ADDENDUM TO THE OPERATING MANUAL

FLUID CATALYTIC CRACKING UNIT

PLANT 3B

TEXACO INC.

PUGET SOUND PLANT

ESTIMATE 3910

BECHTEL INCORPORATED

HOUSTON, TEXAS

1973

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1. GENERAL DESCRIPTION

I - GENERAL DESCRIPTION

A. INTRODUCTION

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

Reactor Charge Heater

Emergency Box Cooler

Fresh Feed Pumps

B. BASIS OF DESIGN

General

The process design of the FCCU section is based on feeding 30,000 BPSD of hot fresh feed to the charge drum and feed preheat exchangers. Some 6,000 BPSD of hot intermediate recycle gas oil are combined with the fresh feed for a total heater charge of 36,000 BPSD. The heater is designed for 750°F outlet temperature. The emergency box cooler is designed for 36,000 BPSD and 200°F outlet temperature. Process flow conditions for the preheat section are shown on process flow diagram 3-RA-40.

C. DESCRIPTION OF ADDITIONS AND MODIFICATIONS TO THE UNIT

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

Reactor Feed Heat Section (Reference PFD 3-RA-40)

Hot gas oil from the Crude Unit and Deasphalting Unit and/or cool feed from storage are charged through the existing light gas oil-reactor feed exchanger, 3B-E4, and the existing slurry quench-reactor feed exchanger, 3B-E5 A&B. This stream is combined with the hot recycle gas oil and the combined stream is heated in the new reactor charge heater, 3B-F3. The preheated combined stream flows to the reactor feed riser.

A new emergency box cooler is provided. Activation of the pushbutton, or low pressure drop across the spent or regenerated catalyst slide valve, will cause the valve in the line to the feed riser to close, the valve in the

oil line to the emergency box cooler, 3B-E40, to open, and the valve in the service water to the emergency box cooler, 3B-E40, to open. Hot reactor feed will be diverted from the feed riser, through the emergency box cooler, 3B-E40, and the cooled reactor feed flows either to the hot charge drum, 3B-C23, via 3LIC-62VB, or to storage via line 3B-O-1.

2. CONTROL FEATURES

2 - CONTROL FEATURES

A. PRINCIPAL CONTROL FEATURES

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

Reactor Feed Heat Section (Reference P&ID 3-RA-41)

The fresh feed flow controller, 3FRC-30, and the recycle feed flow controllers, 3FRC-11 and 3FRC-302, are left in place. Since a flow controller, 3FIC-600, is provided for the combined fresh feed and recycle streams, the flow controller for the fresh feed stream, or one of the recycle feed streams, must be taken out of service and the related control valve or bypass valve placed in the full open position. The fresh feed flow controller, 3FRC-30, is, preferably, taken out of service as there is no danger of "starving" the combined fresh feed and recycle feed flow controller, 3FIC-600, with the fresh feed flow controller out of service.

Total feed to the feed riser is controlled upstream of the reactor charge heater, 3B-F3, by a master controller, 3FIC-600. The master controller, 3FIC-600, makes equal distribution of the charge to the six coils of the reactor charge heater, 3B-F3, by setting uniform rates on the individual coil flow controllers, 3FFIC-620, 3FFIC-621, 3FFIC-601, 3FFIC-602, 3FFIC-603, and 3FFIC-604. Each heater coil is provided with a low flow switch, 3FSL-620, 3FSL-621, 3FSL-601, 3FSL-602, 3FSL-603, and 3FLS-604. Low flow through any heater coil will actuate common low flow alarm 3FAL-624. A further sustained reduction in flow through any heater coil will cause the fuel supply to the heater to shut off. A momentary reduction in flow through a heater coil will not cause the fuel supply to the heater to shut off, due to the action of time delay relay 3FY-622. Bypass switches 3FHS-620, 3FHS-621, 3FHS-601, 3FHS-602, 3FHS-603, and 3FHS-604 are provided to inhibit the heater fuel shutoff function of each low flow switch. A selector switch, 3FHS-623, allows the flow through any one heater coil to be recorded, 3FR-623.

The combined oil oultet temperature from the reactor charge heater, 3B-F3, is on temperature control, 3TIC-302, by adjustment of the amount of fuel oil or fuel gas to the burners. A selector switch, 3HS-606, provides a convenient means of firing fuel oil or fuel gas, or both. In this latter case, one fuel control valve, 3PV-641 or 3FV-606, is remotely positioned by a hand controller, 3HIC-606, to set a constant firing rate, while the other fuel control valve is automatically positioned by the temperature controller, 3TIC-302, to trim the firing operation as required.

In the event of a power failure, the reactor charge heater outlet temperature transmitter, 3TT-302, will be powered by batteries. If the batteries should fail or weaken, the output signal from the temperature transmitter, 3TT-302, will be low and high heater firing could result. A low temperature switch, 3TSL-302, is provided to prevent this occurrence. If the output signal from the temperature transmitter, 3TT-302, is low, the low temperature switch, 3TSL-302, causes the output signal from the temperature controller, 3TIC-302, to be replaced by the output signal from the hand controller, 3HIC-302. With proper setting of the hand controller, 3HIC-302, high heater firing is avoided.

Emergency Box Cooler

Low pressure drop across the spent catalyst slide valve, PdCL-14A, or low pressure drop across the regenerator catalyst slide valve, PdCL-14B, or activation of the pushbutton will (1) close the riser inlet valve, 3PdCL-14VN, (2) close the recycle gas oil valve, 3FRC-11, (3) close the slurry recycle valve 3FRC-302, (4) open the emergency box cooler process inlet valve, 3PdCV-14VB, (5) open the emergency box cooler water inlet valve, 3PdCL-14VM, (6) open the fresh feed pump discharge bypass valve, 3PdCL-14VH, to the blowdown drum, (7) close the spent catalyst slide valves, 3PdCL-14VF and 3PdCL-14VG, (8) close the regenerated catalyst slide valves, 3PdCL-14VC and 3PdCL-14VD, (9) open emergency steam valve, 3PdCL-14VE, and (10) close slurry quench reactor feed exchangers temperature control valve 3PdCL-14VK.

A light cycly oil line is provided that ties in just downstream of the emergency box cooler process inlet line block valve, 3PdCV-14VB, to permit flushing of the emergency box cooler, 3B-E40, when not in use. Flow of light cycle oil through this line is limited by a restricting orifice, 3FO-608.

3. PREPARATION FOR OPERATION

3 - PREPARATIONS FOR OPERATIONS

A. INTRODUCTION

This section describes only those preparations for operations that are necessitated by the addition of the reactor charge heater, 3B-F3. Reference should be made to the Operating Manual for the FCCU for a general description of preparations for operations.

B. DRYING THE REACTOR CHARGE HEATER

The masonry in all heaters, firebrick, or refractory linings, must be dried by slow heating. Damage from cracking and expansion strains will occur if damp settings are heated too rapidly. The vendor's recommended drying procedure should be followed. An alternate procedure is given below:

1. Check that the fuel gas system has been purged, and that it is blinded or otherwise secured against leakage of gas into the heater. Remove blinds in the gas supply header just prior to lighting burners. If natural gas is available, it should be used to dry out the heater.

   If fuel gas is not available, fuel oil will be fired to dry out the heater. The fuel oil system must be thoroughly cleaned and charged with fuel oil. The fuel oil circulation should be established. Fuel oil temperature should be approximately 280°F.

2. Break flanges at the oil coil outlets, venting them to atmosphere, or otherwise provide means for venting steam from the coils to the atmosphere.

3. Blowdown condensate drains on atomizing steam lines, snuffing steam lines, and coil steam lines.

4. Purge the heater firebox with steam for at least 15 minutes, to eliminate all combustible gas from the firebox. The damper and air registers should be wide open. A steam plume should be readily noticeable from the top of the stack.

5. Light an alternate pattern of burners. During the drying period, rapid changes in temperature or highly localized temperature must be avoided. The lowest possible burner

flame and maximum number of burners should be used for better heat distribution, while obtaining the desired temperature. The burners should be alternated at hourly intervals, for uniform heat distribution, and the performance of all burners should be verified.

The purpose of the dryout is to eliminate water from the furnace masonry. It follows that maximum ventilation should be provided. The stack dampers should be fully open. All registers of unfired burners should be fully open.

6. During the drying period, the heater arch temperature is used as the point of regulation. Raise the heater temperature at 50 to 75°F per hour to 500°F. Maintain at 500°F for 24 hours. Increase the temperature at 50 to 75°F per hour to 750°F. Maintain at 750°F for 24 hours. Increase the temperature at 50 to 75°F per hour to 1000°F.

   At near 500°F, steam should be carefully introduced into the coils. Steam should not be introduced into the coils, particularly in vertically installed coils, until temperatures have progressed above the steam condensation temperature. Introduction of steam into cold coils will cause considerable "water hammer".

   The most accurate indication of readiness of a furnace for operation is the shell temperature. When the fires are started in a new furnace, the moisture of the outer surface of the refractory evaporates into the combustion gases, but much of the moisture held deeper in the refractory is driven back into the insulation next to the shell. During this period, the furnace shell remains cold. Then, as heat density in the combustion chamber is increased, the lining heats through and the moisture frm the insulation begins to evaporate. This causes the furnace shell to heat up by the generation of steam on the adjacent insulation. When this moisture has been thoroughly evaporated, however, the shell temperature will again fall. If the operator keeps some progressive account of the shell temperature, he will note this rise and fall during the drying out process, and when the shell temperature has decreased to the rated casing temperature, the furnace can be considered ready for operation.

The 1000°F temperature may be maintained for a few hours, and then gradually reduced at not more than 75°F per hour. When the heater has cooled to about 350°F, the steam to the coils may be discontinued. The burners may be extinguished at about 300°F, and further cooling continued by natural draft.

7. Upon completion of drying, the heater coils should be drained, blown out, and flanged up. Everything is left in readiness for process operation.

8. After cooling of the heater, the masonry and internals should be inspected, and repairs made if indicated.

4. STARTUP PROCEDURE

4 - STARTUP PROCEDURE

A. INTRODUCTION

The procedure given here is for initial startup of the reactor charge heater, 3B-F3, and commissioning of the emergency cooler, 3B-E40, with the existing FCCU in operation. Feed to the FCCU is flowing through the reactor charge heater bypass line. Reference should be made to the Operating Manual for the FCCU for a description of the startup procedure for the existing FCCU.

It is assumed the reactor charge heater, 3B-F3, and the emergency cooler, 3B-E40, have been made ready for operation as described in the preceding Section III. It is assumed that all utilities are available and ready for service.

The reactor charge heater, 3B-F3, and the emergency cooler, 3B-E40, are steam-purged, tightness-tested, and pressured with fuel gas. Reactor charge heater burners are lit on low fire. Oil is gradually diverted from the reactor charge heater bypass line through the reactor charge heater to the reactor riser. When all the oil is flowing through the heater, the feed rate and operating conditions should be adjusted to desired operating levels.

B. STEAM PURGE AND TIGHTNESS-TEST

Introduce steam through the steamout connection at line 3B-O-204-10" and through the steamout connections at each reactor charge heater pass. Purge through the reactor charge heater, 3B-F3, and the emergency cooler, 3B-E40. Vent steam and air at all high point vents. Drain condensate at all low point drains. When the system has been thoroughly purged, close vents and drains and tightness-test the system by gradually increasing the pressure to 100 psig with steam.

C. PRESSURE WITH FUEL GAS

After a successful tightness test, reduce the steam pressure to about 15 psig. Make a temporary connection and pressure the system to about 25 psig with fuel gas while all steam to the system is discontinued. Drain steam condensate from all low point drains. Make sure that all steam condensate is drained, as hot oil is to be introduced into the system.

D. INTRODUCE OIL

The emergency cooler, 3B-E40, is flushed with light cycle oil. The emergency dump system is not put into service at this time. Valving should be arranged such that if relief valve 3PSV-127A operates, it can discharge to storage.

Light a few burners in the reactor charge heater, 3B-F3, and bring the flue gas temperature at the arch to about 300°F. With the master heater flow controller, 3FIC-600, on manual control and the heater pass flow control valves closed, slowly open the block valve in line 3B-0-204-10" and admit oil to the heater inlet header. At this point, it should be recognized that hot oil is introduced into a wet system. The hot oil should be brought in slowly, and with caution. It must be remembered that a volume of water will expand to about 1600 volumes of steam when vaporized at 212°F and at atmospheric pressure. This vaporization takes place with violent force and, when in a closed place, is capable of causing physical damage to piping and equipment.

With the individual pass flow controllers on manual control, slowly admit oil through the heater passes, one pass at a time, to the block valve in the heater discharge header, 3B-0-213-10". Open the block valve in line, 3B-0-215-8", to the emergency cooler and permit the hot oil to flow through the emergency cooler, through the jump over from the emergency cooler discharge line to the emergency tankage (slops) header. After the system is free of water, close the block valve in line, 3B-0-215-8", to the emergency cooler and the block valve in the heater feed line, 3B-0-204-10". Open the block valve in the heater discharge line, 3B-0-219-6", and the block valve in the line to the emergency cooler and permit hot oil to back through the heater discharge line and the emergency cooler to the slops header. After the heater discharge line is free of water, close the block valve in the jump over line to the slops header and isolate the emergency cooler. Close the individual pass flow control valves.

With the individual pass flow controllers receiving their set point from master flow controller 3FIC-600, and with master flow controller 3FIC-600 on manual control, slowly start oil flow through the reactor charge heater, 3B-F3, while reducing flow through the reactor charge heater bypass. Light additional burners and adjust firing as required to maintain the oil temperature to the reactor riser. Commission the emergency dump system to the emergency cooler, 3B-E40.

When all of the oil is passing through the reactor charge heater, 3B-F3, and the heater bypass is closed, place the heater outlet temperature controller, 3TIC-302, and the heater master flow controller, 3FIC-600, on automatic control. Note that when the heater master flow controller is on automatic control, the fresh feed flow controller, 3FRC-30, or one of the recycle feed flow controllers, 3FRC-11 or 3FRC-302, must be taken out of service with the respective control valve or bypass valve in the open position. Adjust feed and recycle flow rates and operating conditions as directed by supervision.

5. OPERATING VARIABLES

5 - OPERATING VARIABLES

A. INTRODUCTION

Reference should be made to the Operating Manual for the FCCU for a description of the operating variables. The following discussion is limited to the reactor charge heater, 3B-F3.

B. REACTOR CHARGE HEATER FIRING

Control the combined pass outlet temperature of the heater with temperature controller 3TIC-302. This controller resets the pressure controller regulating the fuel gas supply to the gas burners of the heater, or resets the flow controller regulating the fuel oil supply to the fuel oil burners of the heater. During reduced firing rates, it may be necessary to take burners out of service to maintain the design burner fuel gas pressure to avoid burner backfiring. Maintain the burner air and firebox pressure to obtain clear burner flame and the design excess air in the flue gasses. Burner firing must be even, so that there is no flame impingement on the tubes or furnace walls. Flame impingement will cause localized hot spots, and coking or tube failure can result. Visual inspection of the tubes for hot spots must be done routinely, several times per shift.

C. HEATER SOOTBLOWERS

Electrically-driven rotary sootblowers are provided in the convection section of the reactor charge heater, 3B-F3, for cleaning the extended surface tubes during oil firing operations. Steam is used as the blowing medium. The sootblowers should be operated every 8 hours, or on indication of higher stack gas temperature, when oil is being fired. The sootblowers can be operated automatic-sequential or manually. The sootblowers are conveniently operated from the Vulcan EC-15 automatic-sequential controller.

Automatic-Sequential Operation

1. Place the start-run-stop (S-R-S) selector switch in the stop position.
2. Place the 4 toggle switches in the up (auto) position.
3. Place the steam supply selector switch in the auto position. The steam supply valve, 3PV-658, will open. The adjustable time delay (15 minutes maximum) for warmup will run out before blower operation will begin. High pressure switch 3PSH-658, downstream of the steam supply valve, must be satisfied before the sootblowers will sequence.

4. Place the start-run-stop (S-R-S) selector switch in the start position and hold momentarily, then release. The blowers will then operate in sequence.

5. On completion of the sootblowing cycle, the unit will shut down. Place the steam supply switch in the close position. Open the circuit breaker to remove power supply to the controller.

Individual Manual Operation

The sootblowers can be operated individually in any sequence from the Vulcan EC-15 automatic-sequential controller or from the sootblower location.

1. Perform steps 1 through 3 of the automatic-sequential operation procedure, or place the steam supply selector switch in the open position.

2. Manual operation of a sootblower from the controller is accomplished by depressing the three-way toggle switch for the desired sootblower. Blowing will stop when the selected blower completes its cycle.

3. Manual operation of a sootblower at the sootblower location is accomplished by operation of the pushbutton in the sootblower housing.

4. After manual operation, return the steam supply selector switch to the off position.

Automatic-Sequential Controller

In addition to the control and switching functions described above, the Vulcan EC-15 automatic-sequential controller has the following features:

1. A light labeled "CO" to indicate that the controller is operating.

2. A light labeled "LV" to indicate that power has been lost.

3. A light labeled "RF" to indicate that a sootblower has failed to rotate.

4. A light labeled "LHP" to indicate that the steam header has not come up to pressure.

5. A light for each sootblower to indicate operation of that sootblower.

6. An ammeter to indicate the power consumption of the operating sootblower.

D. EMERGENCY COOLER

Valving in the piping to and from the emergency cooler is arranged such that oil can freely flow through the cooler to storage in the event emergency valve 3PdCV-14VB opens. During periods of cold weather, steam should be utilized to prevent freezing of water in the cooler.

6. SHUTDOWN PROCEDURE

6 - SHUTTING DOWN PROCEDURE

A. INTRODUCTION

Reference should be made to the Operating Manual for the FCCU for a description of shutting down procedures. The following discussion is limited to the reactor charge heater, 3B-F3, and the emergency cooler, 3B-E40.

During normal shutdowns, firing of the reactor charge heater is reduced as feed rate is reduced and then discontinued. The heater is steamed out in conjunction with the remainder of the FCCU. A procedure for heater decoking is given at the end of this section.

During an emergency shutdown, firing of the reactor charge heater, 3B-F3, may be stopped by operation of emergency shutdown switch 3HS-601. Oil feed may be diverted from the reactor riser to the emergency cooler, 3B-E40, by operation of the emergency pushbutton.

B. HEATER DECOKING

The FCCU need not necessarily be taken out of service for heater decoking. The FCCU can be returned to the operating mode that was used before the reactor charge heater was installed. The reactor charge heater can then be isolated, purged with steam and decoked as described in the following paragraphs. After heater decoking, the heater is returned to service by the procedures given in Section 4.

Means are provided for steam-air decoking the tubes in the 3B-F3 reactor charge heater.

The typical decoking manifolds are shown on P&ID 3-RA-41.

Internal coke deposition may be removed from heater tubes by steam-air decoking. This is accomplished in two consecutive operations. The spalling operation is removal of coke by cracking and fragmentizing the coke by external heating of the tubes, and blowing the loosened coke from the coils. The burning operation is removal of coke by controlled combustion, (i.e., burning,) of coke with air in the presence of steam, which carries the products of combustion from the coils. The decoking procedure is described in four steps:

Preparation

Coke Spalling

Coke Burning

Cleanup

Preparation

1. The tubes are steamed free of oil, in the normal manner, at shutdown.

2. The appropriate decoking manifold arrangement is connected to the coils.

4. Verify that all tube hangers and guides are present and in good condition; if not, repair or replace as required before proceeding with decoking operations.

5. Verify that plant air, steam, and service water are available to the manifold.

Spalling

1. Establish service water flows as quench water to the quench drum, 3B-C40.

2. The burners shall be lighted with nonluminous flames, if possible. It is advantageous to light the fires during the afternoon, so that the burning portion of the decoking operation can take place at night when red spots on the tubes can more easily be detected. Operate with a minimum amount of excess air, so as to reduce external tube oxidation.

3. Establish steam flow through the coils. Initially, a high flow rate should be maintained to flush oil that may still be deposited on the coke. The rate will be decreased during coke spalling to prevent erosion by coke particles.

4. Increase the bridgewall temperature at a rate of approximately 300°F per hour to 1100-1150°F, with a maximum temperature of 1300°F.

5. Increase steam flow through the coil being decoked to produce a mass velocity of 18 pounds/square foot/second.

6. If spalling has not started at the above temperature, the following steps will be taken until spalling does start:

   a. Reverse the flow through the coil.

   b. Alternately decrease and increase steam flow.

   c. Lower flue gas temperature by 100-200°F.

   d. Add a small amount of air, for not more than 5 minutes, then be sure to close off the air.

7. The rate of spalling is determined by observing the quenched effluent. Spalling rate is judged by appearance of quench water stream.

   a. Light grey - containing soot or fine coke particles.

   b. Dark grey to black - containing increased size and quantity of coke.

8. When heavy spalling starts, decrease steam flow to prevent erosion. The amount of steam flow rate is dependent on operator's judgment; the pressure in coil inlet and observation of the effluent is the guide. As effluent darkens, steam flow is decreased and inlet pressure observed. As effluent becomes lighter, steam flow is increased and the observed inlet pressure may be a guide for flow adjustment. High velocity may produce fine dust. This is determined by reducing steam flow for 10 to 15 minutes and observing the effluent. Should find dust continue, further reduce the steam flow to make sure the dust is not produced by high velocity.

9. Continue spalling operation until assured that spalling has stopped.

Burning

1. Reduce the radiant section flue gas outlet temperature about 50-100°F.

2. Reduce the steam flow to produce a rate of 5650 LB/HR.

3. Gradually introduce air to the coils at a quantity equal to one-tenth of the weight of the steam, i.e., 5650 LB/HR. Observe the appearance of the tubes. Do not permit the tubes' temperature to exceed 1250-1300°F., i.e., dark red color. Decrease air flow, if necessary, to avoid high temperature. With a good coke burning operation, the progress of the burn can be observed by tube color. As the burning coke in the tube progresses, the tube temperature, hence red color, also progresses.

   Do not allow the tubes to attain a cherry red color. If the temperature rises, decrease the air flow.

4. After about one hour of burning, the flow is reversed. If coke burn is heavy, it is advisable to periodically increase the steam flow for short periods, to avoid plugging.

5. The effluent is observed throughout the burning operation. The appearance of the effluent during spalling and burning indicates the progress.

   a. Greyish-milky is the appearance before and after decoking.

   b. Light grey appearance indicates fine soot particles.

   c. Dark grey to black indicates larger particle size and greater volume of coke.

   d. A reddish-brown color appears during coke burning and blowing out period.

6. When coke burning is completed, the reddish-brown color disappears and decoking is completed.

Cleanup

1. Upon completion of coke burning, discontinue air flow.

2. Temporarily increase the steam flow to full line pressure. Hold for a few minutes, and then reverse in direction. Repeat this three or four times, to remove all loose ash and scale.

3. Maintain low steam flow and decrease firing at approximately 500°F per hour rate, as indicated by radiant section outlet flue gas. When radiant tube metal temperature has dropped to 500°F, stop steam flow.

4. At 400-450°F radiant section outlet flue gas temperature, discontinue firing. Follow plant safety practices in discontinuing heater firing. Discontinue steam to tubes.

5. Flush the tubes thoroughly with service water. A hydrostatic test of the tubes may be made following the water flush.

6. Upon completion of the water wash, the tubes are dried. Re-establish the air flow to remove water. Relight several burners to bring the radiant section flue gas temperature to around 400°F.

7. Intermittently discontinue water quench and observe the blowoff line effluent. In this manner, it may be determined when coil is dry.

8. After completion of drying, discontinue heater firing. Follow the plant safety practices in discontinuing the heater firing. Stop air flow.

9. Disconnnect the decoking manifold from the heater coils. Replace the removable normal crossovers and swingout spools. Also turn the Figure 8 blinds to normal. The heater is made ready for normal service.

7. APPENDIX

7. APPENDIX

7.1 Process and Utility Diagrams

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7.1 PROCESS AND UTILITY DIAGRAMS

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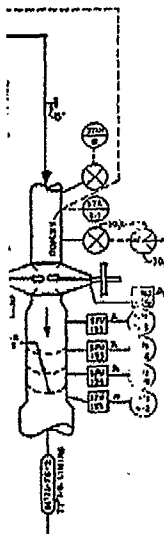
SECTION 7.1 PROCESS AND UTILITY DIAGRAMS



ITEM NUMBERS

19 .	36"OD x ⅜"WALL SMLS. FABRICATED REDUCER PIPE
212	300# SCRD. A.S. GATE VALVE
213	300# SCRD. P.S. GATE VALVE
214-12	600# SCRD. P.S. GATE VALVE, 12.5RRV TRIM 8 STEM
310	300# WELD NECK FLANGE ½"R.F.
610-21	300# FLGD. C.S. GATE VALVE, ½"R.F. CRANE 33E OR EQ. BOLT B.E.
611-21	300# FLGD. C.S. GATE VALVE, ½"R.F. CRANE 33E OR EQ. BOLT B.E.
615	300# FLGD. C.S. GATE VALVE, ½"R.F. PAC. 3310 OR EQ.
617	300# FLGD. C.S. GATE VALVE, ½"R.F. PAC. 3310 OR EQ.
617-21	300# FLGD. C.S. GATE VALVE, ½"R.F. SPECIAL
814	
1005	300# FLG. "Y" STRAINER ¾" R.F.
1013	
1701	150# FLG. BELLOW TYPE EXPANSION JOINT ½"R.F.
1770	WATER SPRAY NOZ. ASSEMBLY-STEAM DISPERSING TYPE 40 G.P.M.
1777	WATER SPRAY NOZ. ASSEMBLY-STEAM DISPERSING TYPE 15 G.P.M.
6610-21	300# FLGD. GATE VALVE, 16"R.F. ½" NO. ½"R.F. CRANE 33E OR EQ.
6637	300# FLGD. GATE VALVE, 16"R.F. ½" NO. ½"R.F. CRANE 33E OR EQ.
6637-21	300# FLGD. GATE VALVE, 16"R.F. ½" NO. ½"R.F. CRANE 33E OR EQ.

LEGEND

PIPING SYMBOLS

GATE VALVE — CHECK VALVE
GLOBE VALVE
P.D. — VALVE WITH BLAST PROOF SEE DETAIL "D"
CONTROL VALVE (CLOSES ON AIR FAILURE) — CONTROL VALVE (OPENS ON AIR FAILURE)
SAFETY RELIEF VALVE — ATMOSPHERIC UNIT S=STEAM, A=AIR SEE DETAIL "A"
INSULATION LINE & FLANGED INSULATION THICKNESS PER CODE LETTER — PURGE UNIT S=STEAM & AIR, A=AIR SEE DETAIL "B"

INSTRUMENT SYMBOLS

LOCAL MOUNTED — TRANSMITTER MA=ORIFICE PRESS. TAP L.P.=LOW PRESS. TAP
BOARD MOUNTED — TRANSMITTER OR PRESSURE SWITCH BOARD MOUNTED
TEXTURE LINE SMALL CONN. — INDICATING TRANSMITTER
INSTR. CONTROL AIR LINE
PNEUMATIC LEAD — CAPILLARY TUBING

PLANT NUMBER
INSTRUMENT IDENTIFICATION
INSTRUMENT NUMBER

INSTRUMENT IDENTIFICATION

ALL INSTRUMENTS ARE CODED IN ACCORDANCE WITH I.S.A. STANDARDS EXCEPT AS NOTED

LINE IDENTIFICATION

PIPING SPEC. — LINE SIZE — PLANT NO. (IF ANY) — PLANT LETTER (T.T. CO.) — TEXACO SERVICE DESIG. — LINE SERIAL NO.

PIPING SPECIFICATION

J3R-211B	150# R.F., C.S. ⅛" CORR. ALLOWANCE
J3E-211B	150# R.F., C.S. ⅛" CORR. ALLOWANCE
J3S-211B	150# R.F., C.S. ⅛" CORR. ALLOWANCE
J3Q-611B	300# R.F., C.S. ⅛" & ¼" CORR. ALLOWANCE
J3S-211B	150# R.F., C.S. ⅛" CORR. ALLOWANCE
J3T-611B	300# R.F., C.S. ⅛" CORR. ALLOWANCE
J3-211B	125# NOM. RATING, ⅛" CORR. ALLOWANCE
J3R-211B	300# NOM. RATING, R.F., ⅛" CORR. ALLOWANCE
J3-211B	150# NOM. RATING, R.F., ⅛" CORR. ALLOWANCE

SERVICE DESIGNATION

HC	HYDROCARBONS
CV	CATALYST HYDROCARBON STREAMS
V	CATALYST VIA HYDROCARBON STREAM
A	AIR-PROCESS, PLANT, ATMOSPHERIC
S1	STEAM, CONDENSATE, SPRAY WATER
FG	FLUE GAS

NOTES

REFERENCE DRAWINGS

P.F.D. FCCU FRACTIONATION SECTION	3-DA-8
P.F.D. CO BOILER	3-BA-18
P.F.D. AIR BLOWERS & CATALYST STORAGE	3-BA-10
P.F.D. STEAM & CONDENSATE	3-BA-9
P.F.D. AIR, FUEL GAS, & FUEL OIL	3-BA-11
LIST OF REVISIONS TO THIS DRAWING	3-RA-18

No.	Date	Texaco Revisions	By	Ch'kd	Appvd
1	9-8-65	ADDED NOTE 5 PER DWG. 3-RA-41 REV. 1	CC		
2	9-23-65	ADDED NOTE 6 PER DWG. 3-RA-41 REV. 2	CC		
3	10-8-65	ADDED NOTE 7 PER DWG. 3-RA-41 REV. 3	CC		
4	11-8-65	ADDED NOTE 8 PER DWG. 3-RA-41 REV. 4	CC		
5	11-15-65	ADDED NOTE 9 PER DWG. 3-RA-41 REV. 5	CC		
6	12-6-65	ISSUED FOR CONSTRUCTION	CC		
7	1-5-66	ISSUED FOR APPROVAL	CC		
8	1-18-66	ISSUED FOR REFERENCE	CC		

DRAWN M. MUNOZ — CHECKED — APPROVED — SCALE — DESIGNED C. CHAN

BECHTEL CORPORATION
SAN FRANCISCO

THE TEXAS COMPANY
PUGET SOUND WORKS

PROCESS PIPING & INSTRUMENT DIAGRAM
REACTOR & REGENERATOR SECTION
FLUID CATALYTIC CRACKING UNIT

BECHTEL 2525 3-RA-4 M

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 SPECIFICATION FOR NEW LINES IS IN ACCORDANCE WITH GEMS J-208, TABLE 2
3. LINE NUMBER 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
   NI - NO INSULATION
4. REPLACE EXISTING 10" LINE TO INLET 6" PISTON OPERATED VALVE, 3P6CL-14B WITH NEW 9CR PIPE & VALVE - 3P8CL-14VN. EXISTING VALVE 3P6CL-14VB WILL BE INSTALLED IN EMERGENCY COOLER INLET LINE. SEE DWG. 3-RA-41.
5. PUSH BUTTON OR LOW PRESSURE DROP SIGNAL ACROSS THE SPENT CATALYST OR REGENERATED CATALYST SLIDE VALVE WILL AUTOMATICALLY CLOSE INLET VALVE TO RISER AND WILL PERFORM THE FOLLOWING ACTIONS SHOWN ON DWG. 3-RA-41: OPEN PROCESS VALVE TO EMERGENCY COOLER, OPEN WATER VALVE TO EMERGENCY COOLER, CLOSE THE SLURRY RECYCLE CONTROL VALVE & CLOSE RECYCLE GAS OIL TO 3B-F3 AT 3FRC-11.

LINE IDENTIFICATION

1A = D - 422 - 8" - 113A - N1

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

No.	Date	Texaco Revisions	By	Ch'kd	Appvd
10	2/16/66	ADDED INST. SYS.-EX. PER DWG. 3-RA-41 REV. 6			
11	3/4/66	ADDED VALVES PER DWG. 3-RA-41 REV. 7			
12	4/6/66	REVISED 9 CR. SPEC. TO 6 CR.			
13	4/14/66	REVISED PER DRAWING DA-1104 REV. 0			
14	5/6/66	ISSUED FOR CONSTRUCTION			
15	7/7/66	ADDITIONS TO BE MADE TO ISSUED FOR APPROVAL			

SCALE NONE — DESIGNED — DRAWN

BECHTEL HOUSTON

TEXACO INC. PUGET SOUND PLANT

PROCESS PIPING & INSTRUMENT DIAGRAM
REACTOR & REGENERATOR SECTION
FLUID CATALYTIC CRACKING UNIT

BECHTEL - 2525 TEXACO EST. - 3910 3-RA-4 20

WA-TEX 000894

LEGEND — ITEM NUMBERS

28	SCH 80 SEAMLESS PIPE
53	36" FABRICATED STEEL PIPE X" WALL
165	600# SCRD. NEEDLE TYPE GLOBE VALVE
201	150# SCRD BRONZE GATE VALVE
215-15	
232-15	600# S.W. F.S GATE VALVE
389	3000# CAST COCK BALANCED MODEL 302
600	150# FLGD. C.S. GATE VALVE, R.F.F., INC. TR. & S.
602	150# FLGD. C.S. GATE VALVE, R.F.F. MONEL TR. & S.
607	150# FLGD. C.S. GATE VALVE, R.F.F., INC. DISC FOR EQ.
611	300# FLGD. C.S., GATE VALVE, R.F.F., CRANE 33XR
611-7-51	300# FLGD. SCHD. X-HD GATE VALVE R.T.J.
615	300# FLGD. C.S. GATE VALVE, R.F.F., INC. 3330-9
611-7-51	300# FLGD. SCHD. X-HD. GATE VALVE, ORD.
765	600# FLGD. P.S. BLOWOFF VALVE, R.F.F.
840	
900	150# FLGD. C.S. LUB. PLUG, R.F.F., WR OPER.
907	150# FLGD. C.S. LUB. PLUG, R.F.F., GEAR OPER.
1002	
1003	300# FLGD. C.S. "Y" STRAINER, R.F.F.
1308	
1350	SAMPLE COOLER PER DWG SD-DL-15A
1701	150# FLGD BELLOW TYPE EXPANSION JOINT, R.F.F.
4310	300# P.S. LARGE DIAMETER WELD NECK FLANGE
4902	

LEGEND — PIPING SYMBOLS

	GATE VALVE		SPECTACLE BLIND 1551
	GLOBE VALVE		PLUG COCK
	CHECK VALVE		
	HAND CONTROL VALVE		
	STRAINER		TEMPORARY STRAINER
	CONTROL VALVE AIR-AIR FAILURE OPEN		SPECTACLE BLIND OPERATED
	CONTROL VALVE AIR-AIR FAILURE CLOSE		ANGLE VALVE
	SAFETY VALVE		BUTTERFLY CONTROL VALVE WITH HANDWHEEL OPERATOR
			ANGLE CONTROL VALVE AIR-AIR FAILURE OPEN AIR-AIR FAILURE CLOSE
			STEAM TRACED SEWER

INSTRUMENT SYMBOLS

	LOCAL MOUNTED		TRANSMITTER
	BOARD MOUNTED		PURGE UNIT (ROTAMETER) PURGING FLUID-FLUSHING OIL, FUEL GAS, AIR, ETC.
	PRESSURE LINE		ELECTRICAL LEAD
	INSTRUMENT AIRLINE		CAPILLARY TUBING

PLANT NUMBER
INSTRUMENT IDENTIFICATION
INSTRUMENT NUMBER

INSTRUMENT IDENTIFICATION

ALL INSTRUMENTS ARE CODED IN ACCORDANCE WITH I.S.A. STANDARD S5.1-1973 AS MODIFIED. FOR DETAILS REFER TO DWG. No. SD-EA-4.

LINE IDENTIFICATION

10"-SIS | 4"-1A-D-78
PIPING SPEC. SIZE & MATERIAL — LINE SERIAL NO. TEXACO SERVICE DESIGNATION & TEXACO PLANT LETTER

FLUSHING OIL SYSTEM IDENTIFICATION

(1) IDENTIFICATION NUMBERING OF FLUSHING OIL BRANCH & STEAM HEADER, SEE DETAILS THIS DWG.

PIPING SPECIFICATION

JC-S1S	150# GR GATES, C.S. 1/16" CORROSION ALLOWANCE
JD-S1S	150# R.F. COCKS, C.S. 1/16" CORROSION ALLOWANCE
JD-61S	300# R.F. GATES C.S. 1/16" CORROSION ALLOWANCE
JDV-61S	300# R.F. GATES, 5% Cr. TRIM, 1/16" CORROSION ALLOWANCE
JDV-C1S	300# R.F. GATES, C.S. 1/16" CORROSION ALLOWANCE
JD-S1S	150# R.F. GATES, C.S. 1/16" CORROSION ALLOWANCE
JD-S1S	150# R.F. COCKS, C.S. 1/16" CORROSION ALLOWANCE
JBF-61S	300# R.F. GATES, C.S. 1/16" CORROSION ALLOWANCE
JPW-S1S	150# R.F. WORKS, HOT WATER, C.S. CEMENT LINED.
JCW-S2S	150# R.F. GATES C.L., 1/16" CORROSION ALLOWANCE

SERVICE DESIGNATION

O	HYDROCARBON & LIQUID OR VAPOR FUEL OIL & GAS
OT	HYDROCARBONS, CATALYST PRESENT
HW	HOT WATER, SOUR WATER
ST	STEAM & CONDENSATE
CW	COOLING WATER
W	SERVICE WATER, TEST WATER
BF	BOILER FEEDWATER

REFERENCE DRAWINGS

PROCESS REQD. REACTION & REGENERATION SECTION FCCU	3-RA-4
PROCESS REQD. WASTE WATER STRIPPING SECTION FCCU	3-RA-6
UTILITY REQD. WATER SYSTEMS FCCU	3-RA-8
UTILITY REQD. STM. COND. & BOILER FEED WATER FCCU	3-RA-9
PROCESS REQD. COMPRESSOR SECT. FCC GAS RECOVERY PLANT	4-RA-6
PROCESS REQD. ABSORPTION SECT. FCC GAS RECOVERY PLANT	4-RA-7
PROCESS REQD. DIST. & TREATING SECT. FCC GAS RECOVERY PLT.	4-RA-8
REQD. TANKAGE & INTERCONNECTING LINES SHEET NO. 2	2-RA-3
PROCESS REQD. BLOWDOWN, SEWER, CASING	3-RA-10
LIST OF REVISIONS TO THIS DRAWING	3-RA-19
FCCU GLAND OIL & FLUSHING OIL	4-RA-11

NOTES

1. FOR LETTER CODE FOR STEAM TRACED LINES, SEE TABLE X, SPECIFICATION N-2. USE INSULATION THICKNESS SHOWN ON LINE TABLE UNLESS NOTED
2.
3. FOR TYPICAL WEATHERPROOFING, BY-PASS & DRAIN VALVES ON COOLING WATER SUPPLY & RETURN RISERS, SEE SWGS, SD-DL-131, & SD-DL-103.

11-19-75	FOR LIST OF CHANGES SEE DWG S-RA-19-1				
7/1/74	FOR LIST OF CHANGES SEE DWG S-RA-19-1				
7/15/74	FOR LIST OF CHANGES SEE DWG S-RA-19-1				
4/4/71	FOR LIST OF CHANGES SEE DWG S-RA-19-1				
8/4/70	FOR LIST OF REVISIONS SEE DWG S-RA-19-1				
4/4/70	ISSUED FOR APPROVAL				

BECHTEL CORPORATION
SAN FRANCISCO

THE TEXAS COMPANY
PUGET SOUND WORKS

PROCESS PIPING & INSTRUMENT DIAGRAM
FRACTIONATION SECTION
FLUID CATALYTIC CRACKING UNIT

BECHTEL 2525 | 3-RA-5 | H

LEGEND

DENOTES PIPING, EQUIP & INSTR. ADDED ON C-11110

DENOTES TIE-IN NUMBERS

Stearns-Roger INCORPORATED

DRAWING STATUS

APPROVED BY THE TEXAS CO. 6-24-77 TL-1273-B

6400-B

3B-GT8A TURBINE

J SR JOB Nº C-11110 DWG. Nº 2203 SHT. Nº 03-1-03 7-9-76

BECHTEL 10099 TEXACO EST. 3910

SYMBOLS

EXISTING
NEW
REMOVE
RE-LOCATE
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
4. PUSH BUTTON OR LOW PRESSURE DROP SIGNAL ACROSS THE SPENT CATALYST OR REGENERATOR CATALYST SLIDE VALVE WILL AUTOMATICALLY CLOSE VALVE TO EMERGENCY COOLER, CLOSE INLET VALVE TO RISER SHOWN IN DWG. 3-RA-4, OPEN EMERGENCY COOLER WATER SHUTOFF VALVE, CLOSE THE SLURRY RECYCLE CONTROL VALVE AND CLOSE RECYCLE GAS OIL TO SPRAYS AT STRC-13.

LINE IDENTIFICATION

1A - D - 432 - 6 - 113A - NI
TEXACO PLANT NUMBER | TEXACO SERVICE SYMBOL | SIZE | NUMBER | INSULATION REQUIREMENTS | TEXACO PIPING MATERIAL SERVICE SPECIFICATION

WA-TEX 000895

1	1/14/77	REVISED TO SHOW TIE-IN NO. 1A-D-432-6-113A-NI, 1B-SS-1-2-SS-97-10, 1A-SS-1-2-SS-97-10.			TL	
2	9/14/77	ADDED TIE-IN 3B-SO-6 & 3B-61 @ PUMP 3B-GT.			TL	
3	2-13-78	ADDED VALVE TAG NO. 607, ADDED INDICATOR SIGN WHERE APPLICABLE			TL	
4	4-26-78	REVISED PER DRAWING SRA-105 REV. 1			TL	
5	11-17-78	REVISED PER DRAWING 8-AA-105 - REV. 0			TL	
6	12-6-78	ISSUED FOR CONST.			TL	
7	4-4-79	UPGRADED TO SD STANDARD ISSUE FOR APPROVAL			TL	

SCALE: 1" = DESIGNED | DRAWN

BECHTEL HOUSTON

TEXACO INC. PUGET SOUND PLANT

PROCESS PIPING & INST DIAGRAM
FRACTIONATION SECTION
FLUID CATALYTIC CRACKING UNIT

BECHTEL 10099 | TEXACO EST. 3910 | 3-RA-5 | 18A

LEGEND

PIPING SYMBOLS

	GATE VALVE		HYDRANT TYPE VALVE
H.R.	FIRE HOSE RACK	D.F.	DRINKING FOUNTAIN
	UNDERGROUND PIPING		
W A S	UTILITY STATION W-WATER, A-AIR, S-STEAM	A	INSULATION, STEAM TRACED, CODE "A"

INSTRUMENT SYMBOLS

	LOCALLY MOUNTED		
	PNEUM. LINE & ELEC. CONN.		

INSTRUMENT IDENTIFICATION

PLANT NUMBER
STM 115 — INSTRUMENT IDENTIFICATION — INSTRUMENT NUMBER

LINE IDENTIFICATION

14"-SS-CW-1 — CCM-31A

- PIPING SPEC. (BECHTEL)
- LINE SERIAL NUMBER
- T.CO. SERVICE DESIGNATION
- PLANT LETTER (T.CO.)
- PLANT NUMBER (BECHTEL)
- LINE SIZE

SERVICE DESIGNATION

CW	COOLING WATER
DW	DRINKING WATER
FW	FIRE WATER
W	SERVICE WATER

PIPING SPECIFICATION

JCM-31B	100# C.S., 1/8" CORR. ALLOWANCE
JDW-31B	125# T.R., C.S. GALV.
JFW-31B	150# R.F., C.S., 1/8" CORR. ALLOWANCE

○ DENOTES TIE-IN NUMBERS
DENOTES PIPING, EQUIPMENT+ INSTRUMENTS ADDED ON C-1111O.

REFERENCE DRAWINGS

PROCESS P&I.D. REACTOR & REGENERATION SECT. FCCU.	3-RA-2
PROCESS P&I.D. FRACTIONATION SECTION, FCCU.	3-RA-5
PROCESS P&I.D. WASTE WATER STRIPPING SECTION, FCCU	3-RA-6
PROCESS P&I.D. COMPRESSION SECTION, GAS RECOV. UNIT	6-RA-6
PROCESS P&I.D. ABSORPTION SECTION GAS RECOV. UNIT	6-RA-7
PROC. P&I.D. DISTILLATION & TREATING SECT. GAS RECOV. UNIT	6-RA-8
PROCESS P.&I.D. WASTE WATER TREATMENT SECTION, FCCU	3-AA-7
PROCESS P & I. D., CO. BOILER SECTION, FCCU	3-RA-13
PROCESS P&I.D. CATALYST STORAGE BIN, FCCU	3-RA-14
FIELD, FIRE DOMESTIC SERVICE & COOLING WATER SYS.	31-GA-1
FIRE PROTECTION OVERALL	99-RA-1

BECHTEL # 10095 TEXACO SET. 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-205 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

LINE IDENTIFICATION

△ 1A - Q - 432 - 6" - 313A - NI
- 1A: TEXACO PLANT NUMBER
- Q: TEXACO SERVICE SYMBOL
- 432: SIZE
- 6": NUMBER
- 313A: TEXACO PIPING MATERIAL SERVICE SPECIFICATION
- NI: INSULATION REQUIREMENTS

Stearns-Roger INCORPORATED

DRAWING STATUS

DRAWING	ISSUE NO.	DATE
DESIGN DEVELOPMENT	1	3/31/72
PRELIMINARY	-	
CONSTRUCTION	5	3/8/72
CONSTRUCTION	10	9/14/72
RECORD AS BUILT		

12	9/14/72	REVISED PER ESTIMATE ADDEC	TRM			
11	7/7/72	PER LIST OF REVISIONS, SEE DWG. 6-RA-11-3	RD			
10	6/6/72	PER LIST OF REVISIONS, SEE DWG. 3-RA-1	G.L.			
9	5/16/72	PER LIST OF REVISIONS, SEE DWG. 3-RA-1	EA			
8	4/24/72	PER LIST OF REVISIONS, SEE DWG. 3-RA-1	TC			
7	3/31/72	ISSUED FOR CONSTRUCTION	RP			
6	3/15/72	ISSUED FOR APPROVAL	J.L.S.			
No.	DATE	REVISIONS	BY	APP'D		

BECHTEL CORPORATION
SAN FRANCISCO

THE TEXAS COMPANY
PUGET SOUND WORKS

UTILITY PIPING & INSTRUMENT DIAGRAM
WATER SYSTEM
FCCU & GAS RECOVERY UNIT

BECHTEL	2525	3-RA-8	E

6400 B
APPROVED BY THE TEXAS CO. 7-11-72 7-27-72

12A	7/1/72	REVISED TIE-IN NO. ON EXIST. LINE 10-W-101				
11	6/7/72	REVISED PER DRAWING 3-AA-108 - REV. 0	1A			
10A	6/7/72	REVISED PER DRAWING 3-AA-108 - REV. 1	1A			
9A	5/16/72	REVISED PER DRAWING 3-AA-108 - REV. 0	EC			
8A	4/24/72	ISSUED FOR CONSTRUCTION	EC			
7A	3/31/72	INITIATED TO JOB AWARD ISSUED FOR APPROVAL	RP			
No.	Date	Revisions	By	Chk'd	Eng'r	Proj. Eng'r

SCALE: 1/2" | DESIGNED | DRAWN

BECHTEL
HOUSTON

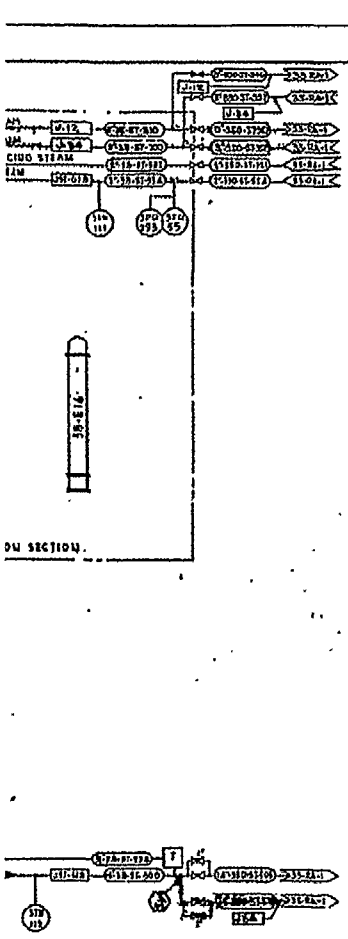
TEXACO INC.
PUGET SOUND PLANT

UTILITY PIPING & INSTRUMENT DIAGRAM
WATER SYSTEM
FCCU & GAS RECOVERY UNIT

BECHTEL	10095	3-RA-8	12A
TEXACO	3910		

S-R JOB No. C-1111O DWG No 62213 SHT. No 03-108 7-1-72

WA-TEX 000896



LEGEND

PIPING SYMBOLS

	GATE VALVE		UTILITY STATION 3-91R3H A-AIR HOSE(S)
	CHECK VALVE		BOURDON - STM. TRACED
	GLOBE VALVE		STEAM TRAP
	UNDERGROUND P		

INSTRUMENT SYMBOLS

	LOCAL MOUNTED		TRANSMITTER
	BOARD MOUNTED		BOARD TRANSMITTER
	PRESSURE LINE		
	CONTROL AIR LINE		

INSTRUMENT IDENTIFICATION

PLANT NUMBER
INSTRUMENT LOOP
INSTRUMENT NUMBER

LINE IDENTIFICATION

PIPING SPEC. (BECHTEL)
LINE SERIAL NUMBER
SERVICE DESIGNATION
PLANT LETTER (T.T.CO.)
PLANT NUMBER (BECHTEL)
LINE SIZE

SERVICE DESIGNATION

SS	STEAM, CONDENSATE
BF	BOILER FEEDWATER

PIPING SPECIFICATION

J8F-61B	600# R.F., C.S., 1/16" CORR. ALLOWANCE
J8T-61B	300# R.F., C.S., 1/16" CORR. ALLOWANCE
J8T-61A	150# R.F., C.S., 1/16" CORR. ALLOWANCE
J8T-81A	150# R.F., C.S., 1/16" CORR. ALLOWANCE
J8T-61B	300# R.F., C.S., 1/16" CORR. ALLOWANCE
J8T-81B	600# R.F., C.S., 1/16" CORR. ALLOWANCE
J8-51B	150# R.F.I.C.S. GATES, 1/16" CORR. ALLOWANCE

ITEM NUMBER

1005	300# C. I. FLGD. Y STRAINER 36 M.P.
1001	125# C. I. FLGD. EXHAUST HEAD
1101	150# FLGD BELLOWS TYPE EXPANSION JOINT.

NOTES

REFERENCE DRAWINGS

PROCESS P&I.D. REACTION & REGENERATION SECTION	3-RA-5
PROCESS P&I.D. FRACTIONATION SECTION,	3-RA-5
PROCESS P&I.D. WASTE WATER STRIPPING SECTION	3-RA-6
PROCESS P&I.D. COMPRESSION SECTION	3-RA-6
PROCESS P&I.D. ABSORPTION SECTION	3-RA-7
PROCESS P&I.D. DISTILLATION & TREATING SECTION	3-RA-8
PROCESS P&I.D. WASTE WATER TREATMENT SECT. FCCU	3-RA-7
UTILITY A&I.D. PLANT, INSTRUMENT & ZEOLITON AIR, FUEL OIL & GAS SYS.	3-RA-11
PROCESS P&I.D. CATALYST STORAGE SECT. FCCU	3-RA-15
PROCESS P&I.D., C.O. BOILER SECTION F.C.C.U.	3-RA-13
PRO. P. & I.D. INHIB. & DOCTOR SOLUTION SYS., GAS REC. UNIT	3-RA-9
P.&I.D. UTILITY DISTRIBUTION	33-RA-1
UTILITY P&I.D., B.D. & PURGE F.C.C.U. REC. UNIT	3-RA-10
LIST OF REVISIONS FOR THIS DRAWING	3-RA-23
P. & I. D. LUBE OIL & GLAND SEAL FOR MAIN AIR BLOWER 38-KJ	3-AA-21
P. & I. D. LUBE OIL & GLAND SEAL FOR COMPRESSOR 6D-KJA&B	3-AA-10

DENOTES TIE-IN NUMBERS

DENOTES PIPING, EQUIPMENT & INST'S ADDED ON C-1110

Stearns-Roger
INCORPORATED

4	12-23	REVISED PER ESTIMATE 24.006	DB		
3	7-19-68	PER LETTER REV. 5 ELEVATIONS, 3-RA-23-5			
2	7-11-68	PER LIST OF REVISIONS 5 ELEVATIONS 3-RA-23-2	JFA		
1	7-5-68	PER LIST OF REVISIONS 5 ELEVATIONS 3-RA-23-1	WAK		
0	6-28-68	ISSUED FOR CONSTRUCTION	SP		
1	6-19-68	ISSUED FOR APPROVAL	L.C.		

BECHTEL CORPORATION
SAN FRANCISCO

THE TEXAS COMPANY
PUGET SOUND WORKS

UTILITY PIPING & INSTRUMENT DIAGRAM
STEAM, CONDENSATE & BOILER FEED WATER
FCCU & GAS RECOVERY UNIT

BECHTEL 2525 3-RA-9 X

BECHTEL 10095 TEXACO REF. 8910

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 CEMS 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

3A-Q-422-3"-J13A-NI

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

4	7/11/68	REVISED PER ESTIMATE 24.006			
3	7/11/68	REVISED PER LETTER REV. 5 ELEVATIONS, 3-RA-23-5			
2	6-28-68	REVISED PER LIST OF REVISIONS 5 ELEVATIONS 3-RA-23-2			
1	6-28-68	REVISED PER LIST OF REVISIONS 5 ELEVATIONS 3-RA-23-1			
0	6-28-68	ADDED UTILITY STATIONS ADDED P.I.D. NO. 3-RA-109 - REV. 0			
1	6-28-68	REVISED PER DRAWING 3-RA-109 - REV. 0			
0	6-28-68	ISSUED FOR CONSTRUCTION			
1	6-19-68	REVISED TO ADD ALKARD ISSUE FOR APPROVAL			

SCALE NONE — DRAWING

BECHTEL
HOUSTON

TEXACO INC.
PUGET SOUND PLANT

UTILITY PIPING & INST DIAGRAM
STM. COND. & BOILER FEED WATER
FCCU & GAS RECOVERY UNIT

BECHTEL 10095 TEXACO REF. 8910 3-RA-9 2A

DRAWING STATUS

DRAWING	ISSUED	DATE
DEVELOPMENT		
ESTIMATE		
CONSTRUCTION	0	6-28-68
AS BUILT		

APPROVED FOR CONSTRUCTION

6400 C
APPROVED BY THE TEXAS CO. TX-1910 7-10-68

TAIL "2"

S-R JOB Nº C-1110 DWG Nº 22213 SHT Nº 03-1-08

WA-TEX 000897

LEGEND

PIPING SYMBOLS

—⋈—	GATE VALVE		
—N—	CHECK VALVE		
—Y—	SPECTACLE BLIND		
F.O.	FLUSHING OIL CONNECTION		

INSTRUMENT SYMBOLS

◯	LOCAL MOUNTED	⊗	TRANSMITTER
⊖	BOARD MOUNTED		

INSTRUMENT IDENTIFICATION

(FPI) — FPI: PLANT NO. / INSTRUMENT IDENTIFICATION / INSTRUMENT NO.

LINE IDENTIFICATION

(6")1B-O-118-GI-112

- 112 — PIPING SPECIFICATION
- GI — LINE SERIAL NO.
- O — T.T.CO. SERVICE DESIGNATION
- 1B — PLANT LETTER (T.T.CO.)
- 118 — PLANT NO. (BECHTEL)
- (6") — LINE SIZE

SERVICE DESIGNATION

O	HYDROCARBONS, LIQUID OR VAPOR ; FUEL GAS
OV	OIL OR VAPOR - CATALYST PRESENT
ST	STEAM & CONDENSATE, FEED WATER
W	SERVICE WATER

PIPING SPECIFICATION

J0-31B	150# R.F. GATES C.S. 1/16" CORR. ALLOW.
J0-11B	300# R.F. GATES, C.S. 1/8" CORR. ALLOW.
J0-61B	150# R.F. GATES, C.S. 1/4" CORR. ALLOW.
J0Y-61B	300# S.W. GATES, 1/8" CORR. ALLOWANCE
J0-99B	150# R.J. GATES, C.S. 1/16" CORR. ALLOW.

ITEM NUMBERS

GIB	300# FLGD. C.S. GATE VALVES, RING JOINT
GIB-ST	300# FLGD. C.S. GATE VALVES, RING JOINT, WITH FLUSHING OIL CONN.
GIT	300# FLGD C.S. GATE VALVES W/ A.P.I. 600-1 TRIM
1981	300# FLGD "Y" STRAINER, 3/16" M.P.
1901	150# FLGD. SWIVEL TYPE EXPANSION JOINT 7/16" M.P.

NOTES

1. ○ DENOTES TIE-IN NUMBERS
2. * DENOTES PIPING, EQUIPMENT & INSTRUMENTS ADDED ON C-1111O

FROM WASTE WATER STRIPPERS AREA "2

REFERENCE DRAWINGS

PROCESS P.&I.D. FRACT. SECT. FLUID CATALYTIC CRACKING UNIT	3-RA-8
PROCESS P.&I.D. WASTE WATER STRIPPING SECT. FCCU	3-RA-G
UTILITY P.&I.D. PLANT AIR & FLUE GAS FUEL OIL & GAS, FCC UNIT	3-RA-11
PROCESS P.&I.D. COMPOSITION SECT. GAS RECOVERY UNIT	4-RA-6
PROCESS P.&I.D. ABSORPTION SECT. GAS RECOVERY UNIT	4-RA-7
PROCESS P.&I.D. DIST. & TREATING SECT. GAS RECOVERY UNIT	4-RA-8
PROC. P.&I.D. AMINE & DOCTOR SOLN. SYS. GAS, RECOVERY UNIT	4-RA-9
PROCESS FLOW DIAG. BLOWDOWN SYS.	19-RA-E
P.&I.D. FLANGES & INTERCONNECTING LINES SHEET NO. 9	51-RA-5

BECHTEL 10095 — TEXACO EST. 3910

SYMBOLS

- EXISTING
- NEW
- REMOVE
- RELOCATE
- NOT USED

△ 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

△

LINE IDENTIFICATION

1A-O-422-8"-J12A-NI

- 1A — TEXACO PLANT NUMBER
- O — TEXACO SERVICE SYMBOL
- 422 — LINE NUMBER
- 8" — SIZE
- J12A — TEXACO PIPING MATERIAL SERVICE SPECIFICATION
- NI — INSULATION REQUIREMENTS

10/4/73

△	12/3/73	REVISED PER EST. 34000, REF DR. 10-5778	RA						
△	5/23/73	REVISED PER ESTIMATE 34000	PBW						
△	7/1/58	FOR LIST OF REV. SEE DWG 3-RA-12-2	DEB						
△	4/18/58	FOR LIST OF REV. SEE DWG 3-RA-12-1	GL						
△	7/20/57	ISSUED FOR CONSTRUCTION	GL						
△	6-10-57	ISSUED FOR APPROVAL	SP						
No.	DATE	REVISIONS	BY	CHKD	APPD	ENGR	SUPV	PROJ	MGR

△	4/1/74	RELOCATED TIE-IN 38-52							
△	10/1/73	ADDED LIQUID OR 7-8, 36-4, 40-4 LINE NE 30-O-128-1J15W/P3910	JAW						
No.	DATE	REVISIONS	BY	CHKD	APPD	ENGR	SUPV	PROJ	MGR

DRAWING STATUS

DRAWING	ISSUE NO.	DATE
DEVELOPMENT	1	6/5/57
PRELIMINARY	3	10/4/57
APPROVED FOR CONSTRUCTION		

Stearns-Roger INCORPORATED

6400 B — APPROVED BY THE TEXAS CO. 7-15-57 — 7-15-57

BECHTEL CORPORATION
SAN FRANCISCO

THE TEXAS COMPANY
PUGET SOUND WORKS

UTILITY PIPING & INSTRUMENT DIAGRAM
BLOWDOWN, PUMPOUT & EMERGENCY COOLING
FLUID CATALYTIC CRACKING UNIT

BECHTEL — JOB NO. 2525 — DRAWING NO. 3-RA-10 — REV. 5

BECHTEL
HOUSTON

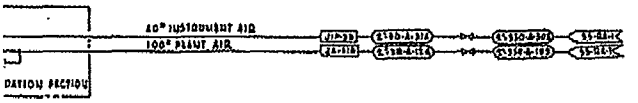
TEXACO INC.
PUGET SOUND PLANT

UTILITY PIPING & INSTRUMENT DIAGRAM
BLOWDOWN, PUMPOUT, & EMERGENCY COOLING
FLUID CATALYTIC CRACKING UNIT

BECHTEL — 10095 — TEXACO EST. — 3910 — 3-RA-10 — 7A

S-R JOB No. C-1110 DWG. NO. 22218 SHT. NO. 03-1-10, 2/25/58

WA-TEX 000898



LEGEND

PIPING SYMBOLS

	GATE VALVE		SPECTACLE BLIND OPERATING
	SPECTACLE BLIND		INSULATION + STM. TRACED
	CHECK VALVE		PLUG VALVE
	SAFETY VALVE	W S A	UTILITY STATION WATER, STEAM, AIR

INSTRUMENT SYMBOLS

	LOCAL MOUNTED		TRANSMITTER
	BOARD MOUNTED		COMBINATION SERVICE
	PNEUM. LINE & SWITCH-2 DIAM.		
	INSTR. ELECTRICAL SIGS		

INSTRUMENT IDENTIFICATION

PLANT NUMBER
INSTRUMENT IDENTIFICATION
INSTRUMENT NUMBER

LINE IDENTIFICATION

PIPING SPECIFICATION
LINE SERIAL NUMBER
TEXAS CO. SERVICE DESIGNATION
PLANT LETTER (T.T.CO.)
PLANT NUMBER (BECHTEL)
LINE SIZE

SERVICE DESIGNATION

A	PLANT AIR, INSTRUMENT AIR & AERATION AIR.
O	FUEL OIL & FUEL GAS

PIPING SPECIFICATION

J0-31B	125# NOM. RATING. 1/8" CORR. ALLOW.
J0-30B	150# R.F. STL. CORR. ALLOW.
J0-63B	150# R.F. COCKS. 1/8" CORR. ALLOW.
J0-61B	300# R.F. GATES. 1/8 CORR. ALLOW.
JP-1B	125# NOM. RATING

ITEM NUMBERS

896	125# C.I. FLG'D. 45° HORIZONTAL SWING CHECK VALVE WITH RENEWABLE SEAT OF 316 STAINLESS, BARRELESS
619	300# FLG'D. C.S. GATE VALVE, 1/16" RF.
694	125# FLG'D. I.B.B.T. GATE VALVE

⬡ DENOTES TIE-IN NUMBER
* DENOTES PIPING, EQUIPMENT & INSTRUMENTS ADDED ON C-1111O.

REFERENCE DRAWINGS

PROCESS P & I.D., REACTOR & REGENERATION SECT., F.C.C.U.	3-RA-2
UTILITY P & I.D., WATER SYSTEM F.C.C.U.	3-RA-8
UTILITY P & I.D., STM. COND. & BOILER FEED WATER F.C.C.U.	3-RA-9
UTILITY P & I.D., BLOWDOWN & PUMPOUT F.C.C.U.	3-RA-10
PROCESS P. & I.D.-GAS STORAGE SECT. F.C.C.U. GAS REC. UNIT	3-RA-12
PROCESS P & I.D.-C.O. BOILER SECTION, F.C.C.U.	3-RA-13
PHOENIX P & I.D. WASTE WATER TREATMENT SECT. F.C.C.U.	3-RA-7
LIST OF REVISIONS TO THIS DRAWING	3-RA-11
PROCESS P. & I.D., DISTILLATION & TREATING SECT. GAS REC. UNIT	3-RA-8
P. & I.D. TANKAGE & INTERCONNECTING LINES	3-RA-5
UTILITY DISTRIBUTION	3-RA-1

A	5/8/72	REVISED PER ESTIMATE 3400C	TRW				
A	7/11/72	FOR LIST OF REVISIONS SEE DWG 3-RA-11	RAD				
A	7/24/72	FOR LIST OF REVISION SEE DWG 3-RA-11-2	O.L.				
A	7/31/72	FOR LIST OF REVISIONS, SEE DWG. 3-RA-11-1	WLL				
A	7/31/72	For List of Revised Sht. Nos. & Revisions					
A	7/31/72	ISSUED FOR CONSTRUCTION FOR LIST OF	GAL				
A	8/11/72	ISSUED FOR APPROVAL	SP				

Stearns-Roger Incorporated

DRAWING STATUS

DRAWING	ISSUE	DATE
DETAILED PRINTS		
REVISED PRINTS		
AS-BUILT PRINTS		
APPROVED FOR CONSTRUCTION		
ISSUED FOR CONSTRUCTION		

6400 B
APPROVED BY THE TEXAS CO. 7-24-72

BECHTEL CORPORATION
SAN FRANCISCO

THE TEXAS COMPANY
PUGET SOUND WORKS

UTILITY PIPING & INSTRUMENT DIAGRAM
PLANT, INSTRUMENT & AERATION AIR, FUEL OIL & GAS
FCCU & GAS RECOVERY UNIT

BECHTEL 2525 | 3-RA-11 X

BECHTEL - 10095 TEXACO EST. 3910

SYMBOLS

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 ORMS 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

LINE IDENTIFICATION

1A - O - 422 - 6" - 112A - NI

1A — TEXACO PLANT NUMBER
O — TEXACO SERVICE SYMBOL
422 — SIZE NUMBER
6" — SIZE
112A — TEXACO PIPING MATERIAL SERVICE SPECIFICATION
NI — INSULATION REQUIREMENTS

WA-TEX 000899

A	9/6/72	REVISED SPEC. ON LINES 38-O-1134-6"-E3D					
A	8-8-72	ADDED BLOCK VALVE SPEC. E3D OF 11"-W 38-18, CHGD "A" COMPLETION					
A	7/24/72	REVISED PIP DRAWING RAA-111 REV. O					
A	7/14/72	ISSUED FOR CONSTRUCTION					
A	7/11/72	UPDATED TO AS-BUILT 10-18 FOR APPROVAL					

SCALE NONE | MICRO

BECHTEL HOUSTON

TEXACO INC. PUGET SOUND PLANT

UTILITY PIPING & INST DIAGRAM
PLT. INST & AERATION AIR, FUEL OIL & GAS
FCCU & GAS RECOVERY UNIT

BECHTEL - 10095 | TEXACO EST. 3910 | 3-RA-11 | 11A

S-R JOB No. C-1111O DWG. No. 22218 SHT. No. 03-1-11. 8/15/72

EQUIPMENT LIST PLANT 3

3B-C1	FRACTIONATOR
3B-C2	OVERHEAD ACCUMULATOR
3B-C3	AIR SURGE DRUM
3B-C4	PRODUCT STRIPPER
3B-C5	CONDENSATE FLASH DRUM
3B-C6	HOT CATALYST STORAGE HOPPER
3B-C7	FRESH CATALYST STORAGE HOPPER
3B-C8	WASTE WATER SURGE DRUM
3B-C9	WASTE WATER STRIPPER
3B-C10	AIR WATER CONTACT TOWER
3B-C11	AIR WATER SEPARATOR
3B-C12	CATALYST FINES HOPPER
3B-C14	REACTOR
3B-C15	REGENERATOR
3B-C16	FUEL GAS KNOCKOUT DRUM
3B-C17	INT. BOILER BLOWDOWN DRUM
3B-C18	CONT. BOILER BLOWDOWN DRUM
3B-C19	BLOWDOWN DRUM
3B-C20	SEAL TANK
3B-C21	BY PASS SEAL TANK
(SEE BELOW FOR "C" NO. CONT'N)	
3B-D1	CONDENSATE STORAGE
3B-D2	PHOSPHATE MIXING
3B-D3	COMPRESSOR LUBE OIL MAKEUP
3B-E1 A-K	FRACT. OVERHEAD CONDENSERS
3B-E2	INTERMEDIATE REFLUX STM. GEN'R.
3B-E3	SLURRY QUENCH STM. GEN'R.
3B-E4	FRESH FEED LGO EXCHANGER
3B-E5 A/B	FRESH FEED PREHEATER
3B-E6 A/B	LIGHT GAS OIL COOLER
3B-E7	INTERMEDIATE GAS OIL COOLER
3B-E8	IGO - BFW EXCHANGER
3B-E9	FRACTIONATOR BOTTOMS COOLER
3B-E10	SURFACE CONDENSER (AIR BLOWER TURBINE)
3B-E11	FRACT. BTMS. - BFW EXCHANGER
3B-E12	WASTEWATER FEED BTMS. EXCHANGER
3B-E13	W.W. STRIPPER REFLUX COOLER
3B-E14 A/B	WASTEWATER COOLER
3B-E15	EMERGENCY COOLING COIL
3B-E16 & 16A	LUBE OIL COOLERS (3B-KT4 & 3B-KT4A)
3B-E18 A/B	LUBE OIL COOLERS (3B-K1)
3B-E17 A/B	LUBE OIL COOLERS (3B-K2)
3B-F1	AIR HEATER
3B-F2	CO BOILER
3B-G50	FRESH FEED
3B-G50A	COMMON SPARE (3B-G50 & 3B-G6)
3B-G2 & 2A	FRACT. O/HD. REFLUX & SPARE
3B-G3 & 3A	SLURRY QUENCH & SPARE
3B-G4 & 4A	INTERMEDIATE REFLUX & SPARE
3B-G5	LIGHT GAS OIL
3B-G5A	COMMON SPARE (3B-G5 & 3B-G7)
3B-G6	RECYCLE GAS OIL
3B-G7	INTERMEDIATE GAS OIL PRODUCT
3B-G8 & 8A	FRACT. BOTTOMS PROD. & SPARE
3B-G9 & 9A	SOUR WATER & SPARE
3B-G10 & 10A	MAIN AIR BLOWER TURB. COND. & SPARE
3B-G11	WASTE WATER STRIPPER FEED
3B-G11A	COMMON SPARE (3B-G11 & 3B-G14)
3B-G13 & 13A	WASTE WATER STRIPPER BOTTOMS & SPARE
3B-G14	WASTE WATER STRIPPER REFLUX
3B-G15 & 15A	[illegible] WATER & SPARE
3B-G16	SLOP OIL
3B-G17	FCCU (BLOWDOWN) PUMPOUT
3B-G18	PHOSPHATE INJECTION
3B-G19	PHOSPHATE INJECTION
3B-G20	PHOSPHATE INJECTION
3B-G21 & 21A	LUBE OIL (3B-KT4 & 3B-KT4A)
3B-G22 & 22A	LUBE OIL & SPARE (3B-K1)
3B-G23 & 23A	LUBE OIL & SPARE (3B-K2)
3B-G24	CO BOILER WASH WATER
3B-G25	CONDENSATE RETURN
3B-G27	SOUR GAS. K.O. DRUM PUMPOUT
3B-H1	AIR EJECTORS & CONDENSERS
3B-K1	MAIN AIR BLOWER
3B-K2	LIFT AIR BLOWER
3B-K4 & 4A	FORCED DRAFT FAN & SPARE
3B-T1	ELEVATOR (F.C.C. STRUCTURE)
3B-C22	JOHNSON ELECTRAP
3B-C23	FCCU HOT CHARGE DRUM
3B-C24	4B-K1A K.O. POT
3B-C25	SOUR GAS K.O. DRUM

EQUIPMENT LIST PLANT 4

4B-C1	ABSORBER DE-ETHANIZER
4B-C2	SPONGE COLUMN
4B-C3	DEBUTANIZER COLUMN
4B-C4	SPLITTER COLUMN
4B-C5	STEAM CONDENSATE DRUM
4B-C6	INTERSTAGE SEPARATOR
4B-C7	2ND STAGE SEPARATOR
4B-C8	WATER DRAW OFF POT
4B-C9	DEBUTANIZER OVERHEAD ACCUMULATOR
4B-C10	SPLITTER OVERHEAD ACCUMULATOR
4B-C11	HEAVY FCC GASO CAUSTIC TREATER
4B-C12	LIGHT FCC GASO CAUSTIC TREATER
4B-C13	GUM INHIBITOR DRUM
4B-C14	CORROSION INHIBITOR DRUM
4B-C15	JOHNSON ELECTRAP
4B-C16	4B-K1B K.O. POT
4B-D1	DOCTOR SOLUTION MIXING TANK
4B-E1	GAS COMPRESSOR INTERCOOLER
4B-E2	GAS COMPRESSOR AFTERCOOLER
4B-E3 A&B	ABSORPTION OIL COOLER
4B-E4	ABS. DE-ETHANIZER 1ST INTERCOOLER
4B-E7	LIGHT FCC GASOLINE PRECOOLER
4B-E8	ABS-DE-ETHANIZER OIL REBOILER
4B-E9	ABS DE-ETHANIZER STEAM REBOILER
4B-E10 A&B	DEBUTANIZER OVERHEAD CONDENSER
4B-E11	DEBUTANIZER REBOILER
4B-E12	GASO SPLITTER O.H. CONDENSER (LIGHT)
4B-E13	GASO SPLITTER REBOILERS
4B-E14	HEAVY FCC GASO COOLER
4B-E15	LIGHT FCC GASO COOLER
4B-E16	SURFACE COND. GAS COMP TURB.
4B-E17	INHIBITOR DRUM HEATER
4B-E18	HEAVY FCC GASOLINE AFTER COOLER
4B-E19 A&B	LUBE OIL COOLERS (4B-K1 A&B)
4B-E50	SPLITTER FEED-BOTTOMS EXCHANGER
4B-E51	SPLITTER [illegible]
4B-G50 & 50A	ABSORPTION OIL CHARGE PUMP & SPARE
4B-G4 & 4A	INTERSTAGE SEPARATOR LIQUID & SPARE
4B-G5 & 5A	2ND STAGE SEPARATOR LIQUID & SPARE
4B-G6 & 6A	LEAN SPONGE OIL & SPARE
4B-G7	ABS. DEETH. 1ST INTERCOOLER CIRC.
4B-G7A	COMMON SPARE FOR G7 & G8
4B-G8	ABS. DEETH. 2ND INTERCOOLER CIRC.
4B-G9 & 9A	ABS. DEETH. REBOILER & SPARE
4B-G10	RECIRCULATED LEAN OIL
4B-G11	DEBUTANIZER PROD
4B-G11A	COMMON SPARE FOR G10 & G11
4B-G12	SPLITTER BOTTOMS
4B-G50A	COMMON SPARE FOR G12 & G-50
4B-G50	SPLITTER REFLUX & PRODUCT
4B-G14	No 1 CAUSTIC CIRCULATING
4B-G15	No 2 CAUSTIC CIRCULATING
4B-G18	INHIBITOR BLEND INJECTION (PROPORT.)
4B-G19	INHIBITOR CIRCULATING
4B-G20 & 20A	COMPRESSOR TURB. COND. & SPARE
4B-G21 & 21A	DEBUTANIZER REFLUX & SPARE
4B-G22	CORROSION INHIBITOR INJECTION
4B-G23	CORROSION INHIBITOR INJECTION
4B-G24	DOCTOR SOLUTION INJECTION
4B-G25	No 3 CAUSTIC CIRCULATING
4B-G26	No 4 CAUSTIC CIRCULATING
4B-G27 & 27A	LUBE OIL (4B-K1A & B)
4B-G28	WATER INJECTION (TO 4B-E2)
4B-H1	AIR EJECTORS & CONDENSERS
4B-K1A	1ST. STAGE GAS COMPRESSOR
4B-K1B	2ND. STAGE GAS COMPRESSOR
4B-K2	FREON REFRIGERATION SYSTEM
4B-KE2A	ABSORPTION OIL CHILLER
4B-KE2B	BUTANE REFRIGERANT CONDENSER

NOTE: ALL HORIZONTAL VESSELS ARE LOCATED TO SEAM-LINE AT ℄ OF VESSEL

SCALE IN FEET. 0 5 10 20 30 40 50

Revision notes

- ADDED LOCATING DIMENSIONS FOR 3B-G24, 3B-D1, 3B-K4A, [illegible] AT 3B-G16, STARTER RACK, 4B-G5, 4B-G5A, 4B-G4, 4B-G4A, 4B-G6, 4B-G18, 4B-G19, 4B-G22, 4B-G23 & 4B-G21A, RELOCATED [illegible]. ADDED 4B-G6A
- ADDED LOCATION OF EQUIPMENT IN COMPRESSOR HOUSE & 3B-E12, 3B-E8, 3B-E9, 3B-E11, 4B-C16, 4B-C14, 4B-D1 & 4B-E17 & PANEL AT 3B-F2. LOCATED PUMPS AS INDICATED. RELOCATED PUMPS 3B-G24, 3B-G25, 3B-G4, 3B-G4A & PANEL AT 4B-K2
- ADDED [illegible] 3B-T1. 3B-G20 WAS 3B-G19A. RELOCATED PIPE SUPPORT COLUMN AT 3B-E13. RELOCATED 3B-C16, C17, C18, D2 & PIPEWAY. LOCATED PUMPS AS NOTED. 4B-KE2A & B WERE 4B-E6 & 4B-E5. CHGD. DESCRIPTION 4B-E14, 15, 23 & 26.
- ADDED HOLD ON 3B-D1, 3B-C5, 3B-C16, 3B-C18, 3B-G17, 3B-D2, 3B-G18, 3B-G19 & 3B-G19A. RELOCATED EQUIPMENT AS FOLLOWS: 3B-E5, 4B-E3A, 4B-E3B, 4B-E4, 4B-E5, 4B-K2, 4B-G23, 4B-C10, 4B-E14, 4B-C11 & 4B-C12. ADDED 3B-D3, 4B-E18, 4B-G26 & 4B-D1. SWITCHRACK RELOCATED (CHANGED TO STARTER RACK)
- RELOCATED SWITCHRACK AT COMP. HOUSE, [illegible] [illegible]

	9/11/58	ADDED CO PANEL WEST OF 3-C12, CHG'D. [illegible]	B.C.					
		REVISED EQUIPMENT LIST (BATTERY LIMITS AT 3B-E10 (1). ADDED DIM'S AT 3B-G16 & STARTER RACK.						
		SEE REVISION NOTE AT LEFT.	J.L.F.					
		SEE REVISION NOTE AT LEFT.						
		SEE REVISION NOTE AT LEFT.						
		SEE REVISION NOTE AT LEFT.						
		SEE REVISION NOTE AT LEFT.						
		FOR REVISION NOTES SEE DWG. 3-RA-14						
		WAS DWG 3-RA-014 ISSUED FOR CONSTRUCTION						
No.	DATE	REVISIONS						

SCALE 1"=40'-0" | DRAWN | RICHARD W. MARTIN

DISTRIBUTION

6400 B

APPROVED BY THE TEXAS CO.

BECHTEL CORPORATION
SAN FRANCISCO

THE TEXAS COMPANY
PUGET SOUND WORKS

PLOT PLAN
FLUID CAT CRACKER & GAS RECOVERY UNIT

JOB No. 2525 | DRAWING No. 3-RA-14

		LOCATED PUMPS						
		ISSUED FOR CONSTRUCTION						
		UPDATED TO JOB AWARD ISSUED FOR APPROVAL						
No.	Date	Revisions	By	Chk				

SCALE | DESIGNED | DRAWN

BECHTEL
HOUSTON

TEXACO INC.
PUGET SOUND PLANT

PLOT PLAN
FLUID CAT CRACKER & GAS RECOVERY UNIT

BECHTEL - 10095 | TEXACO - 3910 | 3-RA-14 | 16A

WA-TEX 000900

NOTES.

1. THIS FC (NEW) CONTROLS TOTAL FLOW BY RESETTING INDIVIDUAL HEATER COIL FLOW CONTROLLERS (NEW)
2. NORMAL OPERATION WITH 250 B/H ICGO RECYCLE AND NO HCGO RECYCLE. ALTERNATE CASE WITH 250 B/H HCGO RECYCLE AND NO ICGO RECYCLE.
3. PUSHBUTTON OR LOW PRESSURE DROP SIGNAL ACROSS THE SPENT OR REGENERATED CATALYST SLIDE VALVE AUTOMATICALLY OPENS VALVES IN LINES TO EMERGENCY COOLER AND CLOSES INLET VALVE TO RISER. THE EXISTING VALVE AT THE RISER WILL BE RELOCATED AS THE EMERGENCY COOLER VALVE AND A NEW VALVE WILL BE INSTALLED AT THE RISER.
4. NORMAL OPERATION- HOT FEED FROM CRUDE AND DEASPHALTING UNITS. ALTERNATE OPERATION- COLD FEED FROM STORAGE.
5. STREAM 7 PROPERTIES ARE FROM TEXACO TEST RUN.
6. STREAM 8 PROPERTIES ARE FROM TEXACO'S NEW DESIGN.

SERVICE WATER

TO STORAGE

OR P&CL 14A & B

TO FEED RISER

TO LIGHT GAS OIL PRODUCT COOLERS

TO FRACTIONATOR

HCGO TO GAS RECOVERY UNIT REBOILERS

SYMBOLS

- EXISTING
- NEW
- REMOVE
- RELOCATE
- NOT USED DO NOT REMOVE
- REPLACE

TEXACO INC.
ENGINEERING DEPARTMENT
HOUSTON, TEXAS

PROCESS FLOW DIAGRAM FCC UNIT REACTOR FEED HEAT AND EMERGENCY COOLING

BY	DATE	ESTIMATE	B. M.	BY	DATE	DESCRIPTION	SYMBOL
				AAK	9/28/72	ISSUED FOR ESTIMATE ALSO FOR CHANGE EXPLOSION-BID	0
APPROVED		JOB		REVISIONS			

INITIALS	DATES STARTED	DATES FINISHED
DRAWN BY	RWD	
CHECKED BY		
TRACED BY		
CHECKED AND RELEASED		

SCALE:

NUMBER ASSIGNED AND TRACING RECORD ENTERED — DATE

3-RA-40 0

WA-TEX 000901

PIPING SYMBOLS

- GATE VALVE (SEE NOTE 2)
- GLOBE VALVE
- CHECK VALVE
- BUTTERFLY VALVE
- ANGLE VALVE
- PRESSURE SAFETY VALVE
- BALL VALVE (3A)
- PRIMARY PROCESS LINE
- SECONDARY PROCESS OR UTILITY LINE
- PNEUMATIC INSTRUMENT LINE
- ELECTRIC INSTRUMENT LINE
- "Y" TYPE STRAINER
- CONE TYPE STRAINER
- HOSE CONNECTION
- SHUTDOWN SLIP OR MAINTENANCE BLIND
- OPERATIONAL OR SPECTACLE BLIND
- OPEN DRAIN HUB

FOR COMPLETE LIST OF INSTRUMENT SYMBOLS, REFER TO TEXACO STANDARD DRAWINGS: 15-1789, 15-1790 AND 15-1791

Notes

20. 3B-9-218
3B-[illegible]-237
3B-[illegible]T-1
3B-[illegible]T-2
3B-ST-12
3B-[illegible]T-56
3B-[illegible]T-64
3B-MISC-114

UTILITY LEGEND

AP	PLANT AIR
AS	STARTING AIR
DOW	SEWER - OILY WATER
Gf	GAS REFINERY FUEL
Ig	INSTRUMENT AIR SUPPLY
Of	OIL FUEL
Rf	TO FLARE DRUM
S250	250# STEAM
S40	40# STEAM
Sc250	250" STEAM CONDENSATE
Wy	WATER - SERVICE

NOTES

1. LOCATE TOGETHER.
2. FOR HEATER DECOKING SEE DETAIL "X"
3. PUSH BUTTON OR LOW PRESSURE DROP SIGNAL ACCROSS THE SPENT CATALYST OR REGENERATOR CATALYST SLIDE VALVE WILL AUTOMATICALLY OPEN VALVE TO EMERGENCY COOLER, CLOSE INLET VALVE TO RISER SHOWN ON DWG. 3-RA-4, OPEN EMERGENCY COOLER WATER SHUTOFF VALVE, CLOSE THE SLURRY RECYCLE CONTROL VALVE AND CLOSE RECYCLE GAS OIL TO 3B-FB AT 3FRC-11.
4. RELOCATE EXISTING FCC RISER INLET VALVE 3Pd CL 14VB AS CLOSE TO TEE AS POSSIBLE. PIPE FROM TEE TO VALVE TO BE 9 CR
5. CAN USE EXISTING TURBINE 3B-GTIA
6. ADJUSTABLE ORIFICE IN PNEUMATIC LINE TO EFFECT SLOW OPENING AND CLOSING OF VALVE 3Pd CL 14V-M.
7. ANGLE OF INTERSECTION SHOULD BE 45° OR LESS
8. REPLACE EXISTING FCC INLET PIPING WITH 9CR PIPE
9. (3A)
10. 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 & INSULATED
    - NI - NO INSULATION
11. UNLESS OTHERWISE SPECIFIED, THE VALVE SELECTION SHALL BE BY THE CONTRACTOR GEMS.
12. REFER TO GEMS J-10, PARA. 513 FOR TEXACO'S PHILOSOPHY WITH REGARDS TO BLINDS TO BE SUPPLIED BY THE CONTRACTOR. PARTICULAR ATTENTION SHOULD BE GIVEN TO THE MODIFICATION OF PARA. 513.1 WHICH COVERS SHUTDOWN BLINDS.
13. RELIEF VALVES 3-PSV-7485 REQUIRE "P" SIZE ORIFICE
14. TRANSFER LINE PRESSURE DROP MUST BE CHECKED BY CONTRACTOR AFTER HEATER SELECTION HAS BEEN MADE

TEXACO INC.
ENGINEERING DEPARTMENT
HOUSTON, TEXAS

ENGINEERING FLOW DIAGRAM
FEED PREHEAT
FLUID CATALYTIC CRACKING UNIT

INITIALS	DATES (STARTED / FINISHED)	SCALE: NONE
DRAWN BY	HJH	NUMBER ASSIGNED AND TRACING RECORD ENTERED — DATE
TRACED BY		
CHECKED BY		
TRACING CHKD		3-RA-41
APPROVED		

NO.	BY	DATE	DESCRIPTION	SYMBOL
[illegible]	AJK	3/1/72	ISSUED FOR ESTIMATE SHUTDOWN - EXPANSION - RIP	8

REVISIONS

BECHTEL - 10095 TEXACO EST. - 3910

SYMBOLS

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

NOTES

15. REVISIONS OF MAJOR SYSTEMS ARE DESIGNATED BY THE SYMBOLS SHOWN ABOVE. MINOR REVISIONS ARE CIRCLED AND INCLUDE A TRIANGULAR REVISION MARK.
16. PIPING SERVICE SPECIFICATIONS FOR NEW LINES ARE IN ACCORDANCE WITH GEMS J-208 TABLE 7.
17. 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

(3A) (1A)

LINE IDENTIFICATION

1A - Q - 432 - 4" - J13A - NI

- 1A — TEXACO PLANT NUMBER
- Q — TEXACO SERVICE SYMBOL
- 432 — SIZE NUMBER
- 4" — SIZE
- J13A — TEXACO PIPING MATERIAL SERVICE SPECIFICATION
- NI — INSULATION REQUIREMENTS (3A)

NO.	DATE	REVISIONS	BY	CHKD	ENGR. APPR.	PROJ. ENGR.	APPR.
11A	1/8/73	REVISED INSUL. THICKNESS ON LINES PER NOTE 20				TR	
10A	12-18-72	ADDED "ST" TO LINES 48-D-250 THRU 254; REVISED SPEC				TR	
9A	11/1/72	ADDED INST. NO. 3HIC-145 PER LETTER WBH-101-10/31/72				TR	
8A	11/8/72	CHANGED 3PSOV-14V-K TO BOARD MOUNTED				TR	
7A	11/1/72	ADDED 3HIC-14VB PER WBH-263 9-14-72				TR	
6A	11/1/72	REVISED PER DWG 3-AA-141 REV. 3A				TR	
5A	6/6/72	REVISED PER DWG 3-AA-141 REV. 2A				TR	
4A	5/10/72	REVISED PER DWG 3-AA-141 REV. 1	HJ			TR	
3A	2-23-72	REVISED PER DRAWING 3-AA-141 - REV. 0	TSC				
2A	12/1/71	ISSUED FOR CONSTRUCTION	TSC			TR	
1A	10/1/71	UPDATED TO JOB AWARD ISSUED FOR APPROVAL	TSC				
11A		ADDED LINE 3B-D-2201-3"-H TO FLOW TEST TO TIE IN @ HOT CHAMBER DOWN 2B-23B PER CLIENT LETTER WBH-18-10-6-72	WB			TR	

SCALE NONE | DESIGNED | DRAWN

BECHTEL
HOUSTON

TEXACO INC.
PUGET SOUND PLANT

PROCESS PIPING & INST. DIAGRAM
FEED PREHEAT
FLUID CATALYTIC CRACKING UNIT

Job No.	Dwg. No.	Rev.
BECHTEL - 10095	3-RA-41	11A
TEXACO EST. - 3910		

WA-TEX 000902

EQUIPMENT LIST

38-E40	EMERGENCY COOLER
38-F3	REACTOR CHARGE HEATER
38-C40	QUENCH DRUM

WA-TEX 000903

No.	Date	Revisions	By	Chkd.	Dsgn. Engr.	Engr.	Proj. Engr.	Appr.
5	7/4/73	LOCATED ANALYZER BLDG.	FVH	FLB				
4	7-20-73	ADDED PIPE SUPPORT COLS. P3-B,C,74A	FVH	GLB				
3	6-11-73	LOCATED ANALYZER HOUSE, CHANGED DWGS & INTERLOCK COLUMNS & ELEVATIONS	JF	FVH				
2	1/22/73	ISSUED FOR CONSTRUCTION PER TEXACO LETTER NO WBH-55	RP	(3)				
1		UPDATED TO JOB AWARD ISSUED FOR APPROVAL	TE	(3)				

SCALE | DESIGNED | DRAWN

TEXACO INC.
ENGINEERING DEPARTMENT
HOUSTON, TEXAS

PLOT PLAN
FCCU HEATER & EMERGENCY COOLER

INITIALS	DATES Started	DATES Finished
DRAWN BY		
TRACED BY		
CHECKED BY		
TRACING WAS USED FOR DRAWING NO.		

SCALE:

NUMBER ASSIGNED AND TRACING RECORD ENTERED DATE 2-17-72

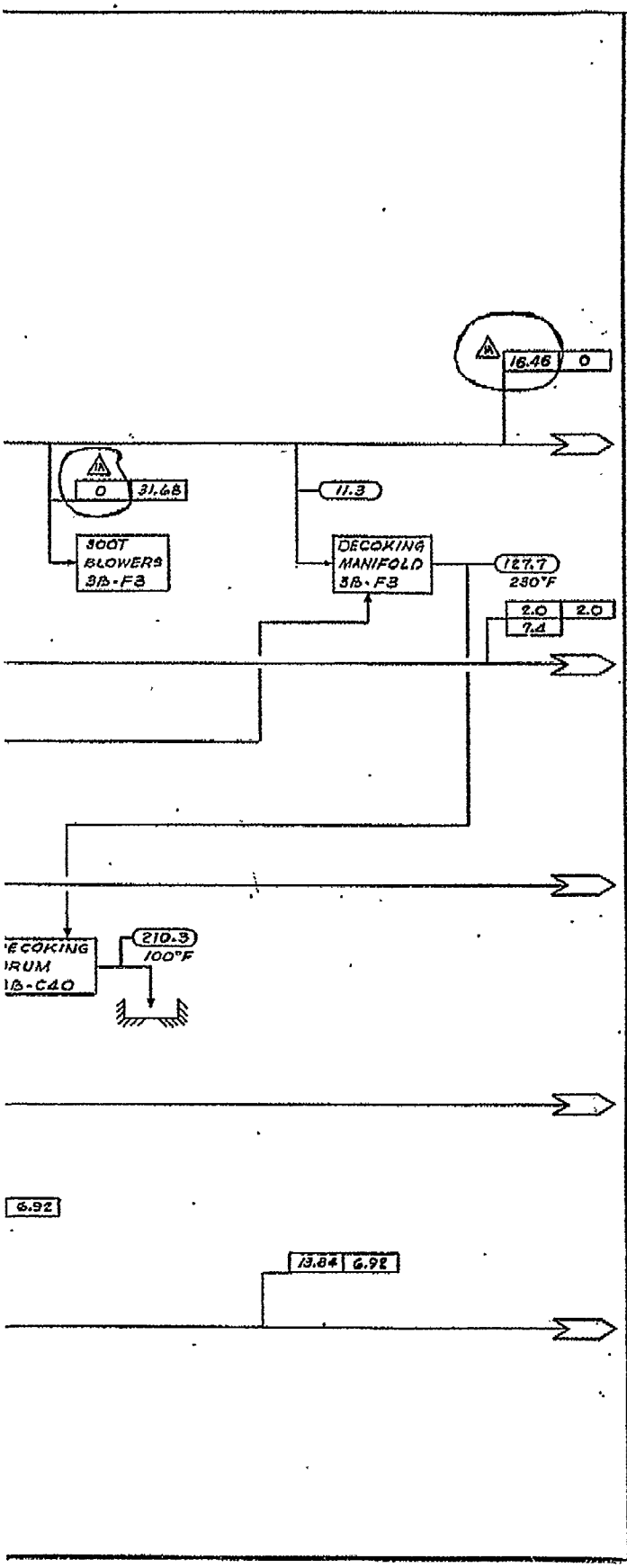
3-AA-42

BECHTEL
HOUSTON

TEXACO INC.
PUGET SOUND PLANT

PLOT PLAN
FCCU HEATER & EMERGENCY COOLER

Job No.	Dwg. No.	Rev.
BECHTEL - 10008	3-RA-42	5A
TEXACO ENT - 3910		



LEGEND

1	2
3	

1 - NORMAL OPERATION FIRING HEATER ON FUEL GAS.

2 - NORMAL OPERATION FIRING HEATER ON FUEL OIL.

3 - SPARE FRESH FEED PUMP OPERATING.

TEMP °F — DESIGN - DECOKING OPERATION

ALL FIGURES IN 1000 #/HR. EXCEPT AS NOTED

No.	Date	Revisions	By	Chkd.	Design Supv.	Engr.	Proj. Engr.	Appr.
1	9/1/72	ISSUED FOR INFORMATION	MB		AL	RL	RA	
2	9/11/72	ISSUED FOR DESIGN	RA		AE	RL	RA	

SCALE | DESIGNED | DRAWN

BECHTEL HOUSTON

TEXACO INC. PUGET SOUND PLANT

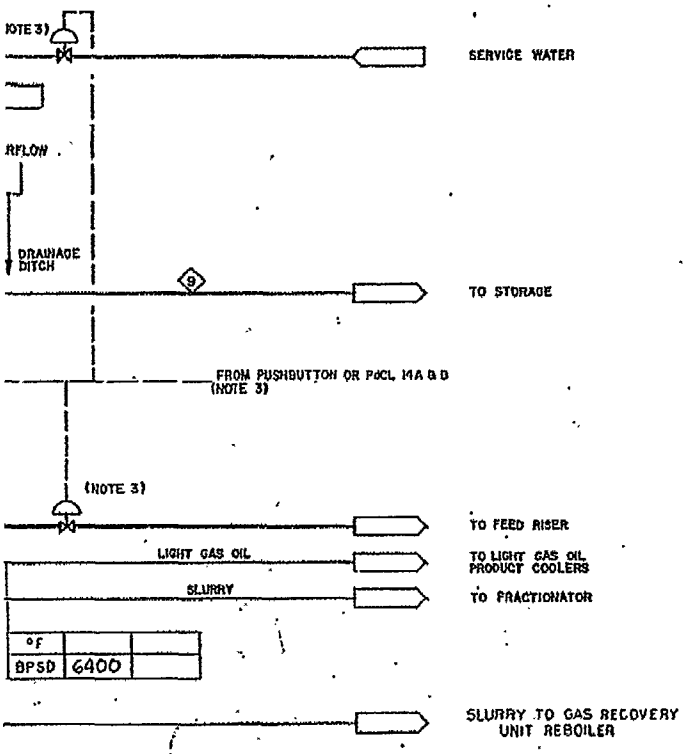
UTILITY USAGE DIAGRAM
FCCU UNIT PLANT 3B

Job No.	Dwg. No.	Rev.
BECHTEL - 10005 TEXACO JOB - 3910	3-RA-43	1A

WA-TEX 000904

ER

NOTES:
1. THIS FC(NEW) CONTROLS TOTAL FLOW BY RESETTING INDIVIDUAL HEATER COIL FLOW CONTROLLERS (NEW)
2. NORMAL OPERATION WITH 250 B/H ICGO RECYCLE AND NO HCGO RECYCLE. ALTERNATE CASE WITH 250 B/H HCGO RECYCLE AND NO ICGO RECYCLE.
3. PUSHBUTTON OR LOW PRESSURE DROP SIGNAL ACROSS THE SPENT OR REGENERATED CATALYST SLIDE VALVE AUTOMATICALLY OPENS VALVES IN LINES TO EMERGENCY COOLER AND CLOSES INLET VALVE TO RISER. THE EXISTING VALVE AT THE RISER WILL BE RELOCATED AS THE EMERGENCY COOLER VALVE AND A NEW VALVE WILL BE INSTALLED AT THE RISER.
4. NORMAL OPERATION—HOT FEED FROM CRUDE AND DEASPHALTING UNITS.
   ALTERNATE OPERATION— COLD FEED FROM STORAGE.
5. STREAM 7 PROPERTIES ARE FROM TEXACO TEST RUN.
6. STREAM 8 PROPERTIES ARE FROM TEXACO'S NEW DESIGN.
7. TI LOCATED ON LCGO STRIPPER OUTLET



WA-TEX 000905

No.	Date	Revisions	By	Chk'd	Chief Engr.	Engr.	Proj. Engr.	Asst.
1	7/11/73	ISSUED FOR INFORMATION			JE	TR	7/11	
2	11/1/73	ISSUED FOR APPROVAL	LH		JE	TR	11/13	

SCALE | DESIGNED | DRAWN

BECHTEL HOUSTON

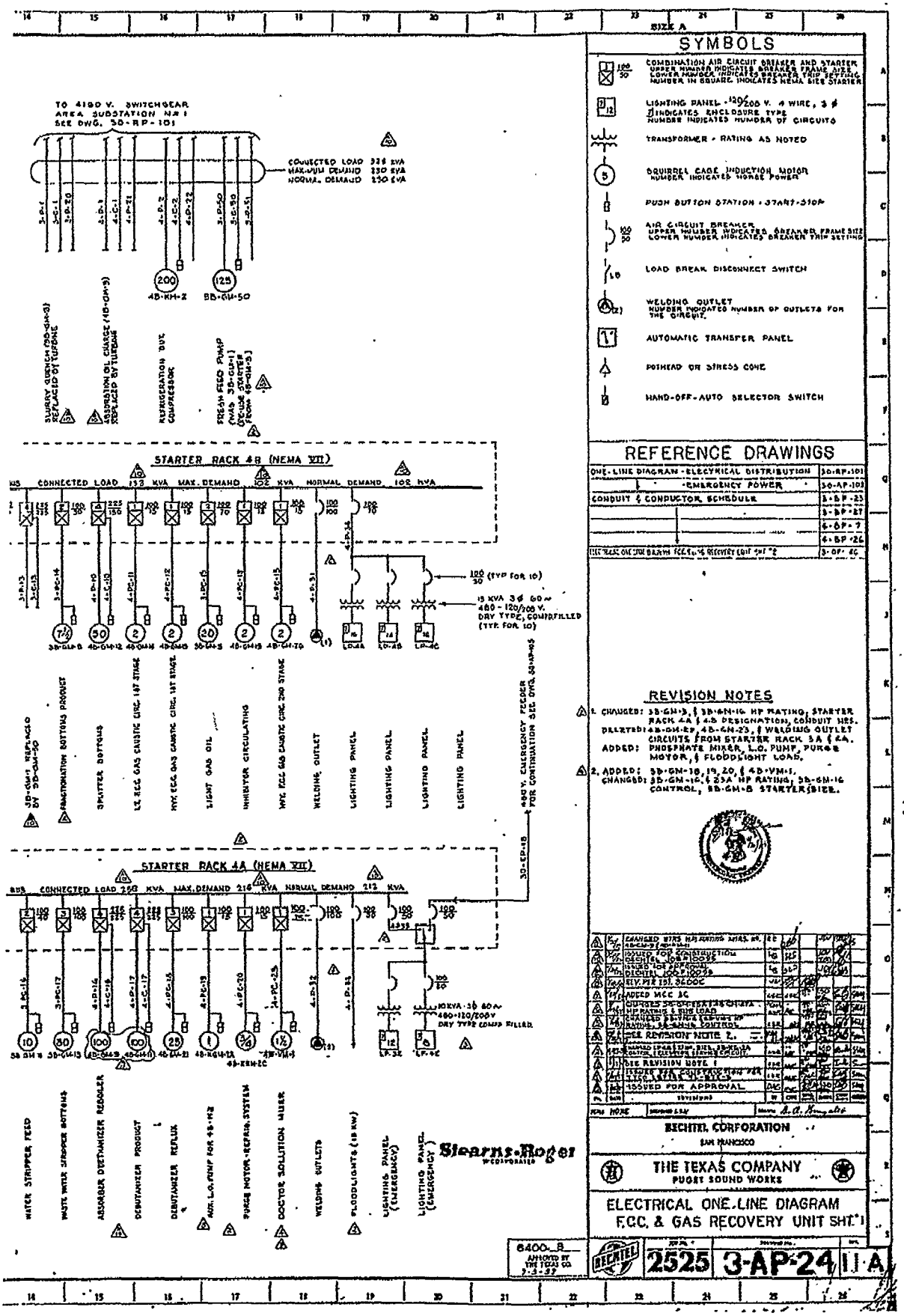
TEXACO INC. PUGET SOUND PLANT

FLAG FLOW DIAGRAM
REACTOR FEED HEAT AND
EMERGENCY COOLING FCC UNIT

Job No.	Dwg No.	Rev.
BECHTEL - 10095 TEXACO DIV. - 3819	3-RA-44	1A

D

1



7.2 VESSEL DRAWINGS

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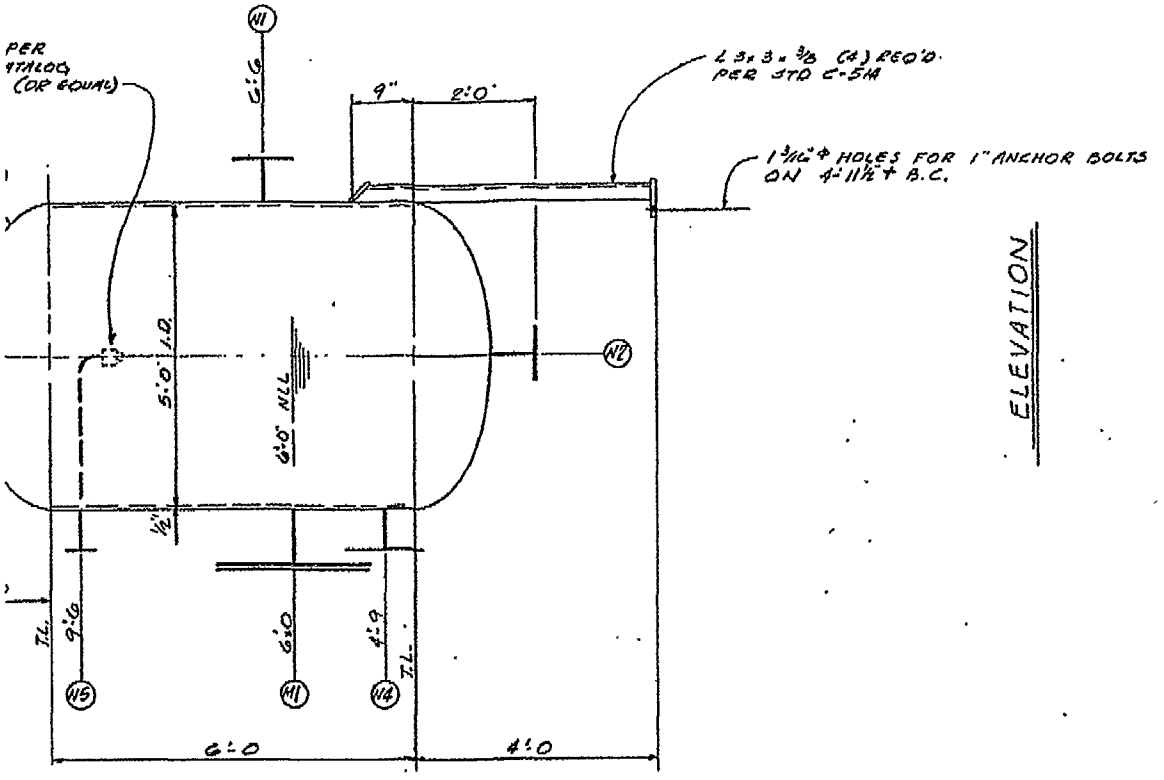
SECTION 7.2 VESSEL DRAWINGS

SIZE D



ELEVATION

WA-TEX 000909

4	2/23/73	ADDED INSULATION (P.P.)	3/4	R	R	TMH	MAC 3/6	
3	9/18/73	RELEASED FOR CONSTR, REV. FULL JET NOZZ. MODEL# ADDED: ORIENT. CMSD NOZZLE N3 FROM B"	1 0 1 1	3/4	R	TMH	MAC 9/18	
2	7/7/73	ISSUED FOR PURCHASE RELEASED SHELL AND HEAD MATERIAL	1 0 1 1	3/4	R	TMH	7/7	
1	7/7/72	ISSUED FOR QUOTES	1/4	3/4		JCW	6/30	
No		REVISIONS	BY	CHKD	DESIGN SUPV	ENGR	PROJ ENGR	APPD

SCALE 3/8" = 1'-0 | DESIGNED RothCELL | DRAWN J. HartFIELD | TRACED | CHIEF ENGR

BECHTEL
HOUSTON

TEXACO INC.
PUGET SOUND PLANT

DECOKING DRUM
ITEM 3B-C40
FCC & GAS RECOVERY UNIT

JOB No.	DRAWING No.	REV.
BECHTEL 10095 TEX EST 3910	3-DC-40	3.A

ITEM DESCRIPTION	SPEC	REFERENCE DWG	REMARKS	M/R NO
FIREPROOFING (MFG. & TYPE)			N.R.	
INSULATION THK 4 INCHES		135-2666	N.R.	C-31
INSULATION SUPPORTS			N.R.	
PLATF & LADDER (SUPP. CLIPS)			N.R.	
PIPE SUPPORT CLIPS			N.R.	
SUPPTS FOR				
SURF PREP & SHOP PAINT	V-10C			C-31
PERT. THREAD LUBRICANTS		93-3179-C		C-31
MANWAY (REINF. PAD) & DAVITS		75-E915-G		C-31
NOZZLES & MANWAYS		75-E911-G		C-31
SUPPORT LEGS		C-514		C-31
DOCUMENTS	C-504			C-31
TOLERANCES	K/M9 & A80			C-31
VESSEL CONSTRUCTION	K/M9 & A80			C-31

4. REMOVABLE INTERNALS....

2. UNLESS OTHERWISE SHOWN OR NOTED
   (a) NOZZLE & MANWAY EXTENSION FROM INSIDE OF SHELL TO FLANGE FACE SHALL BE 7" FOR NOZZLES, 12" FOR MANWAYS
   (b) ELEVATIONS ARE ABOVE UNDERSIDE OF BASE &
   (c) [redacted]
   (d) ALL BOLT HOLES STRADDLE CENTERLINES (NORTH, SOUTH OR VERTICAL)
   (e)

3. VESSEL MFR SHALL SUPPLY AND INSTALL ALL ITEMS SHOWN OR REFERENCED ON THIS DWG UNLESS OTHERWISE NOTED OR INDICATED IN REMARKS COLUMN (AT RIGHT)
   INST = INSTALLATION ONLY N/R = NOT REQ'D FURN = SUPPLY ONLY

TEE SPRAY
TLET
NT
TION
LET
TWAY W/DAVIT
SERVICE & REMARKS

ONNECTIONS | GENERAL NOTES

7.3 COMBUSTION EQUIPMENT

TABLE OF CONTENTS

SECTION 7.3 COMBUSTION EQUIPMENT

FIRED HEATER DATA SHEET

Customer TEXACO INC. — Manufacturer FOSTER WHEELER CORP
Location PUGET SOUND PLANT — Equip. No. 3B-F3
Unit FCCU EXPANSION — Req. No. 10095-F-01
Service REACTOR CHARGE HEATER — Item No. 2
Number Required ONE — Type V.C.H.C.
* Total Duty per Heater, MM Btu per Hr Absorbed 81.0

PROCESS DESIGN CONDITIONS

	RADIANT	CONVECTION
*Heater Section		
*Service		
*Heat Absorption, MM Btu per Hr.	81.0	
*Fluid	GAS OIL	
*Flow Rate, Lb per Hr.	473,371	
Flow Rate, BPD		
*Pressure Drop, psi (Allowable)	30 (2)	
Pressure Drop, psi (Calculated) ... CLEAN / MAX	18 / 30	
*Average Flux Density, Btu per Hr per Sq Ft (Allowable)/(Calculated)	12000/12000	/
Maximum Flux Density, Btu per Hr per Sq Ft (Allowable)/(Calculated)	/	/
Velocity Limitation	—	
Maximum Inside Film Temperature, Deg F (Allowable)/(Calculated)	/	/
Fouling Factor	—	
Corrosion or Erosion Characteristics	—	
Inlet Conditions		
*Temperature, Deg F	521	
*Pressure, ~~(psia)~~ (psig)	70 (2)	
*Liquid Flow, Lb per Hr	473,371	
*Vapor Flow, Lb per Hr	—	
*Liquid, (Deg API) (Sp Gr at 60 F)	25.4	
*Vapor, Molecular Weight	—	
*Liquid Viscosity, Cp	0.54	
Outlet Conditions:		
*Temperature, Deg F	750	
*Pressure, ~~(psia)~~ (psig) ... CLEAN	52	
*Liquid Flow, Lb per Hr	473,371	
*Vapor Flow, Lb per Hr	—	
*Liquid, (Deg API) (Sp Gr at 60 F)		
*Vapor, Molecular Weight	—	
*Liquid Viscosity, Cp	0.24	

Remarks and Special Requirements:
*1. Distillation Data or Composition Attached
2. SELLERS PRESSURE DROP CALCULATIONS SHALL NOT TAKE CREDIT FOR STATIC HEAD BETWEEN HEATER INLETS AND OUTLETS.
* Items So Designated To Be Filled In By Buyer I.B.P. 400°F

No	DATE	REVISIONS	BY	CH'K	APPR
2	2-12-73	GENERAL REVISION, ISSUED FOR CONSTRUCTION	TL		
1	9-14-72	ISSUED FOR PURCHASE	TL		
A		ISSUED FOR QUOTATION	YB		

ORIGIN — BECHTEL — JOB No 10095 — DRAWING No DS-3-F-1 — REV 2

R&C SEE FORM 3764-8-71

SHEET 1 OF 6

MECHANICAL DESIGN CONDITIONS

General

*Plot Limitations — *Stack Limitations

*Tube Limitations — Other Limitations

*Required Drawings

*Structural Design Data: Wind Load _____ Seismic Factor _____

*List of Applicable Standards or Specifications: 1. 3.

2. 4. SEE ATTACHMENT

Coil Design

	Radiant	Convection
*Heater Section		
*Service	Process	
*Design Pressure, psig	150	
*Design Fluid Temperature, Deg F	750	
*Corrosion Allowance: Tubes	1/8"	—
Fittings	1/8"	
Hydrostatic Test Pressure, psig	550	
Number of Passes/Tubes per pass	6 / 18	6 / 12
Overall Tube Length, Ft	33'-6	27'-6
Effective Tube Length, Ft	34'-6	26'-0
Bare Tubes: Number	108	18
Total Exposed Surface, Sq Ft	4860	552
Extended Surface Tubes: Number		54
Total Exposed Surface, Sq. Ft.		14,000
Tube Spacing, Center to Center, In. (Staggered) (In Line)	8	8
Tube Center to Furnace Wall, In. Min	6	
*Stress Relieve	Yes - 241 MAX	
*Weld Inspection Requirements, X-Ray or Other	Yes - 100%	

Tubes

Vertical or Horizontal	Vert	Horiz
*Tube Material (ASTM Specification and Grade)	A-200 GR T-9	
Outside Diameter, In	4.5	
Wall Thickness, (Minimum) (Average), In	0.265	
Maximum Tube Wall Temperature, Deg F (Calculated)/(Design)	/900	/900
Inside Film Coefficient (Calculated) (Based on Outside Surface)		
Design Basis for Tube Wall Thickness	CEMS H-1M7	

Description of Extended Surface:

Type	—	Fins
Fin or ~~Stud~~ Material	—	11% Cr & 18-8
Fin or ~~Stud~~ Dimensions ... Height x Thickness	—	1 x 0.105
Fin or ~~Stud~~ Spacing ... No. Per Inch	—	3
Maximum Fin or Stud Temperature	—	N.A.
Extension Ratio	—	

Plug-Type Headers

Manufacturer and Type		
*Material (ASTM Specification and Grade)		
Nominal Rating		
*Location	NONE	
*Welded or Rolled		

Return Bends

Manufacturer and Type	180° Welded Return Bend	
*Material (ASTM Specification and Grade)	9% Cr-1% Mo	
Nominal Rating or Schedule	To Suit Tube	
*Location	Firebox	Header Box

R&C SFE FORM 370B 10-71

MECHANICAL DESIGN CONDITIONS (CONT'D)

Coil Design (Cont'd)

*Heater Section	RADIANT	CONVECTION
*Service		PROCESS
Terminals		
Manufacturer and Type	FLANGED	FLANGED
*Material (ASTM Specification and Grade)	A-182 GR F9	A-182 GR F9
Nominal Rating	TO SUIT TUBE	TO SUIT TUBE
*Location	OUTSIDE F.B.	OUTSIDE H.B.
*Welded or Rolled	WELDED	WELDED
Flange: Size and Rating	150# R.F.	150# R.F.
Location	SEE NOTE 1	
Stress Group To Complete		
*Nozzle Movement:		
*Direction		
*External Nozzle Load		
*Direction		
*Pipe Load Supported By Heater		
*Special Support Brackets Required		

Comments

Crossovers

*Welded or Flanged	WELDED	-
*Pipe Material (ATSM Specification and Grade)	A-200 GR T9	-
Pipe Size and Wall Thickness	4.5 x 0.205	-
Location	INTERNAL	-
Flange Rating	—	-

Tube Supports

Ends, Top, ~~Bottom~~		
Material	A-447 TP11	
Thickness	—	
Type and Thickness of Insulation	—	
Insulation Reinforcement	—	
Intermediate:		
Material		A-447 TP11
Spacing, Ft		13'-0
Type and Thickness of Coating		
Guides: Location	BOTTOM	
Material	1½ SCH 80 25-12 PIPE	

Notes

1) RADIANT OUTLETS ARE TO BE GROUPED

RSC SFE FORM 376C 8/71

MECHANICAL DESIGN CONDITIONS (CONT'D)

Header Boxes
Location CONVECTION SECTION Material CARBON STEEL Thickness 3/16
Insulation: Material CASTABLE, LHV 1:2:4 Mix Thickness 2
Anchoring Material CARBON STEEL CHAIN LINK FENCING
Are Header Box Doors Bolted or Hinged? BOLTED

Burners
Manufacturer and Type JOHN ZINK - COMB GAS & OIL - "MA" Size 24 Number 7
Location RADIANT FLOOR
Size and Type of Pilots 3/4" - GAS - 1-PER BURNER
Heat Release per Burner at Design Excess Air and Draft: (MM Btu per hour)
Normal 14,000,000 Minimum 7,000,000 Maximum 16,800,000
Minimum Distance Burner Centerline to Tube Centerline:
Horizontal 6'-0 MIN. Vertical N.A.

Settings:
Exposed Vertical Walls:
Thickness Hot-Face Temperature: Design Calculated
Wall Construction
Outside Casing: Thickness Material Outside Temperature
Tieback Design and Material NONE Spacing
Support Material
Method of Fastening Tiebacks to Structure

Shielded Vertical Walls:
Thickness 5 Hot-Face Temperature: Design 2000 Calculated 1200
Wall Construction CASTABLE, LHV 1:2:4 MIX
Outside Casing: Thickness 1/4 MIN Material CARBON STEEL Outside Temperature
Tieback Design and Material V-CLIPS, SS TYPE 304 Spacing
Support Material
Method of Fastening Tiebacks to Structure WELDING

Arch:
Thickness 6 Hot-Face Temperature: Design 2000 Calculated
Arch Construction CASTABLE, L.H.V. 1:2:4 MIX
Outside Casing: Thickness 1/4 Material CARBON STEEL Outside Temperature 1200
Tieback Design and Material V-CLIPS, SS TYPE 304 Spacing
Support Material
Method of Fastening Tiebacks to Structure WELDING

Floor:
Thickness 6 Hot-Face Temperature: Design 2000 Calculated
Floor Construction CASTABLE, L.H 1:4 MIX
Minimum Floor Elevation
Outside Casing: Thickness 1/4 Material CARBON STEEL Outside Temperature 1200

Convection Section:
Thickness 5 Design Hot-Face Temperature 2000
Construction CASTABLE, L.H.V. 1:2:4 MIX
Outside Casing: Thickness 3/16 Material CARBON STEEL Outside Temperature 1200

H&C SFE FORM 3780 (6/71)

MECHANICAL DESIGN CONDITIONS (CONT'D)

Settings (Cont'd)

Tieback Design and Material: V-CLIPS, SS TYPE 304

Support Material:

Method of Fastening Tiebacks to Structure: WELDING

Internal Wall:

Type: NONE Dimensions: Material:

Stack

Number: ONE Self-Supporting or Guyed: SELF SUPPORT Location: TOP OF HEATER

Material: CARBON STEEL A-36 Thickness: Minimum Thickness: 1/4

Inside Metal Diameter: 6'-6", EXIT 4'-3" Height Above Grade: 182'-5" Stack Length: 122'-9"

Lining: Material: Thickness:

Type of Material or Reinforcement:

Extent of Lining: NONE

Dampers

Location: Stack or Bottom Air Plenum: STACK

Material: CARBON STEEL - 1/4 MIN Multiple or Single Leaf: MULTIPLE

Description of Provision for Operation from Grade: WINCH

Hot Ducts, Breeching, Flues, and Collectors

Material: CARBON STEEL - 1/4 THICK ASTM Specification: A-36 Size:

Insulation: Type: CASTABLE - LHV 1.2.4 MIX Thickness: 1 1/2

Type of Anchoring Material: CARBON STEEL CHAIN LINK FENCING

Size of Access Door into Breeching: NONE

~~Cold Air Ducts and~~ Plenum

Material: CARBON STEEL - 1/4" THICK ASTM Specification: Size:

* Miscellaneous

Overall Dimensions of Furnace: "CONV INLET, RAD OUTLET"

Platforms: Location: BOTT RAD — SOOTBLOWERS — DECOKING CONN'— STACK

Width: Min. 2'-6 3'-0 3'-0 CLEAR

Type of Floor: 1/4 - CHECKERED PLATE

Stairs: Location: TO BOTTOM RADIANT PLATFORM

Ladders: Location: 1) FROM GRADE TO SOOTBLOWER PLATF W/ STEP-OFF AT RAD PLATF

2) SOOTBLOWER PLATF TO DECOKING CONN 3) SOOTBLOWER PLATF TO STACK PLATF

Access Doors: Location and Size: 1) FLOOR 2) STACK

Observation Doors: Location and Size: 1) 7-OBS DOORS RAD. 2) 6-RAD FLOOR PEEPS

Miscellaneous Connections (Number and Size):

Draft: 1"-150# RF - 6 Flue Gas Sample: 1"-150# RF - 4

Temperature: 1 1/2"-150# RF - 8 Smothering Steam: 2" IPS - 6

Header Box Drain: 1" - IPS - 2 Stack Drain: 1 1/2" IPS. - 1

Coil Drains: NONE Other:

ASC SFE FORM 375E-6 7-

MECHANICAL DESIGN CONDITIONS (CONT'D)

Painting and Galvanizing Requirements: HEATER STEEL: SURFACE PREP. SSPC-SP3, PAINT 1.5 MILS MIN. D.F.T., TO FEDERAL SPEC TT-P-86, TYPE II
2) PLATFORMS, LADDERS, STAIRS AND LIGHT STRUCTURAL - GALVANIZED PER SPEC S-2M
3) STACKS, METALLIZED ON EXTERIOR USING THE METCO 120 SYSTEM

Are Painter's Trolley and Rail Included? NONE
Extent of Tube-Handling Facilities: NONE
Explosion Doors: Location and Size: 2 - 18" x 18"

Special Equipment (Soot Blowers, Air Preheaters, Noise Suppressors, Fans, Etc.)
1) 18 - TUBE SKIN THERMOCOUPLES
2) 4 - ROTARY SOOTBLOWERS W/ AUTOMATIC CONTROL PANEL
3) 1 - NOISE PLENUM

COMBUSTION DESIGN CONDITIONS

	OIL	GAS
*Type of Fuel	OIL	GAS
*Excess Air: Percent	30%	20%
Guaranteed Efficiency, Precent (LHV) (See Note)	81.0	
Calculated Efficiency, Percent (LHV)	82.0	
Radiation Loss, Percent of Heat Release (LHV)	1.5	
Flue Gas Temperature, Deg F, Leaving Radiant Section	1530	
Flue Gas Termperature, Deg F, Leaving Convection Section	670	650
Flue Gas Mass Velocity Through Convection Section Lb/Sp Ft/Sec	0.44	0.40
Draft at Bridge Wall, In. H O 30% EXCESS AIR & 120% OF DESIGN	0.10	
Draft at Burners, In. H O	0.45	
*Ambient Air Temperature, Deg F	60	
*Altitude, Ft Above Sea Level	95	
Calculated Heat Release, MM Btu per Hr (LHV)	98.8	
Volumetric Heat Release, Btu per Hr per Cu Ft		

Note: A fuel saving of _____ MM Btu per hr will offset a $1,000 increase in furnace cost (erected).
A tube side pressure decrease of _____ psi will offset a $1,000 increase in furnace cost (erected).

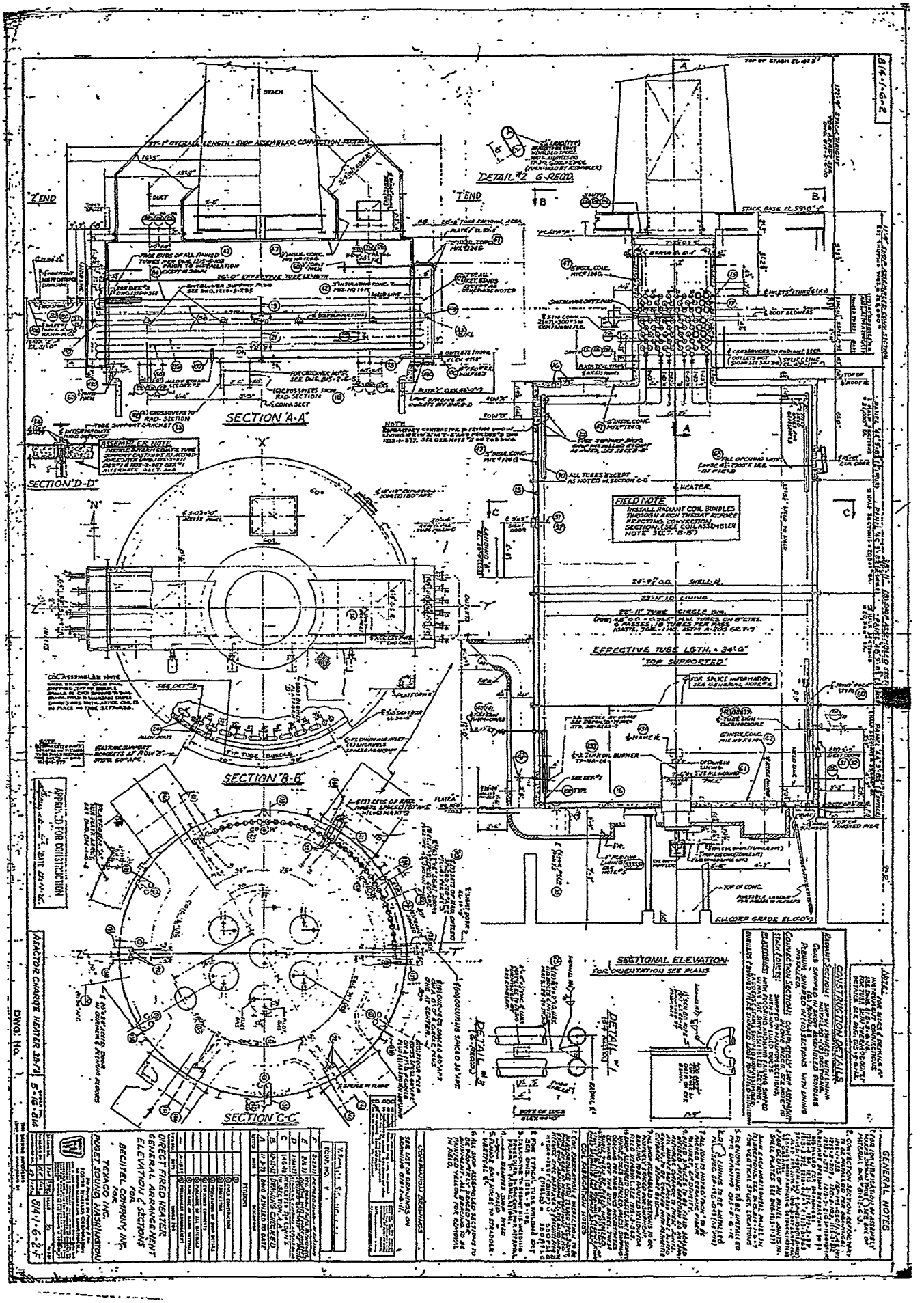
FUEL CHARACTERISTICS

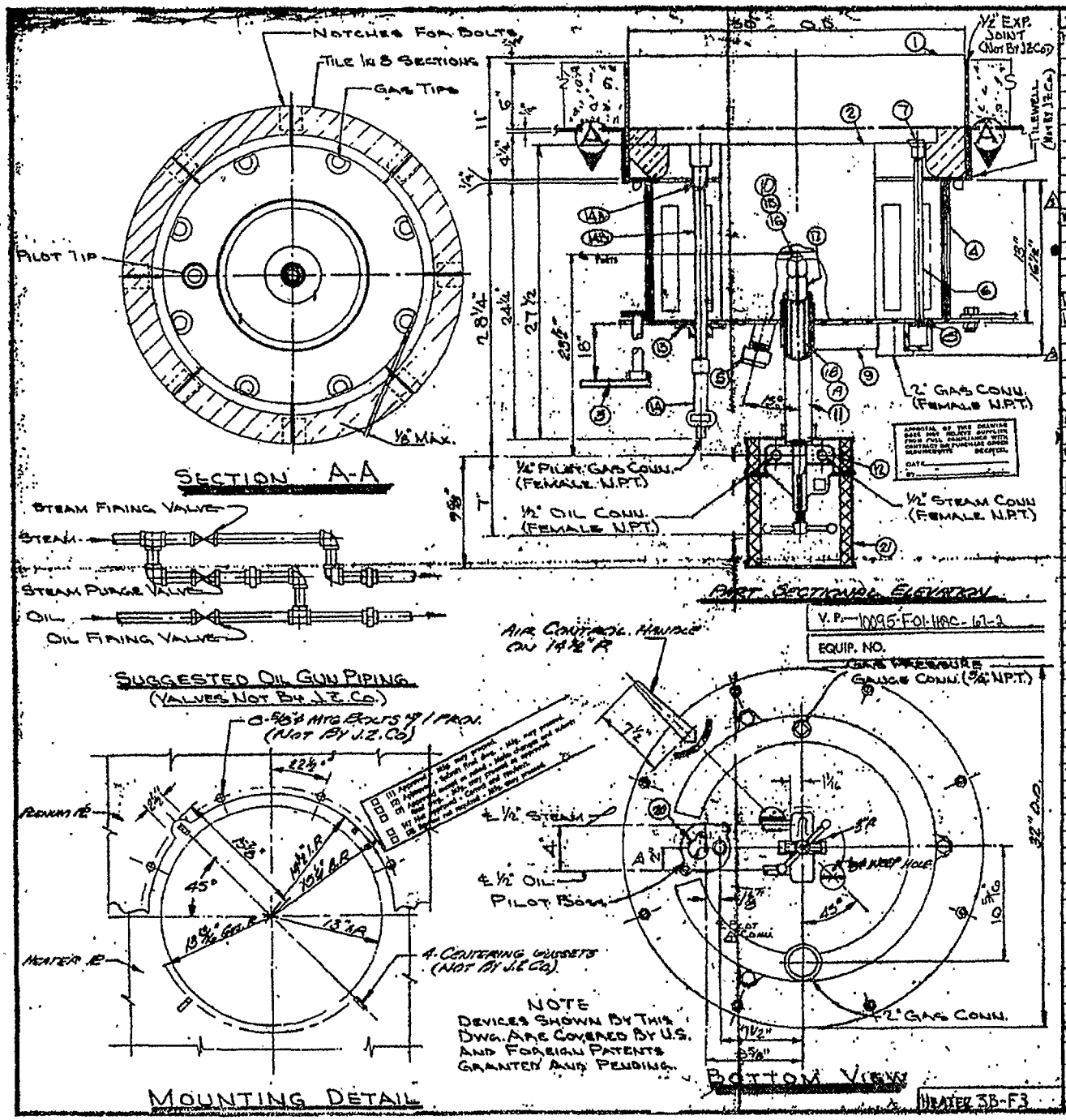
	OIL			GAS		
	MAX.	NORM.	MIN.	MAX.	NORM.	MIN
*Type of Fuel						
*Heating Value: HHV		18,560		1713	1211	869
LHV		17,000		1542	1090	782
*See Fuel Data Sheet: REFINERY FUEL GAS:	MAX.	NORM	MIN			
PRESSURE PSIG	70	60	47			
SPECIFIC GRAVITY	1.095	0.83	0.64			
FUEL OIL:						
PRESSURE PSIG	250	235	200			
TEMP °F	310	280	250			
API GRAVITY	12	10	10			
VISCOSITY SSU @ PT	95-102	150-170	280-320			
SULFUR, PERCENT (BY WT)		1.2				

FUEL PRESSURES ARE UPSTEAM OF CONTROL VALVE

SEE FORM 370F (6/77)

DS-3-E-11 ? 6 6


SECTION 'A-A'
SECTION 'B-B'
SECTION 'C-C'
SECTION 'D-D'
DETAIL #2 6-REQD.
SECTIONAL ELEVATION
FIELD NOTE
INSTALL RADIANT COIL BUNDLES THROUGH ARCH THROAT REFORE ERECTING CONNECTION SECTIONS. (SEE COIL ASSEMBLER NOTE SECT. 'B-B')
EFFECTIVE TUBE LGTH. = 34'-6"
"TOP SUPPORTED"
GENERAL NOTES
CONSTRUCTION MATERIALS
REACTOR CHARGE HEATER 30-H
DIRECT FIRED HEATER
GENERAL ARRANGEMENT
ELEVATION & SECTIONS
FOR
TEXACO INC.
PUGET SOUND, WASHINGTON
BECHTEL CORPORATION INC.
DWG. No. 814-1-G-2-2
5-16-84



— PARTS LIST PER BURNER —

ITEM	QTY	DESCRIPTION	PART No.	MAT'L
1	1	BURNER FLOOR TILE	MA-T-948	B.F.C.
2	1	REGEN TILE	URG-19K-WH	C.F. 141-A
3	1	AIR CONTROL ASS'Y	57A009	
4	1	AIR REGISTER ASSY	57F047	STEEL
5	2	PIPE CAP 1/4" & BLEED HOLE	2"	STEEL
6	8	GAS NIPPLES	1/2 PIPE	STEEL
7	8	GAS TIPS	Part-824-A	303 S.S.
8	25	GASKET	224-2 1/2	ASB
9	1	GAS MANIFOLD	DP-21-24	C.I.
10	1	ATOMIZER SPUD	Part-953-S	STEEL
10A				
11	1	OIL GUN GUIDE TUBE	1 1/2 PIPE	STEEL
12	1	OIL BODY ASS'Y	1A57009	
13	1	PILOT BOSS	DBS-3/4	C.I.
14	1	PILOT MIXER	HFG-3/4	C.I.
14A	1	PILOT TIP	J-A-3/4	CR. NI.
14B	1	PILOT NIPPLE	3/4 PIPE	STEEL
15	1	OIL TIP	96B	CR. STL.
16	1	ATOMIZER	60-A	303 S.S.
17	1	SLEEVE	22B	CR. STL.
18	1	OIL TUBE	3/8 PIPE	STEEL
19	1	STEAM TUBE	1" PIPE	STEEL
20	1	LIGHTING PORT COVER	35-B	C.I.
21	1	OIL BODY NIPPLE	1A49B	

FOR PARTS & DETAILS SEE J.Z. DWG. CA-ST-2002

FOR OPERATING PRESSURE SEE J.Z. CAPACITY CURVE # 2096
F.W. CONTRACT NO 516-814

HEAT RELEASE PER BURNER (MBH)
MAX: 16,800,000 BTU/HR.
NORM: 14,000,000 BTU/HR.
MIN: 7,000,000 BTU/HR.

FUEL GAS	MAX.	NORM.	MIN.
BTU/SCF (NET)	1342	1270	782
SP. GR.	1.055	0.855	0.64

GAS TIP DRILLING: 1-1/4" ID 16 DIA. PORT 4 @ 5 1/2 &
ARMS PORTS (CA-V-799-Q)
FUEL OIL 17,000 BTU/LB (GAV)
API GR: 12
RECOMMENDED (MAXIMUM VISCOSITY 150 SSU AT

PILOT GAS PRESSURE 6-5 PSIG
PILOT MIXER ORIFICE DRILLED 2 @ 1/16"
REVISION 3: ADDED PUMP CORRECTED MATL. JULY 5-7-73
REVISION 2: CORRECTED PILOT BOSS PART NO. 3-5-73
REVISION 1: REVISED PER CUST. APPROVED PRINT 1-25-73
ORDER: BECONTREL STORAGE & TRADING
ADDRESS: PUGET SOUND, WASHINGTON
P.O. No. NC-5-16-814-1 SHOP ORDER 026ANT

JOHN ZINK COMPANY
TULSA OKLAHOMA

DETAIL JOHN ZINK MA-12A
COMB. OIL & GAS BURNER
(7" FIRED)
FOR: FOSTER WHEELER CORP.

DRAWN R.D. APPROVED
CHECKED J.P.
DATE 11-8-72

J-Z
DWG. NO. 516-814

WA-TEX 000919

7.4 HEAT EXCHANGERS

TABLE OF CONTENTS

SECTION 7.4 HEAT EXCHANGERS

EXCHANGER SPECIFICATION SHEET

1	CUSTOMER AND PROJECT LOCATION	TEXACO INC.	EXCHANGER MFR.	SCOTT CO.
2	PLANT	PUGET SOUND	REQ. NO.	E-61
3	EXCHANGER NO.	3B-E40	ITEM NO	1
4	SERVICE OF UNIT	EMERGENCY COOLER		
5	SIZE	TYPE	CONNECTED IN	SERIES / PARALLEL
6	SURFACE PER UNIT 11,000	EFF.	SHELLS PER UNIT ONE	SURFACE PER SHELL / EFF

PERFORMANCE OF ONE UNIT

		Box ~~Shell~~ SIDE		TUBE SIDE	
7	FLUID CIRCULATED	WATER		GAS OIL	
8	TOTAL FLUID ENTERING LBS/HR	1,800,000		473,371	
9	VAPOR				
10	LIQUID	1,800,000		473,371	
11	STEAM				
12	NON-CONDENSIBLES				
13	FLUID VAPORIZED OR CONDENSED				
14	STEAM CONDENSED				
15	GRAVITY-LIQUID API			25.6	
16	VISCOSITY-LIQUID CP			0.44@750°F 1.5@380°F	
17	MOLECULAR WEIGHT-VAPORS				
18	SPECIFIC HEAT-LIQUIDS		BTU/#		BTU/#
19	LATENT HEAT-VAPORS		B.T.U/#		BTU/#
20	TEMPERATURE IN	50	°F	750	°F
21	TEMPERATURE OUT	150	°F	250	°F
22	OPERATING PRESSURE PSIG				
23	NUMBER OF PASSES			6	
1	VELOCITY		FT/SEC	5.8	FT/SEC
2	PRESSURE DROP ALLOW/CALC		#/SQ IN.	20 / 20	#/SQ IN
26	FOULING RESISTANCE MIN				
27					
28	HEAT EXCHANGED - BTU/HR	180,000,000	M.T.D. (~~CORRECTED~~)	325	
29	TRANSFER RATE - SERVICE	50	CLEAN	ACTUAL FOULING FACTOR	

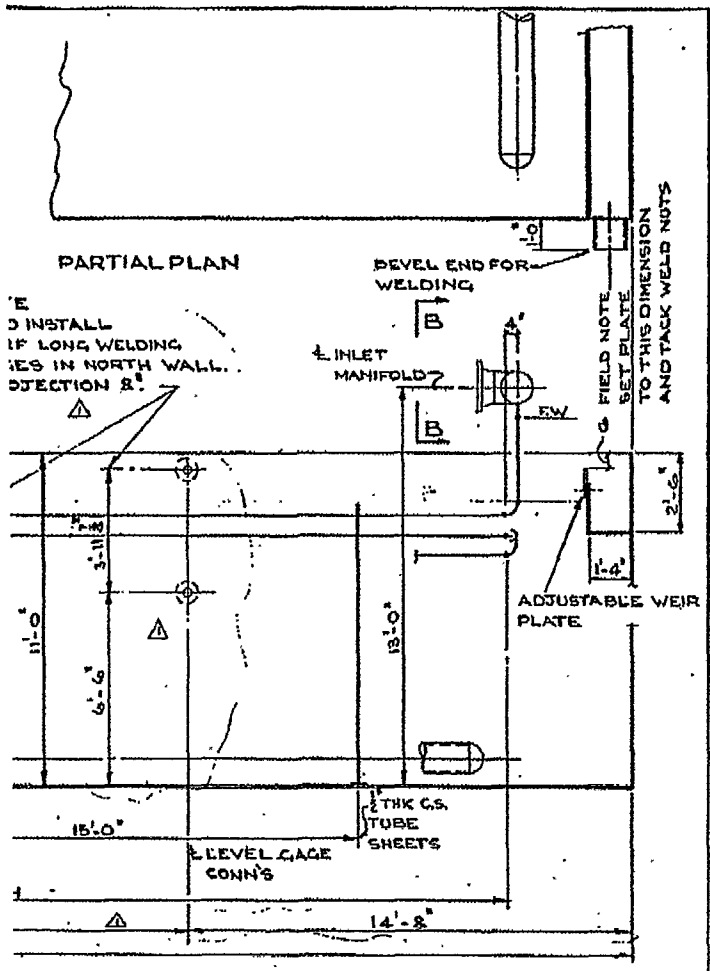
CONSTRUCTION

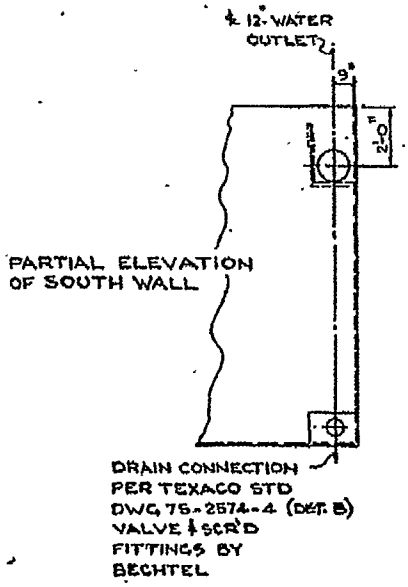
30	DESIGN PRESSURE	#/SQ.IN	150	#/SQ IN
31	TEST PRESSURE	#/SQ.IN	315	#/SQ IN
32	DESIGN TEMPERATURE	°F	800	°F
33	TUBES C.S. A-53 GrB NO 234	O.D. 0.75 AVG WALL 0.237 AVG	LENGTH 40'-0"	PITCH 8" ▲ ◆ □ ◆
34	SHELL	I.D. O.D.	THICKNESS	
35	SHELL COVER		FLOATING HEAD COVER	
36	CHANNEL		CHANNEL COVER	
37	TUBE SHEETS - STATIONARY C.S. 1/2" THK		FLOATING	
38	BAFFLES - CROSS	TYPE	THICKNESS	
39	BAFFLE - LONG	TYPE	THICKNESS	
40	TUBE SUPPORTS		THICKNESS	
41	GASKETS			
42	CONNECTIONS - SHELL - IN	OUT	RATING	
43	-CHANNEL-IN	OUT	RATING	
44	CORROSION ALLOWANCE - SHELL SIDE		TUBE SIDE	
45	CODE REQUIREMENTS	TEMA CLASS		SPEC. E-109
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 - For Additional Information See Drawing 10095-3-DE-1			
50				
51				

FORM H-15B PART B 9/66

REV.	DATE					JOB NO	DRWG. NO.	REV.
0	8-1-72	Issued For Construction	TLC	RL	[illegible]	10095	DS-3-E-19	0

SIZE D (A9A)





LIST OF MATERIAL

ITEM	QUAN	DESCRIPTION	ORDER NO
1	ONE	EMERGENCY EXCHANGER	E-61

GENERAL NOTES

1 FOR LOCATION SEE PLOT PLAN DRAWING 3-RA-42

2 BOX TO BE FABRICATED FROM ¼" C.S. ℄ AND SHIPPED TO SITE IN SECTIONS:
FLOOR IN TWO SECTIONS
END WALLS & SIDE WALLS, IN COMPLETE PANELS.

REFERENCE DRAWINGS

PLOT PLAN	3-RA-42
FOUNDATION DETAIL	

NO.	DATE	REVISIONS	BY	CHK	APPD. ENGR.	APPD. OWNER	CUST.
3		ADDED INST CONNECTIONS	ML			TWL	MS
2		ISSUED FOR PURCHASE/CONSTRUCTION	ML	RD		TWL	MS

SCALE | DESIGNED | DRAWN

BECHTEL CORPORATION
SAN FRANCISCO HOUSTON NEW YORK

TEXACO INC.
PUGET SOUND PLANT

ARRANGEMENT OF EMERGENCY EXCHANGER 3B-E40

JOB No.	DRAWING No.	REV.
BECHTEL - 10005	3 - DE - 1	1
TEXACO EST - 3910		

WA-TEX 000923

7.5 PUMPS

TABLE OF CONTENTS

SECTION 7.5 PUMP DATA AND CURVES

Table 7.5-1
Centrifugal Pump Summary Sheet
Plant 3B FCC Unit
Anacortes, Washington

	Performance Data								Construction Data							Driver Data			
	Flow Temp °F	GPM @ P.T.	Design Flow PSIG		Sp. GR @	NPSH Feet	B.H.P.		Max Wrk'g PR	Material		Impeller Dia. Inches		No. of	Shaft		Rated		Full Load
Service		Design	Suction	Discharge	P.T.	Required	Design	Max	PSIG	Case	Impeller	Rated	Max.	Stages	Seal	RPM	H.P.	Type	Amps
Overhead Reflux	100	690	6	63	0.75	7.0	32	36	266	C.I.	C.I.	7-1/16	7-1/2	1	Mech.	3550	36	Turb	-
Slurry Quench	675	2380	11	84	0.76	8.0	142	175	300	11-13 Cr.	11-13 Cr.	15-3/8	16-1/2	1	Packed	1750	156	Turb	-
Fresh Feed	410	1018	3	130	0.78	9.0	105.5	117	667	Steel	C.I.	10-3/4	13-1/4	1	Mech.	3600	125	Motor	16.8
Spare	410	1018	3	130	0.78	9.0	105.5	117	667	Steel	C.I.	10-3/4	13-1/4	1	Mech.	3550	117	Turb	-

CENTRIFUGAL PUMP DATA SHEET

JOB NO. 10095 ITEM NO 3B-G50/A
PURCHASE ORDER NO. 10095-G01
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 FLUID CATALYTIC CRACKING SERVICE FCC FRESH FEED
NO. PUMPS REQ'D 2 NO. MOTORS REQ'D 1 ITEM NO. 3B-G50 PROVIDED BY PUMP MFR MTD BY FIELD
NO. TURBINES REQ'D 1 ITEM NO 3B-G50A PROVIDED BY EXISTING MTD BY FIELD
PUMP MFR BYRON JACKSON SIZE AND TYPE 4X6X13¼H DSJ SERIAL NO. 731-H-0013/12

OPERATING CONDITIONS, EACH PUMP

LIQUID FCC FEED U.S. GPM at PT. NOR. 1018 RATED
DISCH. PRESS., PSIG 130
PT. F. NOR. 410 MAX. SUCT. PRESS., PSIG MAX. RATED 3.4
SP GR at PT 0.78 DIFF. PRESS., PSI 126.6
VAP PRESS. at PT, PSIA 11.8 DIFF. HEAD, FT 375
VIS. at PT, Ssu CP 1.0 NPSHA, FT 9, CORRECTED
CORR/ERDS CAUSED BY HYD. HP

PERFORMANCE

PROPOSAL CURVE NO 2771-1
RPM 3550 NPSHR (WATER) 9
EFF. 71% BHP RATED 105.5
MAX. BHP RATED IMP 117
MAX HEAD RATED IMP 480
MIN. CONTINUOUS GPM 110
ROTATION (VIEWED FROM CPLG END) CCW

CONSTRUCTION

NOZZLES	SIZE	RATING	FACING	LOCATION
SUCTION	6	300#	RF	TOP
DISCHARGE	4	300#	RF	TOP

CASE-MOUNT ☒ CENTERLINE ☐ FOOT ☐ BRACKET ☐ VERT (TYPE)
SPLIT ☐ AXIAL ☒ RAD: TYPE VOLUTE ☐ SGL ☒ DBL ☐ DIFFUSER
PRESS ☐ MAX. ALLOW. 667 PSIG 60 F. ☐ HYDRO TEST 1000 PSIG
CONNECT ☒ VENT ☒ DRAIN ☐ GAGE
IMPELLER DIA ☐ RATED 10 5/16 (3) ☐ MAX 13¼ ☐ TYPE: D.S.
MOUNT ☐ BETWEEN BRGS ☒ OVERHUNG ☐ WEAR RG. DIAM./CLRNC. 0.023
BEARINGS-TYPE: ☐ RADIAL ND-3214LR ☐ THRUST ND 45312LIA
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-2500-504K

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-2MT
GEMS P-2B1
CASE - STEEL
BASEPLATE. ☐ FSDR

AUXILIARY PIPING

○ C.W. PIPE PLAN F ○ CU: ○ S.S.: ○ TUBING: ○ PIPE
☐ TOTAL COOLING WATER REQ'D, GPM (2) 10 ○ SIGHT F.I. REQ'D
○ PACKING COOLING INJECTION REQ'D: ☐ TOTAL GPM ☐ PSIG
○ SEAL FLUSH PIPE PLAN 21 ☒ C.S. ○ SS ○ TUBING ☒ PIPE SCH 80 SOCK WELD
○ EXTERNAL SEAL FLUSH FLUID ☐ GPM ☐ PSIG
○ AUXILIARY SEAL PLAN ○ C.S. ○ SS ○ TUBING ○ PIPE
○ AUX. SEAL QUENCH FLUID Water Quench Piping by Pump Mfr.

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 ○ CS ○ SS ○ BRZ ○ NONE
FLOAT SWITCH ☐
PUMP THRUST, LB ☐ UP ☐ DOWN

MOTOR DRIVER

HP 125 RPM 3600 FRAME 405TS VOLTS/PHASE/CYCLES 4000 V-3T-60
MFR. AC BEARINGS BALL LUBE GRS
TYPE HORIZ INSUL B FULL LOAD AMPS 16.8
ENC TEFC TEMP RISE, C 80 LOCKED ROTOR AMPS 110
(3) ○ VHS ○ VSS VERT. THRUST CAP., LB SERVICE FACTOR 1.0

APPROX WT. PUMP & BASE 2000
MOTOR 2320 TURBINE

API STANDARD 610 GOVERNS UNLESS OTHERWISE NOTED.

FORM NO 130 (REVISED APRIL 71)

NO	DATE						JOB NO	DRAWING NO	REV.
3	1-22-74	ISSUED FOR CONSTRUCTION							
2	1/15/73	REVISED SEAL FLUSH PLAN	WT		PB		10095	DS-3B-G-1	3
1	12/22/72	ISSUED FOR PURCHASE	WT	TAN	WB				
0	10/2/72	ISSUED FOR QUOTATION	WT						

BECHTEL

SHEET 1 OF 1

WA-TEX 000927

CENTRIFUGAL PUMP DATA SHEET

JOB NO. 10095 ITEM NO. 3B-G2
PURCHASE ORDER NO.
REQUISITION NO.
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 ECC UNIT SERVICE OVERHEAD REFLUX
NO PUMPS REQ'D ___ NO. MOTORS REQ'D ___ ITEM NO. ___ PROVIDED BY ___ MTD BY ___
NO. TURBINES REQ'D 1 ITEM NO. 3B-GT2 PROVIDED BY ___ MTD BY ___
PUMP MFR UNITED SIZE AND TYPE 4" TC-AA SERIAL NO. 74799/800 SPARE

OPERATING CONDITIONS, EACH PUMP

LIQUID GASOLINE U.S. GPM at PT, NOR. 690 RATED ___
DISCH. PRESS., PSIG 62.6
PT. F. NOR 100 MAX ___ SUCT. PRESS., PSIG MAX. ___ RATED 6.0
SP GR at PT 0.75 DIFF. PRESS., PSI 56.6
VAP. PRESS. at PT, PSIA 16.2 DIFF. HEAD, FT 174
VIS. at PT, Sse ___ CP .75 NPSHA, FT 15
CORR/EROS CAUSED BY ___ HYD. HP ___

PERFORMANCE

PROPOSAL CURVE NO. ___
RPM 3550 NPSHR (WATER) ___
EFF. 73.5 BHP RATED 32
MAX. BHP RATED IMP 36
MAX. HEAD RATED IMP 210
MIN. CONTINUOUS GPM —
ROTATION (VIEWED FROM CPLG END) CCW

CONSTRUCTION

NOZZLES	SIZE	RATING	FACING	LOCATION
SUCTION	6"	150#	FF	TOP
DISCHARGE	4"	250#	FF	TOP

CASE-MOUNT ☒ CENTERLINE ☐ FOOT ☐ BRACKET ☐ VERT. (TYPE) ___
SPLIT ☐ AXIAL ☒ RAD; TYPE VOLUTE ☐ SGL ☒ DBL ☐ DIFFUSER
PRESS ☐ MAX ALLOW. 266.6 PSIG 60° F. ☐ HYDRO TEST 400 PSIG
CONNECT ☒ VENT ☒ DRAIN ☐ GAGE
IMPELLER DIA ☒ RATED 7 11/16 ☒ MAX. 7 1/2 ☐ TYPE: ___
MOUNT ☐ BETWEEN BRGS ☒ OVERHUNG ☐ WEAR RG DIAM./CLRNC ___
BEARINGS-TYPE ☒ RADIAL BALL ☒ THRUST BALL
LUBE ☒ RING OIL ☐ FLOOD ☐ OIL MIST ☐ FLINGER ☐ PRESSURE
COUPLING ☒ MFR FALK ☐ MODEL SPACER TYPE
DRIVER HALF MTD BY ○ PUMP MFR ○ DRIVER MFR ○ PURCHASER
PACKING ☐ MFR & TYPE ___ ☐ SIZE/NO. OF RINGS 8 - 3/8"
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 ○ ___
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 ○ SS ○ 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 (1) EXISTING PUMP- INSTALLED NEW TURBINE DRIVER.

FORM NO. 130 (REVISED APRIL 71)

NO	DATE			JOB NO.	DRAWING NO.	REV.
0	1-27-74	ISSUED FOR CONST.	JES TJC	10095	DS-3-G-2	0

SHEET 1 OF 1

WA-TEX 000928

CENTRIFUGAL PUMP DATA SHEET

JOB NO. 10095 ITEM NO. 3B-G3
PURCHASE ORDER NO.
REQUISITION NO.
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 ECC UNIT SERVICE SLURRY QUENCH PUMP
NO. PUMPS REQ'D NO. MOTORS REQ'D ITEM NO. PROVIDED BY MTD BY
NO. TURBINES REQ'D 1 ITEM NO. 3B-GT3 PROVIDED BY MTD BY
PUMP MFR BINGHAM SIZE AND TYPE 8X10X16½ CF-H-S SERIAL NO. 33086/87

OPERATING CONDITIONS, EACH PUMP

LIQUID SLURRY OIL U.S. GPM at PT. NOR. 2380 RATED
DISCH. PRESS., PSIG 83.7
PT. F. NOR. 675 MAX. SUCT. PRESS., PSIG MAX. RATED 11
SP GR at PT 0.763 DIFF. PRESS., PSI 72.7
VAP PRESS. at PT. PSIA 17 DIFF. HEAD, FT 220
VIS. at PT. See .43 CS NPSHA, FT 27
CORR/EROS CAUSED BY. HYD. HP

PERFORMANCE

PROPOSAL CURVE NO.
RPM 1760 NPSHR (WATER) 27
EFF. 71 BHP RATED 142
MAX. BHP RATED IMP 175
MAX. HEAD RATED IMP 250
MIN. CONTINUOUS GPM —
ROTATION (VIEWED FROM CPLG END) CCW

CONSTRUCTION

NOZZLES	SIZE	RATING	FACING	LOCATION
SUCTION	10"	300#	RJ	END
DISCHARGE	8"	300#	RS	TOP

CASE-MOUNT ☒ CENTERLINE ☐ FOOT ☐ BRACKET ☐ VERT. (TYPE)
-SPLIT ☐ AXIAL ☐ RAD; TYPE VOLUTE ☐ SGL ☒ DBL ☐ DIFFUSER
-PRESS ☐ MAX. ALLOW. 300 PSIG 60° F. ☐ HYDRO TEST 450 PSIG
-CONNECT ☒ VENT ☒ DRAIN ☐ GAGE
IMPELLER DIA ☐ RATED 15 3/8 ☐ MAX. 16½ ☐ 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 ☐ MFR FALK ☐ MODEL SPACER TYPE
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 ○
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. (1) EXISTING PUMP - INSTALLED NEW TURBINE DRIVER.

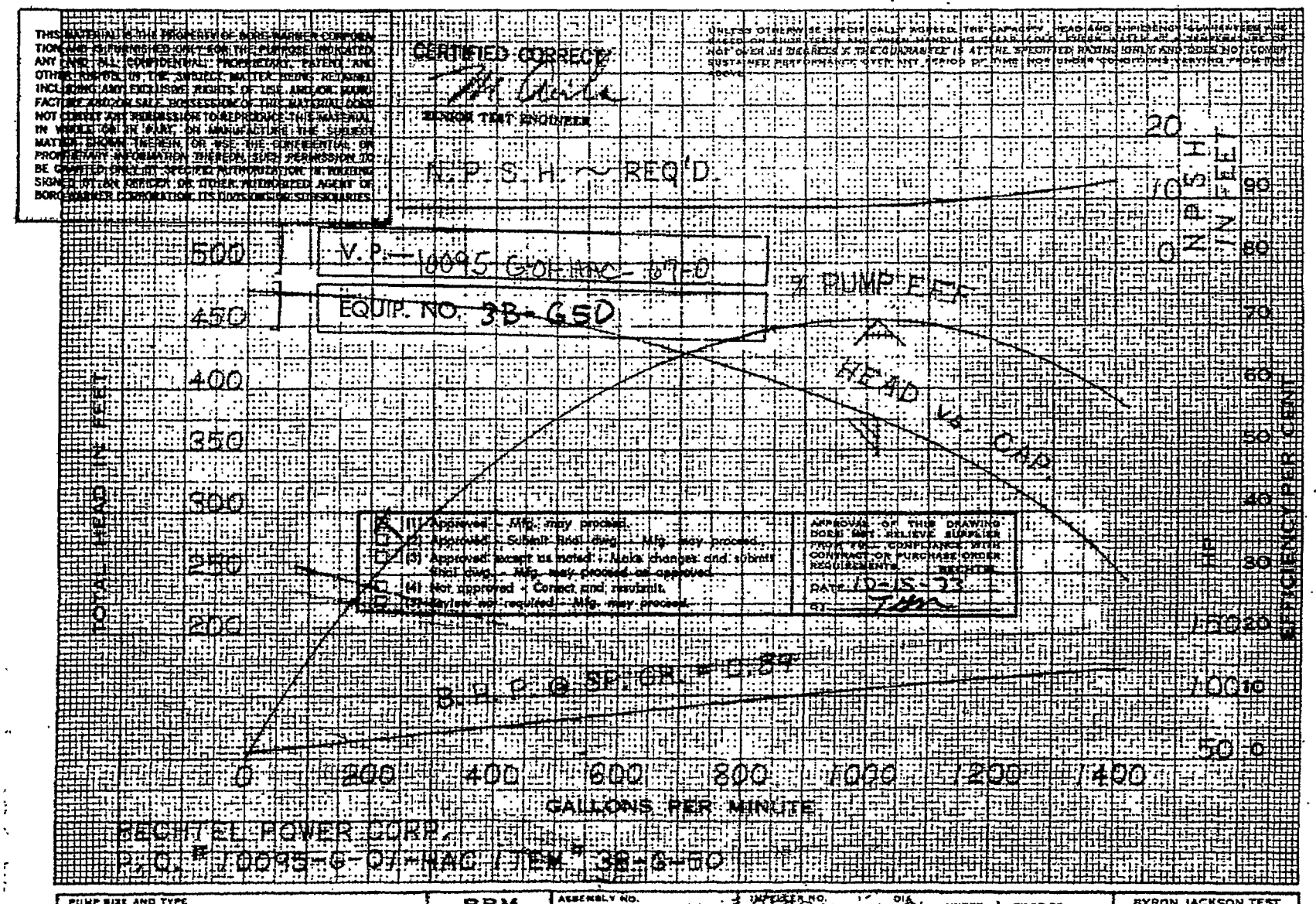
FORM NO 130 (REVISED APRIL 71)

NO.	DATE		JOB NO.	DRAWING NO.	REV.
D	1-22-74	ISSUED FOR CONST.	10095	DS-3-G-3	D
			SHEET 1 OF 1		

BECHTEL

WA-TEX 000929

BYRON JACKSON

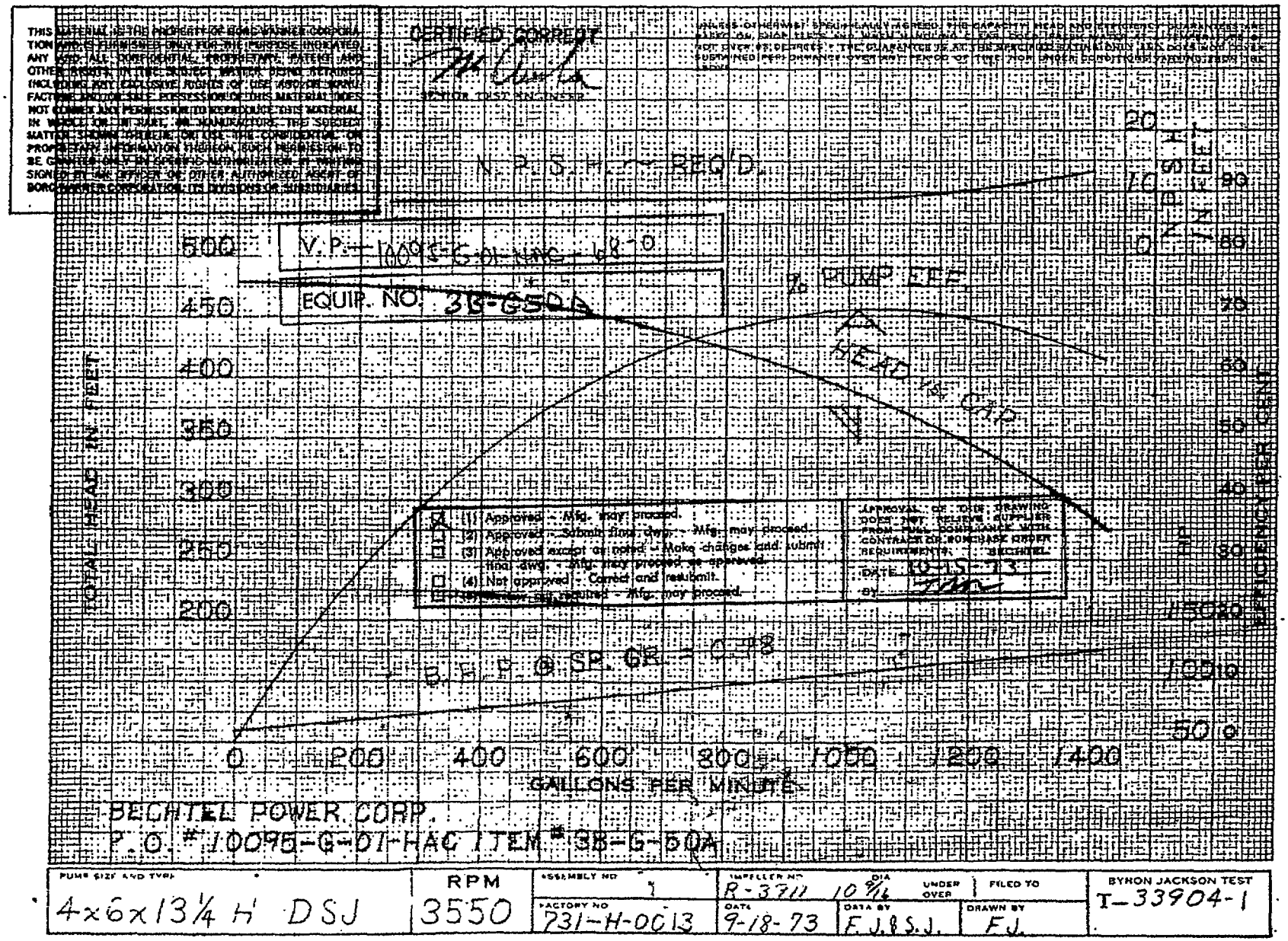


RECTIFEL POWER CORP.
P.O. # 10095-G-07-MAC / ITEM # 3B-G-50

PUMP SIZE AND TYPE	RPM	ASSEMBLY NO.	IMPELLER NO.	DIA.	FILED TO	BYRON JACKSON TEST.
4 x 6 x 13¼ H DSJ	3550	FACTORY NO. 731-H-0012	R-3941	10⅝ UNDER / OVER		T-33928-1
		DATE 9-10-73	DATA BY F.J. & S.J.	DRAWN BY F.J.		

WA-TEX 000930

BYRON JACKSON



PUMP SIZE AND TYPE	RPM	ASSEMBLY NO	IMPELLER NO	DIA	UNDER / OVER	FILED TO	BYRON JACKSON TEST
4x6x13¼ H DSJ	3550	1	R-3711	10 9/16			I-33904-1
		FACTORY NO 731-H-0013	DATE 9-18-73	DATA BY F.J. & S.J.		DRAWN BY F.J.	

7.6 INSTRUMENTS

TABLE OF CONTENTS

SECTION 7.6 INSTRUMENT DATA

TABLE 7.6-1
RELIEF VALVE SUMMARY SHEET
PLANT 3B FCC UNIT
ANACORTES, WASHINGTON

Tag No.	Service	Size	Set Press
3PSV-127A	3B-F3	6" x 8"	114 PSIG
3PSV-127B	"	"	"
3PSV-630	3B-GT3	3" x 4"	300 PSIG
3PSV-634	3B-GT2	1-1/2" x 2-1/2"	65 PSIG

TABLE 7.6-2
RESTRICTION ORIFICE SUMMARY SHEET
PLANT 38 FCC Unit
ANACORTES, WASHINGTON

Tag No.	Service	Location	Line Size	Orifice Size	Flow Rate
3FO-608	Lt. Cycle Oil	3B-0-218	2"	0.433	-
3FO-610	Flushing Oil	4B-0-372	2"	0.433	-
3FO-611	Fuel Oil	3B-0-228	1-1/2"	0.234	14 GPM

TABLE 7.6-3
FLOW ELEMENT SUMMARY SHEET
PLANT 3B FCC UNIT
ANACORTES, WASHINGTON

Flow Element No.	Service	Orifice Size	Line Size	Meter Coefficient
3FE-600	3B-F3 Feed	6.773	10" Sch 40	300 BPH
3FE-601	" "	2.489	4" Sch 80	40 BPH
3FE-602	" "	"	"	"
3FE-603	" "	"	"	"
3FE-604	" "	"	"	"
3FE-607	Fuel Gas to 3B-F3	3.681	6" Sch 40	20000 SCFH
3FE-620	3B-F3 Feed	2.489	4" Sch 80	40 BPH
3FE-621	" "	"	"	"

TABLE 7.6-4

ALARM AND SHUTDOWN SETTINGS

PLANT 3B FCC UNIT

ANACORTES, WASHINGTON

Alarm No.	Switch No.	Service	Switch Location	Switch Function	Switch Activates at	Switch Actuated by:	Switch Set Point	Remarks
3TAH-300	3TSH-300	3B-F3 Heater	IN TR-300	High Temp.		Mechanical		In Bristol Recorder
3TAL-302	3TSL-302	3B-F3 Outlet	Main Panel	Low Temp.	5.4 PSIG	Inst. Air	5.4 PSIG	
3TAH-304	3TSH-304	3B-E40 Outlet	Main Panel	High Temp.		Thermocouple	750°F	
3TAH-305	3TSH-305	3B-F3 Stack	Main Panel	High Temp.		Thermocouple	750°F	
3PALL-600	3PSLL-600	3B-F3 F.O. HDR.	Main Panel	Low Pressure	5.4 PSIG	Inst. Air	5.4 PSIG	
3HA-601	3HS-601	3B-F3 Heater	Main Panel	Shutdown Alarm		P/B		
3PAL-602	3PSL-602	3B-F3 Fuel Oil	Main Panel	Shutdown Alarm	5.4 PSIG	Inst. Air	5.4 PSIG	
3FAL-606	3FSL-606	3B-F3 Feed	Main Panel	Low Flow		Inst. Air		
3FALL-606	3FSLL-606	3B-F3 Feed	Main Panel	Shutdown Alarm		Inst. Air		
3PAL-607	3PSL-607	3B-F3 Fuel Gas	Main Panel	Low Press	5.4 PSIG	Inst. Air	5.4 PSIG	
3FALL-622	3FY-622	3B-FB Heater	Main Panel	Shutdown Alarm		Relay Cont.		
3FAL-624	3FSL-620	3B-F3-Pass #1	Main Panel	Low Flow	5.4 PSIG	Inst. Air	5.4 PSIG	
3FAL-624	3FSL-621	3B-F3-Pass #2	Main Panel	Low Flow	5.4 PSIG	Inst. Air	5.4 PSIG	
3FAL-624	3FSL-601	3B-F3-Pass #3	Main Panel	Low Flow	5.4 PSIG	Inst. Air	5.4 PSIG	
3FAL-624	3FSL-602	3B-F3-Pass #4	Main Panel	Low Flow	5.4 PSIG	Inst. Air	5.4 PSIG	
3FAL-624	3FSL-603	3B-F3-Pass #5	Main Panel	Low Flow	5.4 PSIG	Inst. Air	5.4 PSIG	
3FAL-624	3FSL-604	3B-F3-Pass #6	Main Panel	Low Flow	5.4 PSIG	Inst. Air	5.4 PSIG	
3PAL-641	3PSL-641	3B-F3 Fuel Gas	Main Panel	Low Press	5.4 PSIG	Inst. Air	5.4 PSIG	
3PAL-679	3PSL-679	Soot Blower Purge	Main Panel	Low Press		Inst. Air		

FORM NO. J-GS-1 (8/80)

SERVICE CONDITIONS	FLUID												
	INLET PSIG	MIN.	OPER.	MAX.		100						200	
	OUTLET PSIG	MIN.	OPER.	MAX.		75						90	
	INLET TEMP. °F		OPER.	MAX.	521						280		
	OPER. SP. GR. (gas) / Vapor MOL. WT.				0.735	-					0.92		
	Tsh °F or % FLASH	OPER. VISC. C.P.				.54						6 CP	
	CRIT. PRESS. Pc	VAPOR PRESS. Pv											
	OPER. FLOW	SIZING FLOW			115	300					13	18	
	MIN. FLOW	MAX. FLOW											
	FLOW UNITS	ΔP SIZING			GPM	25					GPM	110	
	ΔP SHUT OFF	ΔP MIN.			150						300		
	Cv @ SIZING ΔP & FLOW	MIN. Cv			CALC.						1.64		
	Cv-VALVE SELECTED	FACTORS			12.9						3.22		
					KM = .59						KM = .70		
VALVE BODY	SIZE	TYPE			2"	GLOBE					1"	GLOBE	
	PRESS. RATING	CONNECTIONS			300#	RF							
	MATERIAL	CLASS			C.S.								
	BONNET TYPE	BOLTS			EXT	STD					PLAIN	STD.	
	PACKING	TYPE	MAT'L		TEFLON	ASBESTOS							
	LUBRICATOR	ISOL. VALVE			YES	YES							
TRIM	PORT SIZE	NO. OF PORTS			FULL	BAL'D					3/8"	1	
	CHARACTER.	PLUG TYPE			LIN.	CAGE					= %	M. FLOW CAGE	
	GUIDE TYPE	TRIM SPEC.				A							
	ACTION PUSH TO OPEN-CLOSE	FLOW: OPENS-CLOSES			CLOSE	CLOSE					CLOSE	OPEN	
ACTUATOR	ACTUATOR TYPE				DIAP.								
	MOTIVE POWER	LINEAR / ROTARY			AIR	LIN.							
	PRESS./VOLTAGE	POS. ON POWER FAIL			-	D					-	C	
	THRUST OR TORQUE REQ.	SHUT OFF	OPER.										
	SIZE	MAX. OUTPUT			40						30		
	MANUAL O'RIDE	POS. FEEDBACK TYPE			-	-							
	POSITIONER OUTPUT	SINGLE/DUAL			3-15	S					-	-	
	INPUT SIGNAL	SUPPLY PSIG			3-15	20					3-15	-	
	BY-PASS	GAUGES			YES	YES					-	-	
MISC.													
	AIRSET MTD & PIPED				YES						-		
PURCH.	M. R. / P. O. NUMBER				J-411								
	MANUFACTURER				FISHER								
	MODEL NO.				657 ED						667	ES	
GENERAL	P. & I. D. NUMBER				3-PA-41						3-PA-41		
	SERVICE				REACTOR FEED TO F3						FUEL OIL TO HA-ES		
	LINE SIZE - NO. - SPEC.				4" J117A		4" J117A		4" J117A		4" J117A	2" J13A	
	INSTRUMENT TAG NO.				3FV-601		3FV-602		3FV-603		3FV-604	3FV-606	

NO.	DATE	REVISIONS		NOTES
1	3-7-73	GEN. REVISION	JT	
0	1-31-73	ISSUED FOR PURCHASE	JT TSH	

ORIGIN R&C ENG.

BECHTEL

CONTROL VALVES

JOB NO. 10095

TEXACO EST 3910 PORT ARTHUR REFINERY 3003

DATA SHEET NUMBER DS-J-126 REV. 1

FORM J-GS0 (8/80)

FORM NO. J-050 (8/69)

SECTION			Col. 1		Col. 2		Col. 3		Col. 4		Col. 5	
	FLUID											
SERVICE CONDITIONS	INLET PSIG	MIN. / OPER. / MAX.	250		30		60				-	-
	OUTLET PSIG	MIN. / OPER. / MAX.	247		8		15					
	INLET TEMP. °F	OPER. / MAX.	500		70		70					
	OPER. SP. GR.	Gas/Vapor MOL. WT.	—	19	1.0		.83	24.1				
	Tsh °F or % FLASH	OPER. VISC. C.P.	94°F									
	CRIT. PRESS. Pc	VAPOR PRESS. Pv										
	OPER. FLOW	SIZING FLOW	7450	10400	31600		108M	151M				
	MIN. FLOW	MAX. FLOW										
	FLOW UNITS	ΔP SIZING	LB/HR	3	GPM	22	SCFH	46				
	ΔP SHUT OFF	ΔP MIN.	250	Cf=.61	60		75					
	Cv @ SIZING ΔP & FLOW	MIN. Cv	Cs=200		767		1920					
	Cv-VALVE SELECTED	FACTORS	Cs=255		843		1960					
			C1=30.4		Km=.85		C1=34.4					
	NOISE - DBA		64.6		—		87		ARBITRARY SIZING			
VALVE BODY	SIZE	TYPE	3"	GLOBE	3"	GLOBE	2"	GLOBE	3"	BALL	2"	BALL
	PRESS. RATING	CONNECTIONS	300#	RF								
	MATERIAL	CLASS	C.S.									
	BONNET TYPE	BOLTS	EXT	STD	A.C.U	STD.						
	PACKING	TYPE / MAT'L	TEFLON ASBESTOS		TEFLON ASBESTOS							
	LUBRICATOR	ISOL. VALVE	YES	YES								
TRIM	PORT SIZE	NO. OF PORTS	FULL	1	FULL	3			FULL	1		
	CHARACTER.	PLUG TYPE	Q.O.	CAGE	LIN	T.P.	MOD PAR	CONT		BALL		
	GUIDE TYPE	TRIM SPEC.		A		C						
	ACTION PUSH TO OPEN-CLOSE	FLOW: OPENS-CLOSES	CLOSE	OPEN								
ACTUATOR	ACTUATOR TYPE		PIST.				DIAP.					
	MOTIVE POWER	LINEAR / ROTARY	AIR	LIN.								
	PRESS./VOLTAGE	POS. ON POWER FAIL	—	O			—	C				
	THRUST OR TORQUE REQ.	SHUT OFF / OPER.										
	SIZE	MAX. OUTPUT	40		60		40					
	MANUAL O'RIDE	POS. FEEDBACK TYPE	—	—								
	POSITIONER OUTPUT	SINGLE/DUAL	—	—			3-15	S	—	—		
	INPUT SIGNAL	SUPPLY PSIG	ON-OFF	60			3-15	20	ON-OFF	60		
	BY-PASS	GAUGES	—	—								
MISC.			SIDE MOUNT						FISHER 656			
			HANDWHEEL						ACTUATOR			
	AIRSET MTD & PIPED		—				YES		—			
PURCH.	M. R. / P. O. NUMBER		J-811									
	MANUFACTURER		FISHER						HILLS-McCANNA			
	MODEL NO.		471-S-GU-ES		657 A		667 A		[illegible]			
GENERAL	P. & I. D. NUMBER		3-FA-41		3-CA-41		3-CA-41		3-FA-41			
	SERVICE		STM TO TURB 3B-650A		COOLING H2O TO 3B-640		FUEL GAS TO 3B-E3		FUEL GAS SHUT OFF		FUEL OIL SHUT OFF	
	LINE SIZE - NO. - SPEC.		3" J34		10" J03B		6" J16		6" J16		2" J13A	
	INSTRUMENT TAG NO.		3TV-643		3PDCL-14VM		3PV-641		3HV-603		3HV-604	

NO.	DATE	REVISIONS			NOTES
1	3-7-75	GEN REVISION	JT		
0	1-31-75	ISSUED FOR PURCHASE	JT		

ORIGIN R&C ENG.	BECHTEL	CONTROL VALVES	JOB NO. 10095
		[illegible]	DATA SHEET NUMBER: DS-J-127 / REV. 1

FORM NO. J-050 (8/69)

FORM NO. J-05J (8/84)

SERVICE CONDITIONS	FLUID							STEAM								
	INLET PSIG	MIN.	OPER.	MAX.				40			250			100		
	OUTLET PSIG	MIN.	OPER.	MAX.				36						75		
	INLET TEMP. °F		OPER.	MAX.				150			500			521		
	OPER. SP. GR. (Liq.) / Vapor MOL. WT.							0.65				18		0.735	—	
	Tsh °F or % FLASH		OPER. VISC.-C.P.													
	CRIT. PRESS. Pc		VAPOR PRESS.-Pv													
	OPER. FLOW		SIZING FLOW					1490	2086		8000	11200		215	300	
	MIN. FLOW		MAX. FLOW													
	FLOW UNITS		ΔP SIZING					—	4		#/HR	70		GPM	25	
	ΔP SHUT-OFF		ΔP MIN.											150		
	Cv @ SIZING ΔP & FLOW		MIN. Cv					840			67.5			52		
	Cv-VALVE SELECTED		FACTORS					843			67.5			72.9		
								Km=.75						Km=.58		
											C_v=32					
VALVE BODY	SIZE		TYPE		8"	GLOBE		8"	GLOBE		1½	GLOBE		2"	GLOBE	
	PRESS. RATING		CONNECTIONS		300#	RF								300#	RF	
	MATERIAL		CLASS					S.S.-B	C.S		C.S			C.S.		
	BONNET TYPE		BOLTS					EXT	STD					EXT	STD.	
	PACKING		TYPE	MAT'L				TEFLON						TEFLON ASBESTOS		
	LUBRICATOR		ISOL. VALVE					YES	YES					YES	YES	
TRIM	PORT SIZE		NO. OF PORTS					FULL	2		—	—		RED	BALD	
	CHARACTER.		PLUG TYPE					LIN	T.P. E		Q.O.	CAGE A		LIN	CAGE A	
	GUIDE TYPE		TRIM SPEC.													
	ACTION PUSH TO OPEN-CLOSE		FLOW: OPENS-CLOSES					CLOSE	OPEN		CLOSE	OPEN		CLOSE	CLOSE	
ACTUATOR	ACTUATOR TYPE							P.O.P.			DIAP.					
	MOTIVE POWER		LINEAR / ROTARY					AIR	LIN		—	—		—	—	
	PRESS./VOLTAGE		POS. ON POWER FAIL		—	C		—	—		—	C		—	O	
	THRUST OR TORQUE REQ.		SHUT OFF	OPER.												
	SIZE		MAX. OUTPUT					86			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		IN-OFF	20		3-15	20	
	BY-PASS		GAUGES					YES	YES		NO	NO		YES	YES	
MISC.					SEE EXISTING											
					VALVE ON P. 10											
	AIRSET MTD & PIPED				3-RA-4, NEW			YES			YES			YES		
PURCH.	M. R. / P. O. NUMBER				SAME, SAME			J-411			J-411			J-411		
	MANUFACTURER				TAG NO.			FISHER			FISHER			FISHER		
	MODEL NO.				—			476D-A			657 ES			657 ED		657 ED
GENERAL	P. & I. D. NUMBER				3-RA-41			3-RA-4			3-RA-41			3-RA-41		
	SERVICE				REACTOR FEED To 3R-E-46			FEED TO RX RISER			STM TO SOOT BLOWER			REACTOR FEED TO E-3		
	LINE SIZE - NO. - SPEC.				10" J14B			10" J113A			2"-J34			4" J117A		4" J117A
	INSTRUMENT TAG NO.				3PdC-14VB			3PdC-14VN			3PV-658			3FV-620		3FV-621
2	10-24-73	REVISED 3PDCL-14 VN						STM 2								
1	3-7-73	GOL REVISION						JT 0								
0	1-31-73	ISSUED FOR PURCHASE						J. TAN J								
NO.	DATE	REVISIONS								NOTES						

ORIGIN R&C ENG.

BECHTEL

CONTROL VALVES

JOB NO. 10095

TEXACO INC. 3910 ... PERMIAN ... 10095

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