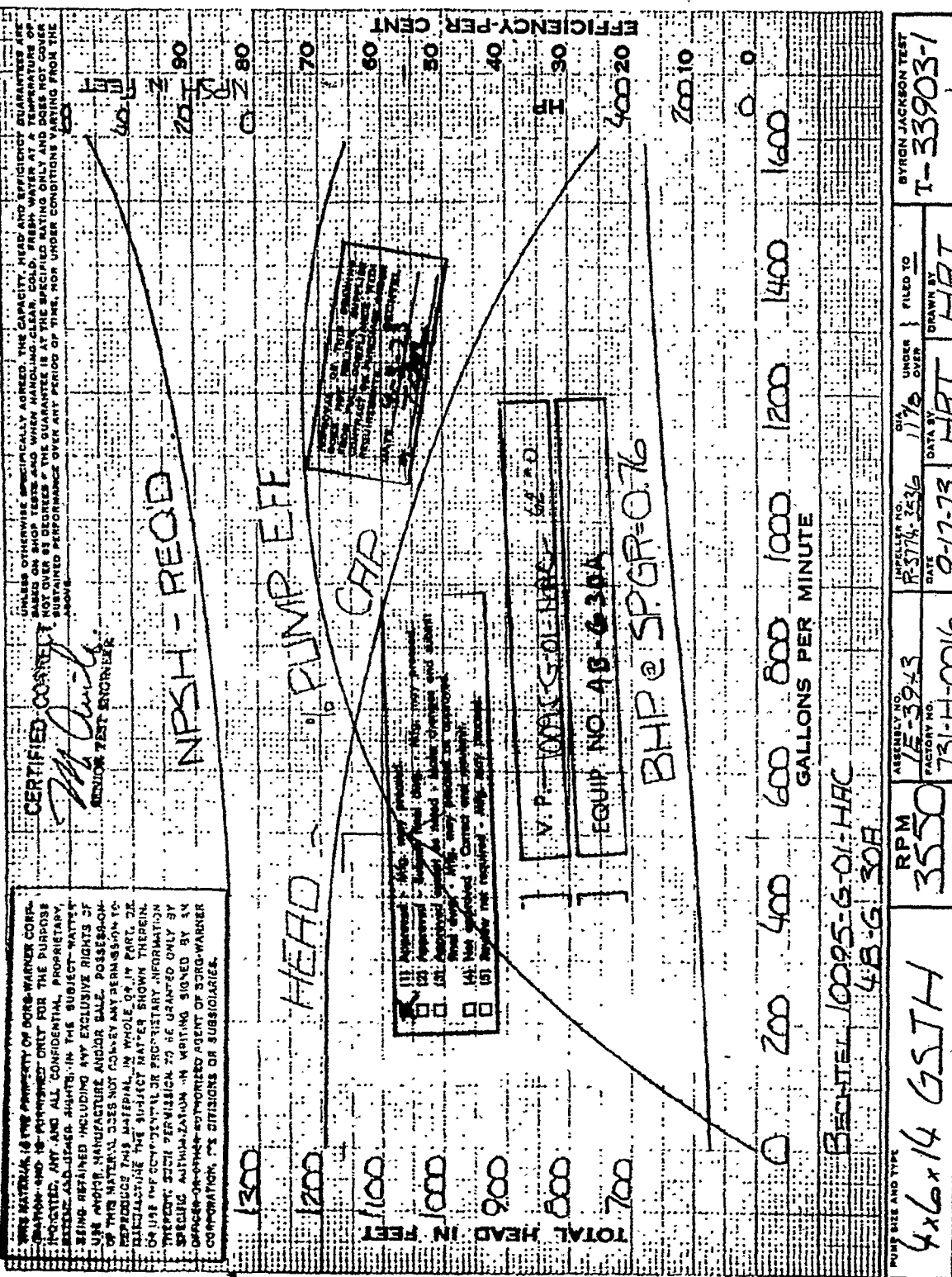
BYRON JACKSON



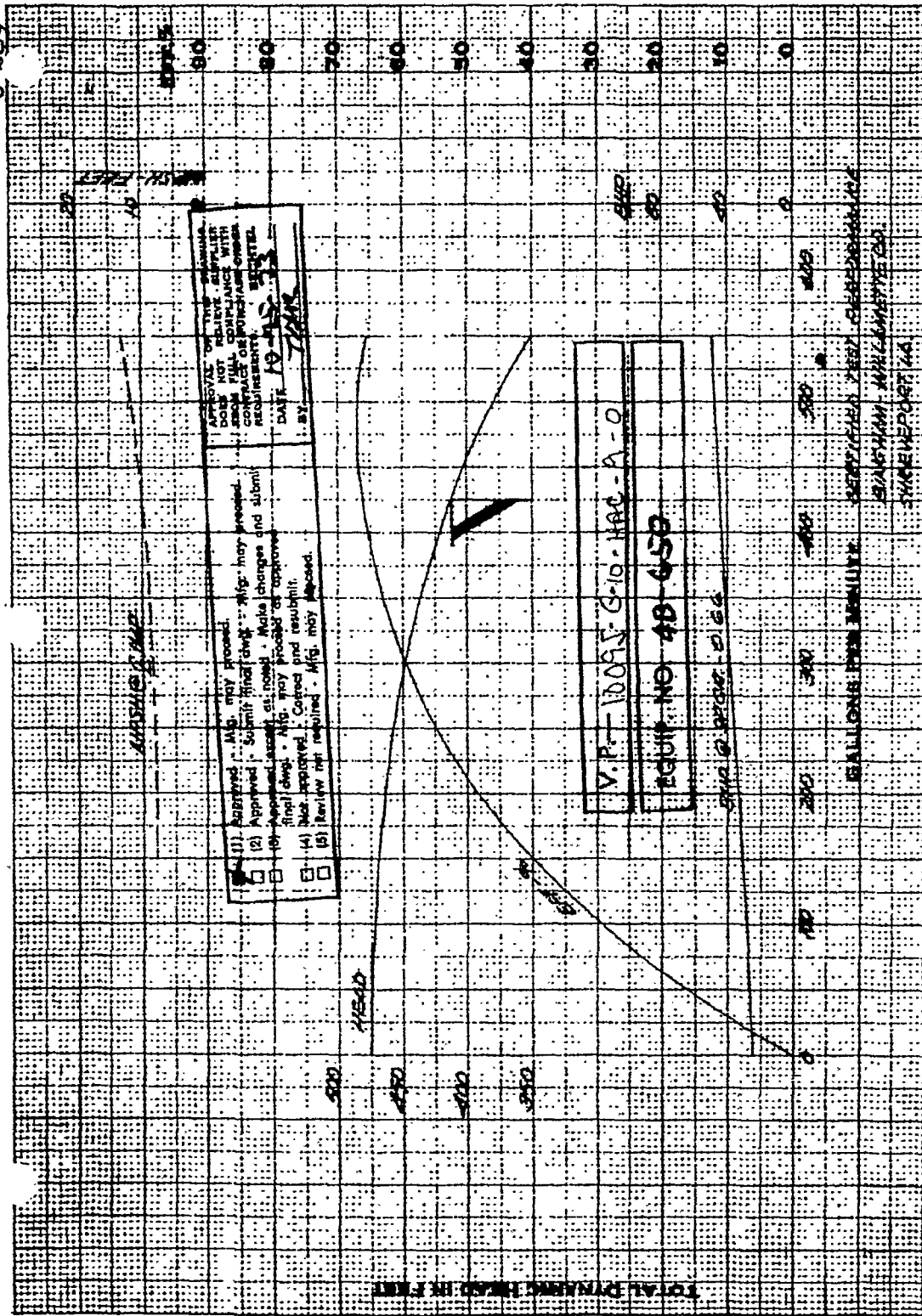
BYROI JACKSON



BYRON JACKSON

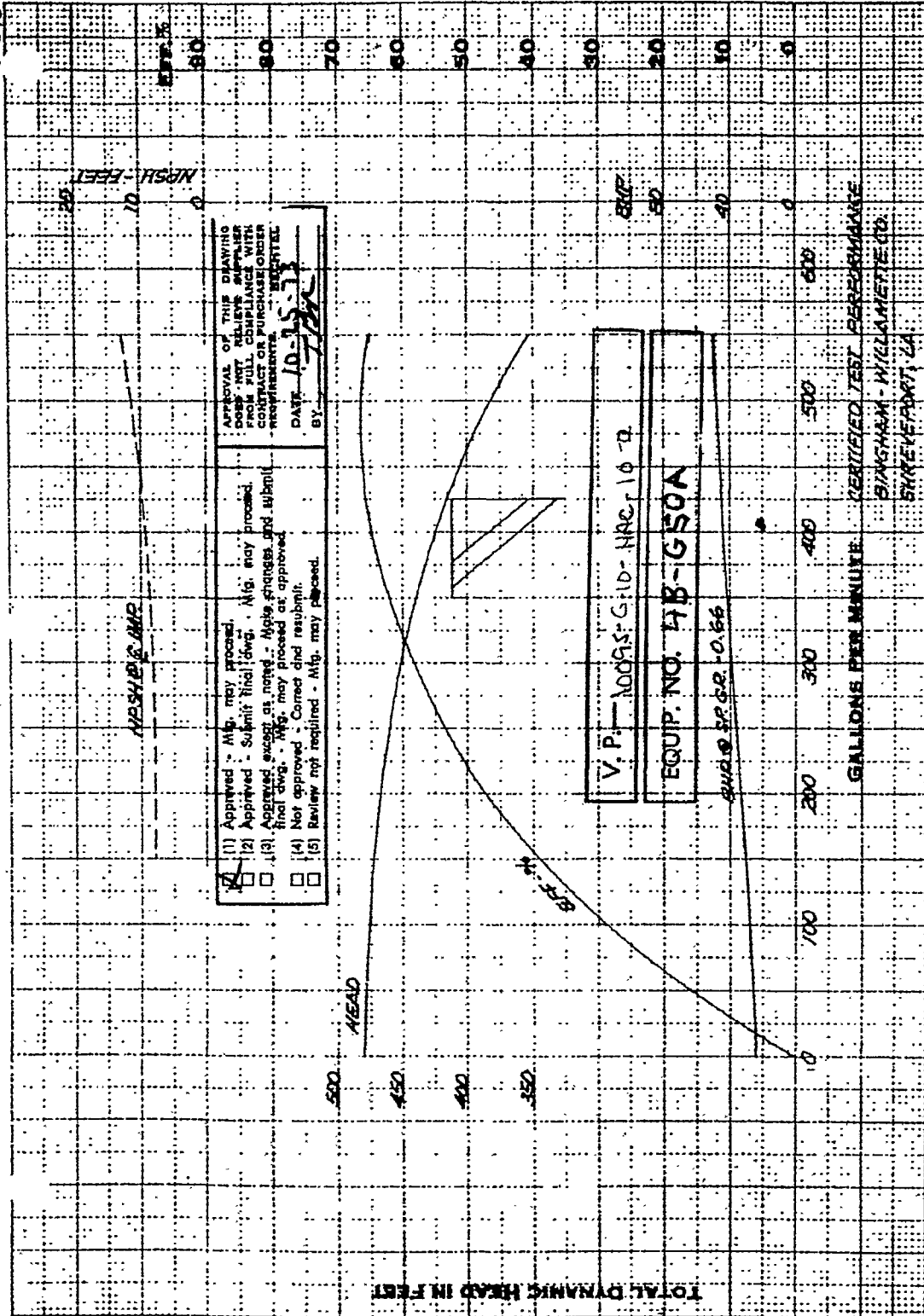


S-689



BECHTEL, INC. TEXACO, INC. CUST. ITEM NO: 48-G-50 PUMP NO: 223555		CHARACTERISTIC CURVE SHEET BINGHAM PUMP DIVISION BINGHAMWILLAMETTE COMPANY PORTLAND OREGON 97208		IMPPELLER MAX. DIA. 11 1/2 MIN. DIA. 10 5/8 DIA. 10 5/8 EYE DIA. 14.2 AREA IN. 313.73		IMPPELLER PATT. 313 CAP-A N.P.S.M. REQUIRED REFERENCE 3-4 x 11 1/2 CAP		PUMP 3560 R.P.M. CURVE NO. S-689	
--	--	---	--	--	--	--	--	---	--

S-690



APPROVAL OF THIS DRAWING
DOES NOT RELIEVE SUPPLIER
FROM FULL COMPLIANCE WITH
CONTRACT OR PURCHASE ORDER
REQUIREMENTS. BECHTEL

DATE: 10-15-73
BY: [Signature]

(1) Approved - Mfg. may proceed.
(2) Approved - Submit final dwg. - Mfg. may proceed.
(3) Approved, except as noted - Make changes and submit final dwg. - Mfg. may proceed at approved.
(4) Not approved - Correct and resubmit.
(5) Review not required - Mfg. may proceed.

BECHTEL, INC. TEXACO, INC. CUST. ITEM NO: 4B-G-50A PUMP NO: 223556	CHARACTERISTIC CURVE SHEET					PUMP	
	IMPELLER					PUMP	
	MAX. DIA. 1 1/2					CAP	
	MIN DIA. 10 5/8					R. P. M.	
BINGHAM PUMP DIVISION BINGHAM-WILLAMETTE COMPANY PUMP NO: 223556					IMPELLER PATT. 333 CAP-4		3560
IMPELLER PATT. 333 CAP-4					REFERENCE		CURVE NO. S-690
IMPELLER PATT. 333 CAP-4					NPSH REQUIRED		
IMPELLER PATT. 333 CAP-4					SO IN		
IMPELLER PATT. 333 CAP-4					AREA		
IMPELLER PATT. 333 CAP-4					IN		

7.5 INSTRUMENT DATA

TABLE OF CONTENTS

SECTION 7.5 INSTRUMENT DATA

Summary Sheet - Flow Element

Table 7.5-1

Summary Sheet - Relief Valves

Table 7.5-2

Control Valve Data Sheets

TABLE 7.5-1
FLOW ELEMENT SUMMARY SHEET
GAS RECOVERY UNIT PLANT 4B
ANACORTES, WASHINGTON

<u>Flow Element No.</u>	<u>Service</u>	<u>Orifice Size</u>	<u>Line Size</u>	<u>Meter Coefficient</u>
4FE-100	Hvy Gasoline to 4B-C11	2.596	4" Sch 40	50 BPH
4FE-105	Abs. Oil Chg. Pump	1.600	3" Sch 40	15 BPH

TABLE 7.5-2
RELIEF VALVE SUMMARY SHEET
GAS RECOVERY UNIT PLANT 4B
ANACORTES, WASHINGTON

<u>Tag No.</u>	<u>Service</u>	<u>Size</u>	<u>Set Press</u>
4PSV-205	4B-GT30	2" x 3"	300 PSIG
4PSV-206	4B-E7	3/4" x 1"	75 PSIG

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SERVICE CONDITIONS		FLUID									
INLET PSIG		MIN.	OPER.	MAX.	389			135		340	124
OUTLET PSIG		MIN.	OPER.	MAX.	374			48		320	106
INLET TEMP. °F		OPER.		MAX.	100			342	84		135
OPER. SP. GR.		Vapor MOL. WT.		0.75	-			0.27	105	0.78	0.24
T _{in} °F or % FLASH		OPER. VISC. C.P.									
CRIT. PRESS. PC		VAPOR PRESS. PV									
OPER. FLOW		SIZING FLOW		457	640			613	228M	450	630
MIN. FLOW		MAX. FLOW								350	290
FLOW UNITS		ΔP SIZING		5.1M	10			5.1M	97	6.1M	20
ΔP SHUT OFF		ΔP MIN.		385				143	340	150	
Cv @ SIZING ΔP & FLOW		MIN. Cv		175				2-2465	125	87	
Cv-VALVE SELECTED		FACTORS		236				4660	148	148	
				Km=.67				C1=33.2	Km=.68		
NOISE DBA								101.3			
SIZE		TYPE		4" G.03E	3" G.03E						
PRESS. RATING		CONNECTIONS		300#	RF						
MATERIAL		CLASS		C.S.				C.S.			
BONNET TYPE		BOLTS		1.6.11	STC.			1.6.11	STC.		
PACKING		TYPE MAT'L		TEFLON				TEFLON			
LUBRICATOR		ISOL. VALVE		YES	YES			YES	YES		
PORT SIZE		NO. OF PORTS		FULL	BAL'D			FULL	BAL'D		
CHARACTER.		PLUG TYPE		LIN.	CAGE			LIN.	CAGE		
GUIDE TYPE		TRIM SPEC.			A				A		
ACTION PUSH TO		FLOW: OPENS-CLOSES		CLOSE	CLOSE			CLOSE	CLOSE		
ACTUATOR TYPE				D.A.P.				DIAP.			
MOTIVE POWER		LINEAR / ROTARY		AIR	LIN.			AIR	LIN		
PRESS./VOLTAGE		POS. ON POWER FAIL		-	C			-	O		-
THRUST OR TORQUE REQ.		SHUT OFF OPER.									
SIZE		MAX. OUTPUT		45				40	40	40	
MANUAL O'RIDE		POS. FEEDBACK TYPE		-	-			-	-		
POSITIONER OUTPUT		SINGLE/DUAL		3-15	S			3-15	S		
INPUT SIGNAL		SUPPLY PSIG		3-15	20			3-15	20	3-15	
BY-PASS		GAUGES		YES	YES			YES	YES		
MISC.								SENSE EXISTING			
PURCH.								4ERS-11V IN			
M.R. / P.O. NUMBER				J-411				J-411			
MANUFACTURER				FISHER				FISHER			
MODEL NO.				667 ED				667 ED	657 ED	667 ED	
P. & I. D. NUMBER				4-BA-6	4-BA-9			4-BA-3	4-BA-7	4-BA-9	
SERVICE				ABSORPTION OIL				SPLITTER FEED	4-BA-7	4-BA-9	
LINE SIZE - NO. - SPEC.				4" J061B	4" J063B			8" J051B	4" J061B	4" J13A	
INSTRUMENT TAG NO.				4FV-11	4FV-29			4FV-31	4FV-19	4PV-46	
NOTES											
1 3-7-73 GEN. REVISION											
2 1-31-77 ISSUED FOR PURCHASE											
NO. DATE		REVISIONS									
ORIGIN R&C ENG.		CONTROL VALVES						JOB NO. 10095			
BECHTEL		TEXACO						DATA SHEET NUMBER		REV.	
		3910						DS-5-129		1	

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SERVICE CONDITIONS		FLUID									
INLET PSIG		MIN.	OPER.	MAX.	95	75				335	
OUTLET PSIG		MIN.	OPER.	MAX.	85	65				300	
INLET TEMP. °F		OPER.		MAX.	100	100				75	
OPER. SP. GR.		Vapor		MOL. WT.	0.81					0.79	-
T _h °F or % FLASH		OPER.		VISC. C.P.	0.45						
CRIT. PRESS. P _c		VAPOR PRESS. P _v									
OPER. FLOW		SIZING FLOW			197	279	270	327		450	630
MIN. FLOW		MAX. FLOW									
FLOW UNITS		ΔP SIZING			GPM	10		10		GPM	35
ΔP SHUT OFF		ΔP MIN.			130		80			335	
Cv @ SIZING ΔP & FLOW		MIN. Cv			80		92.2			94.0	
Cv-VALVE SELECTED		FACTORS					148			148	
							K _m =.68			K _m =.68	
SIZE		TYPE			3" GLOBE	3" GLOBE	2" GLOBE	3" GLOBE			
PRESS. RATING		CONNECTIONS			300# RF	300# RF					
MATERIAL		CLASS			C.S.	C.S.				C.S.	
BONNET TYPE		BOLTS			RAIN STD	RAIN STD				RAIN STD	
PACKING		TYPE MAT'L			YES	YES				YES	YES
LUBRICATOR		ISOL. VALVE			YES	YES				YES	YES
PORT SIZE		NO. OF PORTS			2 1/2" 1	FULL BALL				FULL BALL	
CHARACTER.		PLUG TYPE			LIN. CAGE	LIN. CAGE				LIN. CAGE	
GUIDE TYPE		TRIM SPEC.			A	A				A	
ACTION OPEN-CLOSE		FLOW: OPENS-CLOSES			CLOSE OPEN	CLOSE CLOSE				CLOSE CLOSE	
ACTUATOR TYPE					DIAP	DIAP				DIAP	
MOTIVE POWER		LINEAR / ROTARY			AIR LIN	AIR LIN				AIR LIN	
PRESS./VOLTAGE		POS. ON POWER FAIL			- C	- C					
THRUST OR TORQUE REQ.		SHUT OFF OPER.									
SIZE		MAX. OUTPUT			45	40				40	
MANUAL O'RIDE		POS. FEEDBACK TYPE			-	-				-	-
POSITIONER OUTPUT		SINGLE/DUAL			-	-				3-15 5	
INPUT SIGNAL		SUPPLY PSIG			3-15	3-15				3-15 20	
BY-PASS		GAUGES			-	-				YES YES	
MISC.											
PURCH.		AIRSET MTD & PIPED									
M. R. / P. O. NUMBER		J-411			J-411					J-411	
MANUFACTURER		FISHER			FISHER					FISHER	
MODEL NO.		667 ES			667 ED					667 ED	
P. & I. D. NUMBER		4-RA-8			4-CA-3		4-1A-3		4-1A-7	4-RA-8	
SERVICE					COLD UNITED E.C. GASA		INTERSTAGE SEP. V/A		ABSORBER CHG		
LINE SIZE - NO. - SPEC.		4" - J0513			4" - J13A		3" J0613		4" - J013	4" J51E	
INSTRUMENT TAG NO.		4FV-100			4FV-102		4LV-70		4TV-93	4LV-70	
NOTES											
REVISIONS											
ORIGIN R&C ENG.		BECHTEL									
CONTROL VALVES											
JOB NO.		10095									
DATA SHEET NUMBER		25-3-130									
REV.		1									

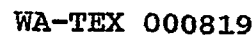
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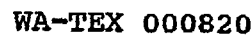
FLUID											
INLET PSIG		MIN. OPER. MAX.		275		265		234			
OUTLET PSIG		MIN. OPER. MAX.		75		65		229			
INLET TEMP. °F		OPER. MAX.		110				112			
OPER. SP. GR.		VAPOR MOL. WT.		1.0		1.2		0.475			
T ₉₀ °F OF % FLASH		OPER. VISC. C.P.								VALVE SIZED	
CRIT. PRESS. P _c		VAPOR PRESS. P _v									
OPER. FLOW		SIZING FLOW		6.0		43		3.0		51	
MIN. FLOW		MAX. FLOW						14		20	
FLOW UNITS		ΔP SIZING		6MM		200		6MM		5	
ΔP SHUT OFF		ΔP MIN.		275						NO DATA	
Cv @ SIZING ΔP & FLOW		MIN. Cv		6.57		3.9		6.1		FURNISHED	
Cv-VALVE SELECTED		FACTORS		12.2		9.69		9.86			
				K _v = .91		K _v = .8		K _v = .86			
						SPLIT BODY					
SIZE		TYPE		1" GLOBE						2" GLOBE	
PRESS. RATING		CONNECTIONS		300# RF		300# RF		300# RF		300# RF	
MATERIAL		CLASS		C.S.		MONEL		J.S.		C.S.	
BONNET TYPE		BOLTS		PLAIN STD.						PLAIN STD.	
PACKING		TYPE MAT'L		TEFLON ASBESTOS						TEFLON	
LUBRICATOR		ISOL. VALVE		YES YES						YES YES	
PORT SIZE		NO. OF PORTS		FULL 1		3/4" 1		1/2" 1		2 3/4" 1	
CHARACTER.		PLUG TYPE		7/8 M.FORM		7/8 CUT		7/8 M.FORM		LIN. CAGE	
GUIDE TYPE		TRIM SPEC.		A		THROTTLE		A		A	
ACTION PUSH TO		FLOW: OPENS-CLOSES		CLOSE OPEN						CLOSE CLOSE	
ACTUATOR TYPE				DIAP.						DIAP.	
MOTIVE POWER		LINEAR/ROTARY		AIR LIN.						AIR LIN	
PRESS./VOLTAGE		POS. ON POWER FAIL		- C						- C	
THRUST OR TORQUE REQ.		SHUT OFF OPER.									
SIZE		MAX. OUTPUT		30		30		30			
MANUAL O/RIDE		POS. FEEDBACK TYPE		- -						- -	
POSITIONER OUTPUT		SINGLE/DUAL		3-15 S						- -	
INPUT SIGNAL		SUPPLY PSIG		3-15 20				3-15 -		3-15 -	
BY-PASS		GAUGES		YES YES						- -	
MISC.						CS. FLANGES					
PURCH.		AIRSET MTD & APED		YES						-	
		M. R. / P. O. NUMBER		J-411						J-411	
		MANUFACTURER		FISHER						FISHER	
		MODEL NO.		667 EB		667 E		667 ES		667 ED	
		P. & I. D. NUMBER		S-RA-25		S-RA-25		S-RA-5		S-RA-6	
		SERVICE		SPENT MEA		SPENT NASH FROM 61-659		LPG FROM 51-641		2ND STG. SEP. LEVEL	
		LINE SIZE - NO. - SPEC.		3" J35A		2" J35B		3" J32		4" J300B	
		INSTRUMENT TAG NO.		SLV-201		SLV-205		SLV-210		4LV-72	
NO.		DATE		REVISIONS		NOTES					
1		5-7-75		GEN REVISION		JT					
0		1-31-73		ISSUED FOR PURCHASE		JT					
ORIGIN		R&C		ENG.		CONTROL VALVES		JOB NO		10045	
								DATA SHEET NUMBER		REV.	
								DS-2-131		1	

7.6 TRAY LOADINGS

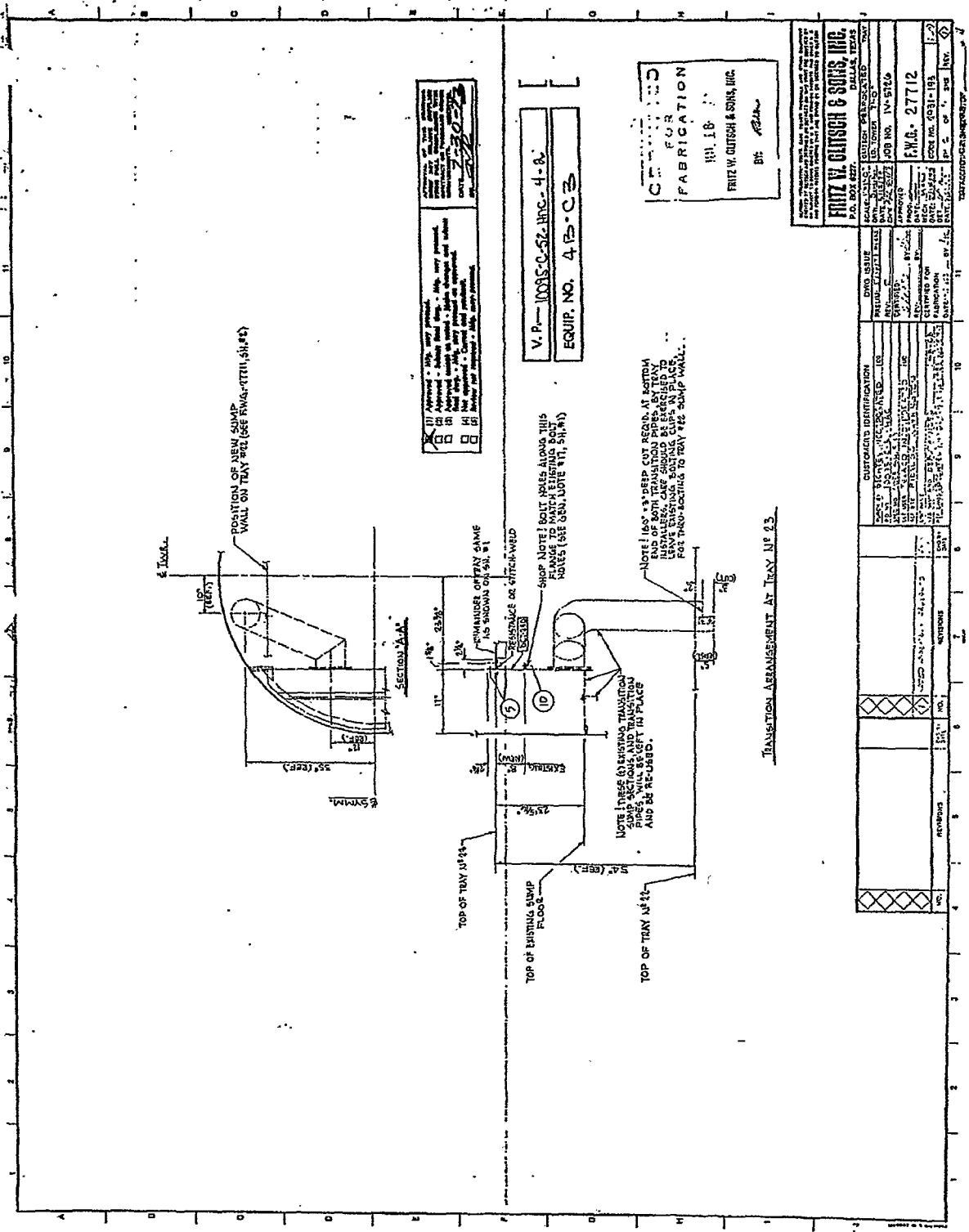
TABLE OF CONTENTS
SECTION 7.6 TRAY LOADINGS

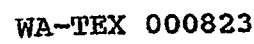
Tray Loadings	Table 7.6-1
Drawing No.	Title
V.P. 10095-C-52-HAC-1-2	Glitsch Perforated Tray F.W.G. 27711 - Sh. 1 of 8
V.P. 10095-C-52-HAC-2-2	Glitsch Perforated Tray F.W.G. 27711 - Sh. 2 of 8
V.P. 10095-C-52-HAC-3-2	Debutanizer 4B-C3 F.W.G. 27712 Sh. 3 of 5
V.P. 10095-C-52-HAC-4-2	Glitsch Perforated Tray F.W.G. 27712 Sh. 2 of 5
V.P. 10095-C-52-HAC-5-2	Glitsch Perforated Tray F.W.G. 27712 Sh. 1 of 5
V.P. 10095-C-52-HAC-6-2	Debutanizer 4B-C3 F.W.G. 27711 Sh. 3 of 8
V.P. 10095-C-52-HAC-7-2	Debutanizer 4B-C3 F.W.G. 27711 Sh. 4 of 8
V.P. 10095-C-52-HAC-8-2	Debutanizer 4B-C3 F.W.G. 27711 Sh. 5 of 8
V.P. 10095-C-52-HAC-9-0	Bolting & Clamping Assemblies F.W.G. 27711 Sh. 6 of 8
V.P. 10095-C-52-HAC-10-0	Packing List F.W.G. 27711 Sh. 7 of 8
V.P. 10095-C-52-HAC-11-0	Packing List F.W.G. 27711 Sh. 8 of 8
V.P. 10095-C-57-HAC-12-0	Bolting & Clamping Assemblies F.W.G. 27712 Sh. 4 of 5
V.P. 10095-C-52-HAC-13-0	Packing List F.W.G. 27712 Sh. 5 of 5





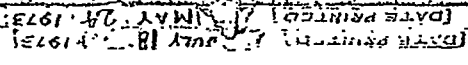
SCALE, NONE
DRN. J.G.
CHKD. YAO
APPROVED:











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PACKING LIST

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SAB. REFUGES/172
SIR J OF S SHS REV.

DATE	REL: 6/25/73	REV
PAGE	1	3
NO	1	3
CODE NO	2	3

PACKING LIST

SH. NO.	NAME OF PART	QTY	MARKING	TOTALS		QUANTITY PER TRAY	
				INCL. SPARE	NET TOTAL	TRAY #25	TRAY #52
						(1)	(8)
	DOWNCOMER TRUSS	120	TR-240	12	10	1	1
	TRAY FLOOR	121	TE-300	9	9	1	1
	"	122	TE-301	1	1	1	1
	"	123	TE-302	20	20	2	2
	"	124	TE-303	20	20	2	2
	" (MANUAL)	125	TE-304	10	10	1	1
	DOWNCOMER	126	TC-410	9	9	1	1
	DOWNCOMER BRACE	127	DCB-4100	9	9	1	1
	SEAL PLATE	128	SP-510	12	12	2	2
	"	129	SP-511	2	2	2	2
	BOTTOM TRAY CLAMP #23-E	130		345	320	30	30
	1 1/2" x 1/2" FRICTIONAL WASHERS	131		744	620	60	60
	STANDARD WASHERS FOR 5/8" B BOLTS	132		342	312	30	30
	3/4" x 1" B BOLTS	133		544	414	40	40
	3/4" x 1 1/2" B BOLTS	134		120	92	10	10
	NUTS FOR 3/8" B BOLTS	135		20	20	2	2
	LOCK KEY LOCK CLAMPS #2	136		253	210	20	20
	"	137		253	210	20	20
	" STUDS #5	138		253	210	20	20
	ST 1 1/2" x 1/2" x 1/2" TUBE 20M	139		121	97	10	10
	ITEMS LISTED BELOW TO BE WELODED IN FWB SHOP						
	NUTS WELODED IN PLACE (100% W/153)	320		320	320	30	30
	25 OF NUTS WELODED IN PLACE (25% W/153)	345		345	345	30	30

SHOP NOTES

- SEE BOTTOM OF PACKING LIST FOR ITEMS TO BE WELODED IN FWB SHOP.
- ALL BOLTING TO BE DIE STAMPED INDICATING TYPE OF MATERIAL.
- ALL SHEET AND PLATE MATERIAL TO BE AS NOTED ON LAYOUT DRAWING.
- MATERIAL FOR HARDWARE ITEMS TO BE AS FOLLOWS:
 TRAY CLAMPS: 12 GA. TYPE 410
 FRICT. WASHERS: 12 GA.
 STD. WASHERS: 14 GA.
 MIN. LOCK CLAMPS: 1/2"
 MIN. LOCK STUDS: 3/8" x 6 TYPE 304
 WELDED BOLTS: 3/8" x 3
 WELDED NUTS: 3/8"
 WELDED NUTS: 3/8"
- PACKING MATERIAL TO BE AS FOLLOWS:
 LISTING TAPE: 1/2" x 1/2" x 1/2" RUST PROOF
 ASD. WICK: 1/2" x 1/2" x 1/2"
 O.D. WASHER GASKETS: 1/2"
 RISER GASKETS: 1/2"
 1" O.D. WASHER GASKETS: 1/2"
 TWO (2) PRINTS EACH OF THE FOLLOWING DRAWINGS ARE TO BE CRATED AND SHIPPED WITH THE PACKAGED MATERIAL:
 FWB 27712 SR. 1 TO 5 INCL.
 FWB 27712 SR. 1 TO 5 INCL.
- * SPARE ALLOWANCE
 BOLTING & HARDWARE: 15%, 10 MIN
 ASD. WASHER TAPE: 25%, 10 MIN
 MIN. PL WASHERS: 2%, 10 MIN
 NUTS: 2%, 10 MIN

REVISIONS

NO. DATE

REVISIONS

CUSTOMER IDENTIFICATION

BECHTEL INCORPORATED

P.O. # 10095-C-52-HAC

ULTIMATE TEXAS INCORPORATED

NEW MEXICO FEDERAL WASHINGTON

DATE: 10-10-68

BY: [Signature]

FOR: [Signature]

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Table 7.6-1
Tray Loadings
Plant 4B - Gas Recovery Unit
Anacortes, Washington

DEBUTANIZER 4B-C3

	Bottom Trays		Feed	Top
Tray Nos.	1-6	7-21	22	23-32
Tray Spacing, Ft.	2.5	2.0	2.0	2.0
Vapor, CFS	23.8	22.1	15.9	29.8
Liquid, GPM	1262	1209	992	377

Density, LBS/CF

Vapor	1.89	1.81	1.56	1.51
Liquid	34.6	34.5	34.9	32.0
Viscosity, Cp	0.13	0.12	0.12	0.12
Surface Tension in Dynes/CM	6.0	5.5	5.0	6.0