Interoffice Communication

To R. G. Checksfield, Houston, Texas

From L. W. Cresswell, Ponca City, Oklahoma

Date October 2, 1978

Subject Waste Water Treatment Revisions Design - Ethylene Feedstock Project Expansion Case - Lake Charles Refinery

Attached is a process design for revisions to the existing refinery waste water treatment facilities to accommodate the Ethylene Feedstock Expansion Case. The design calls for a new intermediate waste water holding tank for high flow rate, intermittent streams, and a dissolved air flotation unit to remove oil and solids prior to biological treatment.

The projected effluent levels for the EFS case indicate a serious problem with meeting the most lenient of expected NPDES permits without the installation of this pretreatment equipment. The expansion will cause a 35 percent increase in hydraulic loading to the activated sludge unit, coupled with an 80 percent increase in raw waste organic loading. The presently oversized activated sludge unit will become fully loaded for the EFS case.

Please direct your comments or questions to us by October 9, 1978, or we will assume that the design is accepted as issued.

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LAKE CHARLES REFINERY

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LAKE CHARLES REFINERY

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WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

Drawing Number	Title
SD-2568-42-116-L	Process Flow Diagram - Wastewater Treatment Facilities - Ethylene Feedstock Project - Expansion Case - Lake Charles Refinery
SD-2568-42-118-L	Process Flow Diagram - Wastewater Treatment Facilities - Ethylene Feedstock Project - Expansion Case - Lake Charles Refinery
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SD-2568-42-120-L	P&I Diagram - New Dissolved Air Flotation Unit - Ethylene Feedstock Project - Expansion Case - Lake Charles Refinery
SD-2568-42-121-D	P&I Diagram - Tie-Ins for T-2603 - Ethylene Feedstock Project - Expansion Case - Lake Charles Refinery
SD-2568-42-122-C	P&I Diagram - CPI Lift Station - Ethylene Feedstock Project - Expansion Case - Lake Charles Refinery
SD-2568-83-1-C	S-2601 - Dissolved Air Flotation Feed Sump - Ethylene Feedstock Project - Expansion Case - Lake Charles Refinery
SD-2568-83-2-B	S-2602 - Sludge Sump - Wastewater Treatment Revisions - Ethylene Feedstock Project - Expansion Case - Lake Charles Refinery
SD-2568-83-3-B	S-2603 - Slop Oil & Solids Sump - Wastewater Treatment Revisions - Ethylene Feedstock Project - Expansion Case - Lake Charles Refinery
SD-2568-89-6-B	T-2601 - Flocculation Tank - Wastewater Treatment Revisions - Ethylene Feedstock Project - Expansion Case - Lake Charles Refinery

SD-2568-89-7-B	T-2602 - Polyelectrolyte Dilution Tank - Ethylene Feedstock Project - Expansion Case - Lake Charles Refinery
SD-2568-93-3-B	T-2603 - Intermediate Holding Tank - Ethylene Feedstock Project - Expansion Case - Lake Charles Refinery
SD-2568-95-4-B	T-2603 - Dike Detail - Wastewater Treatment Revisions - Ethylene Feedstock Project - Expansion Case - Lake Charles Refinery

DESIGN BASIS

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

I. Background

The Lake Charles Refinery's waste water effluent is currently meeting the limitations specified by its existing NPDES permit. Table I shows a comparison of refinery monthly average effluent data to existing permit values for the period of January, 1977 through May, 1978. Even at the higher 95 percent probable levels, all parameters were in compliance except for total chromium. Chromium permit levels were exceeded on two occasions due to inadvertent discharges into the sewer. Better housekeeping practices in the future should prevent continued chromium violations.

Although the existing discharge permit is being met, the refinery is currently encountering problems in the operation of the waste treatment facilities. The major sources of these problems are:

1) Large flow surges through the treatment system due to various intermittent discharges.

2) High oil concentrations in the Activated Sludge Unit Feed.

At present these problems cause the treatment system to experience upsets. Oil builds up in the biological floc of the activated sludge unit, which reduces the treatment efficiency. The high oil level also reduces oxygen transfer and causes solids carryover in the clarifier. Nevertheless, the overall system currently produces a good effluent which easily meets permit values as a result of:

1) The activated sludge unit (ASU) is oversized for the present loading. Therefore, the unit is able to "limp through" upsets caused by high oil levels.

2) A large partially aerated lagoon followed by a dissolved air flotation unit downstream of the ASU do a good job of polishing the ASU effluent.

The present surges in raw waste flow are caused by intermittent discharges from three major sources. The coker blowdown pond is periodically pumped down at a rate of 200 gpm. Ballast water is also occasionally received from the dock facilities at a rate of 200 gpm, and water draws from the crude tankage in the east and south tank farms can be received at rates of 200 gpm and 180 gpm, respectively. These sources often contain large quantities of oil which can overload the API and CPI separators and end up in the ASU.

Data from the refinery indicates oil concentrations of up to 250 mg/l can occur in the ASU feed. Generally, 50 mg/l of oil is considered to be the maximum oil concentration that should be fed to a biological system. At oil concentrations above 50 mg/l in the waste water, the oil accumulates in the biosludge to a high level which reduces bio efficiency. Oxygen transfer to the waste is also significantly reduced. If insufficient oxygen is transferred to satisfy the requirements for BOD reduction, anaerobic conditions occur. The result is poor effluent quality and increased loading on the final treatment.

Theoretically, the existing 4-25 HP surface aerators in the ASU should be able to transfer 210 lbs/hr of oxygen to the waste under normal conditions. This is sufficient oxygen for treatment of the current 95 percent probable BOD loading to the ASU of 3,695 lbs/day. However, current data from the refinery indicates a dissolved oxygen (DO) level of zero in the ASU 10 to 15 percent of the time. DO levels approaching zero indicate inadequate oxygen supplied for BOD reduction.

II. Projected EFS Raw Waste Levels

Implementation of the Ethylene Feedstock Project will result in the expansion of the Lake Charles Refinery to include primarily a new 30,000 BPSD FCC, a new 105,000 BPSD crude unit, and a sulfuric acid plant. As a result of the expansion, the average flow to the biological treatment facilities will increase from 616 gpm to 835 gpm. The predicted raw waste contaminant loadings for the expansion case are shown in Table II, column 1. The large increase in BOD loading is primarily due to additional desalter water from the new crude unit.

For the EFS case, the stable operation of the ASU will become more critical to the overall efficiency of the waste water treatment facilities due to the increased flow and contaminant loadings. Modifications must be made to the system to eliminate the frequent upsets of the ASU seen in the past. The final effluent flotation unit alone will not be able to adequately treat a poor ASU effluent to meet the projected future discharge permit.

III. Projected EFS Case Final Effluent Vs. Discharge Permit

Table V shows the maximum expected NPDES permit values in column 2 for the case of a direct scale-up of the existing permit based on crude throughput. Since the Lake Charles Refinery discharges to a water quality limited stream, there is a chance that the existing permit will not be changed for the expansion case. However, until Conoco enters into negotiations with the EPA for a new permit, it would be safe to assume that the maximum expected permit values will be the higher values in Table V.

Predicted EFS case final effluent concentrations without pretreatment are shown in Table III. The effluent was predicted, assuming no changes were made to the overall treatment scheme. As can be seen, the expected maximum effluent permit values (most lenient values) cannot be met unless a pretreatment dissolved air flotation unit is installed.

IV. New Intermediate Holding Tank

The most practical method of eliminating the raw waste flow surging problem appears to be the installation of an intermediate holding tank. The new tank would collect water from the coker blowdown pond, the tank farm water draws, and the ballast water tank. Some oil separation would take place in the tank with the water discharging to the API at a controlled rate.

A 10,000 bbl capacity tank with an internal floating roof tank has been specified for this service. The floating roof will be required to satisfy State Air Emission requirements for oil water separators. The tank was designed to handle approximately 3,000 bbl of water from the coker blowdown pond and the tank farm water draws. Each source will be received at a rate of $\sim$200 gpm. The additional 7,000 bbl of capacity will be needed to handle ballast water from the dock facilities. Since the dock facilities occasionally have 15,000 bbl of water that must be processed, it will be required in the future to control the rate at which this water is sent to the holding tank. This can easily be done due to excess capacity of the dock facilities tankage and the fact that ballast water is only received at an average of 15,000 bbl every two weeks.

Oil, water, and sludge will be drawn off the new holding tank at various levels by a series of discharge lines spaced at intervals on the side of the tank. The water will be sent by flow control to the API separator at a normal rate of 80 gpm, while the oil will be periodically drawn off manually and pumped to slop treatment. The slop pump and spare have been specified for a rate of 60 gpm each to allow oil pump down in approximately 3 hours under normal conditions.

V. Activated Sludge Feed Pretreatment

A. Introduction

The problems of high oil concentrations in the ASU feed and supplying sufficient oxygen to the ASU for BOD removal must both be solved for the expansion case. The only feasible solution appears to be pretreatment of the ASU feed.

The 95 percent probable BOD loading to the ASU after the expansion without feed pretreatment is predicted to be 6,556 lbs/day. The oxygen required to process this BOD loading is 350 lbs/day, an increase of 140 lbs/day from the 210 lbs/day presently supplied. The additional oxygen could be supplied by adding more aeration to the ASU, but this would not eliminate upsets from high oil concentrations.

Pretreatment of the feed to a biological system for oil and solids removal is the best method of ensuring stable operation of the system. Pretreatment of the ASU feed with dissolved air flotation would eliminate both the oil and oxygen transfer problems.

B. Pilot Tests

Dissolved air flotation pilot studies were conducted on the Lake Charles Refinery CPI effluent in the early 1970's. The pilot dissolved air flotation unit yielded a consistently good effluent. Flotation treatment of the ASU feed would greatly improve the operation of the ASU by removing the oil and suspended solids. This would raise the active fraction of micro-organisms in the ASU mixed liquor.

Research studies performed on the ASU in the early 1970's indicated that pretreatment with dissolved air flotation would also greatly improve the oxygen transfer efficiency in the unit. The experimental data indicated that the alpha value (the ratio of oxygen transfer coefficient in the waste to the that of pure water) would be increased from 0.67 to 0.95 with flotation. This would enable the existing aerators in the ASU to supply 290 lbs/hr of oxygen to the waste. Since a sizeable portion of the suspended BOD will be removed by flotation, the 95 percent probable BOD loading to the ASU will be reduced from 6,556 lbs/day to 4,875 lbs/day. This lower BOD level will require only 260 lbs/hr of oxygen which can easily be transferred by the existing aerators after feed pretreatment.

C. Dissolved Air Flotation Unit Design Basis

The new dissolved air flotation unit (DAF) will be located west of the existing CPI and will treat the CPI effluent water. The DAF effluent will then be pumped to the existing equalization section of the ASU.

The normal design flow to the new DAF after the expansion will be 495 gpm. The 491 gpm effluent from the DAF will combine with 340 gpm of cooling tower blowdown to give an average flow of 831 gpm to the ASU. By installing the new intermediate holding tank, the flow rate to the new DAF should be relatively constant except during storm conditions.

The maximum flow during storm conditions to the new DAF will be limited to 1,400 gpm in the expansion case by limiting the feed pump discharge rate. Any excess over 1,100 gpm will back up the sewer to the CPI and switch on the existing storm water diversion pumps, as presently occurs with the existing system. The DAF effluent will combine with 340 gpm of cooling tower blowdown to give 1,440 gpm of feed to the ASU during storm conditions. Currently, the ASU processes approximately 1,200 gpm under maximum storm conditions. The ASU will process the same amount of storm water after the expansion, with the increase in flow due only to an increase in process water.

1. Flotation Performance

The projected feed to the new dissolved air flotation unit was estimated based upon probability plots of contaminant levels from recent plant data (January, 1977 to May, 1978) plus predicted effluents for the new units included in the expansion. The expected dissolved air flotation unit performance during normal and storm conditions is summarized in Table IV. Only the critical feed parameters affected by flotation are shown. The performance of the unit was predicted based on dissolved air flotation pilot tests previously conducted on the CPI effluent.

2. Chemical Requirements

The previous pilot test results indicated that the solids removal efficiency of a dissolved air flotation unit on the CPI effluent was enhanced with proper chemical treatment. Often both a coagulant (alum) and a flocculant (polyelectrolyte) are used for chemical treatment. However, the pilot test results indicated that 6 ppm of a cationic polyelectrolyte alone gave the best results. Eliminating the alum will benefit the operation of the unit by simplifying the chemical feed system and also reducing the sludge production associated with the alum solids.

The cationic polyelectrolyte (Nalco 603) will be diluted to a 10 weight percent solution in water before addition. The polyelectrolyte dilution tank was specified to provide a 7-day supply of chemical at normal flows. The chemical will be added by proportionating pumps which are controlled by the DAF feed pump flow.

The polyelectrolyte will be added to the waste upstream of the flocculation tank. The flocculation tank will provide a retention period for the formation of floc. The tank was sized to allow approximately 10 minutes retention time, since pilot tests indicated 5-15 minutes retention is required for formation of a good floc. Good flocculation will significantly increase the flotability of the solids.

3. Flotation Cells

Flotation cells are normally sized to give an overflow rate (including recycle) at normal flow of 1.5 to 2.5 gpm/sq ft. However, due to high oil and solids loading in the feed and the large increase in flow during storm conditions, a slightly more conservative overflow rate has been used for this design. The flotation cell was specified as a 25-foot diameter tank with overflow rates of 1.36 and 3.02 gpm/sq ft at the normal and storm flows. The volume of the tank specified will allow sufficient retention time for the air to contact the solids (floc) and float them to the surface.

4. Recycle Saturation System

The recycle saturation system, included as part of the flotation cell package, will provide the necessary air to float the solids to the surface of the flotation cell. Air and a portion of the flotation cell effluent will be contacted in the saturation column at about 65 psig (80 percent saturation efficiency). Air in the recycle stream will be released in the flotation cell by depressurization through a specifically designed back pressure control valve. Excess air (25 percent) will be provided to the saturation column to keep the system purged of nitrogen which is less soluble in water than oxygen. The recycle rate will be maintained at about 35 percent of the feed rate by flow ratio control.

5. Sludge Handling System

The floated solids and oil will be skimmed from the flotation cell as an approximately 4 weight percent solution. This high concentration will be achieved due to the large amount of oil and solids in the feed. The float will then gravity flow to the sludge sump where the concentration will be increased by settling to a 5 weight percent solution. The size of the sump was specified to provide 3 days of sludge storage at the normal rate. The 5 weight percent sludge will be removed by vacuum truck for disposal.

TABLE I

CURRENT WASTE WATER EFFLUENT

LAKE CHARLES REFINERY

Parameter	Monthly(1) Average 50% Probability	Monthly(1) Average 95% Probability	NPDES Permit Daily Average
BOD_5, lb/day	130	275	320.0
COD, lb/day	675	1,600	2,500.0
TOC, lb/day	195	325	760.0
TSS, lb/day	185	340	420.0
NH3, lb/day	53	150	170.0
Oil and Grease, lb/day	28	72	136.0
Phenol, lb/day	0.28	0.7	2.0
Chromium, lb/day(2)	2.1	6.0	5.0
Sulfide, lb/day	.047	.08	3.4

NOTES:

(1) Based on values reported during the period from January, 1977 through May, 1978 for both the process lagoon and firepond discharges combined.

(2) Compliance has been met 92 percent of the time. Violation of the permit limitation values occurred on two occasions due to inadvertent discharges into the process sewer.

TABLE II

BIOLOGICAL SYSTEM FEED

LAKE CHARLES REFINERY

Parameter	Current Feed	PROJECTED FUTURE FEED W/O DAF	PROJECTED FUTURE FEED W/DAF
BOD_5, 50% (Lb/Day) Probable	1,551	2,816	2,101
BOD_5, 95% (Lb/Day) Probable	3,695	6,515	4,875
Oil, 50% (Lb/Day) Probable	237	319	177
Oil, 95% (Lb/Day) Probable	1,857	2,505	295
TSS, 50% (Lb/Day) Probable	2,811	2,010	335
COD, 50% (Lb/Day) Probable	5,231	7,691	-
Flow, (GPM)	616	835	831

TABLE III

PROJECTED FUTURE EFFLUENT VALUES

LAKE CHARLES REFINERY

	REFINERY EFFLUENT, 30-DAY AVERAGE LBS/DAY			
	W/O ASU FEED PRETREATMENT(1)		W/ASU FEED PRETREATMENT(2)	
Parameter	50% Probable	95% Probable	50% Probable	95% Probable
BOD_5(3)	311	808	185	309
COD(3)	1,617	4,697	946	1,796
TSS(4)	237	534	237	350
Oil & Grease(5)	34	88	34	88
Phenolic Compounds(5)	0.34	0.86	0.34	0.86
Ammonia (as N)(6)	96	135(8)	96	150
Sulfide(5)	0.06	0.10	0.06	0.10
Total Chromium(7)	2.6	5.9	2.6	3.8
TOC(3)	467	953	273	364

NOTES:

1. Projected effluent for the EFS case assuming no changes are made to the existing waste treatment scheme.
2. Assumes a new intermediate waste water holding tank is installed upstream of the API separator for crude tank draws, coker blowdown, and ballast waters with a new dissolved air flotation unit downstream of the existing CPI separator (activated sludge feed pretreatment).
3. BOD_5 values for the projected effluents were calculated using computer simulation of the refinery activated sludge process followed by flotation treatment. COD and TOC values were calculated from the existing case COD/BOD_5 ratios.
4. Effluent TSS values were projected based on existing data on the final flotation unit for higher loadings.
5. These parameters were calculated from a direct scaleup of existing effluent values based only on flow increases.
6. A new sour water stripper is being designed to allow NH_3 compliance with the existing permit for the EFS case.
7. Projected 95 percent chromium levels were calculated based on the pounds of suspended solids discharged (assumes housekeeping improvements with respect to spills, etc.).
8. More of the NH_3 is used up as nutrient in the activated sludge unit for the non-pretreatment case due to much higher BOD_5 loadings. This assumes that the ASU does not completely fall apart from the much higher loadings.

TABLE IV

PREDICTED DAF PERFORMANCE

Parameter	NORMAL		STORM	
	Feed	Effluent	Feed	Effluent
Flow, gpm	495	-	1,100	-
Oil, mg/l				
Maximum	422	50	422	50
Average	54	30	54	30
Suspended Solids, mg/l				
Maximum	600	90	600	110
Average	335	50	335	70
BOD_5, mg/l				
Maximum	1,097	820	-	-
Average	467	350	-	-

TABLE V

PROJECTED NPDES PERMIT FOR EFS EXPANSION

LAKE CHARLES REFINERY

Parameter	Existing Permit	Calculated EFS Permit Based On Existing Permit Scaleup(1)
BOD_5	320	616
COD	2,500	4,814
TSS	420	809
Oil & Grease	136	262
Phenolic Compounds	2.0	3.9
Ammonia (as N)	170	327
Sulfide	3.4	6.6
Total Chromium	5.0	9.6
TOC	760	1,464

NOTE:

(1) A direct scaleup of the existing permit based on crude throughput and the 1.04/0.99 overall multiplier change (Process Factor x Size Factor) in going from the present case to the EFS case.

PROCESS DESCRIPTION

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT

EXPANSION CASE

LAKE CHARLES REFINERY

I. Intermediate Holding Tank

The intermediate holding tank (T-2603, nominal 10,000 bbl) will be located between the API and CPI oil-water separators. Oily water from the east tank farm crude tanks, south tank farm, ballast water tank, and coker blowdown pond will be transferred to T-2603. Approximately 1,500 barrels of water will be pumped from the crude tanks (T-371, 372, and 373) in the east tank farm on an intermittent basis every two days. Ballast water from the dock, also intermittently, will be discharged at a rate of 200 gpm into T-2603. Water from the coker blowdown pond will flow continuously into the intermediate holding tank at a normal rate of 50 gpm and a maximum rate of 200 gpm. In addition, water from the south tank farm will be pumped to T-2603 by P-976 at a rate of 180 gpm intermittently. Part of the oil and solids will separate by gravity from the oily waste water in T-2603. The waste water will flow by gravity from T-2603 to the API oil-water separator on flow control (FIC-2603). Under normal conditions, a constant flow to the API separator of 80 gpm will be maintained. A ground reach tank gauge, LI-2601, will be used to aid in manually adjusting FIC-2603 to control the liquid level in T-2603 between a maximum and minimum level for the normal 24 hour/day cycle. In this way the level will go through a normal daily cycle, while allowing the flow to the API separator to remain about constant.

A board-mounted high, low level alarm, LAHL-2601, located in the reformer control room will alert the operators to protect the tank from overfilling and prevent the loss of separated oil during low flow conditions.

A layer of oil will form underneath the internal floating room (installed to prevent hydrocarbon vapor loss) and will be removed as necessary. By using the 1-inch sample draw nozzles, the oil layer depth will be determined. The oil layer will be drawn off through one of the three oil withdrawal nozzles. Reciprocating pump, J-2603, or spare, J-2604, will transfer the oil from T-2603 at a rate of 60 gpm to the existing slop oil facilities for further treatment.

A nozzle located at the bottom of T-2603 will allow the removal of solids or heavy oil. J-2603 or J-2604 will transfer the heavy oil to the slop oil treating facilities. A recycle line from the reciprocating pumps will be used to help suspend the solids in the bottom of the tank and aid in solids removal.

A sludge sump (S-2603, 4 feet wide by 4 feet long by 5 feet deep) will be used to collect liquid discharged from the sample draw nozzles and can also be used to discharge viscous solids from the bottom of T-2603. Material from S-2603 will normally be transferred to the slop oil facilities using J-2603 and J-2604.

The tank dike around T-2603 will prevent loss of contaminated storm water and will contain oily water which may be released due to tank leaks. When necessary, stormwater will be transferred to the waste water treatment facilities by opening a block valve, which will allow gravity flow to the API outlet basin. If a serious leak occurs, water will flow through a 10-inch overflow line (located approximately 3 feet above grade) through the dike to the API outlet basin. This water will be pumped by P-453 to the stormwater diversion pond for temporary storage.

II. Dissolved Air Flotation Unit

Effluent from the CPI oil-water separator will flow through the existing 18-inch sewer to a new sump (S-2601, refer to SD-2568-83-1-C for details). The flotation unit feed pumps, P-2601 and P-2602, will be located in S-2601. Pump discharge will be controlled by LC-2601, which obtains its signal from a float located in S-2601. There will also be a board-mounted flow indicator, FI-2601, on the discharge line of P-2601 and 2602, with a low flow alarm, FAL-2601, in the reformer control room.

The level control point will be at the 5-foot level in S-2601. The control range will be 24 inches (12 inches above and below the control point). Normal flow, about 495 gpm, will require the use of only one pump (P-2601 or P-2602 rated at 650 gpm each). Under normal flow conditions, P-2602 will serve as a complete spare. During storm conditions, the level in the sump will rise, and P-2602 will automatically switch on when the level rises to a height of 6 feet in S-2601. With both pumps in operation, the flotation unit feed pumps will be limited to about 1,100 gpm. Flow will be restricted to about 1,100 gpm by restricting the travel of the level control valve. During larger magnitude storms, when the flow to S-2601 exceeds 1,100 gpm, P-453 (located in the API separator outlet box) will be actuated by a level controller located in the CPI oil-water separator and the excess storm water will be pumped to the stormwater diversion pond (maximum rate is 2,000 gpm). The dissolved air flotation unit can be bypassed during pump failure or maintenance to the unit by allowing the level in S-2601 to build until the water overflows through the existing outlet sewer down to the existing CPI outlet basin.

Waste water will be pumped from S-2601 to the flocculation tank, T-2601, with polymer addition prior to T-2601. A cationic polyelectrolyte (Nalco 603 recommended) will be used. The polymer injection point should allow the release of polymer into the center of the waste water stream. Polyelectrolyte, as 10 weight percent solution, will be transferred to the injection point by polyelectrolyte feed pump, J-2601. The polyelectrolyte feed pump will be equipped with flow ratio control. The pump will receive an air signal (reset) from FT-2601 and will automatically make adjustments to maintain a constant 6 ppm polyelectrolyte dosage. J-2602 will serve as a spare to J-2601. J-2601 or J-2602 will be automatically shutdown by FSL-2601 when a low liquid flow through sump, S-2601, occurs. Both polyelectrolyte feed pumps will be equipped with simplex screens on their suction lines to remove solid particles and prevent plugging. The polyelectrolyte will be further diluted to 1 weight percent by the addition of recycle water prior to injection in the waste water stream. Adequate mixing of the polyelectrolyte and waste water will occur in the line to the flocculation tank, T-2601.

The flocculation tank will provide a period of gentle agitation for the formation of floc (groups of solids particles). T-2601 will provide a 9.5 minute retention time at normal flow conditions and a 4.5 minute retention time at maximum flow. Inlet and outlet baffles will be used to prevent short circuiting. Formation of the solid particles into floc will increase the floatability. Gentle agitation will be accomplished by flocculation mixer, A-2601. A-2601 will be a variable speed mixer.

Water containing the flocculated solids will gravity flow from the flocculation tank to the dissolved air flotation cell, AF-2601. This line should be of minimum length (with minimum bends) to reduce shearing of the flocculated material. Recycle will be added to the waste water stream prior to introduction into the flotation cell. Flow will be uniformly distributed throughout the flotation cell by the influent feedwell. The recycle stream will be saturated with air under pressure in the saturation column, D-2601. The release of recycle pressure will cause the formation of many small bubbles which will attach themselves to the flocculated material, and float the solids to the surface of the flotation cell. Float will be skimmed from the surface of AF-2601 by rotating skimmer arms. The float (approximately 4 weight percent solids) will flow by gravity from the float box in AF-2601 to the sludge sump, S-2602. The float box will have an inclined dewatering beach or ramp to reduce the volume of sludge that must be handled. AF-2601 will be equipped with a center sludge well and bottom scrapers. This will allow removal of non-floatable solids that might settle in the flotation cell. A line from the sludge well to the sludge sump, S-2602, will allow periodic removal of settled solids. Clarified waste water will flow under a baffle and over a weir to the peripheral launder. Effluent from the dissolved air flotation unit will flow by gravity to the CPI lift station.

A portion of the flotation unit overflow will be pumped from the recycle outlet box by recycle pump, P-2603 (P-2604 spare) to a saturation column, D-2601. Recycle flow will be controlled by a flow ratio controller, FRIC-2602, in the common pump discharge line. FRIC-2602 will have a local indicator mounted on a centrally located control panel in the flotation unit area. In addition, FRIC-2602 will have a board-mounted indicator, FI-2602, and low flow alarm, FAL-2602, in the reformer control room. The flotation recycle pumps will be automatically shutdown by FSL-2601, when a low liquid flow through S-2601 occurs.

The recycle stream will be saturated with air at 65 psig in the saturation column, D-2601. A pressure regulator, PCV-2601, along with a rotameter, FI-2603, will be used to control the air rate to the saturation column. Excess air will be released by an automatic air vent valve, which also will control the liquid level in D-2601. Saturation column efficiency will be 80 percent. After exiting from the saturation column, the recycle stream will pass through a hand-controlled pressure release valve before combining with the flotation feed.

Float from the cell will contain 1,817 lbs/day of solids and oil under normal conditions. The float will concentrate to a 5 weight percent solution by settling and will be removed from S-2601 by vacuum truck approximately every 2-3 days.

Cationic polyelectrolyte will be diluted to a 10 weight percent solution in dilution tank, T-2602. Mixing requirements will be met by A-2602. The polyelectrolyte (Nalco 603 recommended) will be contained in 55-gallon drums. A drum pump will be used to transfer polyelectrolyte to the dilution tank. Dilution water addition will be controlled by a manually operated valve. A target gauge with graduated metering stick will be available for dilution water and polyelectrolyte addition measurements. Approximately 300 gallons of 10 weight percent polyelectrolyte will be required every 7 days.

III. CPI Lift Station

Effluent from the dissolved air flotation unit will flow by gravity through an existing 24-inch pipe to the CPI lift station. The activated sludge unit feed pumps, P-2605 or P-987, will then transfer the waste water to the equalization section of the activated sludge unit as occurs for the existing system. Pump discharge will be regulated by level control. Under normal flow conditions, only P-2605 will be required (P-2605 is rated at 800 gpm). P-987 will serve as a spare for T-2605. During a storm, the sump level will rise, and P-987 will automatically switch on. With both pumps in operation, the equalization feed from the process sewers will be limited to 1,100 gpm by restricting the travel of the existing level control valve.

WORK LIST

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

I. Intermediate Holding Tank

1. Install a new internal floating roof tank, T-2603, fabricated as shown in Drawing SD-2568-93-3-B in the area immediately west of the existing API oil-water separator (refer to plot plan SD-2568 -42-119-L). Construct a dike around the new tank (refer to Drawing SD -2568 -93-3-B for a description of the dike) Construct the dike drain line 4-DO-26050-N-A2-3 with block valve and 10-DO-26049-N-A2-3 overflow line as shown in SD-2568-95-4-B.

2. Construct a new concrete sludge sump, S-2603, next to tank T-2603. Sump dimensions are to be 4 feet wide by 4 feet long by 5 feet deep.

3. Tie in a new 6-inch C.S. line, 6-DO-26024-N-A2-3, to an existing 6-inch line from the east tank farm at sump in rundown area and install a 6-inch block valve in existing line. Route the new 6-inch line to T-2603. Approximately 1,400 feet of pipe will be required.

4. Connect the existing 4-inch C.S. ballast water line from the dock facilities to line 26024 using a new 4-inch C.S. line (4-DO-26025 -N-A2-3) and block valve at the API separator.

5. Install a 4-inch C.S. line (26026) and block valve to connect an existing 6-inch pipe in the pipe rack east of the CPI separator and T-2603 to direct flow from the coker blowdown pond and the south tank farm (P-976) to T-2603. Approximately 120 feet of pipe will be required.

6. Install J-2603 and J-2604 next to sump, S-2603. Tie in all lines and block valves as shown in P&I Diagram SD-2568-42-121-D. All valves are to be operable from the ground level.

7. Install 3-inch discharge lines with check and block valves on J-2603 and J-2604 and route the pipe to an existing 3-inch slop oil line from the API separator located in the pipe rack east of the CPI separator (approximately 120 feet of pipe will be required). Also, tie in the new 3-inch line to an existing 2-inch line as shown in P&ID SD-2568-42-121-D. Provide a 3-inch C.S. line (26036) and block valve to recycle flow from the pumps to T-2603.

8. Connect the solids withdrawal nozzle on T-2603 to the sludge pump, S-2603, and to J-2603, 2604 with new 4-inch C.S. line and block valves as shown in the P&I Diagram. Also provide a 4-inch vacuum truck hose connection.

9. Install 10 1-inch valves and piping for the sampling system and route to sump S-2603. All valves must be operable from the ground level.

10. Install a ground reach tank gauge, LI-2601, with board-mounted level alarm, LAHL-2601, on T-2603.

11. Install the 4-inch water drain lines and valves, 10-inch overflow line, segmental orifice, and 3-inch butterfly control valve as shown in drawing SD-2568-42-121-D. Water will gravity flow through a new 6-inch line (6-DO-26030-N-A2-3) to the API inlet box. Approximately 200 feet of line will be required.

12. Install FIC-2603 on T-2603 water drain line (4-DO-26027-N-A2-3).

II. New Dissolved Air Flotation Unit (DAF)

A. Flotation Feed System

1. Install the flotation feed sump, S-2601, as shown in drawing SD-2568-83-1-C immediately west of T-115. The existing 21-inch concrete sewer from the CPI should be connected to feed the sump. The sump will overflow to the existing 21-inch concrete sewer to the CPI lift station.

2. Install the flotation feed pumps, P-2601 and 2602, in the new sump, S-2601.

3. P-2601 is to be provided with level switches to turn on and off at 5 feet-0 inches and 4 feet-0 inches from the sump floor, repsectively.

4. P-2602 is to be provided with level switches to turn on and off at 6 feet-0 inches and 5 feet-0 inches from the sump floor, respectively.

5. Install the board-mounted flow indicator, FI-2601, and low flow alarm, FAL-2601. The instruments will receive an electrical signal from FT-2601. The instruments are to be included in the package with FI-2601.

6. Install the low flow switch, FSL-2601, to receive an air signal from FT-2601. The flow switch should shut-off the recycle pumps and the chemical feed pumps during periods of low flow.

7. Install LC-2601 in the flotation feed sump, S-2601. A stilling well for the ball float mechanism is to be provided. The output from LC-2601 will operate the DAF feed flow through a 4-inch standard pattern continental butterfly valve in line 6-DO-26001-N-M2-4.

B. Chemical Feed System

1. Install fiberglass polyelectrolyte dilution tank, T-2602, equipped with a target level gauge. The tank should be electrically traced and insulated. Provide the 1-inch drain line, 1-DO-26022-N-R37-1, to drain to the feed sump, S-2601.

2. Install the top-mounted polyelectrolyte dilution mixer, A-2602, in T-2602.

3. Install the chemical feed pumps, J-2601 and 2602, adjacent to T-2602. Connect the feed lines of both pumps to T-2602.

4. Provide J-2601 and 2602 with low flow shutdown switches. The shutdown switches will receive an electrical signal from the low flow switch, FSL-2601.

5. Tie-in line 1-WU-26016-N-M2-4 to existing service water line at the CPI to provide dilution water for T-2602. Tie-in line 1/2-WU-26015-N-M2-4 to provide further dilution of the chemical pump discharge.

6. Tie-in line 1/2-DC-26019-N-R37-1 to the discharge of J-2601 and 2602 and route to the 6-inch feed pump discharge line, 6-DO-26001-N-M2-4. This connection should be made to allow the introduction of the chemicals into the center of the 6-inch line.

7. Install the flocculation tank, T-2601, with top-mounted flocculation mixer, A-2601. Provide the 2-inch drain line, 2-DO 26021-N-M2-4, to drain to the feed sump, S-2601.

8. Tie-in line 6-DO-26001-N-M2-4 from the feed pumps to T-2601. Route the 10-inch gravity flow discharge line from T-2601, 10-DO-26002-N-M2-4, to the flotation tank, AF-2601. The 10-inch line is to have minimum length and number of bends.

C. Flotation System

1. Install the dissolved air flotation cell, AF-2601, with the associated equipment listed on the specification sheet.

2. Provide the 12-inch gravity flow line, 12-DO-26004-N-M2-4, from AF-2601 to existing sewer manhole downstream of new DAF feed sump, S-2601.

3. Install the saturation column, D-2601, near AF-2601, with all associated equipment listed on the specification sheet.

4. Install the 6-inch recycle line, 6-DO-26009-N-M2-4, from D-2601 to AF-2601. Install the back pressure value (pressure release mechanism) in 6-inch line as close to AF-2601 as possible.

5. Install the recycle pumps, P-2603 and 2604, and connect the 6-inch discharge line, 6-DO-26007-N-M2-4, to D-2601. Install the 8-inch suction line, 8-DO-26006-N-M2-4, from AF-2601 to P-2603 and 2604.

6. Install FRIC-2602 in the common discharge line from P-2603 and 2604. The control valve is to be a 4-inch standard pattern continental butterfly valve. FRIC-2602 is to receive an air signal from FT-2602. The package is to include the board-mounted flow indicator and low flow alarm, FI-2602 and FAL-2602.

7. Provide P-2603 and 2604 with low flow shutdown switches. The shutdown switches will receive an electrical signal from the low flow switch, FSL-2601.

8. Install the 1-inch line, 1-DO-26013-N-M2-4, from the discharge of P-2603 and 2604 to the top of AF-2601 for wash water.

9. Install the 1/2-inch line, 1/2-DO-26014-N-M2-4, from the discharge of P-2603 and 2604 to the chemical feed line, 1/2-DC-26019-N-R37-1. Install the flow indicator, FI-2604, in the 1/2-inch line from the recycle pump discharge.

10. Provide the 3/4-inch air line, 3/4-AU-26010-N-M2-4, from the existing 2-inch plant air line at the CPI to the saturation column, D-2601. The line should contain the back-pressure regulator, PCV-2601, and flow indicator, FI-2603, which are included with the saturation column package.

D. Sludge Handling System

1. Install the sludge sump, S-2602, near the flotation tank, AF-2601, as shown in the sump drawing.

2. Install the 6-inch line from the float withdrawal box on AF-2601, 6-DM-26003-N-M2-4, for gravity flow to the sludge sump.

3. Install the 2-inch line from the sludge well on AF-2601, 2-DM -26005-N-M2-4, for gravity flow to the sludge sump.

4. Install the 2-inch overflow line, 2-DO-26011-N-M2-4, from the sludge sump to the DAF feed sump, S-2601.

5. Install the 3-inch sludge withdrawal line, 3-DM-26012-N-M2-4, in the lower end of the sludge sump. Provide a vacuum truck connection on the line for batch sludge withdrawal.

III. CPI Lift Station

1. Replace P-986 with a new pump, P-2605, and connect it to the existing 8-inch piping. Retain P-986 as a spare for P-987 and P-2605.

2. Field check existing level control valve and limit travel to that necessary to restrict flow to a maximum of 1,100 gpm.

EQUIPMENT LIST

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKR CHARLES REFINERY

	Service
Sumps	
S-2601	DAF Feed Sump
S-2602	Sludge Sump
S-2603	T-2603 Sludge Sump
Flotation Cells	
AF-2601	New DAF Unit Flotation Cell
Tanks	
T-2601	DAF Flocculation Tank
T-2602	Polyelectroylte Dilution Tank
T-2603	Intermediate Holding Tank
Drums	
D-2601	DAF Recycle Saturation Column
Pumps	
P-2601 and P-2602	DAF Feed Pumps
P-2603 and P-2604	DAF Recycle Pumps
P-2605	New ASU Feed Pump
J-2601 and J-2602	Polyelectrolyte Feed Pumps
J-2603 and J-2604	Oil and Solids Removal from T-2603
Mixers	
A-2601	Flocculation Tank Mixer
A-2602	Polyelectrolyte Dilution Mixer

AIR FLOTATION TANK SPECIFICATIONS

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

Item No.	AF-2601 (1)	
Location	Dissolved Air Flotation Unit	
Service	Removal of Oil and Suspended Solids from ASU Feed	
Fluid	Refinery Wastewater	
Influent	**Normal**	**Storm**
Flow, GPM	495	1,100
Oil, mg/l		
Maximum	422	422
Average	54	54
Suspended Solids, mg/l		
Maximum	600	600
Average	335	335
pH, Range	6-9	6-9
Temperature Range, °F	120-150	90-120
Chemical Feed, GPH		
Cationic Polymer, 10 wt%	1.8	4.0
Effluent (2)		
Oil, mg/l		
Maximum	50	50
Average	30	30
Suspended Solids, mg/l		
Maximum	90	110
Average	50	70
Float (Average)		
Flow, GPM	4	7
Oil, lbs/day	140	315
Suspended Solids, lbs/day	1,700	3,500
Operating Conditions		
New Flotation Area, sq ft	491	
Overflow Rate, GPM/sq ft (3) (recycle included)		
Normal Flow	1.36	
Maximum Flow	3.02	
Retention Time, Minutes (recycle included)		
Normal Flow	50	
Maximum Flow	22	
Recycle Rate, GPM		
Normal Flow	173	
Maximum Flow	400	
Recycle Saturation Pressure, psig	65	
Saturation Efficiency, %	80	

AIR FLOTATION TANK SPECIFICATIONS

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

Operating Conditions (Cont'd)

Flotation Tank Dimensions	
Diameter	25'-0"
Depth, Water	9'-0" (4)
Total	9'-6"
Freeboard	6"
Material of Construction	C.S.
Corrosion Allowance	1/8"

NOTES:

1. Vendor will supply a detailed drawing of the flotation cell.
2. Effluent concentrations are predicted valves based upon Conoco pilot tests.
3. Flow ratio control on the recycle stream will maintain the recycle flow at 35 percent of the flotation feed. After startup, the recycle rate can be adjusted for optimum performance.
4. Not including bottom slope to central sludge cone.
5. The unit will include the following:
   a. A walkway with hand rails extending to center of tank (center drive mechanism).
   b. A sludge rake and float scraper driving mechanism with built in automatic torque overload indication, alarm contact and cut off switches, and including a 3/4 HP variable speed explosion-proof driver.
   c. A float removal assembly consisting of a float box and two surface scrapers with neoprene wipers.
   d. An influent diffusion feed well to uniformly distribute the air-water-solids mixture across the tank area.
   e. The sludge raking arms with blades and adjustable squeegees.
   f. A peripheral underflow baffle for the flotation compartment.
   g. An adjustable V-notched peripheral weir.
   h. A peripheral launder with two discharge boxes (effluent and recycle).
   i. Saturation column and associated equipment (see D-2601 specifications).
6. The flotation cell interior is to be coated with Carbolines Carbomastic 14 or equivalent for corrosion protection.

RECYCLE SATURATION COLUMN SPECIFICATIONS

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

Item No.	D-2601(1)
Location	Dissolved Air Flotation Unit
Service	Saturation of DAF Recycle With Air
Fluid	Treated Wastewater
Liquid Rate(2)	
Normal Flow, gpm	173
Maximum Flow, gpm	400
Vapor Rate(3)	
Normal Flow, lb/hr	11.6
Maximum Flow, lb/hr	26.1
Operating Pressure, psig	65
Saturation Efficiency, %	80
Design Conditions	
Liquid, pH	6-9
Liquid Temperature Range, °F	90-150
Atmospheric Temperature, °F	
Winter Design, Min.	26
Summer Design, Max.	100
Atmospheric Pressure, psia	14.7
Design Pressure, spgi	100

NOTES:

1. Vendor will furnish a detailed drawing of recycle saturation system.
2. Liquid rate (recycle) stream will be maintained at 35 percent recycle by flow ratio control.
3. Based on 25 percent excess air at maximum flow to maintain continuous purging of the saturation column.
4. The following will be included with D-2601:
   a. Inlet and outlet nozzles, sight glass, pressure gauge, pressure release valve, automatic air vent valve, and all tower internals.
   b. Specifically designed back pressure release assembly with pressure relief valve adjusted by manual hand wheel.
   c. Compressed air control panel consisting of pressure gauge, flow indicator, solenoid valve, flow control valve, and air regulator.

TANK SPECIFICATIONS

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

Item No.	T-2601
Location	Dissolved Air Flotation Unit
Service	Flocculation of Suspended Solids in Refinery Waste Water
Fluid	Refinery Waste Water
Dimensions, Ft	
Diameter	9
Height	
Total	13
Normal Liquid	10
Capacity, Gallons	
Total	6,200
Normal Liquid	4,700
Retention Time, Minutes	
at Normal Rate	9.5
at Maximum Rate	4.5
Design Conditions	
Operating Pressure, psig	0
Design Pressure, psig	0
Operating Temperature, °F	120-150
Design Temperature, °F	150
Material of Construction	C.S.(6)
Corrosion Allowance	1/8-Inch
Type	Open top, vertical cylindrical tank.

NOTES:

1. The centerline of outlet nozzle is to be 36 inches below top of sidewall and the same elevation as the flotation cell overflow weir.
2. Pipe connection between T-2601 and AF-2601 is to have the minimum length and number of bends.
3. An 1/4 HP variable speed mixer (A-2601) is to be top-mounted to meet mixing requirements.
4. A walkway with handrails to the center of the tank will be provided.
5. Four antivortexing baffles and inlet and outlet baffles will be provided.
6. The tank interior will be coated with Carbolines Carbomastic 14 or company approved equal.

TANK SPECIFICATIONS

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

Item No.	T-2602
Location	Dissolved Air Flotation Unit
Service	Polyelectrolyte Dilution and Storage Tank
Fluid	10 weight percent solution of cationic polyelectrolyte.
Dimensions, Ft.	
Diameter	4
Height	
Total	5
Normal Liquid	3.5
Capacity, Gal.	300
Run Time Between Mixes, Days	7
Design Conditions	
Operating Pressure, psig	0
Design Pressure, psig	0
Operating Temperature, °F	40-100
Design Temperature, °F	110
Material of Construction	Fiberglass
Corrosion Allowance	None
Type	Vertical Cylindrical

NOTES:

1. A 1/4-HP propeller-type mixer (A-2602) is to be top-mounted to meet mixing requirements.
2. Tank is to be equipped with a target level gauge. The graduated metering stick will allow proper dilution water addition.
3. A 1-inch service water line is to be supplied to the top of T-2602 for dilution water addition.
4. Tank is to be provided with fiberglass top and observation hatch.
5. Entire chemical addition area to be surrounded by curbing or small retaining wall to contain spills.
6. Tank is to be electrically traced and insulated.

TANK SPECIFICATIONS

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

Item	T-2603
Location	West of API Oil-Water Separator
Service	Intermediate Holding Tank
Fluid	Oily Water
Dimensions, Ft.	
Diameter	43'-0"
Height	40'-0"
Capacity Barrels	10,000
Design Conditions	
Operating Pressure, psig	0
Design Pressure, psig	0
Operating Temperature, °F	40-90
Design Temperature, °F	90
Material of Construction	C.S.
Corrosion Allowance	1/8-inch
Type	Internal Floating Roof

NOTES:

1. Internal floating roof support legs are to be constructed of galvanized steel.

2. Tank is to be equipped with a ground reach tank gauge.

3. T-2603 is to be enclosed by an earthen dike. Dike will have approximate dimensions of 85 feet long by 50 feet wide by 6 feet high.

MIXER SPECIFICATIONS

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

Item No.	A-2601
Location	Dissolved Air Flotation Unit Flocculation Tank T-2601
Service	Provide Gentle Agitation for Flocculation
Tank Dimensions, Ft	
Diameter	9
Height	
Total	13
Normal Liquid	10
Liquid Volume, gal	4,700
Retention Time, Minutes	9.5 (495 gpm) 4.5 (1,100 gpm)
Fluid	Refinery wastewater with cationic polymer added to aid in flocculation.
Temperature, °F	120-150
Viscosity, cp	1
Sp Gr	1.0
pH	6-9
Mixer(1)	
Type	Turbine
HP	1/4 (variable speed 15-45 rpm)
Entry Position	Top
Material of Construction	Type 304 S.S. Shaft and Blades

NOTES:

1. A-2601 is to provide a uniform energy distribution in tank T-2601. The drive for A-2601 has been specified as variable speed to allow for adjustment to maximize floc formation without floc shear.

MIXER SPECIFICATIONS

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

Item No.	A-2602	
Location	Dissolved Air Flotation Unit Polyelectrolyte Tank T-2602	
Service	Batch Mixing of Polyelectrolyte with Dilution Water	
Tank Dimensions, ft		
Diameter	4	
Height		
Total	5	
Normal Liquid	3.5	
Liquid Volume, Gal.	330	
Fluids		
	Water	Polyelectrolyte
Volume, gal	300	30
Temperature, °F	40-100	40-100
Viscosity cp at 60°F	1.0	100
Sp Gr	1.0	1.16
pH	6-9	6-7
Mixer		
Type	Propeller	
HP	1/4 (350 rpm)	
Entry Position	Top	
Material of Construction	Type 304 S.S. Shaft and Bladea	

SUMP SPECIFICATIONS

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT -- EXPANSION CASE

LAKE CHARLES REFINERY

Item	S-2601
Location	Air Flotation Unit Area
Service	Air Flotation Feed Sump
Fluid	Oily Water
Dimensions	
Length	10'-0"
Width	5'-0"
Depth, Total	11'-6"
Normal Liquid	5'-0"
Maximum Liquid	6'-0"
Retention Time, Minutes	
Normal Rate	3.8
Maximum Rate	2.0
Design Conditions	
Operating Pressure, spig	0
Design Pressure, psig	0
Operating Temperature, °F	90-150
Design Temperature, °F	150
Material of Construction	Concrete

SUMP SPECIFICATIONS

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

Item	S-2602
Location	Air Flotation Unit Area
Service	Collection of Float From Air Flotation Unit
Fluid	Float (4% solids) in Waste Water
Dimensions	
Length	18'-0"
Width	13'-0"
Depth, Total	7'-6"(4)
Normal Liquid	7'-0"(4)
Capacity, Gallons	11,400
Retention Time, Hours	
Normal Rate	47
Maximum Rate	27
Design Conditions	
Operating Pressure, psig	0
Design Pressure, psig	0
Operating Temperature, °F	90-150
Design Temperature, °F	150
Material of Construction	Concrete

NOTES:

1. A 3-inch vacuum truck connection will be provided for removal of bottoms sludge.
2. A 2-inch line will be provided for overflow to the new DAF feed sump.
3. The sump will be sloped one foot towards the point of sludge withdrawal.
4. Dimensions at overflow end of sump.
5. The sump will be provided with a redwood cover and baffle.

SUMP SPECIFICATIONS

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

Item	S-2603
Location	T-2603 Intermediate Holding Tank
Service	Slop Oil and Solids Draw
Fluid	Slop Oil-Water-Solids
Dimensions	
Length	4'-0"
Width	4'-0"
Depth	5'-0"
Material of Construction	Concrete

ENGINEERING CENTER

CONOCO

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

CENTRIFUGAL PUMPS

A.F.E. NO. _____ W. O. NO. _____

DATE 8/9/78 ING. NO. _____

MADE BY ZAE REQ. NO. _____

APP'D BY _____ P. O. NO. _____

B.M. NO. _____

PLANT LOCATION L. C. Refinery PROJECT ETHYLENE FEEDSTOCK - EXPANSION CASE

1 APPLICABLE TO: ESTIMATE (X) PURCHASE ( )

2 P-2601, 2602

3 SERVICE Dissolved Air Flotation Feed Pumps

4

5 MOTOR DRIVE (✓) TURBINE ( )

6

7 **OPERATING CONDITIONS**

8 LIQUID Water — U.S. gpm at PT. NOR. 495 RATED 650

9 — DISCH PRESS., psig 35

10 PT F 150 — SUCT PRESS., psig MAX 0 RATED 0

11 SP GR at PT 0.90 — DIFF PRESS., psi 30

12 VAP PRESS. at PT., psia 3.7 — DIFF HEAD, ft 69

13 VIS at PT, Saybolt Sec 0.8 — NPSH AVAIL., ft 20+

14 CORR/EROS caused by

15 **CONSTRUCTION**

16 CASING MOUNTING (CENTERLINE) (FOOT) (BRACKET) (VERTICAL)

17 SPLIT (AXIAL) (RADIAL)

18 TYPE (SINGLE VOLUTE) (DOUBLE VOLUTE) (DIFFUSER)

19 TAPPED OPENINGS (VENT) (DRAIN) (GAGE CONNS.)

20	NOZZLES	SIZE	ASA RATING	FACING	POSITION
21	SUCTION				
22	DISCHARGE				

23 MATERIAL CODE—EXTERNAL CASING I INTERNAL PARTS 8

24	I - CAST IRON	INTERNALS CODE	I	B	S	C	SPECIAL MTL. CODE
25	B - BRONZE	IMPELLER	I	B	S	C	
26	S - STEEL	INNER CASE PARTS	I	I	S	C	
27	C - 11-13% Cr	SLEEVE (PACKED)	Cr	Cr	Af	Af	
28	A - ALLOY	SLEEVE (SEAL)	C	C	C	C	
29	h - HARDENED	WEAR PARTS	I	B	Cr	Cr	
30	I - FACED	SHAFT	S	S	S	S	
31	X Ni-RESIST						
32							

33	MOTOR DRIVER BY			TURBINE DRIVER BY		
34	ITEM NO.		MTD BY	ITEM NO.		MTD BY
35	HP	RPM	FRAME	HP	RPM	MAT'L
36	MFR			MFR and TYPE		
37	OR COMPANY APPV'D, EQUAL			INLET STEAM, psig		TEMP F
38	TYPE		INSUL	EXHAUST		
39	ENC Exp. Prf.		TEMP RISE C	STEAM RATE, FL		lb/BHP/HR
40	VOLTS/PHASE/CYCLES			BEARINGS		LUBE
41	BEARINGS		LUBE	NOZZLES	SIZE / ASA RATING / FACING / POSITION	
42	FULL LOAD AMPS			INLET		
43				EXHAUST		

44 REMARKS: OPEN IMPELLER VERTICAL

45 SUCT. & DISCH. PUMP BEARINGS ARE

46 TO BE FLUSHED WITH SERVICE WATER

47

48 PUMP IS TO BE MANUFACTURED IN ACCORDANCE WITH THE FOLLOWING STANDARDS.

49 API-610

50 ( ) INDICATES ITEM CHANGED ON LATEST REVISION.

NOTE: THE SOUND LEVELS GENERATED BY THE PUMP AND DRIVER SHALL BE WITHIN THE LIMITS OF THE ATTACHED SPECIFICATION.

QUOTATION WILL NOT BE CONSIDERED IF SUPPLIER DOES NOT COMPLETE RIGHT HAND COLUMN.

VENDOR	
MANUFACTURER	
SIZE AND TYPE	
STAGES	
RPM	
ROTATION FACING CPLG.	
EFF.	
HYD. H.P.	
RATED B.H.P.	
RATED HP DRIVER	
DIA. IMP.	
MAX. DIA. IMPELLER	
N.P.S.H. REQD. IN FT. FLUID PUMPED	
MFRS. BEARING No.	
RADIAL	
THRUST	
PACKING OR SEAL	
FLUSHING, GPM	
MATERIAL EXCEPTIONS BY VENDOR	
WATER COOLING	
BEARINGS	
STUFF. BOX	
PEDESTAL	
GLAND	
TOTAL C.W. REQD.	
COUPLING, MFR.	
COUPLING, TYPE	
GUARD	
MECH. SEAL, MFR.	
MECH. SEAL, TYPE	
PACKING	
DELIVERY, WEEKS	
PUMP PRICE	
DRIVER PRICE	
EST. FREIGHT	
TOTAL PRICE	

SHEET _____ OF _____ REV. _____

4-424-S

9-15-72

SHE000000113

ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

CENTRIFUGAL PUMPS

A F E NO
DATE 7/28/78 W O NO
MADE BY PHS INQ NO
APP'D BY REQ NO.
B M NO P O NO

PLANT LOCATION LAKE CHARLES, LOUISIANA PROJECT Ethylene Feedstock Project - Expansion

APPLICABLE TO: ESTIMATE (X) PURCHASE ( )

P-2603 AND 2604.

SERVICE RECYCLE PUMP & SPARE

MOTOR DRIVE (X) TURBINE ( )

OPERATING CONDITIONS (1)			
LIQUID WATER	U.S. gpm at PT. NOR 173	RATED 400	
	DISCH PRESS., psig 75		
PT F 150	SUCT PRESS., psig MAX 1	RATED 0	
SP GR at PT 1.0	DIFF PRESS., psi 75		
VAP PRESS. at PT, psia 3.7	DIFF HEAD, ft 173		
VIS at PT, Sec cp = 0.6	NPSH AVAIL., ft 20+		
CORR/EROS caused by			

CONSTRUCTION					
CASING MOUNTING (CENTERLINE) (FOOT) (BRACKET) (VERTICAL)					
SPLIT (AXIAL) (RADIAL)					
TYPE (SINGLE VOLUTE) (DOUBLE VOLUTE) (DIFFUSER)					
TAPPED OPENINGS (VENT) (DRAIN) (GAGE CONNS.)					
NOZZLES	SIZE	ASA RATING	FACING	POSITION	
SUCTION					
DISCHARGE					

MATERIAL CODE-EXTERNAL CASING I INTERNAL PARTS X

I CAST IRON
B-BRONZE
S STEEL
C-11-13% Cr
A-ALLOY
n-HARDENED
f FACED
x N/- RESIST

INTERNALS CODE	I	B	S	C	SPECIAL MTL. CODE
IMPELLER	I	B	S	C	
INNER CASE PARTS	I	I	S	C	
SLEEVE (PACKED)	Cr	Cr	Af	Af	
SLEEVE (SEAL)	C	C	C	C	
WEAR PARTS	I	B	Cr	Cr	
SHAFT	S	S	S	S	

MOTOR DRIVER BY			TURBINE DRIVER BY		
ITEM NO.	MTD BY		ITEM NO.	MTD BY	
HP	RPM	FRAME	HP	RPM	MAT'L
MFR			MFR and TYPE		
OR COMPANY APPV'D, EQUAL			INLET STEAM, psig	TEMP F	
TYPE	INSUL		EXHAUST		
ENC EXP. PRF.	TEMP RISE C		STEAM RATE, FL		lb/BHP/HR
VOLTS/PHASE/CYCLES			BEARINGS		LUBE
BEARINGS	LUBE		NOZZLES	SIZE / ASA RATING / FACING / POSITION	
FULL LOAD AMPS			INLET		
			EXHAUST		

REMARKS

PUMP IS TO BE MANUFACTURED IN ACCORDANCE WITH THE FOLLOWING STANDARDS.

API-610

( ) INDICATES ITEM CHANGED ON LATEST REVISION.

NOTE: THE SOUND LEVELS GENERATED BY THE PUMP AND DRIVER SHALL BE WITHIN THE LIMITS OF THE ATTACHED SPECIFICATION.

(1) FLOW AND HEAD DATA WILL BE DEPENDENT UPON SPECIFIC SATURATION SYSTEM SELECTED.

(2) PUMPS TO BE FURNISHED WITH BEARING FLUSH SYSTEM USING PLANT SERVICE WATER.

QUOTATION WILL NOT BE CONSIDERED IF SUPPLIER DOES NOT COMPLETE RIGHT HAND COLUMN.

VENDOR	
MANUFACTURER	
SIZE AND TYPE	
STAGES	
RPM	
ROTATION FACING CPLG	
EFF	
HYD. H.P.	
RATED B.H.P.	
RATED HP DRIVER	
DIA. IMP	
MAX. DIA. IMPELLER	
N.P.S.H. REQD. IN FT. FLUID PUMPED	
MFRS. BEARING No.	
RADIAL	
THRUST	
PACKING OR SEAL	
FLUSHING, GPM	

MATERIAL EXCEPTIONS BY VENDOR

WATER COOLING	
BEARINGS	
STUFF. BOX	
PEDESTAL	
GLAND	
TOTAL C.W. REQD	
COUPLING, MFR	
COUPLING, TYPE	
GUARD	
MECH. SEAL, MFR.	
MECH. SEAL, TYPE	
PACKING	
DELIVERY, WEEKS	
PUMP PRICE	
DRIVER PRICE	
EST. FREIGHT	
TOTAL PRICE	

SHEET ____ OF ____ REV. ____

8-15-72

ENGINEERING CENTER

CONOCO

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

CENTRIFUGAL PUMPS

A.F.E. NO. ____ DATE 2/15 W. O. NO. ____ MADE BY TYP INQ. NO. ____ APP'D BY ____ REQ. NO. ____ S.M. NO. ____ P. O. NO. ____

PLANT LOCATION [illegible] PROJECT Ethylene Feedstock Expansion Unit

1	APPLICABLE TO: ESTIMATE (X) PURCHASE ( )								VENDOR
2	P-2605								MANUFACTURER
3	SERVICE REPLACE P-98b IN CPI LIFT								SIZE AND TYPE
4	STATION								STAGES
5	MOTOR DRIVE (X) TURBINE ( )								RPM
6									ROTATION FACING CPLG.
7	OPERATING CONDITIONS								EFF.
8	LIQUID WATER	U.S. gpm at PT. NOR. 495		RATED 800					HYD. H.P.
9		DISCH PRESS., psig 40							RATED B.H.P.
10	PT F 135	SUCT PRESS., psig MAX 5		RATED 0					RATED HP DRIVER
11	SP GR at PT 0.414	DIFF PRESS., psi 40							DIA. IMP.
12	VAP PRESS. at PT., psia 2.6	DIFF HEAD, ft 93							MAX. DIA. IMPELLER
13	VIS at PT, Gas Cp 0.47	NPSH AVAIL., ft 20+							N.P.S.H. REQD. IN
14	CORR/EROS caused by SAND, GRIT								FT. FLUID PUMPED
15	CONSTRUCTION								
16	CASING MOUNTING (CENTERLINE) (FOOT) (BRACKET) (VERTICAL)								MFRS. BEARING No.
17	SPLIT (AXIAL) (RADIAL)								RADIAL
18	TYPE (SINGLE VOLUTE) (DOUBLE VOLUTE) (DIFFUSER)								THRUST
19	TAPPED OPENINGS (VENT) (DRAIN) (GAGE CONNS.)								
20	NOZZLES	SIZE	ASA RATING	FACING	POSITION				PACKING OR SEAL
21	SUCTION								FLUSHING, GPM
22	DISCHARGE								
23	MATERIAL CODE—EXTERNAL CASING I			INTERNAL PARTS X					MATERIAL EXCEPTIONS BY VENDOR
24	I CAST IRON	INTERNALS CODE	I	B	S	C	SPECIAL MTL. CODE		
25	B-BRONZE	IMPELLER	I	B	S	C			
26	S-STEEL	INNER CASE PARTS	I	I	S	C			
27	C-11-13% Cr	SLEEVE (PACKED)	Cr	Cr	Af	Af			
28	A ALLOY	SLEEVE (SEAL)	C	C	C	C			
29	h-HARDENED	WEAR PARTS	I	B	Cr	Cr			
30	f-FACED	SHAFT	S	S	S	S			
31	X Ni-RESIST								
32									
33	MOTOR DRIVER BY		TURBINE DRIVER BY						WATER COOLING
34	ITEM NO. MTD BY		ITEM NO. MTD BY						BEARINGS
35	HP RPM FRAME		HP RPM MAT'L						STUFF. BOX
36	MFR		MFR and TYPE						PEDESTAL
37	OR COMPANY APPV'D, EQUAL		INLET STEAM, psig TEMP F						GLAND
38	TYPE INSUL		EXHAUST						TOTAL C.W. REQD.
39	ENC EXP. PR. TEMP RISE C		STEAM RATE, FL lb/BHP/HR						COUPLING, MFR.
40	VOLTS/PHASE/CYCLES		BEARINGS LUBE						COUPLING, TYPE
41	BEARINGS LUBE		NOZZLES	SIZE	ASA RATING	FACING	POSITION		GUARD
42	FULL LOAD AMPS		INLET						MECH. SEAL, MFR.
43			EXHAUST						MECH. SEAL, TYPE
44	REMARKS: OPEN IMPELLER VERTICAL SUMP								PACKING
45	PUMP								
46									DELIVERY, WEEKS
47									PUMP PRICE
48	PUMP IS TO BE MANUFACTURED IN ACCORDANCE WITH THE FOLLOWING STANDARDS.								DRIVER PRICE
49	API-610								EST. FREIGHT
50	( ) INDICATES ITEM CHANGED ON LATEST REVISION.								TOTAL PRICE

NOTE: THE SOUND LEVELS GENERATED BY THE PUMP AND DRIVER SHALL BE WITHIN THE LIMITS OF THE ATTACHED SPECIFICATION.

QUOTATION WILL NOT BE CONSIDERED IF SUPPLIER DOES NOT COMPLETE RIGHT HAND COLUMN.

SHEET ____ OF ____ REV. ____

4-424-S

9-15-72

SHE000000115

ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

A.F.E. NO. _____

DATE 7/23/74 W. O. NO. _____

MADE BY PHS INQ. NO. _____

APP'D BY _____ REQ. NO. _____

B. M. NO. _____ P. O. NO. _____

PROPORTIONATING PUMPS

PLANT LAKE CHARLES REFINERY PROJECT ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

1	SERVICE POLYELECTROLYTE CHARGE PUMP	ITEM NO.	J-2601 & 2602
2	AND SPARE	MANUFACTURER	
3	OPERATING CONDITIONS	SIZE	TYPE
4	LIQUID 10 WT % Polyelectrolyte IN WATER	DESIGN SPEED, SPM	
5	PUMPING TEMPERATURE, °F 100 (MAX)	MAX. RECOMMENDED SPEED, SPM	
6	SPECIFIC GRAVITY @ P.T. ~1	MAX. PISTON SPEED, ft/MIN	
7	VAPOR PRESSURE @ P.T. 0.4	STROKE LENGTH, IN	
8	VISCOSITY @ P.T., ~~SSU~~ cp = 100	BORE, IN	
9	CORR/~~EROS~~ CAUSED BY: MILDLY ALKALINE pH = 8.0	SUCTION NOZZLE	
10	U. S. ~~GPM~~, GPH AT PT, NORM. 1.8 DES. DES. 6.0	SIZE CLASS FACE	
11	SUCT. PRESS., psig, MAX. 2 DES. 0	DISCHARGE NOZZLE	
12	DISCH. PRESS., psig, MAX. DES. 100	SIZE CLASS FACE	
13	DIFF. HEAD, ft 231	BRAKE HORSEPOWER	
14	NPSH AVAIL., ft 20+	VOLUMETRIC EFFECIENCY	
15		NPSH REQUIRED	
16	CONSTRUCTION	LIQUID END MAT'L.	
17	CASE MAT'L. REQ'D. TYPE 316 SS (WETTED PARTS)	DIAPHRAGM MAT'L.	
18	LIQUID END MAT'L. REQ'D. TFE DIAPHRAGM	COVER PLATE MAT'L.	
19	STROKE ADJUSTMENT: YES ~~NO~~	LIQUID END GASKET	
20	MANUAL	BALL CHECK VALVES – MAT'L	
21	AUTOMATIC PROPORTIONAL CONTROL X	BALL SEAT MATERIAL	
22	NUMBER OF CYLINDERS	PLUNGER	
23	BASE PLATE REQUIRED	GLAND	
24	COUPLING REQUIRED	LANTERN RING	
25	COUPLING GUARD REQUIRED	PACKING TYPE	
26	MOTOR DRIVER BY	COUPLING MANUFACTURER	
27	ITEM NO. MTD BY	SPEED REDUCER	
28	HP RPM FRAME	MANUFACTURER	
29	MFR		
30	OR COMPANY APPV'D EQUAL		
31	TYPE INSUL.	DELIVERY, WEEKS	
32	ENC EXP. PAF. TEMP. RISE °C	SHIPPING WT.	
33	VOLTS/PHASE/CYCLES	PUMP PRICE	
34	BEARINGS LUBE	MOTOR PRICE	
35	FULL LOAD AMPS	EST. FREIGHT COST	
36			
37		TOTAL PRICE	
38			

39 NOTES:

40 (1) Diaphragm Pump with internal relief valve, flow

41 indicator and back pressure control

42 (2) Flow will vary directly with flotation unit feed. The

43 controller will receive an instrument air signal.

44 Automatic stroke or speed adjustment should be used.

45

46

47

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QUOTATION WILL NOT BE CONSIDERED IF SUPPLIER DOES NOT COMPLETE RIGHT HAND COLUMN.

SHEET _____ OF _____ REV _____

4-432-S

SHE000000116

ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

PROPORTIONATING PUMPS

A.F.E. NO. _____
DATE 2/9/78 W. O. NO. _____
MADE BY [illegible] INQ. NO _____
APP'D BY _____ REQ. NO. _____
B. M. NO. _____ P. O. NO. _____

PLANT [illegible] PROJECT ETHYLENE FEEDSTOCK - EXPANSION CASE

1	SERVICE SLUDGE AND OIL REMOVAL			ITEM NO J-2603, 2604	
2	FROM T-2602			MANUFACTURER	
3	OPERATING CONDITIONS			SIZE	TYPE
4	LIQUID Bottom Solids or Slop Oil			DESIGN SPEED, SPM	
5	PUMPING TEMPERATURE, °F 90			MAX. RECOMMENDED SPEED, SPM	
6	SPECIFIC GRAVITY @ P.T. 1.0			MAX. PISTON SPEED, ft/MIN	
7	VAPOR PRESSURE @ P.T. 0.7			STROKE LENGTH, IN	
8	VISCOSITY @ P.T., ~~SSU~~ P 500			BORE, IN	
9	CORR/EROS CAUSED BY: SUSPENDED SAND & SOLIDS			SUCTION NOZZLE	
10	U. S. GPM, ~~GPH AT~~ PT, NORM.	DES.	DES. 60	SIZE CLASS FACE	
11	SUCT. PRESS., psig, MAX. 17	DES.	0	DISCHARGE NOZZLE	
12	DISCH. PRESS., psig, MAX. 117	DES.	70	SIZE CLASS FACE	
13	DIFF. HEAD; ft 161			BRAKE HORSEPOWER	
14	NPSH AVAIL., ft 15 +			VOLUMETRIC EFFECIENCY	
15				NPSH REQUIRED	
16	CONSTRUCTION			LIQUID END MAT'L.	
17	CASE MAT'L. REQ'D.			DIAPHRAGM MAT'L.	
18	LIQUID END MAT'L. REQ'D.			COVER PLATE MAT'L.	
19	STROKE ADJUSTMENT: YES OR NO (6)			LIQUID END GASKET	
20	MANUAL			BALL CHECK VALVES - MAT'L	
21	AUTOMATIC			BALL SEAT MATERIAL	
22	NUMBER OF CYLINDERS			PLUNGER	
23	BASE PLATE REQUIRED			GLAND	
24	COUPLING REQUIRED			LANTERN RING	
25	COUPLING GUARD REQUIRED			PACKING TYPE	
26	MOTOR DRIVER BY			COUPLING MANUFACTURER	
27	ITEM NO.	MTD BY		SPEED REDUCER	
28	HP RPM		FRAME	MANUFACTURER	
29	MFR				
30	OR COMPANY APPV'D EQUAL				
31	TYPE	INSUL.		DELIVERY, WEEKS	
32	ENC EXP. P F.	TEMP. RISE °C		SHIPPING WT.	
33	VOLTS/PHASE/CYCLES			PUMP PRICE	
34	BEARINGS	LUBE		MOTOR PRICE	
35	FULL LOAD AMPS			EST. FREIGHT COST	
36					
37				TOTAL PRICE	
38					

39 NOTES:

40

41 1. Pump is to be [illegible] duplex [illegible]

42 2. Casing design is to be [illegible]

43 The safety valve will be set to

44 [illegible] discharge pressure.

45 3. Pump is to be supplied with a low pressure control

46 valve.

47 4. Motor power is to be calculated at [illegible] maximum

48 suction pressure

49 5. All fluid properties are for Estion solids.

50 6. Pump is to be supplied with a variable speed

51 drive or an adjustable stroke.

52 7. PUMP IS ALSO REQUIRED TO LIFT LIQUID OUT OF A SUMP

53 SIX FEET BELOW GRADE.

54

4-433-S

QUOTATION WILL NOT BE CONSIDERED IF SUPPLIER DOES NOT COMPLETE RIGHT HAND COLUMN.

SHEET _____ OF _____ REV. _____

PROCESS PIPING SCHEDULE
PROCESS ENGINEERING DEPARTMENT

Date 8/14 '75 Made By PHS
Project EFS - EXPANSION CASE
Plant LAKE CHARLES REFINERY

Line Designation	Service From	Service To	V L	Flow Rate Lb/Hr (Hot BPSD)	Normal °F	Normal PSIG	At T and P LB/CF (SP GR)	At T and P Visc CP	Press Drop PSIG/100'	Vel ft/sec	Remarks
6-DO-26001-N-M2-4	P-2601 & 2602	T-2601	L	550,000	150	35	61.1	0.6	3.22	12.22	20' LENGTH
10-DO-26002-N-M2-4	T-2601	AF-2601	L	550,000	150	0	61.1	0.6	0.260	4.48	20' GRAVITY FLOW
6-DM-26003-N-M2-4	AF-2601	S-2602	L	2,000	150	C	61.1	~10	MIL	MIL	20' GRAVITY FLOW
12-DO-26004-N-M2-4	AF-2601	SEWER	L	550,000	150	0	61.1	0.6	0.11	3.15	200' GRAVITY FLOW
2-DM-26005-N-M2-4	AF-2601	S-2602	L	-	150	-	-	-	-	-	INTERMITTENT 20' SLUDGE WITHDRAWAL
8-DO-26006-N-M2-4	AF-2601	P-2604	L	209,000	150	0	61.1	0.6	0.121	2.56	10' GRAVITY FLOW
6-DO-26007-N-M2-4	P-2603	D-2601	L	200,000	150	80	61.1	0.6	0.47	4.44	15'
6-DO-26008-N-M2-4	P-2604	6-DO-26007-N-M2-4	L	200,000	150	80	61.1	0.6	0.47	4.44	5'
6-DO-26009-N-M2-4	D-2601	AF-2601	L	200,000	150	90	61.1	0.6	0.47	4.44	25'
24-AV-26010-N-M2-4	PLANT AIR	D-2601	V	26	100	100	0.55	0.02	0.032	0.705	75'
2-DO-26011-N-M2-4	S-2602	S-2601	L	5,000	150	C	61.1	0.6	0.108	0.956	75' GRAVITY OVERFLOW
3-DM-26012-N-M2-4	S-2602	VAC TRUCK CON	L	-	150	-	-	-	-	-	15'
1-DO-26013-N-M2-4	6-DO-26008-N-M2-4	AF-2601	L	-	150	80	-	-		-	20' WASH WATER
½-DO-26014-N-M2-4	P-2603 & 2604	½-DC-26019-N-M2-4	L	500	100	100	62.0	0.66	0.6	1.06	20'
½-WU-26015-N-M2-4	4-WU-26016-N-M2-4	½-DC-26014-N-M2-4	L	500	100	100	62.0	0.66	0.6	1.06	10'
1-WU-26016-N-M2-4	SERVICE WATER	T-2602	L	-	100	100	62.0	0.66	-	-	75' CHEMICAL DILUTION WATER
1-DC-26017-N-R37-1*	T-2602	J-2601	L	400	100	0	62.0	0.66	-	-	10'
1-DC-26018-N-R37-1*	1-DC-26017-N-R37-1	J-2602	L	400	100	0	62.0	0.66	-	-	10'
½-DC-26019-N-R37-1*	J-2601	8-DO-26007-N-M2-4	L	400	100	100	62.0	0.66	-	-	20'
½-DC-26020-N-R37-1*	J-2602	½-DC-26019-N-R37-1	L	400	100	100	62.0	0.66	-	-	5'

* R37-1 denotes modified to PVC plastic

PROCESS PIPING SCHEDULE
PROCESS ENGINEERING DEPARTMENT

Date 3/M. 3 Made By _____
Project [illegible]
Plant [illegible]

Line Designation	Service From	Service To	V L	Flow Rate Lb/Hr (Hot BPSD)	Normal °F	Normal PSIG	At T and P LB/CF (SP GR)	At T and P Visc CP	Press Drop PSIG/ 100'	Vel ft/sec	Remarks
2-DO-26021-N-M1-4	T-2601	S-2601	L	—	150	0	-	-	-	-	20' DRAIN LINE
1-DO-26022-N-*R37-1	T-2602	S-2601	L	-	100	0	-	-	-	-	20' DRAIN LINE
4-DO-26023-N-M2-4	4-DO-26024-N-M2	P-2604	L	200,000	150	0	61.1	0.6	0.121	2.56	5'
6-DO-26024-N-A2-3	SUMP IN RUNDOWN AREA	T-2603	L	100,000	70	80	62.3	0.95	0.13	2.22	1400'
4-DO-26025-N-A2-3	Existing 4" Line	6-DO-26024-N-A2-3	L	100,000	70	80	62.3	0.95	0.985	5.04	5'
4-DO-26026-N-A2-3	Existing 6" Line	T-2603	L	100,000	90	80	62.1	0.75	0.785	5.04	120'
4-DO-26027-N-A2-3	T-2602	6-DO-26030-N-A2-3	L	40,000	90	-0	62.1	0.75	0.16	2.02	10' GRAVITY FLOW
4-DO-26028-N-A2-3	10-DO-26029-A2-3	4-DO-26027-N-A2-3	L	40,000	90	0	62.1	0.75	0.18	2.02	10' GRAVITY FLOW
10-DO-26029-N-A2-3	NT-2603	6-DO-26030-N-A2-3	L	390000	90	0	62.1	0.75	0.137	3.19	75' OVERFLOW LINE FOR T-2602
6-DO-26030-N-A2-3	10-DO-26029-N-A2-3	API INLET Box	L	390000	90	0	62.1	0.75	1.67	8.85	200' GRAVITY FLOW
3-HM-26031-N-A2-2	T-2603	J-2603	L	26000	90	0	(0.87)	15	0.64	2.72	10'
3-HM-26032-N-A2-2	3-HM-26033-N-A2-2	J-2604	L	30000	90	0	[illegible]	[illegible]	9.1	[illegible]	5'
4-HM-26033-N-A2-2	[illegible]	[illegible]	L	30000	90	0	[illegible]	[illegible]	[illegible]	1.53	10'
4-HM-26034-N-A2-2	4-HM-[illegible]-N-A2-2	[illegible]	L	[illegible]	90	-0	[illegible]	[illegible]	[illegible]	[illegible]	5'
3-HM-26035-N-A2-2	[illegible]	3-HM-26032-N-A2-2	L	30000	90	-0	(1.[illegible])	500	[illegible]	[illegible]	7'
3-HM-26036-N-A2-2	J-2603 + J-2604	[illegible]	L	30000	90	70	(1.0)	500	[illegible]	[illegible]	15'
3-HM-26037-N-A2-2	J-2603 + J-2604	Existing 3" Line	L	30000	90	70	[illegible]	[illegible]	[illegible]	[illegible]	120'
3-HM-[illegible]-N-A2-2	[illegible]	[illegible]" Line	L	[illegible]	90	70	[illegible]	[illegible]	[illegible]	[illegible]	15'

* R37-1 denotes modified to PVC pipe

- 40 -

SHE00000119

PROCESS PIPING SCHEDULE
PROCESS ENGINEERING DEPARTMENT

Date [illegible] Made By [illegible]
Project [illegible]
Plant [illegible]

Line Designation	Service From	Service To	V L	Flow Rate Lb/Hr (Hot BPSD)	Normal °F	Normal PSIG	At T and P LB/CF (SP GR)	At T and P Visc CP	Press Drop PSIG/ 100'	Vel ft/sec	Remarks
1-HM-26039-[illegible]	[illegible]03	S-[illegible]	L	-	[illegible]	0					10', Gravity Flow
1-HM-[illegible]	"	[illegible]	L		90						2'
1-HM-[illegible]					9[illegible]						[illegible]
[illegible]	"				[illegible]0						[illegible]
1-HM-26043-N-A2-2	"				[illegible]2						[illegible]
1-HM-26044-N-A2-3	"	"			[illegible]0						3'
1-HM-26045-N-A2-3	"	"			[illegible]0						17'
[illegible]-HM-26047-N-A2-3	"				[illegible]0						21'
1-HM-26048-N-A2-3					[illegible]0						25'
[illegible]					[illegible]0						29'
10-DO-26049-N-A2-3	T-2603 DIKE	API OUTLET BOX	L	(68,600)*	90	0	62.1	0.75	0.8	8.14	25' "
4-DO-26050-N-A2-3	T-2603 DIKE	LINE 26049	L		90	0	62.1	0.75	-	-	15' "
8-HM-26051-N-M2-4	P-2605	EXISTING 8" LINE	L	372000	135	40	61.8	047	0.392	4.81	12'
2-HM-26052-N-M2-4	P-2604	LINE 26037	L	30000	90	70	(1.0)	500	9.1	2.72	5'
3-HM-26053-N-A2-3	T-2603	LINE 26031	L	26000	90	0	(0.87)	15	0.64	2.72	20'
3-HM-26054-N-A2-3	T-2603	LINE 26031	L	26000	90	0	(0.87)	15	0.64	2.72	30'

* MAXIMUM FLOW

INSTRUMENT LIST

WASTE WATER TREATMENT REVISIONS

ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

LAKE CHARLES REFINERY

	Service
Level Instruments	
LI-2601	T-2603 Level Indicator
LAHL-2601	T-2603 High, Low Level Alarm
LC-2601	DAF Feed Sump Level Controller
LS-2601 and LS-2602	DAF Feed Pump Level Switches
LG-2601	Saturation Column Level Gauge
LI-2602	Polyelectrolyte Tank Level Indicator
LS-2603	Level Switch for P-2605
Flow Instruments	
FIC-2603	T-2603 Flow Control
FRIC-2602	Recycle Flow Ratio Controller
FT-2601	DAF Feed Flow Transmitter
FT-2602	Recycle Flow Transmitter
FT-2603	T-2603 Flow Transmitter
FY-2601	DAF Feed Flow Transducer
FY-2602	Recycle Flow Transducer
FSL-2601	DAF Feed Low Flow Switch
FI-2601	DAF Feed Flow Indicator (Board)
FI-2602	Recycle Flow Indicator (Board)
FI-2603	Saturation Air Flow Indicator
FI-2604	Polyelectrolyte Dilution Water Flow Indicator
HCV-2601	Recycle Back Pressure Control Valve
Pressure Instruments	
PCV-2601	Saturation Air Pressure Controller
PSV-2601	Saturation Column Safety Valve
PG-2601 and PG-2602	DAF Feed Pump Pressure Gauges
PG-2603 and PG-2604	Recycle Pump Pressure Gauges
PG-2605 and PG-2606	Polyelectrolyte Pump Pressure Gauges
PG-2607	Saturation Column Pressure Gauge
PG-2608	Recycle Pressure Gauge
PG-2609	P-2605 Discharge Pressure

CONOCO

ENGINEERING CENTER

PONCA CITY, OKLAHOMA
SPECIFICATION SHEET
FLOW INSTRUMENTS

A.F.E. NO. ______
DATE 9/25/78 W.O. NO. ______
MADE BY PHS ING. NO. ______
APP'D BY ______ REQ. NO. ______
B. M. NO. ______ P.O. NO. ______

PLANT LAKE CHARLES [illegible] PROJECT: ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

1	TAG NO.	FIC-2603	FRIC-2602 (2)(3)	FI-2601 (5)	
2	SERVICE	T-2603 FLOW	DAF RECYCLE	DAF FEED	
3		CONTROL	FLOW CONTROL	FLOW	
4	INSTRUMENT, TYPE	PNEUMATIC	PNEUMATIC	PNEUMATIC	
5	LOCATION	LOCAL	LOCAL	BOARD (6)	
6	ELEMENT TYPE	SEGMENTAL ORFICE	ORFICE	ORFICE	
7	LOCATION	4-DO-26027-N-A2-3	6-DO-26007-N-M2-4	6-DO-26001-N-M2-4	
8	LINE SIZE, IN. / SCHEDULE	4 / 40	6 / 40	6 / 40	
9	BORE, IN.	(1)	2.348	3.145	
10	RANGE, IN. H_2O	35	100	400	
11	METER FACTOR GPm	15	40	130	
12	VALVE TYPE	BUTTERFLY	BUTTERFLY		
13					
14	LOCATION	4-DO-26027-N-A2-3	6-DO-26007-N-M2-4		
15	MATERIAL	C.S.	CI		
16	BODY SIZE / PORT SIZE	3	4		
17	PLUG FORM				
18	ΔP MIN / NOR / MAX	0.2 / 4.1 / 15	3 / 5.5 / 75		
19	CALC C_v / VALVE C_v	176	224 (4)		
20	AIR TO OPEN OR CLOSE	OPEN	CLOSE		
21	MAX. SHUTOFF ΔP		75		
22	FLUID	WATER	WATER	WATER	
23	TEMPERATURE °F	90	150	150	
24	PRESSURE PSIG	15	75	35	
25	°API (M. W.)				
26	SP. GR. AT STD. COND.	1.0	1.0	1.0	
27	SP. GR. AT P. & T.				
28	CP/CV AT T.&P. / COMPRESSIBILITY				
29	VISCOSITY AT P. & T. cp	0.75	0.95	0.95	
30	RATE NORMAL gpm	80	173	495	
31	RATE MAX / MIN gpm	150 / 0	400 / 0	1100 / 0	
32	NOTES				

(1) The opening is the segment of a circle located in an arc concentric with the pipe and of diameter equal to 98% of that of the pipe. Height of segment opening is to be 2.045 inches.

(2) Flow ratio controller reset by FT-2601

(3) FRIC-2602 PACKAGE TO INCLUDE:

A. FY-2602 FLOW TRANSDUCER
b. FI-2602 BOARD MOUNTED FLOW INDICATOR (REFORMER CONTROL ROOM)
C. FAL-2602 BOARD MOUNTED LOW FLOW ALARM (REFORMER CONTROL ROOM)

(4) CORRESPONDS TO VALVE 56° OPEN AT MAXIMUM FLOW

(5) FI-2601 PACKAGE TO INCLUDE:

A. FY-2601 FLOW TRANSDUCER
b. FAL-2601 BOARD MOUNTED LOW FLOW ALARM (REFORMER CONTROL ROOM)
c. FSL-2601 LOW FLOW SWITCH TO SHUT OF P-2603 / 2604 AND J-2601 / 2602 AT LOW FLOW

(6) MOUNTED IN REFORMER CONTROL ROOM

SHEET ______ OF ______ REV ______

ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

LIQUID LEVEL INSTRUMENTS

A.F.E. NO. _____

DATE 10/17/75 W. O. NO. _____

MADE BY PMS ING. NO. _____

APP'D BY _____ REQ. NO. _____

S. M. NO. _____ P. O. NO. _____

PLANT ALL CHEMICAL REFINERY PROJECT: ETHYLENE FEEDSTOCK PROJECT & ASSOCIATED FACIL.

1	TAG NO.	LS-2601	LS-2602	LS-2603
2	SERVICE	P-2601 LEVEL	P-2602 LEVEL	P-2603
3		SWITCH	SWITCH	LEVEL SWITCH
4	INSTRUMENT, TYPE	LEVEL SWITCH	LEVEL SWITCH	LEVEL SWITCH
5	LOCATION	LOCAL	LOCAL	LOCAL
6	ELEMENT, TYPE	BALL FLOAT	BALL FLOAT	BALL FLOAT
7	LOCATION	DAF FEED SUMP	DAF FEED SUMP	DAF LIFT STATION
8	RANGE, INCHES	(1)	(2)	(3)
9	INTERFACE	AIR - LIQUID	AIR - LIQUID	AIR - LIQUID
10	UPPER DENSITY, LB./CU. FT.	0.075	0.075	0.075
11	LOWER DENSITY, LB./CU. FT.	61.2	61.2	61.8
12	TEMPERATURE °F	150	150	150
13	PRESSURE PSIG	0	0	
14	VALVE TYPE			
15				
16	LOCATION			
17	MATERIAL			
18	BODY SIZE / PORT SIZE			
19	PLUG FORM			
20	ΔP / MIN. / NOR. / MAX.			
21	CALC. Cv / VALVE Cv			
22	AIR TO OPEN OR CLOSE			
23	MAXIMUM SHUTOFF ΔP			
24	FLUID			
25	TEMPERATURE °F			
26	PRESSURE PSIG			
27	°API (SP.GR.)			
28	SP. GR. AT STD. COND.			
29	SP. GR. AT P. & T.			
30	WEIGHT % VAPOR IN—OUT			
31	VISCOSITY AT P. & T.			
32	RATE, NORMAL			
33	RATE:			
34	MAX. / MIN.			

35 NOTES:

(1) Set point to turn on P-2601 is 5'-0" above sump floor.
Set point to turn off P-2601 is 4'-0" above sump floor.
Set point to turn on P-2602 is 6'-0" above sump floor.
Set point to turn off P-2602 is 5'-0" above sump floor.

(2) LS-2602 will start and stop P-2605 when the liquid level is 4'-0" and 2'-0", respectively, above the sump floor.

SHEET _____ OF _____ REV _____

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ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

FLOW INSTRUMENTS

A.F.E NO. _____ WORK ORDER NO _____

DATE 10/1/78 W.O NO _____

MADE BY PHS INQ. NO. _____

APP'D BY _____ REQ NO _____

S. M. NO. _____ P.O. NO _____

PLANT LAKE CHARLES REFINERY PROJECT: ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

1	TAG NO.	FI-2603 (1)	FI-2604			
2	SERVICE	D-2601 AIR FLOW	DILUTION WATER			
3		INDICATOR	FLOW INDICATOR			
4	INSTRUMENT, TYPE					
5	LOCATION	LOCAL	LOCAL			
6	ELEMENT TYPE	ROTOMETER	ROTOMETER			
7	LOCATION	3/4-AV-26010-N-M2-4	1/2-DD-26014-N-ME-4			
8	LINE SIZE, IN. / SCHEDULE	3/4 / 40	1/2 / 160			
9	BORE, IN.					
10	RANGE, IN. H_2O					
11	METER FACTOR					
12	VALVE TYPE					
13						
14	LOCATION					
15	MATERIAL					
16	BODY SIZE / PORT SIZE					
17	PLUG FORM					
18	ΔP / MIN / NOR / MAX					
19	CALC Cv / VALVE Cv					
20	AIR TO OPEN OR CLOSE					
21	MAX. SHUTOFF ΔP					
22	FLUID	AIR	WATER			
23	TEMPERATURE °F	100	100			
24	PRESSURE PSIG	100	100			
25	°API @ M. W.I					
26	SP. GR. AT STD. COND.		1.0			
27	SP. GR. AT F. & T.					
28	CP/CV. AT T.&P. / COMPRESSIBILITY					
29	VISCOSITY AT P. & T.		0.93			
30	RATE NORMAL GPM (SCFM)	(2.5)	1			
31	RATE / MAX / MIN GPM (SCFM)	(10) / (1)	5 / 0.3			
32	NOTES					

(1) TO BE PROVIDED BY FLOTATION UNIT VENDOR

SHEET _____ OF _____ REV _____

ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

PRESSURE INSTRUMENTS

A F E NO _____

DATE 10/1/78 W O NO _____

MADE BY PMS INQ NO _____

APP'D BY _____ REQ NO _____

E M NO _____ P O NO _____

PLANT LAKE CHARLES REFINERY PROJECT ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

1	TAG NO	PCV-2601 (1)	PSV-2601 (1)			
2	SERVICE	D-2601 AIR	D-2601 PRESSURE			
3		PRESSURE CONTROL	RELIEF			
4	INSTRUMENT, TYPE	(2)	SAFETY VALVE			
5	LOCATION	LOCAL	D-2601			
6	RANGE, PSIG	0-100	100			
7	ELEMENT					
8	TYPE / MATERIAL					
9	LOCATION					
10	TEMPERATURE °F					
11	PRESSURE PSIG					
12	VALVE TYPE	PRESSURE				
13		REGULATOR				
14	LOCATION	34-AV-2601D-N-M12-4				
15	MATERIAL					
16	BODY SIZE / PORT SIZE					
17	PLUG FORM					
18	ΔP / MIN / NOR. / MAX.					
19	CALC. Cv / VALVE Cv					
20	AIR TO OPEN OR CLOSE					
21	MAX SHUTOFF ΔP	100				
22	FLUID	AIR				
23	TEMPERATURE °F	100				
24	PRESSURE PSIG	100 (3)				
25	°API IN #1	(29)				
26	SP GR. AT STD COND.					
27	SP GR AT P & T					
28	WEIGHT % VAPOR IN / OUT	100 - 100				
29	VISCOSITY AT P & T					
30	RATE, NORMAL SCFM	2.5				
31	RATE / MAX / MIN. SCFM	10 / 1				
32	NOTES	(1) TO BE PROVIDED BY VENDOR				

(2) DIRECT ACTING (SELF OPERATED) PRESSURE REGULATOR

(3) REGULATOR TO CONTROL AIR AT APPROXIMATELY 70 PSIG

SHEET _____ OF _____ REV _____

ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

LIQUID LEVEL INSTRUMENTS

A.F.E. NO. _____ W. O. NO. _____

DATE 9/[illegible] INQ. NO. _____

MADE BY EHC REQ. NO. _____

APP'D BY _____ P. O. NO. _____

B. M. NO. _____

PLANT LAKE CHARLES ETHYLENE PROJECT: ETHYLENE FACILITIES EXPANSION - OKLAHOMA CASE

1	TAG NO.	LI-2601 (1) (2)	LI-2602	LG-2601 (6)	
2	SERVICE	T-2603 LEVEL	T-2602 LEVEL	D-2601 LEVEL	
3		INDICATOR	INDICATOR	GUAGE	
4	INSTRUMENT, TYPE	LEVEL INDICATOR	LEVEL INDICATOR	LEVEL GUAGE	
5	LOCATION	LOCAL	LOCAL	LOCAL	
6	ELEMENT, TYPE	FLOAT	BALL FLOAT (3)	GUAGE GLASS	
7	LOCATION	T-2603	T-2602	D-2601	
8	RANGE, INCHES (5)	(36)	60		
9	INTERFACE	AIR-LIQUID	AIR-LIQUID	AIR-LIQUID	
10	UPPER DENSITY, LB./CU. FT.	0	0	0	
11	LOWER DENSITY, LB./CU. FT.	55.0	62.1	61.2	
12	TEMPERATURE °F	90	100	150	
13	PRESSURE PSIG	0	0	65	
14	VALVE TYPE				
15					
16	LOCATION				
17	MATERIAL				
18	BODY SIZE / PORT SIZE				
19	PLUG FORM				
20	ΔP MIN. / NOR. / MAX.				
21	CALC. Cv / VALVE Cv				
22	AIR TO OPEN OR CLOSE				
23	MAXIMUM SHUTOFF ΔP				
24	FLUID	SLOP OIL	WATER (4)		
25	TEMPERATURE °F	90	100		
26	PRESSURE PSIG	0	0		
27	°API (M.W.)	29			
28	SP. GR. AT STD. COND.	0.88	1.0		
29	SP. GR. AT P. & T.				
30	WEIGHT % VAPOR IN—OUT				
31	VISCOSITY AT P. & T. cP	13	100		
32	RATE, NORMAL				
33	RATE:				
34	MAX. / MIN.				
35	NOTES:				

(1) LI-2601 IS TO BE A GROUND REACH TANK GUAGE DESIGNATED FOR SEWAGE SERVICE. CABLE MATERIAL SHOULD BE CARBON STEEL (IF AVAILABLE) OR HASTELLOY-B LI-2601 CABLE TO BE CONNECTED DIRECTLY TO THE INTERNAL FLOATING ROOF.

(2) LI-2601 IS TO BE EQUIPPED WITH A BEARL [illegible] HIGH AND LOW LEVEL ALARM. SETPOINTS ARE TO BE AT THE 5'-0" AND 22'-0" LEVELS. LAHL-2601 IS TO BE LOCATED IN THE REFORMER CONTROL ROOM.

(3) TO BE TARGET GUAGE WITH GRADUATED METERING STICK

(4) 10 wt % polymer in water

(5) TO BE SUPPLIED BY FLOTATION UNIT VENDOR

SHEET _____ OF _____ REV _____

ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

LIQUID LEVEL INSTRUMENTS

A.F.E. NO. _____
DATE 10/1/78 W. O. NO. _____
MADE BY AMS ING. NO. _____
APP'D BY _____ REQ. NO. _____
S. M. NO. _____ P. O. NO. _____

PLANT LAKE CHARLES REFINERY PROJECT ETHYLENE FEEDSTOCK PROJECT - EXPANSION CASE

1	TAG NO.	LC-2601			
2	SERVICE	I-2601 LEVEL			
3		CONTROL			
4	INSTRUMENT, TYPE	PNEUMATIC			
5	LOCATION	LOCAL			
6	ELEMENT, TYPE	BALL FLOAT (1)			
7	LOCATION	DAF FEED SUMP			
8	RANGE, INCHES	24 (2)			
9	INTERFACE	AIR-WATER			
10	UPPER DENSITY, LB./CU. FT.	0			
11	LOWER DENSITY, LB./CU. FT.	61.2			
12	TEMPERATURE °F	150			
13	PRESSURE PSIG	0			
14	VALVE TYPE	BUTTERFLY (3)			
15					
16	LOCATION	6-Do-26001-0-M2-4			
17	MATERIAL	CI			
18	BODY SIZE / PORT SIZE	4			
19	PLUG FORM				
20	ΔP / MIN. / NOR. / MAX.	9 / 24 / 50			
21	CALC. Cv / VALVE Cv	362 (4)			
22	AIR TO OPEN OR CLOSE	CLOSE			
23	MAXIMUM SHUTOFF ΔP	50			
24	FLUID	WATER			
25	TEMPERATURE °F	150			
26	PRESSURE PSIG	0			
27	°API (60°F)				
28	SP. GR. AT STD. CONDS.	1.0			
29	SP. GR. AT F. & T.				
30	WEIGHT % VAPOR IN—OUT				
31	VISCOSITY AT F. & T. cp	0.95			
32	RATE, NORMAL gpm	495			
33	RATE:				
34	MAX. / MIN. gpm	1100 / 0			
35	NOTES:				

(1) FLOAT TO BE LOCATED IN STILLING WELL

(2) CONTROL POINT FOR LC-2601 IS TO BE AT THE 24" LEVEL IN LT-2601.

(3) VALVE DISC TO BE LIMITED TO 70° TRAVEL OR TO POSITION WHICH LIMITS FLOW TO 1100 gpm

(4) CORRESPONDS TO VALVE 67° OPEN AT MAXIMUM FLOW

SHEET _____ OF _____ REV _____

CONOCO

ENGINEERING CENTER

PONCA CITY, OKLAHOMA

SPECIFICATION SHEET

PRESSURE GAUGES

A.F.E. NO. _____

DATE 10/11/78 W.O. NO. _____

MADE BY FWS INQ. NO. _____

APP'D BY _____ REQ. NO. _____

R.M. NO. _____ P.O. NO. _____

PLANT LAKE CHARLES REFINERY PROJECT ETHYLENE FEEDSTOCK PROJECT - EXPANSION UNSBL

	TAG NO.	SERVICE	INSTRUMENT RANGE, PSIG	OPERATING PRESS, PSIG	OPERATING TEMP, °F	LOCATION
3	PG-2601	P-2601 DISCHARGE PRESSURE	0-60	35	150	P-2601 DISCHARGE
4	PG-2602	P-2602 DISCHARGE PRESSURE	0-60	35	150	P-2602 DISCHARGE
5	PG-2603	P-2603 DISCHARGE PRESSURE	0-100	75	150	P-2603 DISCHARGE
6	PG-2604	P-2604 DISCHARGE PRESSURE	0-100	75	150	P-2604 DISCHARGE
7	PG-2605	I-2602 DISCHARGE PRESSURE	0-160	100	100	I-2602 DISCHARGE
8	PG-2606	I-2601 DISCHARGE PRESSURE	0-160	100	100	I-2601 DISCHARGE
9	PG-2607	D-2601 PRESSURE	0-100	65	150	D-2601
10	PG-2608	RECYCLE PRESSURE	0-100	65	150	6-DO-2601-N-M12-4
11	PG-2609	P-2605 DISCHARGE PRESSURE	0-60	40	150	P-2605 DISCHARGE
12						
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QUOTATION WILL NOT BE CONSIDERED IF SUPPLIER DOES NOT COMPLETE RIGHT HAND COLUMN

SHEET _____ OF _____ REV _____