PLAINTIFF'S EXHIBIT

TEX-119

ADDENDUM TO THE OPERATING MANUAL

CATALYTIC POLYMERIZATION UNIT

PLANT 5J

TEXACO INC.

PUGET SOUND PLANT

ESTIMATE 3910

BECHTEL INCORPORATED

HOUSTON, TEXAS

1973

1. GENERAL DESCRIPTION

I - GENERAL DESCRIPTION

A. INTRODUCTION

This addendum to the Operating Manual for the Catalytic Polyermization Unit at the Puget Sound Works of TEXACO Inc., Anacortes, Washington, covers the revamp of the Catalytic Polymerization Unit. The principal new equipment for this revamp is:

Saturated C_3-C_4 Amine Treater

Saturated C_3-C_4 Caustic Treater

Saturated C_3-C_4 Regenerated Caustic Treater

Saturated C_3-C_4 Salt Filter

Propane Stripper

Attendant facilities for heat exchange, transfer of liquids, and control of operations.

B. BASIS OF DESIGN

General

In the feed preparation section, the revamp is limited to the cracked C_3-C_4 treater and the saturated C_3-C_4 treaters. The cracked C_3-C_4 treaters are to treat 7,963 BPSD of C_3-C_4 from the Gas Recovery Unit. The saturated C_3-C_4 treaters are to treat a combined total of 7,017 BPSD of C_3-C_4 from the Crude Unit and the CRU.

In the recovery section, the revamp covers only the depropanizer. The depropanizer feed is the effluent from the saturated treaters in the feed preparation section. The condensed depropanizer overhead stream is fed to a new propane stripper from which 420 BPSD of propane product is recovered.

Process flow conditions for the revamped unit are shown on process flow diagrams 5-RA-1 and 5-RA-2.

C. DESCRIPTION OF ADDITIONS AND MODIFICATIONS TO THE UNIT

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

Feed Preparation Section (Reference P&ID's 5-RA-4 and 5-RA-25)

The cracked C_3-C_4 treaters are satisfactory, except that the 1-inch Raschig rings in the cracked C_3-C_4 water wash treater, 5J-C5, are replaced with 2-inch Raschig rings.

Due to the higher feed rate, the saturated C_3-C_4 treaters and salt filter are replaced. The existing treaters are left in place, and may be used as standby for the cracked treaters. The saturated C_3-C_4 amine treater, 5J-C57, has 23 sieve trays. The saturated C_3-C_4 caustic treater, 5J-C58, and the saturated C_3-C_4 regenerated caustic treater, 5J-C59, have packed beds of 2-inch carbon Raschig rings.

The saturated feed stream from the CRU and the Crude Unit flows in sequence through the saturated C_3-C_4 amine treater, 5J-C57, the saturated C_3-C_4 caustic treater, 5J-C58, the saturated C_3-C_4 regenerated caustic treater, 5J-C59, and the salt filter, 5J-C60. The treated stream flows through the depropanizer feed-bottoms exchanger, 5J-E57, to the cat. poly. depropanizer, 5J-C17.

Tie-ins are made at the amine charge pump, 5J-G6, between the present Amine Regeneration Unit and the new Amine Regeneration Unit (Estimate 3600). The saturated C_3-C_4 amine treater, 5J-C57, and the cracked C_3-C_4 amine treater, 5J-C2, may be continued in operation when the present Amine Regeneration Unit is down for turnaround and inspection, by using regenerated amine from the new Amine Regeneration Unit.

Recovery Section (Reference P&ID 5-RA-5)

The existing depropanizer, 5J-C17, is provided with a new feed-bottoms exchanger, 5J-E51. A new depropanizer feed bypass pump, 5J-G62, is also provided that permits saturated C_3-C_4 from the feed preparation section to be pumped directly to CRU No. 2. The bottoms product from the depropanizer, 5J-C17, flows through the depropanizer feed-bottoms exchanger, 5J-E57, and the depropanizer bottoms cooler, 5J-E59, to alkylation or storage. The cat. poly. debutanizer, 5J-C19, is not in service, since the Debutanizar in the atmospheric tower overhead section is in service.

Liquid overhead product from the depropanizer, 5J-C17, is pumped from the cat. poly. depropanizer accumulator, 5J-C18, to the propane stripper, 5J-C61. The propane stripper is packed with 30 feet of 1-1/2-inch carbon steel pall rings. Overhead vapor from the propane stripper, 5J-C61, is combined with vapor from the cat. poly. depropanizer accumulator, 5J-C18, and the combined stream is sent to compressor fuel. Alternately, the propane stripper overhead vapor may be routed through the depropanizer condenser, 5J-E13. Reboil heat is supplied to the propane stripper, 5J-C61, in the propane stripper reboiler, 5J-E58, by exhaust steam. Propane stripper bottoms product is cooled in the LPG cooler, 5J-E18, and sent to storage.

Utilities

Utility consumption by new or modified equipment is given in the following table:

Item No.	Service	Consumption
Exhaust Steam		
5J-E58	Propane Stripper Reboiler	585 Lb./Hr.
Cooling Water		
5J-E59	Depropanizer Bottoms Cooler	146 GPM
Electrical		
5J-G62 & G62A	Depropanizer Feed Bypass Pump & Spare	7.7 HP

2. CONTROL FEATURES

II- CONTROL FEATURES

A. PRINCIPAL CONTROL FEATURES

This section describes only additions and signifcant modifications to the Catalytic Polymerization Unit controls. Reference should be made to the Operating Manual for the Catalytic Polymerization Unit for a description of existing controls.

Feed Preparation Section (Reference P&ID 5-RA-25)

The control scheme for the new saturated C_3-C_4 treaters is the same as the control scheme for the existing saturated C_3-C_4 treaters. A description of the principal control features of the saturated C_3-C_4 feed preparation section follows.

The flow rates of saturated C_3-C_4 streams from the Crude Unit debutanizer and the Platformer debutanizer are controlled in their respective units. The combined saturated C_3-C_4 stream flows in sequence through the saturated C_3-C_4 amine treater, 5J-C57, the saturated C_3-C_4 caustic treater, 5J-C58, the saturated C_3-C_4 regenerated caustic treater, 5J-C59, and the saturated C_3-C_4 salt filter, 5J-C60. The treated stream passes through the depropanizer feed/bottoms exchanger, 5J-E57, to the cat. poly. depropanizer, 5J-C17. The pressure in the saturated C_3-C_4 treater section is set by the pressure in the cat. poly depropanizer, 5J-C17. Control of the cat. poly. depropanizer pressure is described in the following section.

The flow rate of regenerated amine to the saturated C_3-C_4 amine treater, 5J-C57, is controlled by flow controller 5FIC-200. The flow rate of spent amine from the bottom of the saturated C_3-C_4 amine treater is controlled by interface level controller 5LIC-201 to maintain an amine solution-hydrocarbon interface in the top of the amine treater. High and low level alarms, 5LAH-201 and 5LAL-201, are provided for the amine solution-hydrocarbon interface.

Spent caustic is drained from the saturated C_3-C_4 caustic treater, 5J-C58, to spent caustic storage by manual control. The spent caustic is drained when the caustic-hydrocarbon interface appears in level glass 5LG-202. Care must be taken when draining the spent caustic to prevent hydrocarbons entering the spent caustic system. Fresh caustic and dilution water are charged to the saturated C_3-C_4 caustic treater, 5J-C58, by manual control. Fresh caustic is charged when the caustic-hydrocarbon interface appears in level glass 5LG-203.

The flow rate of regenerated caustic to the saturated C_3-C_4 regenerated caustic treater, 5J-C59, is controlled by flow controller 5FIC-201. The flow

rate of spent caustic from the bottom of the saturated C_3-C_4 regenerated caustic treater is controlled by interface level controller, 5LIC-205, to maintain a caustic-hydrocarbon interface in the top of the regenerated caustic treater. High and low level alarms, 5LAH-205 and 5LAL-205, are provided for the caustic-hydrocarbon interface.

Water that accumulates in the bottom of the saturated C_3-C_4 salt filter is drained to the oily water sewer by manual control. The water-hydrocarbon interface may be observed in level glass LG-506.

Recovery Section (Reference P&ID 5-RA-5):

The amount of saturated C_3-C_4 from the feed preparation section that is pumped directly to CRU No. 2 is controlled by flow controller 5FIC-205.

When the propane stripper, 5J-C61, is in operation, a vapor product will be leaving the depropanizer-propane stripper system. For this case, 5HCV-6 and 5HC-20 should be positioned such that the depropanizer pressure controller, 5PIC-106, positions control valve 5PIC-106VB to adjust vapor flow from the system, and the cat. poly. depropanizer accumulator level controller, 5LIC-49, positions control valve 5PIC-106VA to regulate cooling water flow to the depropanizer condenser, 5J-E13. Feed to the propane stripper will be regulated by flow controller 5FIC-207.

When the propane stripper, 5J-C61, is not in operation, an all liquid cat. poly. depropanizer overhead product may be obtained. For this case, 5HCV-6 should be positioned such that the depropanizer pressure controller, 5PIC-106, positions control valve 5PIC-106VA to adjust cooling water flow to the depropanizer condenser, 5J-E13, and the cat. poly. depropanizer accumulator level controller, 5LIC-49, resets the net product flow controller, 5FIC-207. Noncondensibles may be vented from the system periodically by operating hand controller 5HC-20 to open control valve 5PIC-106VB in the accumulator vapor line. A description of other controls on the cat. poly. depropanizer is given on page 21 of the Operating Manual for the Catalytic Polymerization Unit.

The temperature of the propane stripper bottoms is controlled by temperature controller 5TIC-205 that adjusts condensate discharge from the propane stripper reboiler, 5J-E58. Level in the bottom of the propane stripper, 5J-C61, is controlled by level controller 5LIC-210 that adjusts discharge of LPG from the stripper.

3. PREPARATION FOR STARTUP

III - PREPARATIONS FOR OPERATIONS

Reference should be made to the Operating Manual for the Catalytic Polymerization Unit for a description of preparations for operations.

4. STARTUP PROCEDURE

IV - STARTUP PROCEDURE

A. GENERAL

Reference should be made to the Operating Manual for the Catalytic Polymerization Unit for a description of the startup procedure for existing equipment. The startup procedure for the new saturated C_3-C_4 treating section is similar to the startup procedure for the existing saturated C_3-C_4 treating section, and the existing procedure should be used.

B. RECOVERY SECTION

The cat. poly. depropanizer, 5J-C17, and its related equipment, can be started up by the procedure given in the Operating Manual for the Catalytic Polymerization Unit. The new depropanizer bottoms cooler, 5J-E59, and the new depropanizer feed/bottoms exchanger, 5J-E57, are steam purged, tightness-tested, filled with fuel gas, and brought onstream in conjunction with the cat. poly. depropanizer.

The following procedure for startup of the propane stripper, 5J-C61, and its related equipment, assumes that the cat. poly. depropanizer system is operating. The same procedure, with minor modifications, can be used for startup of the propane stripper in conjunction with startup of the cat. poly. depropanizer. An outline of the startup procedure is as follows:

1. Steam-purge for elimination of air.
2. Tightness-test and gas-fill.
3. Inventory and circulate to dry.
4. Adjust operating conditions.

Introduce steam through the steamout connection of the propane stripper and vent steam and air through the 2-inch vent at the top of the propane stripper. Permit the tubes of the propane stripper reboiler, 5J-E58, to fill with steam condensate. When the propane stripper is thoroughly purged, as evidenced by a strong show of steam from the vent, throttle the vent. Purge the propane stripper overhead line, 5J-0-219-3", to the block valve at line 6"-5J-0-45. Purge line 5J-0-220-3" to the block valve at line 4"-5J-0-162.

NOTE: The propane stripper feed line, 5J-0-225-3", and the propane stripper bottoms line, 5J-0-224-3", have been purged and placed in service. These lines will contain hydrocarbons up to the block valves at the propane stripper when the cat. poly. depropanizer is in service.

Close the vent valve on the propane stripper and tightness-test at 25 psig with steam. Drain steam condensate from all low point drains. After a successful tightness test, reduce the steam pressure to about 5 psig. Slowly pressurize the propane stripper by allowing cat. poly. depropanizer overhead vapors to enter the propane stripper through line 5J-0-219-3".

Drain steam condensate from all low point drains. Inventory the propane stripper with liquid from the cat. poly. depropanizer accumulator, 5J-C18, through the propane stripper feed line. Commission the propane stripper reboiler, 5J-E58, and allow overhead vapor from the propane stripper to pass through the depropanizer condenser, 5J-E13, to the cat. poly. depropanizer accumulator, 5J-C18. Add inventory to the propane stripper as required. Continue operation in this manner until the propane stripper is free of water.

During the above propane stripper drying procedure, 5HCV-6 has been positioned such that the cat. poly. depropanizer pressure controller, 5PIC-106, regulates cooling water flow to the depropanizer condenser, and the cat. poly. depropanizer accumulator level controller, 5LIC-49, resets the net overhead product flow controller, 5FIC-207. The net liquid product passes through the LPG cooler, 5J-C20, to the chiller. After the propane stripper is dried, it may be brought onstream by the following steps:

1. Reroute propane stripper overhead vapor from the depropanizer condenser to the cat. poly. depropanizer accumulator vapor line, 4"-5J-0-162.

2. Reposition 5HCV-6 such that the cat. poly. depropanizer pressure controller, 5PIC-106, regulates vapor flow from the cat. poly. depropanizer accumulator, and the cat. poly. depropanizer accumulator level controller, 5LIC-49, regulates cooling water flow to the depropanizer condenser, 5J-E13. Flow of net liquid from the cat. poly. depropanizer accumulator is regulated by flow controller 5FIC-207.

3. Net liquid product from the cat. poly. depropanizer accumulator is rerouted from the LPG cooler, 5J-E18, to the propane stripper.

4. Bottoms product from the propane stripper is routed through the LPG cooler to the chiller. The propane stripper level controller, 5LIC-210, is put in service to regulate flow of propane stripper bottoms.

5. The propane stripper temperature controller, 5TIC-205, is put in service to regulate steam condensate flow from the propane stripper reboiler, 5J-E58.

6. SHUTDOWN PROCEDURE

VI - SHUTDOWN PROCEDURES

Reference should be made to the Operating Manual for the Catalytic Polymerization Unit for a description of shutdown procedures for existing equipment. The shutdown procedure for the new saturated C_3-C_4 treating section is similar to the shutdown procedure for the existing saturated C_3-C_4 treating section, and the existing procedure should be used.

The propane stripper, 5J-C61, is shut down in conjunction with the cat. poly. depropanizer, 5J-C17, as follows:

1. Discontinue steam to the propane stripper reboiler, 5J-E58.
2. Pump out liquid products to storage as described in the Operating Manual for the Catalytic Polymerization Unit.
3. Depressure the system to flare.
4. Purge the system with steam to remove all hydrocarbon vapors and vent to the atmosphere.

Emergency shutdown procedures described in the Operating Manual for the Catalytic Polymerization Unit are applicable to the new saturated C_3-C_4 treating section and the propane stripper.

9. SAFETY FEATURES & REGULATIONS

IX - SAFETY FEATURES AND REGULATIONS

Reference should be made to the Operating Manual for the Catalytic Polymerization Unit for a discussion of safety features and regulations.

The new relief valves installed are listed below:

Relief Valve No.	Service
5PSV-101	Saturated C_3-C_4 Amine Treater, 5J-C57
5PSV-102	Saturated C_3-C_4 Caustic Treater, 5J-C58
5PSV-103	Saturated C_3-C_4 Regenerated Caustic Treater, 5J-C59
5PSV-104	Saturated C_3-C_4 Salt Filter, 5J-C60
5PSV-105	Propane Stripper, 5J-C61

All of the new relief valves discharge through the existing header system to the existing blowdown drum, 5J-C29. Bypass valves are provided around each of the new relief valves, so that the related equipment can be vented to the existing header system.

10. APPENDIX

10.1 PROCESS AND UTILITY DIAGRAMS

PROCESS FLOW DIAGRAM

5-RA-1

PROCESS FLOW DIAGRAM

5-RA-2

BECHTEL-10005 TEXACO EST. 3910

SYMBOLS

- EXISTING
- NEW
- REMOVE
- RELOCATE
- NOT USED - DO NOT REMOVE
- DENOTES TIE-IN NUMBERS (△)

NOTES

1. REVISIONS OF MAJOR 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 GEMS J-208 TABLE 7.
3. LINE NO SUFFIXES FOR INSULATION ON NEW LINES 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 & INSULATED
   - NI NO INSULATION

LINE IDENTIFICATION

TA - O - 432 - 6" - J13A - NI (△A)

- TA — TEXACO PLANT NUMBER
- O — TEXACO SERVICE SYMBOL
- 432 — SIZE NUMBER
- 6" — SIZE
- J13A — TEXACO PIPING MATERIAL SERVICE SPECIFICATION
- NI — INSULATION REQUIREMENTS

Frank H. Lewis
State of Washington
11/19/73
Registered
PROFESSIONAL ENGINEER

△A	6/6/73	ADDED LINE NO. 1-ST-25-11"-J1I (TEXACO SYSTEM NO. 442 CHANGED TO 432)	JC				
△A	5-1-73	REVISED PER DRAWING 5-AA-107 REV. O	RP				
△A	1/4/73	ADDED UTILITY STATION & LINE 51-ST-15-1½"-J8A-PHC	GC				
△A	12/27/72	ISSUED FOR CONSTRUCTION	GP				
△A	9/11/72	UPDATED TO JOB AWARD ISSUED FOR APPROVAL	DHB				
No.	Date	Revision	By	Chkd.	Engr.	Proj. Engr.	Appr.

SCALE | DESIGNED | DRAWN

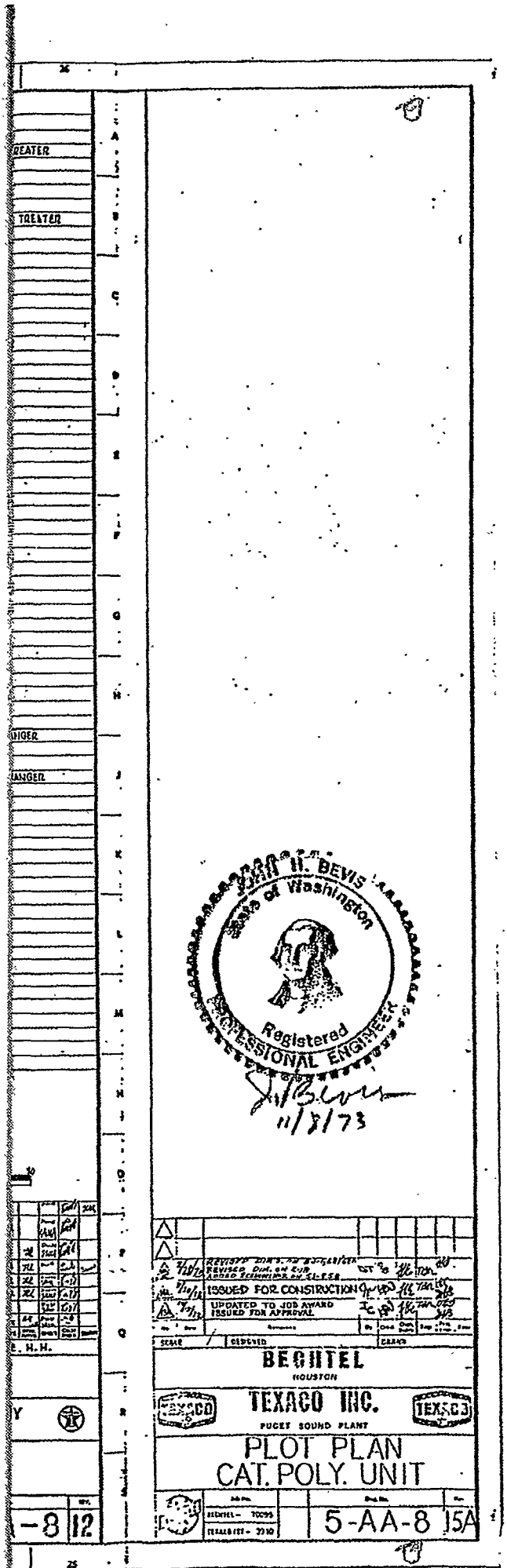
BECHTEL
HOUSTON

TEXACO INC.
PUGET SOUND PLANT

UTILITY PIPING & INSTRUMENT DIAGRAM
STEAM & CONDENSATE SYSTEMS
CATALYTIC POLYMERIZATION UNIT

Job No.	Dwg. No.		Rev.
BECHTEL – 10005	5-AA-7		11A
TEXACO EST – 3910			

WA-TEX 000397



WA-TEX 000398

NEW
REMOVE
RELOCATE
NOT USED (DO NOT REMOVE)

DENOTES TIE-IN NUMBERS

NOTES

1. REVISIONS OF MAJOR 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 GEMS J-208, 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
   - NI NO INSULATION

8A 2A

LINE IDENTIFICATION

1A - D - 432 - 6" - J13A - NI

- 1A — TEXACO PLANT NUMBER
- D — TEXACO SERVICE SYMBOL
- 432 — LINE NUMBER
- 6" — SIZE
- J13A — TEXACO PIPING MATERIAL SERVICE SPECIFICATION
- NI — INSULATION REQUIREMENTS
- 8A —

JOHN H. DEVIS
State of Washington
11/9/73
Registered
PROFESSIONAL ENGINEER

1A	2-1-74	REVISED PER DRAWING 5-AA-110 REV. 1A	PP			
2A	11/9/73	REVISED PER DRAWING 5-AA-110 REV. 0	PC			
8A	7/24/73	ISSUED FOR CONSTRUCTION	ST			
	7/13/73	UPDATED TO JOB AWARD ISSUED FOR APPROVAL				
No.	Date	Revision	By	Check	Supv.	Proj. Engr.

SCALE NONE | DESIGNED | DRAWN

BECHTEL
HOUSTON

TEXACO INC.
PUGET SOUND PLANT

UTILITY PIPING & INSTRUMENT DIAGRAM
AIR & BLOWDOWN SYSTEMS
CAT. POLY. UNIT

BECHTEL - 10095
TEXACO JOB - 3810

5-AA-10 | 1A

WA-TEX 000399

BECHTEL - 10095 TEXACO EST. - 3910

SYMBOLS

- EXISTING
- NEW
- REMOVE
- RELOCATE
- NOT USED - (DO NOT REMOVE)
- DENOTES TIE-IN NUMBERS

NOTES

1. REVISIONS OF MAJOR 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 GEMS J-208, TABLE 7.
3. LINE NUMBER SUFFIXES FOR INSULATION ON NEW 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
   - NI NO INSULATION

LINE IDENTIFICATION

1A - O - 432 - 6" - J13A - N1

- TEXACO PLANT NUMBER
- TEXACO SERVICE SYMBOL
- SIZE
- NUMBER
- TEXACO PIPING MATERIAL SERVICE SPECIFICATION
- INSULATION REQUIREMENTS

JOHN H. BEVIS
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PROFESSIONAL ENGINEER
J H Bevis
11/8/73

No.	Date	Revisions	By	Chk'd	Chk'd Mech	Engr.	Proj. Engr.	Appr.
8A	2-4-73	REVISED PER DRAWING S-AA-111 REV. 0	RP		[illegible]	[illegible]	[illegible]	
7A	1/18/73	ADDED UTILITY STATION & HYDRANT VALVES	TSC		[illegible]	[illegible]	[illegible]	
6A	12/4/72	ISSUED FOR CONSTRUCTION	[illegible]		[illegible]	[illegible]	[illegible]	
5A	7/3/72	UPDATED TO JOB AWARD ISSUED FOR APPROVAL	[illegible]		[illegible]	[illegible]	[illegible]	

SCALE | DESIGNED | DRAWN

BECHTEL
HOUSTON

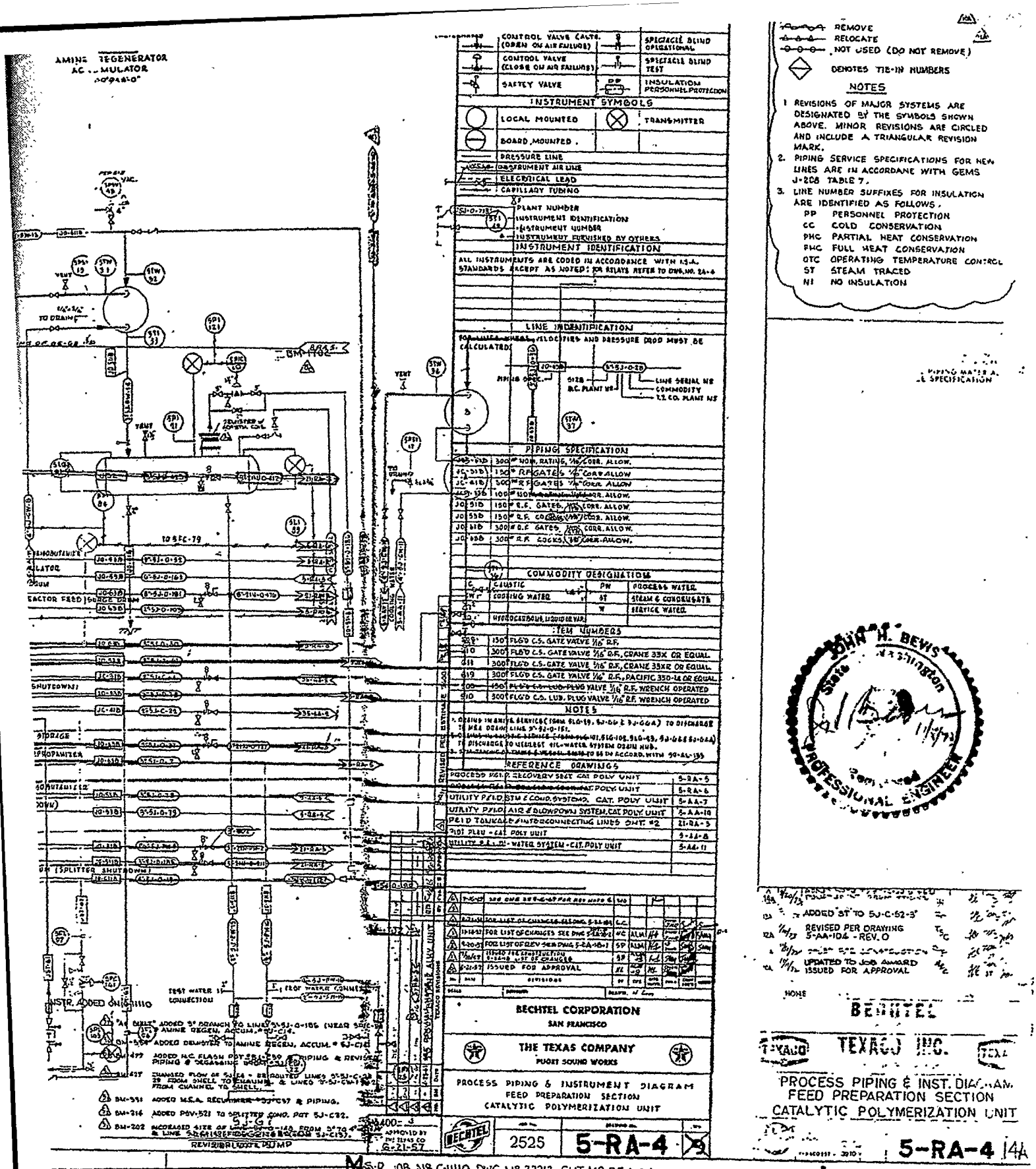
TEXACO INC.
PUGET SOUND PLANT

UTILITY PIPING & INSTRUMENT DIAGRAM
WATER SYSTEM
CATALYTIC POLYMERIZATION UNIT

BECHTEL - 10095
TEXACO EST - 3910

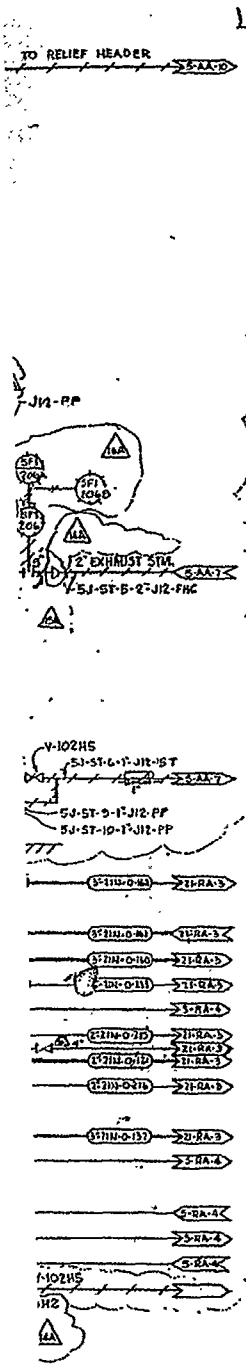
5-AA-11 8A

WA-TEX 000400



M.S.R. JOB No. C-1110 DWG No. 27213 SHT. No. 05-1-04

WA-TEX 000401



	CONTROL VALVE (OPEN ON AIR FAILURE)		SPECTACLE BLIND OPERATIONAL
	CONTROL VALVE (CLOSE ON AIR FAILURE)		ANGLE CONTROL VALVE
	INSULATION STEAM TRACED PP - PERSONNEL PROTECTION		SPECIACLE BLIND TEST

INSTRUMENT SYMBOLS

	FIELD MOUNTED		TRANSMITTER
	BOARD MOUNTED		
	PRESS. LINE & MISC. CONN.		INSTRU. ELECTRICAL LEAD
	INSTRU. CONTROL AIR LINE		CAPILLARY TUBING

PLANT NUMBER
SFI 35 — INSTRUMENT IDENTIFICATION / INSTRUMENT NUMBER

INSTRUMENT IDENTIFICATION

ALL INSTRUMENTS ARE CODED IN ACCORDANCE WITH I.S.A. STANDARDS EXCEPT AS NOTED: FOR RELAYS REFER TO DWG 50-EA-4

LINE IDENTIFICATION

FOR LINES WHERE VELOCITIES AND PRESSURE DROP MUST BE CALCULATED

30-S3B — 4SJ-0-75
PIPING SPEC. — SIZE — LINE SERIAL NO / B.C. PLANT USE — COMMODITY — T.T. CO. PLANT USE

FOR LINES 1½" AND SMALLER NOT REQUIRING PRESSURE DROP CALCULATION:

1"-JO-13B
PIPING SPECIFICATION / SIZE

PIPING SPECIFICATION

JCW-32B	100# NOM. RATING, 1/8" CORR. ALLOW.
JO-31B	150# R.F. GATES, 1/16" CORR. ALLOW.
JO-33B	150# R.F. COCKS, 1/16" CORR. ALLOW.
JO-61B	300# R.F. GATES, 1/16" CORR. ALLOW.
JO-63B	300# R.F. COCKS, 1/16" CORR. ALLOW.
JO-90T	150# R.F. COCKS, 1/16" CORR. ALLOW.

COMMODITY DESIGNATION

CW	CONDENSER WATER	PW	PROCESS WATER
O	HYDROCARBONS, LIQUID OR VAPOR, FUEL OIL & GAS	ST	STEAM & CONDENSATE

ITEM NUMBERS

810	300# FLGD. C.S., GATE VALVE 3/4" N.P.
900	150# FLGD. C.S., PLUG VALVE 3/4" N.P.

REFERENCE DRAWINGS

PROCESS P&I.D. - FEED PREH. SECT. CAT. POLY. UNIT	5-RA-6
PROCESS P&I.D. - REACTOR SECT. CAT. POLY. UNIT	5-RA-6
UTILITY P&I.D. - STEAM & CONDENSATE SYSTEMS	5-AA-7
UTILITY P&I.D. - WATER SYSTEMS	5-AA-11
UTILITY P&I.D. - AIR & BLOWDOWN SYSTEMS	5-AA-10
P&I.D. - FLARE GAS & INTERCONNECTING LINES, SHT #2	11-RA-5
PLOT PLAN - CATALYTIC POLYMERIZATION UNIT	5-AA-8

NOTES

1. STM. TRACING OF VESSEL BOOTS TO BE IN ACCORDANCE WITH DWG. 50-AL-153

3	9-28-59	ADD PIV IN LINE 0-1" - ADD 3" PARTIAL BYPASS & REV. TWR. 5J-C17	WH	FAD			SMH
2	9-12-58	ADDED 1" VALVE ON LINE 0-45 PER F.C.O. F-21-8. ADDED 5J-107 & INDICATED SY-14 TO BE BOARD MOUNTED					SMH
1	6-23-58	FOR LIST OF REV. SEE DWG. 5-EA-14-B	L.C.				
0	11-15-57	FOR LIST OF REV. SEE DWG. 5-EA-14-2	C.C.	A.L.M.			SMH
3	9-30-57	FOR LIST OF REV. SEE DWG. 5-EA-14-1	J.A.				SMH
2	7/11/57	AS-BUILT FOR CONSTRUCTION - SEE DWG. & BLR. LIST OF CHANGES	HL				
1	9-20-57	ISSUED FOR APPROVAL	HL				
No.	DATE	REVISIONS	BY	CHK'D	APP'D	ENGR'G APP'D	CONST'N APP'D

DESIGN | DRAWN | TRACED | CHECKED

BECHTEL CORPORATION
SAN FRANCISCO

THE TEXAS COMPANY
PUGET SOUND WORKS

PROCESS PIPING & INSTRUMENT DIAGRAM
RECOVERY SECTION
CATALYTIC POLYMERIZATION UNIT

ERE | CCE | EFM | ENR
6400 J
APPROVED BY THE TEXAS CO. 6-21-57
DISTRIBUTION

BECHTEL | 2525 | 5-RA-5 | IX

RELOCATE
NOT USED (DO NOT REMOVE)
DENOTES TIE-IN NUMBERS

NOTES

1. REVISIONS OF MAJOR 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 GEMS J-208 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
   - NI NO INSULATION
4. TO KEEP HYDROCARBON FROM ENTERING STEAM CONDENSATE SYSTEM, THE BALL FLOAT SHALL BE SET TO SHUT OFF FOR LIQUID OF SPECIFIC GRAVITY LESS THAN WATER.
5. INSTRUMENT STEAM TRACING SYMBOLS:
   - [T] - TRACED
   - [TH] - TRACED & JACKETED

LINE IDENTIFICATION

1A - O - 4 - 2 - 6" - J12A - PP

TEXACO PLANT NUMBER	TEXACO SERVICE SYMBOL	SIZE	NUMBER	INSULATION REQUIREMENTS	TEXACO PIPING MATERIAL SERVICE SPECIFICATION

JOHN H. BEVIS
State of Washington
11/8/73
Registered PROFESSIONAL ENGINEER

9	9/19/73	ADDING INSTRUMENT STEAM TRACING SYMBOLS AS NOTED	WJ		TG	WH	
8	6-11-73	ADDED LINE 53-0-1CH-1" TIE-IN 53-61 & 62 - CH 6"D VALVE ADDN'D 53-CL1	TR				
7	5/5/73	REVISED PER DRAWING 5-AA-105, REV. 2A	HH				
6	12-2-72	REVISED PER DRAWING 5-AA-105 REV. 1A	PP				
5	7/11/72	REVISED PER DRAWING 5-AA-105 REV. 0	TG				
4	7/11/72	ISSUED FOR CONSTRUCTION	HL				
3	7/11/72	UPDATED TO JOB ISSUED	HL				
2	7/11/72	ISSUED FOR APPROVAL	HL				
No.	Date	Revisions	By				

SEE NONE | DESIGNED | DRAWN

BECHTEL
HOUSTON

TEXACO INC.
PUGET SOUND PLANT

PROCESS PIPING & INST. DIAGRAM
RECOVERY SECTION
CATALYTIC POLMERIZATION UNIT

BECHTEL | JOB NO. 10005 | TEXACO JOB NO. 3810 | DWG. NO. 5-RA-5 | REV. 18A

WA-TEX 000402

LITY LEGEND

R-OILY WATER

STEAM

R-SERVICE

NOTES

SUFFIXES FOR INSULATION
D AS FOLLOWS:
NNEL PROTECTION
CONSERVATION
AL HEAT CONSERVATION
HEAT CONSERVATION
TING TEMPERATURE CONTROL
I TRACED & INSULATED
ULATION
WISE SPECIFIED, THE VALVE
ALL BE BY THE CONTRACTOR

AS J-ID, PARA. 513 FOR
LOSOPHY WITH REGARDS
BE SUPPLIED BY THE
PARTICULAR ATTENTION
EN TO THE MODIFICATION
WHICH COVERS SHUTDOWN

~~WILL SUBMIT A PRECIPITATOR~~
~~FOR SALT FILTER~~

NOTICE

ENTIN CONTAINED ARE THE PROPERTY OF TEXACO
IDENCE UPON THE UNDERSTANDING AND CONDITION
IONS RECEIVING SUCH DRAWING AND INFORMATION
ES DEEMED TO HAVE AGREED TO MAKE NO COPY
DIVER OF ALL OR ANY PART THEREOF EXCEPT AS
TEXACO INC. NOT TO GIVE LEND OR OTHERWISE
URN THIS DRAWING PROMPTLY UPON REQUEST.

ACO INC.
IG DEPARTMENT TEXACO
TON, TEXAS

NG FLOW DIAGRAM
ARATION SECTION
MERIZATION UNIT

NONE

ER ASSIGNED
ID
NO RECORD ENTERED
DATE 1-21-72

5-RA-25

BECHTEL - 10095 TEXACO EST. 3910

SYMBOLS (1A)

EXISTING
NEW
REMOVE
RELOCATE
NOT USED - DO NOT REMOVE
DENOTES TIE-IN NUMBERS

NOTES

1. REVISION OF MAJOR 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 GEMS J-2D8, 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
   - NI NO INSULATION
4. INSTRUMENT STEAM TRACING SYMBOLS: (7A)
   - T - TRACED
   - TH - TRACED & HOUSED

LINE IDENTIFICATION

1A - O - 432 - 6" - J13A - NI

TEXACO PLANT NUMBER; TEXACO SERVICE SYMBOL; NUMBER; SIZE; TEXACO PIPING MATERIAL SERVICE SPECIFICATION; INSULATION REQUIREMENTS (3A)

JOHN H. BEVIS
State of Washington
Registered
PROFESSIONAL ENGINEER
11/8/73

No.	Date	Revisions	By	Chkd.	Dept. Supv.	Engr.	Proj. Engr.	Appr.
7A	[illegible]	REVISED SPEC. ON 53-C50 ADDED INSTRUMENT STEAM TRACING SYMBOLS AS NOTED	[illegible]		[illegible]	[illegible]	[illegible]	
6A	[illegible]	ADDED FLGS TO LINE 53-O-2 & D			[illegible]	[illegible]	[illegible]	
5	8/26/73	DELETED 'ST' FROM 53-C-52			[illegible]	[illegible]	[illegible]	
4A	2-4-73	REVISED PER DWG 5-AA-125 REV. 1A	RP		[illegible]	[illegible] JT	[illegible]	
3A	1/12/73	REVISED PER DRAWING 5-AA-125 REV. 0	TSC		[illegible]	[illegible] JT	[illegible]	
2A	11/30/72	ISSUED FOR CONSTRUCTION	[illegible]		[illegible]	[illegible] JT	[illegible]	
1A	10/23/72	UPDATED TO JOB AWARD. ISSUED FOR APPROVAL REVISED VESSELS 53-C57/58/59/60 PER COPY OF CLIENT'S LETTER OF 10/13/72	DWB		[illegible]	[illegible] JT	[illegible]	

SCALE NONE | DESIGNED | DRAWN

BECHTEL
HOUSTON

TEXACO INC.
PUGET SOUND PLANT

PROCESS PIPING & INSTRUMENT DIAGRAM
SAT. FEED PREPARATION SECTION
CATALYTIC POLYMERIZATION UNIT

Job No.	Dwg. No.	Rev.
BECHTEL - 10095 / TEXACO EST - 3910	5-RA-25	7A

WA-TEX 000403

10.2 VESSEL DRAWINGS

DRAWING

5-DC-40

DRAWING

5-DC-41

DRAWING

5-DC-42

DRAWING

5-DC-43

DRAWING

5-DC-44

10.3 EXCHANGERS

TABLE 10.3-1
EXCHANGER SUMMARY SHEET
CATALYTIC POLYMERIZATION UNIT PLANT 5J
ANACORTES, WASHINGTON

DATA				DESIGN			
	Shell Data			Shell		Tube	
	No. Passes	Diam. Inches	Material	No. Passes	Temp °F	Press PSIG	Temp °F	Press PSIG
	2	15-1/4	C.S.	1	650	300	650	300
	2	12	C.S.	1	400	65	200	275
).	6	19-1/4	C.S.	1	650	300	300	150

EXCHANGER SPECIFICATION SHEET

1	CUSTOMER AND PROJECT LOCATION: TEXACO INC		EXCHANGER MFR. HUGHES-ANDERSON
	PLANT: PUGET SOUND		REQ. NO. E-02
	EXCHANGER NO. 5J-E58		ITEM NO 13
4	SERVICE OF UNIT: PROPANE STRIPPER		
5	SIZE 12×72	TYPE AEU	CONNECTED IN SERIES PARALLEL
6	SURFACE PER UNIT 95 EFF. ~~GR.~~	SHELLS PER UNIT 1	SURFACE PER SHELL 95 EFF ~~GR.~~

PERFORMANCE OF ONE UNIT

		SHELL SIDE		TUBE SIDE	
7	FLUID CIRCULATED	STEAM		PROPANE STRIPPER BTMS	
8	TOTAL FLUID ENTERING LBS/HR	585		9600	
9	VAPOR				
10	LIQUID			9600	
11	STEAM	585			
12	NON-CONDENSIBLES				
13	FLUID VAPORIZED ~~OR CONDENSED~~			3825	
14	STEAM CONDENSED	585			
15	GRAVITY-LIQUID			0.46	
16	VISCOSITY-LIQUID CP			0.009(IN) - 0.09(OUT)	
17	MOLECULAR WEIGHT-VAPORS			43.3	
18	SPECIFIC HEAT-LIQUIDS		B.T.U./#		B T U /#
19	LATENT HEAT-VAPORS		B.T.U./#		B T U /#
20	TEMPERATURE IN	281	°F	112	°F
21	TEMPERATURE OUT	281	°F	116	°F
22	OPERATING PRESSURE PSIG	35		235	
23	NUMBER OF PASSES	1		2	
24	VELOCITY		FT./SEC.		FT/SEC
	PRESSURE DROP ALLOW/CALC.	1.0 / 0	#/SQ.IN.	0.5 / 0.5	#/SQ IN.
26	FOULING RESISTANCE MIN.	0.0005		0.001	
27					

28	HEAT EXCHANGED-BTU./HR	540,000		M T.D. (CORRECTED)	162
29	TRANSFER RATE-SERVICE	35.1	CLEAN	ACTUAL FOULING FACTOR	

CONSTRUCTION

30	DESIGN PRESSURE	65	#/SQ.IN.	275	#/SQ IN
31	TEST PRESSURE	100	#/SQ.IN.	415	#/SQ IN
32	DESIGN TEMPERATURE	400	°F	200	°F

33	TUBES CARBON STEEL	NO. 80	O.D. 3/4" BWG 0.085 MIN.	LENGTH 72	PITCH 1" △ ▲ ■ ●
34	SHELL CARBON STEEL		I.D. ~~O.D.~~ 12"	THICKNESS	
35	SHELL COVER CARBON STEEL			FLOATING HEAD COVER	
36	CHANNEL CARBON STEEL			CHANNEL COVER CARBON STEEL	
37	TUBE SHEETS-STATIONARY CARBON STEEL			FLOATING	
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	2"	OUT 1"	RATING 150# RF	
43	-CHANNEL-IN	3"	OUT 3"	RATING 300# RF	
44	CORROSION ALLOWANCE-SHELL SIDE	1/8"		TUBE SIDE 1/8"	
45	CODE REQUIREMENTS ASME SECTION VIII D1		TEMA CLASS R	SPEC. E1M7	
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 -				
51					

REV.	DATE					JOB NO.	DRWG. NO.	REV.
△	1-24-73	REVISED, ISSUED FOR CONST.	TR	TR		10095	DS-~~5~~-E-3	1
△	12-19-73	ISSUED FOR PURCHASE	TR					

FORM H-158 PART B 9/66

EXCHANGER SPECIFICATION SHEET

1	CUSTOMER AND PROJECT LOCATION: TEXACO INC.		EXCHANGER MFR. WESTERN SUPPLY
	PLANT: PUGET SOUND		REQ. NO. E-03
	EXCHANGER NO. 5J - E57		ITEM NO 3
4	SERVICE OF UNIT: DEPROPANIZER FEED BOTTOM EXCHANGER		
5	SIZE 15 x 240	TYPE AES	CONNECTED IN SERIES PARALLEL
6	SURFACE PER UNIT 473 EFF. ~~OR.~~	SHELLS PER UNIT 1	SURFACE PER SHELL 473 EFF ~~OR.~~

PERFORMANCE OF ONE UNIT

		SHELL SIDE	TUBE SIDE
7	FLUID CIRCULATED	DEPROPANIZER FEED	DEPROPANIZER BTMS.
8	TOTAL FLUID ENTERING LBS/HR	55,357	49,257
9	VAPOR		
10	LIQUID	55,357	49,257
11	STEAM		
12	NON-CONDENSIBLES		
13	FLUID VAPORIZED OR CONDENSED		
14	STEAM CONDENSED		
15	GRAVITY-LIQUID Sp	0.54 (IN) - 0.496 (OUT)	0.459 (IN) - 0.514 (OUT)
16	VISCOSITY-LIQUID Cp	0.14 (IN) - 0.1 (OUT)	0.08 (IN) - 0.11 (OUT)
17	MOLECULAR WEIGHT-~~VAPORS~~	55.8	58.7
18	SPECIFIC HEAT-LIQUIDS	B.T.U./#	B.T.U./#
19	LATENT HEAT-VAPORS	B.T.U./#	B.T.U./#
20	TEMPERATURE IN	100 °F	215 °F
21	TEMPERATURE OUT	154 °F	154 °F
22	OPERATING PRESSURE PSIG	245	235
23	NUMBER OF PASSES	1	2
24	VELOCITY	FT./SEC.	4 FT./SEC
	PRESSURE DROP ALLOW/CALC.	5 / 2 #/SQ.IN.	1.5 / 1.5 #/SQ.IN
26	FOULING RESISTANCE MIN.	0.001	0.001
27			

28	HEAT EXCHANGED - BTU./HR 1,850,000	M.T.D. (CORRECTED) 46	
29	TRANSFER RATE - SERVICE 84.9	CLEAN	ACTUAL FOULING FACTOR

CONSTRUCTION

30	DESIGN PRESSURE	300 #/SQ.IN.	300 #/SQ IN
31	TEST PRESSURE	450 #/SQ.IN.	450 #/SQ IN
32	DESIGN TEMPERATURE	650 °F	650 °F

33	TUBES CARBON STEEL NO 122	O.D. 3/4" BWG. 14 MIN.	LENGTH 240" PITCH 1" ▲ ◆ ◇
34	SHELL CARBON STEEL	I.D. ~~O.D.~~ 15 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 (1)	THICKNESS
39	BAFFLE - LONG	TYPE	THICKNESS
40	TUBE SUPPORTS		THICKNESS
41	GASKETS METAL JACKETED ASBESTOS		
42	CONNECTIONS - SHELL - IN 3"	OUT 3"	RATING 300# 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 D	TEMA CLASS R	SPEC. E1M7
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 SPACING 5 1/2". BAFFLE CUT 23%		
51			

REV.	DATE					JOB-NO.	DRWG. NO.	REV.
△	1-24-73	REVISED; ISSUED FOR CONST.	TL			10095	DS-5-E-1	1
△	10-12-72	ISSUED FOR PURCHASE	TL					

FORM H-158 PART B 9/66

EXCHANGER SPECIFICATION SHEET

CUSTOMER AND PROJECT LOCATION	TEXACO INC	EXCHANGER MFR.	WESTERN - SUPPLY
PLANT	PUGET SOUND	REQ. NO.	E-03
EXCHANGER NO.	5J-E59	ITEM NO	4
4 SERVICE OF UNIT	DEPROPANIZER BOTTOMS COOLER		
5 SIZE	19 x 240	TYPE AES	CONNECTED IN SERIES PARALLEL
6 SURFACE PER UNIT	748 EFF.	SHELLS PER UNIT 1	SURFACE PER SHELL 748 EFF

PERFORMANCE OF ONE UNIT

		SHELL SIDE	TUBE SIDE
7	FLUID CIRCULATED	DEPROPANIZER BTMS	COOLING WATER
8	TOTAL FLUID ENTERING LBS/HR	49,257	73,000
9	VAPOR		
10	LIQUID	49,257	73,000
11	STEAM		
12	NON-CONDENSIBLES		
13	FLUID VAPORIZED OR CONDENSED		
14	STEAM CONDENSED		
15	GRAVITY-LIQUID SP	0.514 (IN) - 0.554 (OUT)	
16	VISCOSITY-LIQUID CP	0.11 (IN) - 0.145 (OUT)	
17	MOLECULAR WEIGHT-VAPORS		
18	SPECIFIC HEAT-LIQUIDS	B.T.U./#	B.T.U./#
19	LATENT HEAT-VAPORS	B.T.U./#	B.T.U./#
20	TEMPERATURE IN	154 °F	76 °F
21	TEMPERATURE OUT	100 °F	100 °F
22	OPERATING PRESSURE PSIG	230	40
23	NUMBER OF PASSES	1	6
	VELOCITY	FT./SEC.	4.84 FT./SEC
	PRESSURE DROP ALLOW/CALC.	4 / 4 #/SQ.IN.	12 / 12 #/SQ.IN.
26	FOULING RESISTANCE MIN.	0.001	0.003
27			

28 HEAT EXCHANGED - BTU./HR 1,750,000 M.T.D. (CORRECTED) 29.8

29 TRANSFER RATE - SERVICE 78.5 CLEAN ACTUAL FOULING FACTOR

CONSTRUCTION

30	DESIGN PRESSURE	300 #/SQ.IN.	150 #/SQ.IN.
31	TEST PRESSURE	450 #/SQ.IN.	225 #/SQ.IN.
32	DESIGN TEMPERATURE	650 °F	300 °F

33 TUBES INH ADM NO. 193 O.D. 3/4 BWG. 16 LENGTH 240" PITCH 1"

34 SHELL CARBON STEEL I.D. 19 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 NAVAL ROLLED BRASS FLOATING NAVAL ROLLED BRASS

38 BAFFLES - CROSS CARBON STEEL TYPE SEGMENTAL (1) THICKNESS

39 BAFFLE - LONG TYPE THICKNESS

40 TUBE SUPPORTS THICKNESS

41 GASKETS METAL JACKETED ASBESTOS

42 CONNECTIONS - SHELL - IN 4" OUT 4" RATING 300# RF

43 - CHANNEL - IN 4" OUT 4" RATING 150# RF

44 CORROSION ALLOWANCE - SHELL SIDE 1/8" TUBE SIDE 1/8"

45 CODE REQUIREMENTS ASME SECTION VIII D1 TEMA CLASS R SPEC. E1M7

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 SPACING 5". BAFFLE CUT 10%

51

REV.	DATE					JOB NO.	DRWG. NO.	REV.
1	8-24-73	REVISED, ISSUED FOR CONST				10095	DS-5-E-2	1
0	10-12-72	ISSUED FOR PURCHASE						

FORM H-156 PART B 9/66

10.4 PUMPS

TABLE 10.4-1
UGAL PUMP SUMMARY SHEET
POLYMERIZATION UNIT PLANT 5J
NACORTES, WASHINGTON

DRIVER DATA			
RPM	Rated H.P.	Type	Full Load Amps
3600	15	Motor	

Existing Pump

CENTRIFUGAL PUMP DATA SHEET

JOB NO. 10095 ITEM NO. 5J-G-3
PURCHASE ORDER NO. 10095-G-02
REQUISITION NO. 10095-G-02
INQUIRY NO. ---
DATE --- REVISION

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

FOR TEXACO, INC. SITE PUGET SOUND
UNIT CAT. POLY SERVICE WATER WASH
NO. PUMPS REQ'D 1 NO. MOTORS REQ'D 1 ITEM NO. 55-GM-3 PROVIDED BY EXISTING MTD BY ---
NO. TURBINES REQ'D - ITEM NO. - PROVIDED BY - MTD BY -
PUMP MFR WILSON-SNYDER SIZE AND TYPE 1½x2-2STG SERIAL NO. 6541

OPERATING CONDITIONS, EACH PUMP

LIQUID WATER U.S. GPM at PT. NOR. 120 RATED 134
DISCH. PRESS., PSIG 307
PT. F. NOR. 80 MAX. SUCT. PRESS., PSIG MAX. RATED 35
SP. GR. at PT. 1.0 DIFF. PRESS., PSI 272
VAP. PRESS. at PT., PSIA 0 DIFF. HEAD, FT 628
VIS. at PT. Saa CP NPSHA, FT ≥ 30
CORR/EROS. CAUSED BY HYD. HP 22.04

PERFORMANCE

PROPOSAL CURVE NO. 29-190-300
RPM 3550 NPSHR (WATER) 11¼
EFF. 52 BHP RATED 42.39
MAX. BHP RATED IMP 50.83
MAX. HEAD RATED IMP
MIN. CONTINUOUS GPM
ROTATION (VIEWED FROM CPLG END)

CONSTRUCTION

NOZZLES	SIZE	RATING	FACING	LOCATION
SUCTION	2	300	RF	TOP
DISCHARGE	1½	300	RF	TOP

CASE-MOUNT: ☐ CENTERLINE ☐ FOOT ☐ BRACKET ☐ VERT. (TYPE)
-SPLIT- ☐ AXIAL ☐ RAD; TYPE VOLUTE ☐ SSL ☐ BSL ☐ DIFFUSER
-PRESS: ☐ MAX. ALLOW. PSIG F: ☐ HYDRO TEST PSIG
-CONNECT: ☐ VENT ☐ DRAIN ☐ GAGE
IMPELLER DIA. ☐ RATED 9" ⚠ ☐ MAX. 10½" ⚠ ☐ TYPE: CLOSED ⚠
MOUNT: ☐ BETWEEN BRGS ☐ OVERHUNG ☐ WEAR RG. DIAM./CLRNC.
BEARINGS-TYPE: ☐ RADIAL ☐ THRUST
LUBE: ☐ RING OIL ☐ FLOOD ☐ OIL MIST ☐ FLINGER ☐ PRESSURE
COUPLING: ☐ MFR MODEL
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 NONE

MATERIALS

API CASE/TRIM CLASS ○ GEMS-P-2M7
GROUP-2A2
CASE-CT
SHAFT-414D-HT
BASEPLATE: ☐

AUXILIARY PIPING

○ C.W. PIPE PLAN ○ CU; ○ S.S.; ○ TUBING; ○ PIPE
☐ TOTAL COOLING WATER REQ'D, GPM ○ SIGHT F.I. 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

VERTICAL PUMPS

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 RPM FRAME VOLTS/PHASE/CYCLES
MFR BEARINGS LUBE
TYPE INSUL. FULL LOAD AMPS
ENC. TEMP RISE, C LOCKED ROTOR AMPS
○ VHS ○ VSS VERT. THRUST CAP., LB SERVICE FACTOR

APPROX. WT. PUMP & BASE
MOTOR TURBINE

API STANDARD 610 GOVERNS UNLESS OTHERWISE NOTED. EXISTING PUMP MODIFIED FOR ABOVE SERVICE - NEW IMPELLER & WEAR RINGS

NO.	DATE						JOB NO.	DRAWING NO.	REV.
1	12-4-72	ISSUED FOR PURCHASE	TMC	TDR	[illegible]		10095	DS-5-G-2	1
0	11-10-72	ISSUED FOR QUOTATION	TMC	TDR	[illegible]				

SHEET 1 OF 1

FORM NO 130 REVISED APRIL 711

CENTRIFUGAL PUMP DATA SHEET

JOB NO. 10095 ITEM NO. 5J-G62/A
PURCHASE ORDER NO. ____
REQUISITION NO. 10095-G01
INQUIRY NO. ____
DATE ____ REVISION ____

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

FOR TEXACO INC. SITE PUGET SOUND
UNIT CATALYTIC POLYMERIZATION SERVICE DEPROPANIZER FEED BY PASS
NO. PUMPS REQ'D 2 NO. MOTORS REQ'D 2 ITEM NO. 5J-G62/A PROVIDED BY PUMPMEK MTD BY PUMP MFR.
NO. TURBINES REQ'D — ITEM NO. — PROVIDED BY ____ MTD BY ____
PUMP MFR BYRON JACKSON SIZE AND TYPE 1½X2X10 2H-5J SERIAL NO. ____

OPERATING CONDITIONS, EACH PUMP

LIQUID C3/C4 U.S. GPM at PT. NOR. 65 RATED ____
DISCH. PRESS., PSIG 327
PT. F. NOR. 100 MAX. ____ SUCT. PRESS., PSIG MAX. 330 RATED 250
SP GR. at PT. 0.475 DIFF. PRESS., PSI 77
VAP. PRESS. at PT, PSIA 232 DIFF. HEAD, FT 376
VIS. at PT, Ssu ____ CP 0.1 NPSHA, FT >30
CORR/EROS. CAUSED BY ____ HYD. HP ____

PERFORMANCE

PROPOSAL CURVE NO. 2424-1
RPM 3550 NPSHR (WATER) 6
EFF. 39% BHP RATED 7.7
MAX. BHP RATED IMP 13.0
MAX. HEAD RATED IMP 400
MIN. CONTINUOUS GPM 15
ROTATION (VIEWED FROM CPLG END) CCW

CONSTRUCTION

NOZZLES	SIZE	RATING	FACING	LOCATION
SUCTION	2	300#	RF	END
DISCHARGE	1½	300#	RF	TOP

CASE-MOUNT: ☒ CENTERLINE ☐ FOOT ☐ BRACKET ☐ VERT. (TYPE) ____
-SPLIT: ☐ AXIAL ☒ RAD; TYPE VOLUTE ☒ SGL ☐ DBL ☐ DIFFUSER
-PRESS: ☐ MAX. ALLOW. 667 PSIG 90 F. ☐ HYDRO TEST 1000 PSIG
-CONNECT: ☒ VENT ☒ DRAIN ☐ GAGE
IMPELLER DIA. ☐ RATED 9 1/2 ☐ MAX 10 1/2 ☐ TYP CLOSED
MOUNT: ☐ BETWEEN BRGS ☒ OVERHUNG ☐ WEAR RG. DIAM./CLRNC. 0.020
BEARINGS-TYPE: ☐ RADIAL ND3210LR ☐ THRUST ND-4520LUA
LUBE: ☐ RING OIL ☐ FLOOD ☐ OIL MIST ☒ SLINGER ☐ PRESSURE
COUPLING: ☐ MFR FAST ☐ MODEL B
DRIVER HALF MTD BY: ☒ PUMP MFR ○ DRIVER MFR ○ PURCHASER
PACKING: ☐ MFR & TYPE ____ ☐ SIZE/NO. OF RINGS ____
MECH. SEAL: ☐ MFR & MODEL BW-QB API CLASS. CODE BSTFJ
☐ MFR CODE QB-2125-5D4N

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
BASEPLATE: ☐ FSDR

AUXILIARY PIPING

○ C.W. PIPE PLAN — ○ CU; ○ S.S.; ○ TUBING; ○ PIPE ____
☐ TOTAL COOLING WATER REQ'D, GPM 0 ○ SIGHT F.I. REQ'D ____
○ PACKING COOLING INJECTION REQ'D: ☐ TOTAL GPM ☐ PSIG
○ SEAL FLUSH PIPE PLAN 12 ☒ C.S. ○ S.S. ○ TUBING ☒ PIPE SCH-80 SOCK WELD
○ EXTERNAL SEAL FLUSH FLUID ____ ☐ GPM ____ ☐ PSIG ____
○ AUXILIARY SEAL PLAN ____ ○ C.S. ○ S.S. ○ TUBING ○ PIPE ____
○ AUX. SEAL QUENCH FLUID WATER. QUENCH CONN REQD

VERTICAL PUMPS

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 15 RPM 3600 FRAME 254T VOLTS/PHASE/CYCLES 440-3-60
MFR AC BEARINGS BALL LUBE GRS
TYPE HORIZ INSUL ____ FULL LOAD AMPS ____
ENC TEFC TEMP RISE, C 60 LOCKED ROTOR AMPS ____
○ VHS ○ VSS VERT. THRUST CAP., LB ____ SERVICE FACTOR ____

APPROX. WT. PUMP & BASE 600
MOTOR 252 TURBINE ____

API STANDARD 610 GOVERNS UNLESS OTHERWISE NOTED

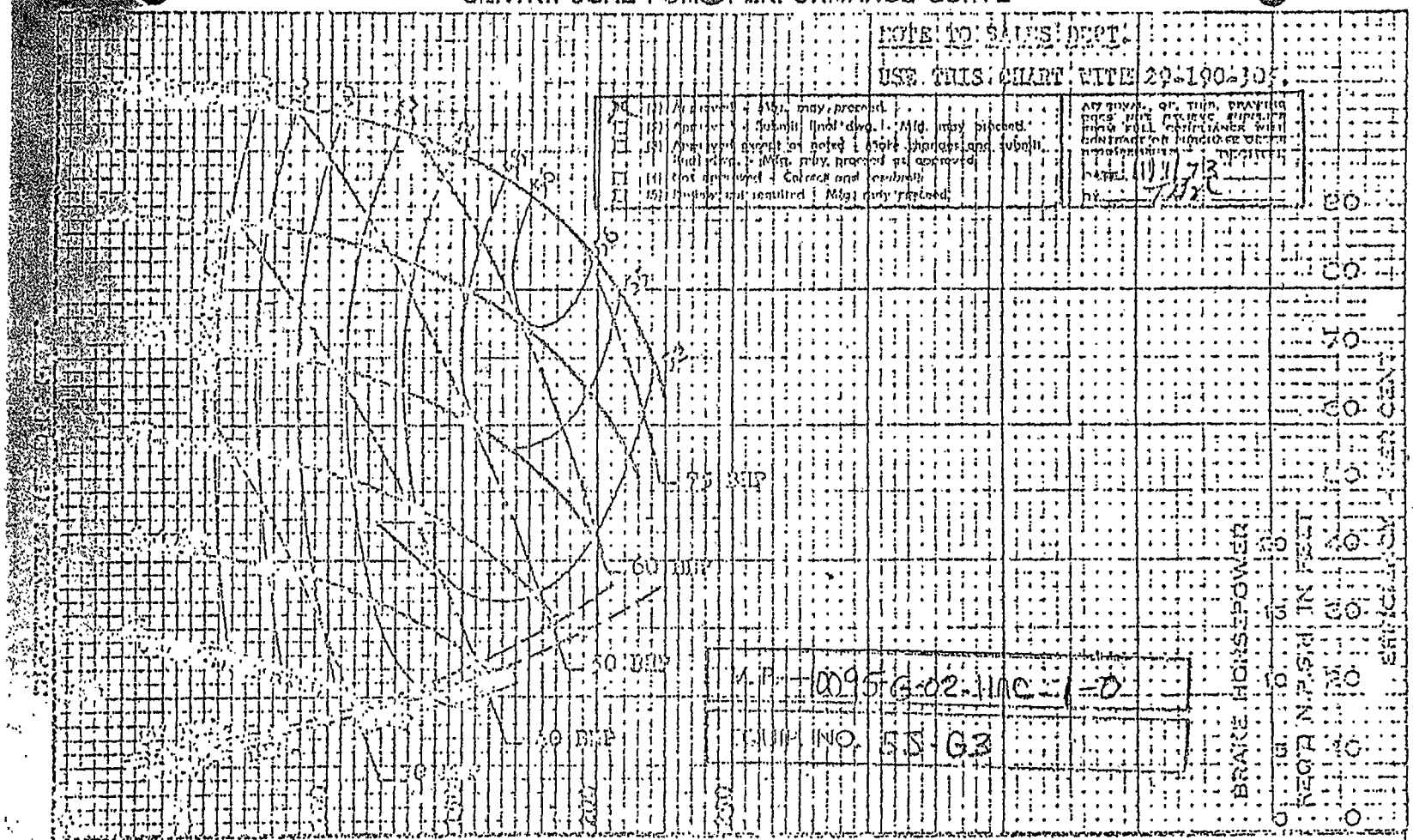
FORM NO 130 (REVISED APRIL 71)

NO.	DATE						JOB NO.	DRAWING NO.	REV.
1	12/26/72	ISSUED FOR PURCHASE	VT	TMB			10095	DS-55-G-1	1
0	10-2-72	ISSUED FOR QUOTATION					SHEET 1 OF 1		

BECHTEL

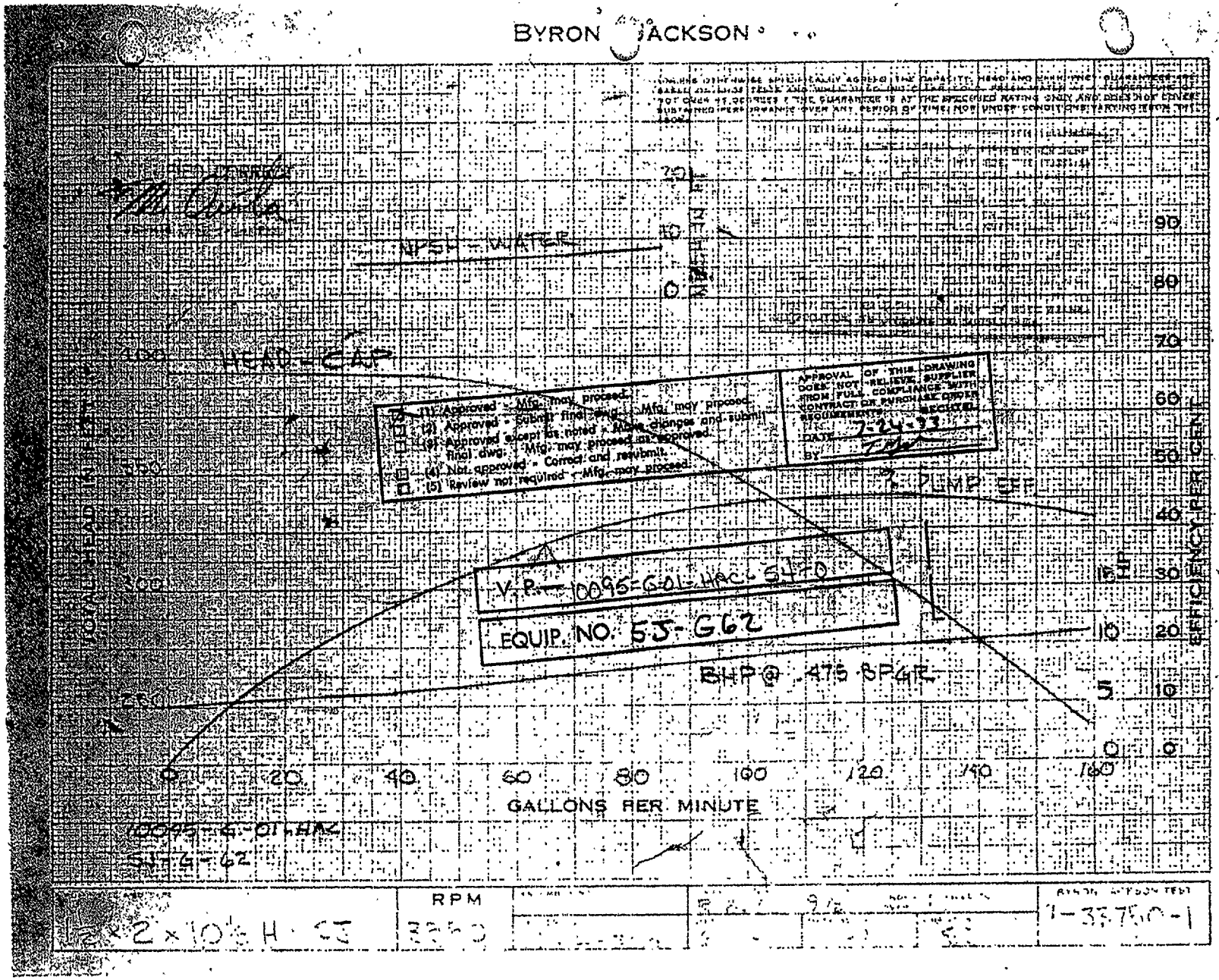
WA-TEX 000418

CENTRIFUGAL PUMP PERFORMANCE CURVE



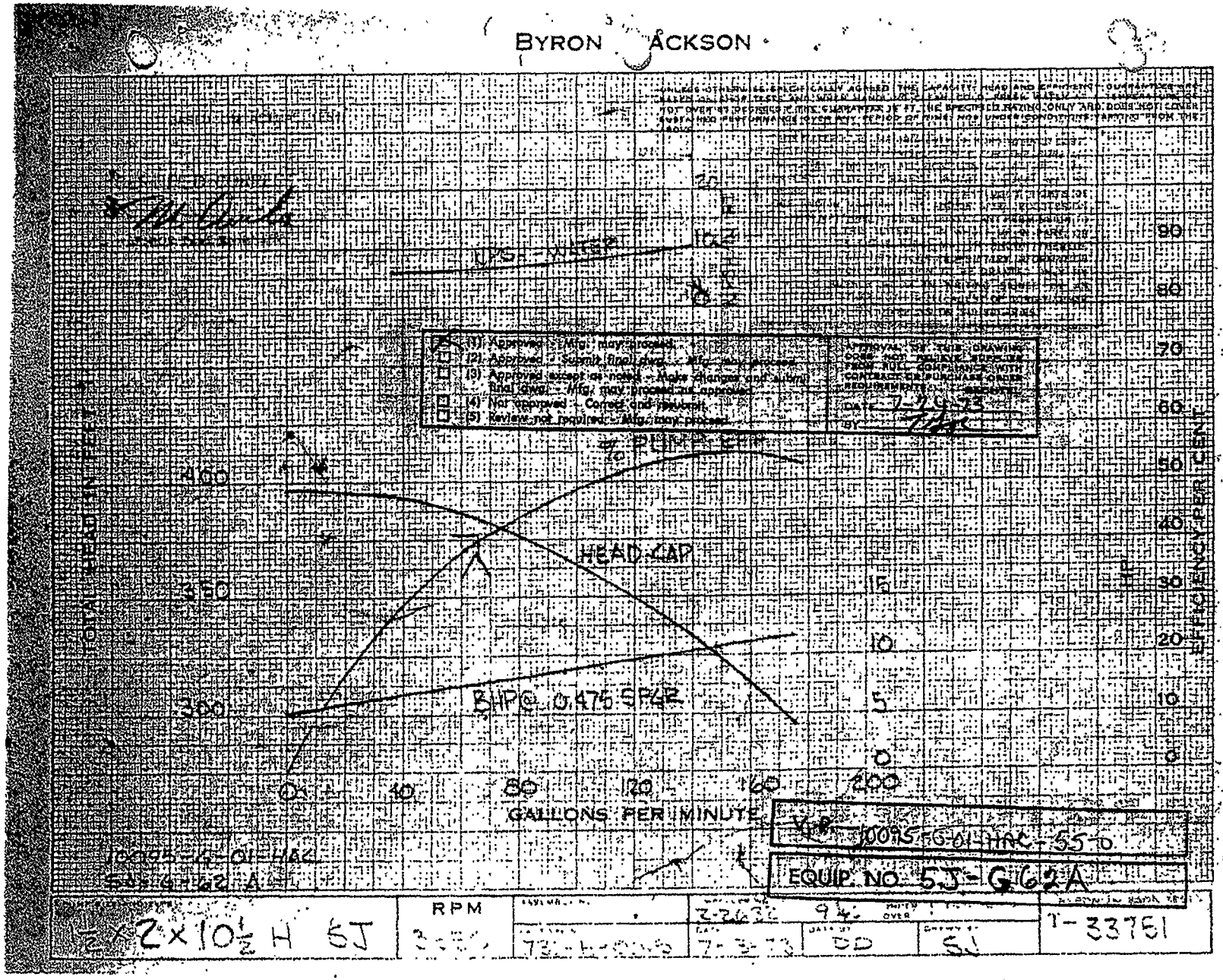
GALLONS PER MINUTE

Wilson-Snyder Pumps	SIZE 1-1/2 x 2	RPM 3550	CUSTOMER TEXACO
	TYPE TWO-STAGE FSN	IMPELLER 29-190-050 DIA. VAR.	ORDER NO. # 6541
	ITEM NO.	EYE AREA 4.4 SQ. IN.	CERTIFIED BY
	DATE	DRIVER HORSEPOWER	CURVE NO. 29-190-300



WA-TEX 000420

BYRON JACKSON



WA-TEX 000421

10.5 INSTRUMENTS

TABLE 10.5-1
FLOW ELEMENT SUMMARY SHEET
CATALYTIC POLYMERIZATION UNIT PLANT 5J
ANACORTES, WASHINGTON

Flow Element No.	Service	Orifice Size	Line Size	Meter Coefficient
5FE-19	Btms. Cooler Outlet	2.132	3" Sch 40	40 BPH
5FE-200	Amine to 5J-C57	1.978	3" Sch 40	15 BPH
5FE-201	Caustic to 5J-C59	1.238	2" Sch 40	8 BPH
5FE-205	Deprop. Feed Bypass	1.123	2" Sch 40	8 BPH
5FE-206	Stm. to 5J-E58	1.959	3" Sch 40	100#/Hr
5FE-207	Deprop. Reflux	0.901	2" Sch 40	4 BPH
5FE-208	Stripper Vapor Outlet	1.923	3" Sch 40	4000 SCFH

3

TABLE 10.5-2
RELIEF VALVE SUMMARY SHEET
CATALYTIC POLYMERIZATION UNIT PLANT 5J
ANACORTES, WASHINGTON

Tag No.	Service	Size	Set Pressure
5PSV-101	5J-C57	2" x 3"	310 PSIG
5PSV-102	5J-C58	"	"
5PSV-103	5J-C59	"	"
5PSV-104	5J-C60	"	"
5PSV-105	5J-C61	1-1/2" x 2"	260 PSIG
5PSV-107	5J-E57	3/4" x 1"	75 PSIG
5PSV-220	5J-E58	1-1/2" x 3"	65 PSIG

4