Diamond Chemicals

Diamond Alkali Company

03-00-6774

~~03-09-6774~~

EDR-325

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Engineering Design Report

Newark Rehabilitation

June 1, 1961 J. R. Siemoneit

DIAMOND ALKALI COMPANY

CENTRAL ENGINEERING DEPARTMENT

CLEVELAND, OHIO

Prepared By:

J. R. Siemoneit

Approved By:

J. J. Lukes

R. C. Sutter
Director of Engineering

DS 00029409

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DS 00029411

I INTRODUCTION

The Newark plant was rehabilitated as a result of the explosion which occurred on February 20, 1960. The explosion destroyed the trichlorophenol (TCP) and the monochloroacetic acid (MCA) units as well as the building housing these units and other associated general office, warehouse, and maintenance facilities. In order for Diamond to meet sales commitments and to maintain its position in the agricultural chemical field, it was necessary that the rehabilitation, particularly of the TCP unit, be done on an urgent basis.

In addition to the new manufacturing units for TCP and MCA, the rehabilitation included new and over-all improved facilities as follows:

1. Improved site clearance by removal of the old Triplex building, an old 1,000,000 gallon oil storage tank, and two large concrete storage tanks.

2. Installation of a new process structure.

3. Relocation of the dichlorphenol (DCP) unit to the new structure.

4. Construction of a new warehouse-maintenance building with plant office, lunch room, and first aid facilities.

5. Construction of a new office-laboratory building.

6. Installation of a central chlorine vaporizing system.

Also included were items to upgrade over-all plant safety, such as the installation of a fire water main, relocation of flammable liquid storage tanks, and modifications in the 2,4-D building.

This report contains the details of design.

II. ESTIMATED ECONOMICS

REQUEST FOR APPROPRIATION

DATE	APPROPRIATION NUMBER
June 1, 1960	03 00 6774

DIVISION, DEPARTMENT OR COMPANY	PLANT/BRANCH	LOCATION
CHLORINATED PRODUCTS	NEWARK	NEWARK, N. J.

DESCRIPTIVE TITLE: NEWARK PLANT REHABILITATION — AMOUNT REQUESTED: $ 1,660,000

TO BE ACCOUNTED FOR AS FOLLOWS:	* GROSS INVESTMENT	* CASH REQUIREMENT	APPROPRIATION AMOUNT
CAPITAL ACCOUNT - DIRECT INVESTMENT	$ 1,471,000	$ 1,471,000	$ 1,471,000
CAPITAL ACCOUNT [redacted] EXISTING FACILITIES	DATE 711,000	xxx	DATE
OPERATING EXPENSE - REPAIRS, TEMPORARY WORK, ETC.	189,000	189,000	189,000
LESS: TAX CREDIT @ 52 %	(97,000)	(97,000)	xxx
WORKING CAPITAL	2,159,000	2,159,000	xxx
SUPPORTING UTILITIES & GENERAL FACILITIES	STOCKED	CASH	xxx
LESS: EXCESS UTILITIES & GENERAL FACILITIES	( )	xxx	xxx
OTHER ITEMS - Des Moines Facilities	260,000	—	
SUB TOTAL	4,693,000	3,722,000	1,660,000
RESTRICTED RESERVE 15 % (MINIMUM 5%)	240,000	240,000	xxx
TOTAL	4,933,000	3,962,000	1,660,000

* NO ENTRIES REQUIRED IN THESE COLUMNS FOR REPAIR AND MAINTENANCE APPROPRIATIONS, OR APPROPRIATIONS UNDER $10,000.
SHOW BELOW: 1) COST SUMMARY (LARGE PROJECTS ONLY), 2) PURPOSE, 3) DESCRIPTION, 4) JUSTIFICATION, 5) BUDGET DATA.
ATTACH: 6) COST ESTIMATE, 7) RETIRED AND TRANSFERRED LISTS, AND, FOR CAPITAL APPROPRIATIONS OVER $10,000, 8) LAYOUTS AND FLOW SHEETS, 9) MANUFACTURING COST ESTIMATE, 10) RETURN ESTIMATE.

COST SUMMARY

Reconditioning of Equipment (Expense)	$ 86,000
Facelifting of D. & T. Building (Expense)	83,000
TCP Process	167,000
MCA Process	174,000
DCP Process	79,000
Office Building	171,000
Process Building	162,000
Warehouse	142,000
Yard Piping	79,000
Electrical Distribution	45,000
Property Purchase	80,000
Area Paving	25,000
Start-up Expense	20,000
Sub-Total	$1,313,000
Engineering	160,000
Construction Overhead	187,000
TOTAL	$1,660,000

PURPOSE

To provide funds for the complete rehabilitation of the Newark Plant.

DS 00029414

DESCRIPTION

The work envisioned by this Appropriation is as follows:

APPROVED 6-17-1960

PREPARED BY	DATE	RECOMMENDED BY:	DATE
[illegible]	[illegible]	[illegible] 6/2/60	
[illegible]	[illegible]	[illegible]	6/2
RECOMMENDED BY: [illegible]	DATE [illegible]	APPROVED BY [illegible]	DATE 6/[illegible]

MAXUS0998106

ADDITIONAL APPROPRIATION DATA

APPROPRIATION NUMBER 03-00-6774

DESCRIPTIVE TITLE
NEWARK PLANT REHABILITATION

DESCRIPTION (continued)

a. Facilities for the production of MCA, DCP, and TCP will be erected. Equipment currently existing at Newark will be reconditioned and utilized where possible in these installations. Facilities include the necessary tankage, explosion control cells for TCP production, and other facilities as required to provide Diamond Alkali with a modern plant for herbicide production.

b. A process structure for the major amount of the above equipment will be erected. This structure (approximately 4,000 sq. ft. area) will be constructed of steel framing with transite siding. It will be necessary to provide additional piling for this structure other than now exists to conform to the building code.

c. A two storied building of concrete block construction will be provided. This facility will encompass all administrative functions on the first floor and will include locker room and adequate wash-room facilities to minimize the chlor-acne problem. The second floor will be occupied by laboratory facilities.

d. A warehouse of approximately 12,000 sq. ft. in area will be constructed. This is to be a steel frame, transite siding type building.

e. Other general facilities such as yard piping, electrical distribution and the paving of selected areas will be provided.

f. It is our intention to purchase the facilities currently existing on the adjacent Tri-Plex property and to provide a parking lot in the immediate neighborhood for our plant personnel. We currently have a lease on the Tri-Plex land that still has 96 years to run.

g. The existing D. & T. building will be facelifted to provide for a safer operation.

JUSTIFICATION

The economics (see Exhibit A) have been based on the 1961 Sales Forecast for the Divisions' herbicide operations and can be summarized as follows:

	Investment	% Return	
Proforma Basis		D Acid $36/#	D Acid $0.40/#
Str. Line Depreciation	$4,813,000	3.4%	5.3%
Appropriation Basis			
Str. Line Depreciation	$4,933,000	3.3%	5.1%

The variation in investment is due to the inclusion of operating expense in the amount shown above under "Appropriation Basis".

DS 00029415

MAXUS0998107

ADDITIONAL APPROPRIATION DATA

APPROPRIATION NUMBER: 03-00-6774

DESCRIPTIVE TITLE: NEWARK PLANT REHABILITATION

JUSTIFICATION (continued)

Payout time is estimated to be as follows:

	36¢/#	40¢/#
D-Acid Price		
On new money	4.9 yrs.	2.8 yrs.
On total investment (ex. Working Capital)	7.7 yrs.	4.4 yrs.

Diamond can anticipate continued growth as is indicated in the attached memorandum from the Division's Sales Manager (see Exhibit "B").

The 1961 sales forecast indicates an approximate 65-70% level of operation, on 5/day basis, at Newark to realize the above return. HCl sales forecast indicates that we will sell all the acid produced in 1961 (see Exhibit "C").

It is important to consider that Diamond Alkali enjoys a reputation as an agricultural producer, and herbicides are a necessary part of this picture. Further, we have invested considerably, both in time and money, towards our establishment of a private label business.

BUDGET

This money is not included in the Chlorinated Products Budget.

2nd Quarter 1960	$ 50,000 (previously approved under approp. 03-00-6774E)
3rd Quarter 1960	338,000
4th Quarter 1960	467,000
1st Quarter 1961	467,000
2nd Quarter 1961	338,000

EXHIBITS

Exhibit A - Economics of Rebuilding and Rehabilitating the Newark Plant
Exhibit B - Sales Manager's Memorandum on Newark Plant
Exhibit C - Sales Forecast on Muriatic Acid Sales
Exhibit D - Manning Table for Newark Plant
Exhibit E - Appropriation Estimate Summary

DS 00029416

DETAILED APPROPRIATION ESTIMATE

DESCRIPTIVE TITLE: Newark Plant Rehabilitation

DATE SUBMITTED: 6-1-60

APPROP. NO: 03-00-6774

WORK INDEX NO.	TYPE OF WORK NO.	APPROP. SUB-ACCT. NO.	DESCRIPTION & QUANTITY	ACCOUNT NUMBER	ESTIMATED COST: MATERIAL	LABOR: COMPANY	LABOR: CONTRACT	TOTAL
			GENERAL FACILITIES		195,000		223,000	418,000
			General		80,000		-0-	80,000
		01-01	Property Purchase		80,000		-0-	80,000
			Prepatory		50,000		139,000	189,000
		03-10	Site Clearing		-0-		48,000	48,000
		05-10	Start-Up Expense				20,000	20,000
		06-10	Equipment Relocations		-0-		8,000	8,000
		06-11	Recondition Equipment		10,000		20,000	30,000
		06-12	Recondition Existing 2-4-D Building		40,000		43,000	83,000
			Yard Piping		31,000		48,000	79,000
		13-10	Pipe Rack Foundations					
		16-10	Pipe Racks					
		31-10	Piping					
		39-10	Insulation					
			Electrical Distribution		25,000		20,000	45,000
		13-15	Foundation					
		61-15	Yard Lighting					
		64-15	Switch Gear					
		66-15	Power Wiring					
			Site Improvements		9,000		16,000	25,000
		71-10	Grading & Drainage					
		72-10	Roads, Parking & Walks					

DS 00029417

PREPARED BY: J. A. Bernay DATE: 6-1-60

CHECKED BY: DATE:

MAXUS0998109

DETAILED APPROPRIATION ESTIMATE

DESCRIPTIVE TITLE: Newark Plant Rehabilitation

DATE SUBMITTED: 6-1-60

APPROP. NO.: 03-00-6774

WORK INDEX NO.	TYPE OF WORK NO.	APPROP. SUB-ACCT. NO.	DESCRIPTION & QUANTITY	ACCOUNT NUMBER	ESTIMATED COST: MATERIAL	LABOR: COMPANY	LABOR: CONTRACT	TOTAL
			TCP UNIT		94,400		72,600	167,000
			Major Equipment		40,100		9,000	49,100
		21-20	Storage					
		51-20	Heat Exchange					
		53-20	Melt Tanks					
		54-20	Filters					
		55-20	Reaction					
		56-20	Mix Tanks					
			Auxiliary Equipment		15,300		5,200	20,500
		58-20	Pumps, Fans					
		59-20	Instrumentation					
		64-20	Power Control					
			Installation Materials		13,400		27,000	40,400
		13-20	Foundations					
		16-20	Equipment Walks & Supports					
		49-20	Equipment Insulation					
		78-20	Printing					
			Piping Materials		22,000		25,000	47,000
		31-20	Piping					
		39-20	Piping Insulation					
			Electrical Materials		3,600		6,400	10,000
		66-20	Power Wiring					

PREPARED BY: J. A. Bernay DATE: 6-1-60

CHECKED BY: DATE:

DS 00029418

MAXUS0998110

DETAILED APPROPRIATION ESTIMATE — DESCRIPTIVE TITLE: Newark Plant Rehabilitation

DATE SUBMITTED: 6-1-60 — APPROP. NO.: 03-00-6774

WORK INDEX NO.	TYPE OF WORK NO.	APPROP. SUB-ACCT. NO.	DESCRIPTION & QUANTITY	ACCOUNT NUMBER	ESTIMATED COST: MATERIAL	LABOR: COMPANY	LABOR: CONTRACT	TOTAL
			MCA UNIT		73,000		101,000	174,000
			Major Equipment		7,500		18,900	26,400
		21-30	Storage Tanks					
		51-30	Heat Exchange					
		53-30	Dryers					
		54-30	Separators					
		55-30	Reaction					
		56-30	Mix Tanks					
			Auxiliary Equipment		16,200		7,800	24,000
		58-30	Pumps					
		59-30	Instruments					
		64-30	Power Control					
			Installation Material		16,700		34,000	50,700
		13-30	Foundations					
		16-30	Equipment Walks & Supports					
		49-30	Equipment Insulation					
		78-30	Equipment Painting					
			Piping Materials		28,000		32,000	60,000
		31-30	Piping					
		39-30	Pipe Insulation					
			Electrical Materials		4,600		8,300	12,900
		66-30	Power Wiring					

PREPARED BY: J. A. Bornay — DATE: 6-1-60 — CHECKED BY: — DATE:

DS 00029419

MAXUS0998111

DETAILED APPROPRIATION ESTIMATE

DESCRIPTIVE TITLE: Newark Plant Rehabilitation

DATE SUBMITTED: 6-1-60

APPROP. NO.: 03-00-6774

WORK INDEX NO.	TYPE OF APPR. NO.	APPROP. SUB-ACCT. NO.	DESCRIPTION & QUANTITY	ACCOUNT NUMBER	ESTIMATED COST: MATERIAL	LABOR: COMPANY	LABOR: CONTRACT	TOTAL
			DCP UNIT		39,500		39,500	79,000
			Major Equipment		12,600		6,600	19,200
		21-40	Storage Tanks					
		51-40	Heat Exchange					
		55-40	Reactors, Absorbers, Chlorinators & Strippers					
			Auxiliary Equipment		6,800		3,100	9,900
		58-40	Pumps & Fans					
		59-40	Instruments					
		64-40	Power Control					
			Installation Materials		6,800		13,700	20,500
		13-40	Foundations					
		16-40	Equipment Walks & Supports					
		49-40	Equipment Insulation					
		78-40	Equipment Painting					
			Piping Materials		11,400		12,800	24,200
		31-40	Piping					
		39-40	Pipe Insulation					
			Electrical Materials		1,900		3,300	5,200
		66-40	Power Wiring					

PREPARED BY: J. A. Bernay DATE: 6-1-60

CHECKED BY: DATE:

DS 00029420

MAXUS0998112

DETAILED APPROPRIATION ESTIMATE

DESCRIPTIVE TITLE: Newark Plant Rehabilitation

DATE SUBMITTED: 6-1-60

APPROP. NO.: 03-00-6774

WORK INDEX NO.	TYPE OF WORK NO.	APPROP. SUB-ACCT. NO.	DESCRIPTION & QUANTITY	ACCOUNT NUMBER	ESTIMATED COST: MATERIAL	LABOR: COMPANY	LABOR: CONTRACT	TOTAL
			Process Building		96,000		66,000	162,000
		11-50	Piling					
		12-50	Foundations					
		14-50	Grade Slabs					
		15-50	Building Frame					
		18-50	Enclosure & Partitions					
		31-50	Service Piping					
		33-50	Sewer Piping					
		41-50-	Heating & Ventilating					
		42-50	Plumbing					
		44-50	Safety and Personnel Equipment					
		49-50	Insulation					
		61-50	Lighting & Panels					
		66-50	Power Wiring to Panels					
		78-50	Painting					

PREPARED BY: J. A. Bernay DATE: 6-1-60

CHECKED BY: DATE:

DS 00029421

MAXUS0998113

DETAILED APPROPRIATION ESTIMATE

DESCRIPTIVE TITLE: Newark Plant Rehabilitation

DATE SUBMITTED: 6-1-60

APPROP. NO.: 03-00-6774

SKD 110-4

WORK INDEX NO.	TYPE OF WORK NO.	APPROP. SUB. ACCT. NO.	DESCRIPTION & QUANTITY	ACCOUNT NUMBER	ESTIMATED COST: MATERIAL	LABOR: COMPANY	LABOR: CONTRACT	TOTAL
			Office & Laboratory Building		100,000		71,000	171,000
		11-60						
		12-60						
		14-60						
		15-60						
		18-60						
		31-60						
		33-60						
		41-60						
		42-60						
		44-60						
		49-60						
		61-60						
		66-60						
		78-60						

PREPARED BY: J. A. Bernay

DATE: 6-1-60

CHECKED BY:

DATE

DS 00029422

MAXUS0998114

DETAILED APPROPRIATION ESTIMATE

DESCRIPTIVE TITLE: Newark Plant Rehabilitation

DATE SUBMITTED: 6-1-60

APPROP. NO.: 03-00-6774

WORK INDEX NO.	TYPE OF WORK F.O.	APPROP. SUB-ACCT. NO.	DESCRIPTION & QUANTITY	ACCOUNT NUMBER	ESTIMATED COST: MATERIAL	LABOR: COMPANY	LABOR: CONTRACT	TOTAL
			Warehouse		85,000		57,000	142,000
		11-70						
		12-70						
		14-70						
		15-70						
		18-70						
		31-70						
		33-70						
		41-70						
		42-70						
		44-70						
		49-70						
		61-70						
		66-70						
		78-70						

DS 00029423

PREPARED BY: J. A. Berney

DATE: 6-1-60

CHECKED BY:

DATE:

DETAILED APPROPRIATION ESTIMATE

DESCRIPTIVE TITLE: Newark Plant Rehabilitation

DATE SUBMITTED: 6-1-60

APPROP. NO.: 03-00-6774

WORK INDEX NO.	TYPE OF WORK NO.	APPROP SUB-ACCT NO.	DESCRIPTION & QUANTITY	ACCOUNT NUMBER	ESTIMATED COST: MATERIAL	LABOR: COMPANY	LABOR: CONTRACT	TOTAL
			Engineering Expense					
		87-90	Design Engineering - D. A. Co.		---		160,000	160,000
		88-90	Associate Engineering					
			Construction Expense		---		187,000	187,000
			GRAND TOTAL		682,900		977,100	1,660,000

DS 00024924

PREPARED BY: J. A. Bergay

DATE: 6-1-60

CHECKED BY:

DATE

MAXUS0998116

SUPPLEMENTAL REQUEST FOR APPROPRIATION

DATE: 10/18/60 | 03 | 00 | 67

DIVISION, DEPARTMENT OR COMPANY: CHLORINATED PRODUCTS

PLANT OR OFFICE: NEWARK

LOCATION: NEWARK, NEW JERSEY

DESCRIPTIVE TITLE: NEWARK PLANT REHABILITATION

REQUESTED INCREASE OR DECREASE: $ 54,000.00

TO BE ACCOUNTED FOR AS FOLLOWS:	REVISED TOTAL GROSS INVESTMENT	REVISED TOTAL CASH REQUIREMENT	APPROPRIATION AMOUNT REVISED TOTAL	APPROPRIATION AMOUNT INCREASE OR (DECREASE)
CAPITAL ACCOUNT - DIRECT INVESTMENT	$ 1,539,000	$ 1,539,000	$ 1,539,000	$ 68,000
CAPITAL ACCOUNT - TRANSFER OF EXISTING FACILITIES	711,000	XXX	XXX	XXX
OPERATING EXPENSE - REPAIRS, TEMPORARY WORK, ETC.	175,000	175,000	175,000	(14,000)
LESS: TAX CREDIT @ 52 %	91,000	91,000	XXX	XXX
WORKING CAPITAL	2,159,000	2,159,000	XXX	XXX
SUPPORTING UTILITIES & GENERAL FACILITIES	XXX	XXX	XXX	XXX
(LESS): EXCESS UTILITIES & GENERAL FACILITIES	XXX	XXX	XXX	XXX
OTHER ITEMS	260,000	XXX	XXX	XXX
SUB TOTAL	4,753,000	3,782,000	1,714,000	54,000
RESTRICTED RESERVE ____ % (MINIMUM 15%)	240,000	240,000	XXX	XXX
TOTAL	$4,993,000	$4,022,000	1,714,000	54,000

* NO ENTRIES REQUIRED IN THESE COLUMNS FOR REPAIR AND MAINTENANCE APPROPRIATIONS OR APPROPRIATIONS UNDER $10,000

SHOW BELOW CHANGES IN: 1) COST SUMMARY (LARGE PROJECTS ONLY), 2) PURPOSE, 3) DESCRIPTION, 4) JUSTIFICATION, 5) BUDGET DATA.

ATTACH IF REVISED: 6) COST ESTIMATE, 7) RETIRED AND TRANSFERRED LISTS, AND FOR CAPITAL APPROPRIATIONS OVER $10,000, 8) LAYOUTS AND FLOW SHEETS, 9) MANUFACTURING COST ESTIMATE, 10) RETURN ESTIMATE.

COST SUMMARY

SECT. NO.	SECTION	ORIGINAL APPROPRIATION	APP'N & SUPPL. TO DATE	REVISED ESTIMATE	SUPPLEMENT REQUIRED
	Reconditioning of Equipment (Expense)	86,000		81,000	(5000)
	Face Lifting of D&T Building (Expense)	83,000		74,000	(9000)
	D&T Building Revisions	—		75,000	75,000
	TCP Process	167,000		174,000	7,000
	MCA Process	174,000		88,000	(86,000)
	DCP Process	79,000		58,000	(21,000)
	Office Building	171,000		160,000	(11,000)
	Process Building	162,000		158,000	(4,000)
	Warehouse Building	142,000		155,000	13,000
	Yard Piping	79,000		209,000	130,000
	Electrical Distribution	45,000		73,000	28,000
	Property Purchase	80,000		98,000	18,000
	Area Paving	25,000		28,000	3,0000
	Start-up (Expense)	20,000		20,000	—
	Sub Total	1,313,000		1,451,000	138,000
	Engineering	160,000		151,000	(9,000)
	Construction Overhead	187,000		112,000	(75,000)
	Total	1,660,000		1,714,000	54,000

ORIGINAL PURPOSE:

To provide funds for the complete rehabilitation of the Newark Plant.

APPROVED
11-10-60 RCS

DS 00024925

PREPARED BY: J.R.Siemoneit — DATE: 10/17/60

CHECKED BY: — DATE:

RECOMMENDED BY: — DATE: 10/26/60

RECOMMENDED BY: — DATE: 10/27/60

RECOMMENDED BY: — DATE: 10/28/60

APPROVED: — DATE: 10/28/60

MAXUS0998117

ADDITIONAL APPROPRIATION DATA

03-00-67

DESCRIPTIVE TITLE
Newark Plant Rehabilitation

SUMMARY OF PROJECT CHANGES

1. Change in Purpose - To provide increased funds for changes to meet the requirements of a new insurance carrier.

2. Description of Changes - The work includes:

a. Installation of sprinklers in the new process building, warehouse building, and the D and T building.

b. Overhaul of existing equipment or facilities for safety including such items as:

Emergency vents on flammable liquid storage tanks.
Heavy duty gauge glasses on flammable tanks.
Relocation of hazardous tank.
Properly sized vents.

c. The net increase as a result of the above insurance requirements is tabulated below:

Reconditioning of Equipment - - - - - - -	$ 3,000
Face Lifting of D and T Building- - - -	17,000
D and T Building Revisions - - - - - - -	12,000
Process Building- - - - - - - - - - - - -	4,000
Warehouse Building- - - - - - - - - - - -	6,000
Sub Total	$42,000
Engineering - - - - - - - - - - - - - - -	6,000
Construction Overhead - - - - - - - - - -	6,000
	$54,000

d. The revised estimate (See Cost Summary) includes an overall corrected distribution of funds by accounts.

JUSTIFICATION OF PROJECT

With the above changes, an insurance premium savings of $20,000/year is possible through the Factory Insurance Association over the premium now paid to Lloyds. In addition, Lloyds was the carrier at the time of our recent claim, and we have no guarantee that Lloyds will not cancel. If cancellation should occur, and we were not prepared to go with FIA, we would face a premium approximately three times greater with the stock companies than the present premium with Lloyds.

INVESTMENT RETURN

	Investment	Percent Return D Acid @ $0.36/#	Percent Return @ $0.40/#
Original Appropriation Basis	$4,933,000	3.3%	5.1%
Supplemental Basis	4,993,000	The new investment has no appreciable effect on the economics.	

DS 00029426

Supplement #1

ADDITIONAL APPROPRIATION DATA

03-00-077

DESCRIPTIVE TITLE

Newark Plant Rehabilitation

BUDGET

This money is not included in Chlorinated Products Budget.

	Original Schedule	Supplemental Schedule
2nd Quartet 1960	$ 50,000	$ 50,000
3rd Quarter 1960	338,000	338,000
4th Quarter 1960	467,000	481,000
1st Quarter 1961	467,000	495,000
2nd Quarter 1961	338,000	350,000

Exhibit

"A" - Letter on Insurance Savings

DS 00029427

EXHIBIT A
Newark Economics
Summary of Anticipated
Return on Investment & Payout (1)

	With "D" Acid Selling For	
	36¢/lb.	40¢/lb.
Return on Operating Investment	3.4%	5.3%
Payout on New Facilities (2)	4.9 yrs.	2.8 yrs.
Payout on Total Facilities (3)	7.7 yrs.	4.4 yrs.

(1) Payout computed using SOD depreciation.

(2) Total new money of $1,900,000 for both facilities and expenses such as start-up, D and T face-lift, and rehabilitation (tax effect of expense items reflected).

(3) Total facilities are new money of $1,900,000 plus existing operating facilities at Newark and Des Moines plus reusable equipment, all at original acquisition cost.

P. A.
6/2/60

DS 00029428

EXHIBIT A
Economics of Reconditioning & Rehabilitating
Newark Plant
Based on Appropriation 03-00-6774

		In Thousands of Dollars		
Investment				
Existing facilities		$ 970		(Includes $116 thous. reusable equipment at (Newark and $260 thous. Des Moines facilities.
New facilities -				
Machinery and process		641		
Building		247		(Does not include $216 thous. new money for (expense items.
General facilities		796		
Total facilities		$ 2,654		
Working capital		2,159		
Total Investment		$ 4,813		
	Tons		Average Net Selling Price	
When "D" Acid Sells for 36¢ per lb.				
Sales - 2, 4-D technical & esters	1,140 A/E	$ 878	$ 770.00	
2, 4-D dry - purchased	235 A/E	181	770.00	
2, 4, 5-T technical & esters	339 A/E	814	2,400.00	
2, 4, 5-T dry - purchased	21 A/E	50	2,400.00	
TCP	200 A/E	212	1,060.00	
Formulations	1,365 A/E	1,870	19.25	
HCL	4,580	88	1,370.00	
Total Sales	3,300 A/E	$ 4,093		(Total tons do not include HCL tonnage.
Cost of Sales		3,248		
Gross Profit		$ 845		
Gross Profit is of Sales		20.6%		
Below-the-line Expenses		501		(1960 budgeted ASSO adjusted for change in 4% (interest on additional investment.
Profit Before Tax @ 52%		$ 344		
Net Profit After Tax		$ 165		
% Return on Investment		3.4%		
When "D" Acid Sells for 40¢ per lb.				
Profit Before Tax		$ 530		
Net Profit After Tax @ 52%		$ 254		
% Return on Investment		5.3%		
Tons of Cl_2 Consumed		3,400		

6/2/60

DS 00029429

MAXUS0998121

III RAW MATERIAL, PRODUCTS, AND UTILITIES

A. TCP Unit - Production at the rate of 160,000 pounds per month sufficient for 160,000 pounds per month (80 tons) of 2,4,5-T acid. Three batches per day allows for 20 per cent outage.

1. Raw Materials

	Source	Specification	Quantity, Pounds/Batch
Tetrachlorobenzene	Purchase	Technical Grade	2600
Methanol	Purchase	Standard Commercial Grade	1400
Caustic (Flake)	Inter-Company Purchase	Standard Commercial Grade	1300

2. Products

Sodium TCP	NaTCP	2404 (1)
	NaOH	392
	NaCl	285
	Water	6236

3. Utilities

	Source	Units	Units Per Hour Normal	Units Per Hour Maximum
Steam	Plant System	M Pounds	3.25 (2)	5.05 (2)
Water	Plant System	M Gallons	16.0	22.4 (3)
Electricity	Purchased	KW	19.6 (4)	24.0 (5)

(1) Initial plant operation indicated yields of 99.0-99.5 per cent on TCB or approximately 2550 pounds per batch.

(2) Includes 1.53 M pounds for anisole still and 0.53 M pounds for methanol still reboiler.

(3) Includes 9.6 M gallons per hour for anisole still and methanol distillation not being used.

(4) Connected load x 0.459 diversity factor (based on 2,4-D operation).

(5) Peak load = 1.225 normal load.

B. MCA Unit - Production at the rate of 513,500 pounds per month sufficient for 80 tons per month of 2,4,5-T acid and 275 tons per month of 2,4-D acid. Two batches per day allows for 20 per cent outage.

1. Raw Materials

	Source	Specification	Quantity, Pounds/Batch
Acetic Acid	Purchase	99.5%	4800
Acetic Anhydride	Purchase	Technical Grade	1360
Chlorine	Inter-Company Purchase	Standard Commercial Grade	8500

2. Products

MCA		MCA 80% by weight Water 20% by weight	10,400 2600
Muriatic Acid		20° Be'	11,300

3. Utilities

	Source	Units	Units Per Hour Normal	Units Per Hour Maximum
Steam	Plant System	M Pounds	0.243	0.636
Water	Plant System	M Gallons	10.8	24.6
Electricity	Purchased	KW	29.3 (1)	35.8 (2)

(1) Connected load x 0.459 diversity factor (based on 2,4-D operation).

(2) Peak load = 1.225 x normal load.

DS 00029431

C. DCP Unit - Production at the rate of 500,500 pounds per month sufficient to meet the 550,000 pounds per month of 2,4-D acid production. (Three batches per day on a five-day week.)

1. Raw Materials

	Source	Specification	Quantity, Pounds/Batch
Phenol	Purchase	Technical Grade	5340
Chlorine	Purchase	Standard Commercial Grade	8500

2. Products

DCP		Technical	9400
Muriatic Acid		20° Be'	11,000

3. Utilities

	Source	Units	Units Per Hour Normal	Units Per Hour Maximum
Steam	Plant System	M Pounds	0.202	1.01
Water	Plant System	M Gallons	6.72	13.2
Electricity	Purchased	KW	5.04 (1)	6.17 (2)

(1) Connected load x 0.459 diversity factor (based on 2,4-D operation).

(2) Peak load = 1.225 normal load.

DS 00029432

D. Utilities For General Facilities

Facility	UNITS PER HOUR Steam, M Pounds	Water, M Gallons	Electricity, KW
1. TCP Process Building	1.34(1)	In Process Requirements	17.2
2. Office Building	1.5)	3.0(2)	48.0
3. Warehouse Building	1.06)		
4. 2,4-D Building	2.60	-	170.0(3)
5. Other General Facilities	-	0.284(4)	123.6(5)

(1) Includes 0.34 M pounds for steam tracing.

(2) Summer requirements for air conditioning units.

(3) Metered load for total building operation including process-peak month March, 1961 corrected for applicable items in 5. Other General Facilities.

(4) Assumes 80 per cent condensate return.

(5) Includes power for boiler, air compressors, river water pumps, and deep well pump.

IV GENERAL DESCRIPTION

A. Site Preparation

Before construction of the new process manufacturing building could begin, it was necessary to remove the old manufacturing building. This building was over fifty years old and occupied an area of 29,000 square feet. Being located next to the Passaic River, it was supported on piles and the location of the new building was adjusted as much as possible to take advantage of the old piling.

Since the old building housed offices, laboratory, and maintenance facilities as well as manufacturing facilities, its removal was in two stages. The first stage cleared the area for a new process building and the second stage was delayed until after the erection of a new office and laboratory building. Also included was the removal and storage of reuseable process equipment for later use.

The five-story Triplex building was then razed and various outdated mixing tanks were removed. The ground floor area of the Triplex building and adjacent sheds occupied approximately 3400 square feet. The removal of the Triplex building freed a portion of the area used for the new warehouse building.

A 1,000,000 gallon steel oil storage tank approximately 70 feet in diameter was removed to clear an area adjacent to the west railroad track for new tank car unloading stations and to provide space for additional future tank storage. Similarly a rectangular concrete bunker type tank 35' wide by 50' long projecting 4' above grade and 6' below grade was demolished to approximately 3' below grade.

Other items of removal for better site clearance and improved layout included two 35' diameter concrete tanks in the west tank farm, parts of the old west tank farm dike wall, a smaller diked area by the southwest corner of the Triplex building, miscellaneous pipe supports and equipment foundations, and a brick shed approximately 12' x 10' used for storage.

B. New Manufacturing Units

1. TCP

The new TCP unit consists of two 1,000 gallon jacketed steel autoclaves equipped with 7 1/2 HP Lightning agitators. The vessels have a design pressure rating of 750 psi and are located within 1' thick reinforced concrete explosion cells open at the top and on one side. The explosion cells are adjacent to but

B. New Manufacturing Units (Cont'd)

walled off from the Process building and open toward the river. An instrument panel located within the building and behind the concrete wall is equipped with dual temperature and pressure instruments (one instrument as a constant check against the other) for each autoclave. Also, the panel has various enunciator lights to indicate adequate water pressure in the cooling water header, the agitator running or stopped, the methanol-caustic feed pumps operating, the autoclave pressure high at 400 psig, the autoclave pressure excessively high a 450 psig, etc. Alarms are also connected in the above circuits indicating high pressure to give audible as well as visual evidence of excessive pressures.

A horn is used to signal the 400 psig range and a siren to signal the 450 psig range. Also at the 450 psig range automatic interlocks cut off the methanol-caustic feed pump, cut off steam if necessary, and open cooling water to the jackets.

Electrical interlocks prevent operation of the methanol-caustic feed pumps if the cooling water header does not have sufficient pressure or if the agitators are not operating in the autoclave.

A hand operated cooling water valve for the jackets and an emergency 1" hand operated pressure bleed valve for each autoclave are located adjacent to the instrument panel for immediate use by the operator in the event of high pressure.

If a pressure rise occurs that can't be controlled by adding cooling water to the jackets, stopping the methanol-caustic feed pumps or using the 1" manually operated pressure bleed valves, then a 4" x 6" pressure relief valve protected by a rupture disc and screen is available on each vessel and set to discharge at 550 psig. This relief valve should reduce to a safe point any pressure build-up and then close to prevent further loss of the batch. Since the discharge through the 4" x 6" relief valve or through the 1" manual bleed valve would be principally methanol, these lines are arranged to discharge the methanol through perforations beneath the water surface of a 7' x 7 1/2" concrete blow down sump. This sump is maintained full of water by passing the discharge process cooling water through the sump before the water overflows to the river. Bubbling the methanol through the water will allow the water to absorb most of the methanol for additional safety.

In the event of any malfunction of the 4" x 6" pressure relief valve or on the outside possibility of an upset reaction so fast that the 4" x 6" valve couldn't handle the load, a 6" rupture disc and a 6" line has been provided to discharge at 650 psig. This line discharges straight above the autoclave at a point 3' above the Process building roof.

B. New Manufacturing Units (Cont'd)

The autoclaves are charged with 2600 pounds per batch of molten tetrachlorobenzene from a 300 gallon steel drop tank. Steam jacketed steel lines are used to transport the molten tetrachlorobenzene either when charging the reactor or when unloading a tank car into storage. When the tetrachlorobenzene is not being transported through the jacketed lines, the steam should be kept off to prevent excessive corrosion. Most organic chlorides will break down releasing HCl when left in static contact with the high temperature of a jacketed line.

After completion of the above tetrachlorobenzene charge, a mixture containing approximately 1300 pounds of caustic and 3300 pounds of methanol are fed into the autoclave slowly. The addition covers a period of approximately 3-4 hours and is made from a 700 gallon steel drop tank through a K3M-2E Hills-McCanna proportioning pump. A 2200 gallon steel jacketed tank with a 3 HP Lightning agitator is used to mix a quantity of the methanol-caustic mixture sufficient for three autoclave batches. The flake caustic used in the mix is elevated in 300 pound drums and dumped into a hopper attached to the top of the mix tank. A stationary electrically operated drum skip hoist is used to elevate the caustic.

After completion of the reaction in the autoclave, excess methanol is distilled from the autoclave and passed through a 150 ft.^{2} steel condenser and a 20 ft.^{2} cooler. The methanol is then caught in a 600 gallon steel crude methanol receiver and pumped to a crude methanol storage tank in the north section of the west tank farm. A distillation column complete with reboiler, condensers, receiver, and the necessary rotameters and temperature instruments has been installed for purification of the recovered crude methanol, as required.

After removal of the excess methanol, the autoclave batch is transferred to the 4,000 gallon crude sodium TCP holding tank. Six autoclave batches can be accumulated in this tank and charged at one time to the anisol still for the removal of anisol. Initial operation, however, indicated that little anisol was produced and the conversion to sodium TCP was 99.0 per cent complete. It may be possible to continue to bypass the anisol still operation.

To remove the byproduct sodium chloride salt produced in the autoclave reaction, a vertical pressure leaf type filter was installed in the product transfer line ahead of the 25 per cent sodium TCP storage tanks. Clean out of the salt accumulation in the 25 per cent storage tanks had formerly been a problem. Calculations indicate that 57 per cent, or

B. New Manufacturing Units (Cont'd)

400 pounds, of NaCl per autoclave batch can be removed in the filter. Clean-out of the filter is accomplished by back washing with water. From the 25 per cent storage, the material is pumped to the D and T building for further processing to make the 2,4,5-T acid.

The TCP unit was designed to handle three batches per day or 160,000 pounds per month of TCP (equivalent to 80 tons per month of 2,4,5-T) allowing for a 20 per cent outage factor.

2. MCA Unit

The MCA unit was rebuilt in the new process building using two 1,000 gallon Pfaudler glass-lined jacketed reactors as the basic reactor units. A mixture of 99.5 per cent acetic acid and acetic anhydride is charged in 6,160 pound batch quantities to one of the reactors. A 700 gallon rubber-lined drop tank is used to drop the measured charge by gravity into the reactor. Gaseous chlorine is then added, slowly at first, then up to a maximum rate of 700 pounds per hour before the feed is tapered off again to complete the batch. A total of approximately 8500 pounds of chlorine is added to each batch. The design requirements are for 513,500 pound per month of MCA sufficient to make 275 tons per month of 2,4-D and 80 tons per month of 2,4,5-T. On the basis of 10,400 pounds per batch per chlorinator requiring 24 hours from charge to charge, two chlorinators can produce 624,000 pounds per thirty-day month. This allows close to 20 per cent for outages to meet the required rate of 513,500 pounds.

An instrument panel was installed near the reactors on which instruments were provided to record and control the reactor temperature and the chlorine flow. The panel also contained instruments indicating the reactor pressure and the final off-gas temperature. The off gas (containing HCl, excess chlorine, and organic material carried through from the reactor) passes through four heat exchangers connected in series. These exchangers stage cool the gas and remove and return to the reactor as much of the organic material as possible. The final or fourth exchanger of the group is operated on refrigerated brine to reduce the final gas temperature as low as possible without freezing the organics condensed. A recording temperature controller is located on the panel and used to control and record the discharge brine temperature from the fourth condenser. This instrument is set by adjusting the discharge brine temperature until a point is reached that will give the lowest possible satisfactory operating temperature for the off gas.

B. New Manufacturing Units (Cont'd)

The off gas is then passed through a National Carbon falling film hydrochloric acid absorber. The 20° Be' muriatic acid produced in this unit contains a small percentage of organics; therefore, it is kept separate from the higher grade acid produced in the DCP unit.

After the HCl absorption step, the gases are dried in a sulfuric acid tower and then passed on to the DCP chlorinators where the excess chlorine is recovered. If the DCP unit is not operating, a packed Pyrex glass scrubber is available complete with a caustic circulating system for scrubbing the excess chlorine from the off gas stream.

The MCA chlorination system has been provided with a back pressure controller to permit pressure operation up to 15 psig. Rupture discs have been provided on the chlorinators for safety in the event of a flow stoppage of any kind in the off gas line. After completion of the chlorine addition, the batch is diluted with water to make an 80 per cent solution of the monochloracetic acid. This material is then pumped to storage in either a re-used 7,000 gallon brick lined tank or a new 5,000 gallon glass lined tank located on the east end of the new process building. From storage, the 80 per cent MCA material is pumped to the D and T building for further processing.

The MCA instrument panel also has been equipped with enunciator lights to indicate the chlorinator pump running, and a warning light to give indication should the plant instrument air pressure drop below 50 psig.

Since the plant use of chlorine presently is confined to the MCA and DCP units located in adjacent sections of the new process building and since the gaseous chlorine distribution is made from the new central vaporizer system on the east side of the plant, the MCA instrument panel also was used to monitor and to permit high pressure control of the chlorine vaporizer system. Therefore, included with the enunciator lights on the panel is a light to indicate when the chlorine pressure at the vaporizer is high (125 psig). Also, an audible signal has been relayed from the chlorine vaporizer to a horn at the panel to warm of the 125 psig pressure range at the vaporizer. If high pressure is noted, a switch on the panel enables the MCA operator to close the liquid feed to the chlorine vaporizer from his remote location. The operator also has available adjacent to the panel a manually operated valve in a line extended from the vaporizer to the caustic scrubber reservoir for bleeding off pressure.

B. New Manufacturing Units (Cont'd)

3. Central Chlorine Vaporizing System

The chlorine vaporizer is equipped with a pressure relief valve (PRV) set at 175 psig, protected with a rupture disc also set at 175 psig. A pressure gauge between the rupture disc and the PRV is available to indicate physical failure of the rupture disc. On the discharge side of the PRV a whistle is installed in the line to give an audible signal should the pressure build up to 175 psig and actuate the pressure relief system. The whistle is an added safeguard to warn the operating personnel of an upset before any extensive amount of chlorine could escape.

The chlorine vaporizer has an internal design pressure of 300 psig at 250° F. It was fabricated using a 20" O.D. steel shell with a flanged cover at the top and a dished bottom. A 6" steel finger is welded through the center of the bottom head with connections for operation on steam. This finger reduces the liquid capacity of the vaporizer and increases the area of heat transfer. A 24" steel jacket with a design pressure of 100 psi at 350° F. covers the 20" shell to provide the balance of the heat transfer area required. Steam pressure to the jacket and to the finger is set at 5 psig by a pressure regulator and guarded with a pressure relief valve set a 10 psig. This limits the steam temperature to a normal operating range of 228° F. and a maximum range of 240° F. The design of the vaporizer was limited in size to reduce the available liquid hold up due to the confined area of the Newark plant. The absolute full capacity of the vaporizer would limit the amount of chlorine to slightly less than 1,000 pounds; however, it would normally operate at approximately 50 per cent or less of its full capacity. Also, a dip pipe on the inlet liquid chlorine line extending to within 4" of the bottom of the vaporizer allows for transfer of the liquid from the vaporizer back to the car if the pressure in the vaporizer starts to exceed the pressure in the car. Therefore, before a pressure build-up in the vaporizer reaches the 175 psig setting of the pressure relief system, most if not all of the liquid should be transferred back to the car. A new chlorine car normally will have a pressure of 80-100 psig. It should be noted that the inlet liquid chlorine valve to the vaporizer and the valve out of the car should be wide open to permit full back flow. As noted earlier, if it should be necessary to close the liquid flow to the vaporizer, a switch is available at the MCA panel for energizing the air operated valve that will shut off the liquid flow. A manually operated block valve is available at the vaporizer.

B. New Manufacturing Units (Cont'd)

The design capacity of the vaporizer was 50 per cent oversized at 5,000 pounds per hour to allow for future plant expansion and to extend the "clean out" cycles.

4. DCP Unit

The former facility for producing DCP was located in a closely confined section of the D and T manufacturing building. Much of the equipment, such as the HCl absorption system, was obsolete and the unit needed general rehabilitation. The unit was rebuilt, therefore, in the new process building to provide better access, better working conditions, and improved operation.

Two existing 1,000 gallon jacketed Pfaudler vessels were used as the basic reactors. With the exception of the instrument panel and instruments, the HCl absorber, the jets for recirculating chlorine, and one chlorinator pump, the unit was reconstructed from existing used equipment.

The process consists of charging the reactors batchwise with 5,340 pounds of phenol from a 700 gallon steel drop tank. Chlorine is then introduced through spargers at a maximum rate of 700 pounds per hour until a total of approximately 8500 pounds has been fed per batch. The batch operation requires 16 hours from charge to charge and produces approximately 9400 pounds per batch of dichlorophenol. At an average of three batches per day with two chlorinators, the production requirement of 500,500 pounds per month of DCP required to make 550,000 pounds (275 tons) per month of 2,4-D is possible on a five-day week. This includes a 20 per cent allowance for outages.

The off gas from a chlorinator passes through two small tantalum heat exchangers connected in series with Pyrex glass traps provided to permit return of entrained or condensed liquid back to the chlorinator. After the temperature of the gases has been reduced from 95-100° C. at the chlorinator to 40-50° C. after the second condenser, a steel entrainment separator is used to catch liquid carry over in the event phenol freezes out in the first or second condenser. This freezing would cause a partial pluggage increasing the pressure drop and allowing the liquid return seal loop to blow through.

The off gas then passes through a sulfuric scrubbing tower where organics are removed and then to a falling film Karbate acid absorber where essentially organic free 20° Be' muriatic acid is produced.

B. New Manufacturing Units (Cont'd)

During the chlorination cycle, a pump is used to recirculate the chlorinator liquor through a jet. The jet pulls a slight suction on the off gas chlorine stream from the MCA chlorinators permitting recovery of this chlorine in the DCP chlorinators. After completion of the chlorination cycle, the finished DCP is pumped to storage in the D and T building for further processing.

An instrument panel was installed near the DCP chlorinators on which instruments are located to record and control the chlorinator temperatures and the chlorine flows. The panel, also, is equipped with gauges to indicate the off gas temperatures after the second condensers, emunciator lights to indicate the recirculating pumps are running, and start and stop buttons for the recirculating pumps.

C. New Process Building

A new process building was erected to house the TCP, MCA, and DCP process operations. The building is generally 35' wide by 129' long and has approximately 4,000 square feet on each of three floors. Three bays were left out of the building at the northwest corner to accomodate the autoclave explosion cells. The first floor is a concrete grade slab supported both on fill or on piles at points of heavy loading. The second and third floors are steel grating and the roof is of the precast gypsum plank type. The building is constructed of a painted galvanized steel frame and is covered with a corrugated asbestos siding. The columns are supported on concrete pile caps covering the new twenty ton treated wood piles. The building was originally planned and located to utilize the pile caps of the old manufacturing building. However, field investigation revealed that the pile caps were unstable, improperly and irregularly located, and that the wood piles had deteriorated to the point that the piles would not carry the load of the new building columns.

During the field investigation of the piles and pile caps, the reinforcement for the bulkhead was found in poor condition. If the bulkhead was ever to be reinforced it had to be done before pouring the slab for the process building. Therefore, piles were driven for a new deadman within the building area and new tie rods were run for the bulkhead reinforcement.

For personnel protection, access to the building is provided through two concrete block fireproof stair towers on the south side and through three standard doors on the north side. Also, on the south side, a 10' wide by 9' high equipment door provides access to a 12' x 12' equipment well open from the ground floor to the third floor.

C. New Process Building (Cont'd)

Inside the building an 8" concrete block wall separates the hazardous methanol area and the corrosive HCl absorption area from the remainder of the building. The methanol and corrosive acid area has one wall louvered top and bottom for continuous natural ventilation and for emergency explosion release toward the river.

Heating is by process equipment supplemented by three unit heaters to maintain a winter temperature of 55-60° F.

Ventilation in the general production area is by natural ventilation supplemented by three manually operated roof fans rated at 3,900 cfm.

Lighting is by Class I, Division 1, Group D (Explosion Proof), incandescent fixtures.

Fire protection is provided by one set of sprinklers at the roof level and at all levels in the stair towers. The floor, being an open grating type, will permit easy passage of sprinkler water to the first floor. A blanked off "T" was installed in the main riser for the sprinkler system near the first floor level at the request of the insurance carrier. If at a later date the installation of additional equipment should cause congestion, it might be necessary to install sprinklers just under the first floor level.

A trench running the full length of the building with feeders from the east tank farm storage slab, chlorinator pump areas, and methanol areas collects all floor spills, accidental or otherwise, and carries the material to an acid bricked sump in which a wier of controlled size prevents large spills from being lost through a connection to the industrial sewer. This sump is emptied by a portable pump.

The back walls of the autoclave explosion cells have been utilized as part of the wall at the northwest corner of the building. This permitted location of the autoclave instrument panel within the building for safety but as near the autoclaves as possible for convenience.

The building is equipped with conveniently located steam, water, and air stations for portable hose connections, 110 volt power outlets for inspection lights, and 440 volt welding receptables. Emergency lights have been provided to operate on a 6 volt battery service in the event of a power failure. Also, a minimum of two 50 pound dry chemical fire extinguishers have been located on each floor and emergency chlorine gas mask stations are adequately provided. In addition, four safety showers and eyewash units are installed on the first floor and three units each on the second and third floors.

D. New Storage Facilities

In the original plant layout, one of the tank storage areas had both flammables and non-flammables located in a congested area at the southwest corner of the plant. A railroad siding serving the tank area was also used to unload chlorine cars. To reduce the traffic and the hazard of operating on the same siding with connected chlorine cars, and to obtain a safer location for the flammable tanks, a new storage area was set up on the south side of the west tank farm.

The following flammable tanks were moved and set on new concrete foundations: the 12,000 gallon kerosene, the 10,000 gallon 40 per cent dimethylamine, the 10,000 gallon ethyl hexanol, and the 20,000 gallon butyl alcohol and isopropyl alcohol tanks in equal compartments. Moved from other areas of the plant to the south end of the west tank farm were a 15,000 gallon phenol and 7,800 gallon BEP (alcohol) tank. These six flammable tanks were set a minimum of 15' clear of the property line and the between tank clearances were established as prescribed by the state code. The new storage area was then enclosed in a dike. Part of an old 6' high brick and block wall existed on the west and north end and a new 8" concrete wall approximately 5' high was constructed on the south and east sides. Access to the tanks was provided by steel ladders and platforms across the adjacent pipe rack and the dike walls. Any spillage or break is fully contained.

At the north end of the west tank farm the existing tanks were rearranged for more efficient utilization. These tanks include a 12,500 gallon acetic acid and acetic anhydride, a 10,000 gallon acetic acid, a 6,000 gallon acetic anhydride, a 2,000 gallon crude distilled methanol, and a 9,900 gallon methanol. This dike has a large reserve capacity for future tanks and also has a dike wall. The south, west, and north walls were existing brick walls and a new 5' high concrete east wall was constructed.

Intermediate process storage facilities are provided at the east end of the process building in an area known as the east tank farm. Prime among the five major tanks are two 15,000 gallon 25 per cent NaTCP tanks, and one 7,500 gallon and one 5,000 gallon 80 per cent MCA tanks. These four tanks sit on a common reinforced concrete mat which has a 6" concrete curb to catch all spills. The curb directs spills into a trench which connects to the first floor building trench and thence into the recovery sump. The fifth tank of the east tank farm is a 4,800 gallon phenol tank separated from the other tanks by a dike wall. This diked area has a sump and drain with a valve through the dike wall for recovery of spills. All of these tanks are provided with safety cage ladders and platforms. Pumps are located adjacent to the tanks with push buttons at convenient remote locations.

D. New Storage Facilities (Cont'd)

Other tanks of smaller capacity such as the intermediate HCl tanks and the brine storage tanks are located around the process building at points as convenient as possible to the connecting equipment.

Incoming tank car deliveries are made generally on the siding at the southwest corner of the plant. Box car loading or unloading can be done in this area and unloading stations are provided for phenol and TCB. Traffic studies indicate that for present operation these two unloading stations will be sufficient, but increased operation may require additional stations on the siding farther south if permission to use this siding can be obtained. If deliveries pile up, this second siding could serve as a holding point. This flexibility would permit full capacity storage and use of the tank cars as additional temporary storage capacity.

Steam, water, and air service connection are provided in or near the storage areas for cleaning tanks or blowing lines. All tanks and motors are grounded to a ground loop system, and all platforms have been equipped with adequate illumination for nighttime operation. Safety shower-eye wash stations are provided in or near the storage areas. The flammable liquid storage tanks are equipped with Shand and Jurs emergency relief vents sized to conform with the Factory Insurance Association (F.I.A.) requirements with flame arrestors being provided for all breather vents.

A foamite system for use against flammable liquid fires was required by the State of New Jersey and was installed in the west end of the new warehouse building. This system was designed by and purchased from the American La France Company after F.I.A. approval. The foam system has a 400 gallon tank for storage of the air foam liquid and two inline proportioners capable of 150 gpm of solution flow. Four stations are available for hose connection, three stations being located along the flammable west tank farm area and one at the northwest corner of the new warehouse. The connections are for 2½" fire hoses with Newark, New Jersey Fire Department threads.

E. Plant Utilities

1. Water

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The water used in the plant comes from three sources: city water, well water, and river water. Two 1,000 gpm electrically driven pumps furnish river water generally for the ester condensers in the D and T building. However, during periods of heavy requirements, river water could be used for cooling in other processes. The plant has one water well with a capacity that varies based on the time of the year, but normally will flow 600 gpm at 40 psig.

E. Plant Utilities (Cont'd)

Domestic and fire water is provided by the City of Newark. Two water mains are available in Lister Avenue. One is the city water line providing 35 pounds pressure and the other a fire water line providing 135 pounds pressure.

The old existing 3" line connecting Lister Avenue was so tuberculated that at times even the faucets at the old office building ran with little pressure. No fire water was available in the plant. Therefore, a new 6" domestic water line and 8" fire water line were run into the plant in a common trench. The domestic line is metered and the fire water line is equipped with a detector check. Both are located in a meter box below grade. The lines enter the plant down a 20' right-of-way and are cross connected in a valve box located in the roadway off the northeast corner of the new office building. This cross connection adds safety by providing two sources of water from the city. The domestic water line also provides drinking water for the plant and services the office building, the warehouse building, and the process buildings. In addition, domestic water is used for boiler water make-up, product dilution, and for HCl absorption.

The fire water line forms a loop around the plant and has four fire hydrants approximately equally spaced. Valves are provided in the loop to permit shutting off either half of the loop in the event of a break. This assures the plant of always having two hydrants in service. Each hydrant is protected by a small house which also contains 300' of fire hose connected to the hydrant. Combination fire hose nozzles that can be adjusted for either a high pressure stream or a "fog" are available.

Branching off the fire water line are connections for sprinkler systems in the office, warehouse, process, and existing 2,4-D buildings. The warehouse branch is also utilized to furnish high pressure water to the foamite mixing equipment.

To assure adequate process water, a connection to the 6" city water line can be made by means of a spool disconnect located at the southeast corner of the first floor of the process building. This connection should only be made, to the normally well water filled line, in the presence of a representative of the Newark Water Department to insure no contamination of the city water lines. In the regular use of city water, such as for product dilution of TCP or in HCl absorption system, the water is not connected directly to the equipment but fed into an open funnel connecting the equipment or into an open tank and pumped to the equipment.

E. Plant Utilities (Cont'd)

2. Steam

The total plant steam is provided by two existing oil-fired boilers. The larger Babcock and Wilcox boiler is rated at 400 boiler HP and provides 13,600 pounds per hour. It is located in the boiler house at the east side of the existing 2,4-D building. A stand-by Cleaver-Brooks boiler rated at 125 boiler HP provides an additional 4,200 pounds per hour. The smaller boiler is located in an extension on the north side of the 2,4-D building. The stand-by boiler is used for peak loads and to keep steam on critical lines or tanks during outage of the B and W boiler.

The normal connected load for the plant is approximately 13,000 pounds per hour and of this amount approximately 5,000 pounds per hour is required for building heating at 0° temperature.

The plant personnel are aware of the potential shortage of steam and will schedule production requirements, which are primarily intermittent, to keep actual loads to a minimum. The plant personnel have operated similar production schedules and equipment previously and are familiar with the problems.

3. Electrical System

a. Incoming Service

Power at 4,160 volts, 3 phase, 60 cycle is brought to an oil circuit breaker by Public Service Gas and Electric Company. The circuit breaker is owned by Diamond Alkali Company and is rated 600 amperes, 5000 volts, 3 pole, 50 MVA interrupting. It is manually operated, and it is set to trip on a 200 ampere current. Also in the cubicle on the line side of the breaker is a 600 ampere, 5 KV, 3 pole, single throw gang operated disconnect switch which is mechanically interlocked with the oil circuit breaker. The switch cannot be opened if the circuit breaker is closed. The breaker cannot be closed if the switch is open.

b. Substation DS 00029446

The substation consists of a $1\frac{1}{4}$" pipe structure with 7.5 KV insulators. The 4,160 volt bus is 2" copper pipe rated 730 amperes and the 480 volt bus is 2" copper tube rated 2000 amperes. Three 250 KVA transformers owned by Public Service Gas and Electric step the voltage down to 480 volts. The substation has been designed so that 500 KVA transformers can be installed. Public Service Gas and Electric will install transformers and secondary metering up to 1000 KVA (3-333 KVA transformers). Above this, Diamond must supply transformers and meter on the primary. The transformers are connected 4,160 wye/480 delta.

E. Plant Utilities (Cont'd)

c. Feeders and Switch Gear

A section of 2000 ampere bus duct carries power from the substation to the outdoor metal-enclosed 480 volt switchgear unit. This switchgear unit has 2000 ampere copper bus. Public Service supplied current and potential transformers which were installed in the unit for metering. Breakers, feeders, and auxiliary equipment are described below.

1. Transformer Breaker

This breaker is a 3 pole electrically operated unit and is rated 2000 ampere continuous, 600 volt, 75,000 ampere interrupting. The unit can be manually operated in an emergency. Power for electrical operation is supplied by a control transformer. There is a "circuit breaker control" switch and there are two lights on this unit. The green light indicates that the breaker is open and that it is safe to work on the feeder breakers and load bus.

CAUTION: Always check load bus with tester as a check on the light before working on the equipment. The red light indicates that the breaker is closed and that the load bus is "hot".

2. Process Building

This feeder consists of two parallel 3-conductor, 350 MCM, 600 volt, interlocked armor cables with a sheath of vinyl plastic over the armor. The breaker is rated 600 amperes, 600 volts, 40,000 ampere interrupting. It is manually operated and it is interlocked with the process building electrical room fans. The feeder terminates at a 3-pole, 600 ampere, 600 volt, breaker in the motor control center.

In order to classify the third floor electrical room as a non-hazardous area, it must be kept under a slight positive pressure as long as the motor control center is energized. This is done by interlocking the electrical room ventilating fans (MP721 and MP722) with the feeder breaker. The interlock is shown schematically in the lower right hand corner of drawing NF 268-1 and the actual wiring is shown on drawing NF 268-2. DS 00029447

A 15 ampere circuit breaker in motor control center unit 6B feeds two magnetic starters which are mounted on the east wall of the electrical room. These starters have a "hand-off-auto" switch in the cover. The starter coil is energized continuously in the "hand" position and never energized in either the "off" or "auto" position. Only

E. Plant Utilities (Cont'd)

one fan should run at a time. The other is a spare for use if the first motor fails to run for any reason. Each starter has a normally open interlock contact. These contacts are connected in parallel and one of them must be closed in order to have power and light in the process building. The parallel interlock contact combination is connected in series with an undervoltage trip coil in the feeder breaker.

A control transformer furnishes the necessary power for operating the undervoltage trip coil and a momentary contact pushbutton has been installed near the feeder breaker with which to by-pass the interlock contacts and energize this coil permitting the feeder breaker to close and remain closed.

3. 2,4-D Building Feeder

This feeder also consists of two parallel 3-conductor, 350 MCM, 600 volt interlocked armor cables with a sheath of vinyl plastic over the armor. The 3-pole breaker is rated 600 amperes continuous, 600 volt, 40,000 ampere interrupting. It is manually operated. It has no interlock. The feeder terminates at a 600 ampere, 600 volt, rain-tight disconnect (safety) switch on the south wall of the 2,4-D building. From the switch 500 MCM single conductor cables in conduit lead to the primary windings of three 150 KVA single phase transformers. The transformers are connected delta-delta with 0° phase shift. From the secondary windings, two parallel 500 CMC cables were applied to the existing leads of the temporary Public Service Gas and Electric 600 KVA transformer bank to energize the existing 240 volt distribution system.

4. Warehouse Feeder

This feeder consists of one 3-conductor, 500 MCM, 600 volt interlocked armor cable with a sheath of vinyl plastic over the armor. The 3-pole breaker is rated 400 ampere, 600 volt, 40,000 ampere interrupting and is manually operated. It has no interlock. It terminates at a 3-pole, 400 ampere, 600 volt breaker in a power panel.

5. Boiler, Locker Room, and East Tank Farm Breaker DS 00029448

A 225 ampere, 600 volt, 3-pole circuit breaker was provided to serve this load concentration by a 3-conductor, #4/0, 600 volt cable of the same construction as those described earlier. When it was decided not to convert the 2,4-D building to 480 volt service, this feeder became unnecessary and available for future expansion or modernization in the area described by the feeder name.

E. Plant Utilities (Cont'd)

d. Power Distribution

1. Process Building

A standard motor control center with terminal blocks in each unit serves all 480 volt loads in the process building, all motors at the north end of the west tank farm, and the well pump. A 600 ampere, 600 volts, 3-pole circuit breaker serves as a disconnect device. The control center is in a concrete block enclosure which is on the third floor and pressurized.

Motors and other loads are served by PVC insulated wire in galvanized conduit. All wiring is explosion proof, Class I, Division 1, Group D except in the third floor electrical room. Lockout type pushbuttons are used in place of disconnect switches at all motors.

2. Warehouse-Maintenance Building

A power panel with circuit breakers serve all 480 volt loads including the office building and a small rack which holds the starters for ten small motors at the south end of the west tank farm. The starters are fused combination magnetic type. A 400 ampere, 600 volt, 3-pole switch is the disconnect device for the rack.

Wiring in the Warehouse Section is explosion proof, Class I, Division II, Group D, and in the Maintenance area is non-explosive proof.

3. Office Building

The office building power panel is fed from the warehouse by a 3-conductor #1/0 cable similar to those described in the section on feeders.

e. Lighting System

DS 00029449

1. Process Building

Three 10 KVA single phase dry type general purpose transformers are mounted on the wall of the third floor electrical room and connected delta-wye to give 208/120 volt, 4-wire service. There are three circuit breaker type lighting panels, one on each floor. The third floor panel is in the electrical room and has a general purpose enclosure. The first and second floor panels are explosion proof, Class I, Division 1, Group D. Fixtures in processing areas are explosion proof. Most lights are incandescent type. Control panel lights are fluorescent.

E. Plant Utilities (Cont'd)

2. Warehouse-Maintenance Building

Three 25 KVA single phase dry type general purpose transformers are mounted on the roof of the office section of this building. They are connected delta-wye for 208/120 volt service. Fixtures in the Warehouse Area are vapor-tight for Class I, Division 2, Group D service and in the Maintenance Area are general purpose. All lighting is served from a circuit breaker panel in the maintenance area. Fluorescent lights are used exclusively.

3. Office Building

This building also has three 25 KVA single phase transformers connected delta-wye. They are mounted on the floor of the mechanical equipment room. There are two lighting panels (circuit breaker type) one on each floor. The second floor panel is in the mechanical equipment room and the first floor panel in the hall of the office section. Lighting fixtures use fluorescent lamps.

4. Yard Lighting

Class I, Division 2, Group D equipment is used in operating areas and general purpose equipment in non-operating areas. Power for lights in the area around the process building and the north half of the west tank farm comes from the process building. Exterior lights on the office and warehouse-maintenance buildings obtain their power from the light panels in the respective areas. A small number of lights at the south end of the west tank farm also obtain their power from the warehouse-maintenance building light panel.

Lights for the new parking area at the Sargent plant and the walkway to it obtain their power from an existing lighting panel at the east tank farm. These were field installed and are not shown on any drawing.

4. Plant Air

a. General Service

Plant air is supplied by two reconditioned air compressors located in the southeast corner of the new process building. One is a 7 x 7 Worthington with a 20 HP motor and the other is a 7.5 x 6 Chicago pneumatic with a 20 HP motor. Both compressors can be operated simultaneously or individually. During operation they maintain a 100 psig pressure throughout the plant for general service.

E. Plant Utilities (Cont'd)

The air is distributed to all areas of the process and 2,4-D buildings, to the west tank farm along the pipe rack, to the tank car unloading stations, to the maintenance area of the warehouse, and to the laboratory in the office building.

b. Instrument Air Service

Instrument air is taken from the above service after being reduced to a range of 50-60 psig. A Pittsburgh Lectrodryer having a capacity of 50 SCFM is used to dry the air to a dew point of -20° F. A prefilter is used to remove oil and instrument air distribution is made to the new process building, the D and T building, and the west tank farm area. A further pressure reduction is made to 20 psig at the various points of usage such as the TCP or MCA instrument panels.

5. Process Refrigeration System

An existing ammonia refrigeration system was overhauled and installed on the south side (first and second floors) of the new process building. The system consists essentially of a 7 x 7 Worthington ammonia compressor rated at 34 tons of refrigeration utilizing a 50 HP motor at 1750 rpm with the necessary evaporator, water cooled condenser, and receiver. The evaporator is equipped with an automatic York float type liquid level control and the condenser, receiver, and evaporator are equipped with pressure relief valves. These valves are connected to vent pipes extended above the roof of the building for safety. In addition, two 1½" manually operated emergency valves to bleed off pressure are installed outside the building on the south side. The emergency valves permit "dumping" of the ammonia on either the suction side (evaporator) or the high pressure discharge side (condenser or receiver) of the system into a 2" line extended to and discharging beneath the water surface of the autoclave "blowdown sump". Manual "dumping" of the ammonia can be extremely important in the event of a fire in the vicinity of the system. "Dumping" would prevent possible rupture of the equipment and spillage of ammonia in the building, making it impossible to fight a fire.

A calcium chloride brine circulating system is used as the cooling medium. The brine reservoir consists of a 3,000 gallon insulated steel tank from which the brine is pumped to the required process service.

6. Sewers

An existing 4" sanitary sewer connecting the City of Newark's service at Lister Avenue was used for sanitary wastes from the new buildings.

E. Plant Utilities (Cont'd)

Industrial wastes from the new process building sump, the new laboratory facilities, and the D and T building empty into an existing 10" vitrified clay industrial sewer. The industrial sewer also connects to the City of Newark's service at Lister Avenue.

F. New Warehouse-Maintenance Building

A 100' x 120' warehouse-maintenance building was constructed near the center of the plant site to replace the facilities destroyed. The north side is for warehousing purposes and occupies approximately 56' x 120' (6,700 square feet) of the total building. The whole area of the warehouse portion was elevated to dock height, approximately 4' above grade for truck loading. The area is serviced by a ramp for fork lift trucks and has four 10' x 10' chain operated overhead doors and three standard personnel doors.

The south side is separated from the north side by a 12" concrete block firewall and has approximately 1,500 square feet of area devoted to a plant stores area, 1,400 square feet for the production staff and maintenance foreman offices, supervisors office, shipping clerks office, first aid room, lunch room, and toilet. The remainder of the space, 2,500 square feet, is used for the maintenance shop. Racks, bins, shelving, partitions, and other miscellaneous items were installed new in the stores and maintenance area. This area is approximately 8" above grade and large overhead doors are installed for fork lift truck or equipment access.

The building is a galvanized structural steel rigid frame type with 20' bay spacing. The columns span east to west 120' clear and were so positioned to permit expansion to the north. The siding and roof is corrugated asbestos with corrolux sky light panels. The walls are carried on pile supported grade beams, and the floors are concrete slab on compacted fill. Use was made of the existing foundation walls of the old manufacturing building and the Triplex building.

The warehouse side is not, generally, heated, but two steam operated space heaters are installed to direct heat into the southwest corner where the foamite equipment is installed. These space heaters are thermostatically controlled to keep the temperature around the foamite equipment above freezing.

The south side or the maintenance-stores section has installed four steam operated space heaters to maintain comfortable working conditions. The office-lunchroom section has a new 7.5 ton air conditioning unit with heating coils for both heating and cooling.

A continuous ridge type ventilator, generally kept closed in the winter, is installed for summer ventilation. The entire building is sprinklered.

G. New Office, Laboratory, and Dressing Room Building

A new two-story building was constructed at the south end of the plant area. The first floor on the north side provides offices for the plant manager and secretary, technical supervisor, engineers, office manager, purchasing agent, general accounting staff, conference room, stock room, lobby, and ladies and men's room. Completely separate from the office area on the first floor and having independent access is the plant operating personnel's basket room, locker room, showers, drying room, washing room, and toilets.

The second floor has approximately an 1,880 square foot laboratory area, new lab furniture, an instrument room, a lab office, lunch room for office personnel, storage, mechanical equipment room, and toilet.

The first floor has a total of 4500 square feet and the second floor a total of 3,840 square feet. The basket room, extending through the second floor, reduces the second floor area.

The building was constructed using wood flooring and wood roof joists on concrete block and steel framing. The first floor is a structural concrete slab on piles. The east or entrance side of the building is faced with brick, and all other exterior walls are painted block.

Two means of access are available to the second floor; one by a stairway from the main lobby, and the other from an outside steel stairway entering directly into the laboratory. The outside stairway permits operating personnel to carry samples to the laboratory without entering the first floor office section.

Heating for the first and second floor offices is provided by steam convectors located on the wall beneath the windows. In the locker area, heating is by steam heated air under forced circulation. Convectors are used, also, under the windows. In the laboratory, existing air conditioning units using circulated air through steam heated coils provide the required heating.

Air conditioning for the offices is by a central ten ton unit with three reused existing five ton units in the laboratory.

Fresh air supply and make-up air is furnished by 12,000 cfm air handling unit in the mechanical equipment room. A high rate of air circulation is used in the basket room to freshen the plant personnel's work clothes. The entire building is sprinklered by pendant or wall type fixtures. Laboratory hoods receive fresh air from the lab area and positive pressure exhaust fans are used to discharge the air and fumes above the roof. Air circulation in the laboratory, therefore, is controlled by the window openings at the hoods.

H. Revision to Existing 2,4-D Building

Limited rehabilitation of the existing 2,4-D building was made to improve safety standards as required by the Factory Insurance Association. These revisions principally consisted of the following:

1. Sectionalizing of the building into three areas:

   a. D and T manufacturing area.

   b. Esterification area.

   c. Formulation and filling area.

   Openings in the existing brick walls were sealed to provide fire stops between the areas. Also, curbs were provided around all door openings to prevent the passage of liquid spills from one area to another.

2. Revision of flammable liquid process vessels to include extension of properly sized vents to the outside of the building and replacement of pyrex glass gauge glasses with the heavy duty armored type.

3. Electrical revisions to include making vapor tight any open connections, replacement of nonexplosive proof motors with the explosion proof type, and replacement of any open lights with the vapor proof type.

4. Revision of the boiler controls to provide an automatic programmed air purge cycle for the firebox to reduce the hazard while firing or during other temporary upsets.

5. Installation of a complete automatic sprinkler system on an extra hazard schedule for the whole building.

The Factory Insurance Association agreed to the limited rehabilitation of the electrical system in view of plans to take a look at a new installation some time within the next four to five years.

I. Site Improvements

Site improvements consisted primarily of clearing the site as outlined in Section A. and addition of new roads and paved areas.

After final construction, all areas were graded as shown on the site plan. Ground drainage in all areas is by natural flow. The east side of the plant is graded to flow towards an opening in the sewer where a large portion of the runoff is removed. The balance is dissipated by percolation through a fairly pervious layer of top soil in the vicinity of the railroad track. On the west side, portions of the runoff flows southwest to the railroad track areas and to pervious soils. The northern part is graded towards the river. The decision for natural drainage was made after studying the soil borings and talking to the

I. Site Improvements (Cont'd)

plant personnel about past experiences. It was reported that only during river flooding has there been any real problem with runoff. It is not expected that the above approach will be as effective as storm sewers, but storm sewers were not considered in this appropriation.

The floor levels of all buildings were raised a minimum of six inches above the highest recorded flood, which occurred during the design stage of this project in 1960.

The fence at the southwest corner of the property, which had two railroad gates, was moved west so as to permit the accommodation of two tank cars or freight cars at the unloading stations.

A parking lot was provided on leased land to the east of the plant site. The land was graded and given a rolled gravel and oil finish. A fence was erected to enclose the area. A pathway was cleaned out and given a fine gravel finish from the parking lot to the old east tank farm area.

The entire plant can be lighted at night by floodlights located on the process, warehouse, and office buildings and by lights on a building adjacent to the parking lot. The tank platforms have separate lights to illuminate those areas used for night operations.

All pipe bridges were kept a minimum of 16' clear of roadways. Guard posts were installed to protect corners of buildings and pipe racks near grade from truck traffic.

The area between the warehouse building and the new process facilities (formerly the concrete floor slab of the old manufacturing building) was cleared, miscellaneous tank or pump bases chipped down to grade, and the open portions filled with lean concrete. The new bituminous paving was made to join the slab with feather edges to provide easy transition for fork lift truck traffic for outside drum storage in this area, if required.

The bulkhead was composed of vertical piling at the bulkhead tied back by steel tierods to horizontal deadmen. As previously related under Section C., new anchor piles, deadmen, and new bulkhead tierods were installed under the new process building to furnish the required reinforcement for the existing bulkhead.

Railroad sidings at the south end of the site were undisturbed except for minor improvements to ties and ballast. All new construction was kept clear of the tracks by a minimum of 8'. A new car stop was erected on the siding that swung north toward the warehouse. Provision was made at this car stop for unloading freight cars by extending the paved road along the east side of the track for approximately one freight car length.

A prefabricated steel solvent shed for the storage of paint and general plant solvents was purchased. This unit was erected by plant forces near the south end of the plant.

I. Site Improvements (Cont'd)

A completely new fire fighting water main system has been installed to serve the plant, as described under Section J.

A new eight-inch fire water main (see Section E.), water sprinklers for all buildings, and a foamite system (see Section D.) were installed to upgrade the fire protection facilities.

DS 00029456

V DRAWINGS

A. Drawings Included In This Report

B. Complete List of Drawings

DRAWINGS

DS 00029457

V DRAWINGS

A. Drawings Included In This Report

The following drawings are included in this section:

NF-200-1 - Sodium TCP Unit - Mechanical Flow Diagram - Sheet #1

NF-200-2 - Sodium TCP Unit - Mechanical Flow Diagram - Sheet #2

NF-200-3 - MCA Flow Diagram - Process

NF-200-4 - DCP Flow Diagram - Process

NF-200-5 - MCA Flow Diagram - Mechanical - Sheet #1

NF-200-6 - MCA Flow Diagram - Mechanical - Sheet #2

NF-200-7 - DCP Flow Diagram - Mechanical

NF-200-8 - TCP Material Balance Sheet

NF-201-1 - TCP Equipment List - Sheet #1

NF-201-2 - TCP Equipment List - Sheet #2

NF-201-3 - TCP Equipment List - Sheet #3

NF-201-4 - MCA Equipment List - Sheet #1

NF-201-5 - MCA Equipment List - Sheet #2

NF-201-6 - DCP Equipment List - Sheet #1

NF-201-7 - Miscellaneous Equipment List

NF-201-8 - MCA Unit - Instrument List

NF-201-9 - MCA Unit - Instrument List

NF-201-10 - MCA Unit - Instrument List

NF-215-1 - Process Building - 1st and 2nd Floor Plan

NF-215-2 - Process Building - 3rd Floor and Roof Plan

NF-259-1 - TCP Unit - Instrument List

NF-259-2 - TCP Unit - Instrument List

A. Drawings Included In This Report (Cont'd)

NF-259-3 - TCP Unit - Instrument List

NF-259-4 - Sodium TCP Unit - Instrument List

NF-259-5 - Sodium TCP Unit - Instrument List

NF-259-6 - Sodium TCP Unit - Instrument List

NF-268-1 - Process Building Motor Control Center - One Line Diagram

NF-282-1 - TCP MCA DCP Equipment Layout - 1st Floor

NF-282-2 - TCP MCA DCP Equipment Layout - 2nd Floor

NF-282-3 - TCP MCA DCP Equipment Layout - 3rd Floor

NS-581-1 - Site Plan - Plant Area

NS-581-4 - Location of Cooling Water and Fire Water Lines in Right of Way

NS-918-2 - Office, Laboratory, and Dressing Room Building - 1st Floor

NS-918-3 - Office, Laboratory, and Dressing Room Building - 2nd Floor

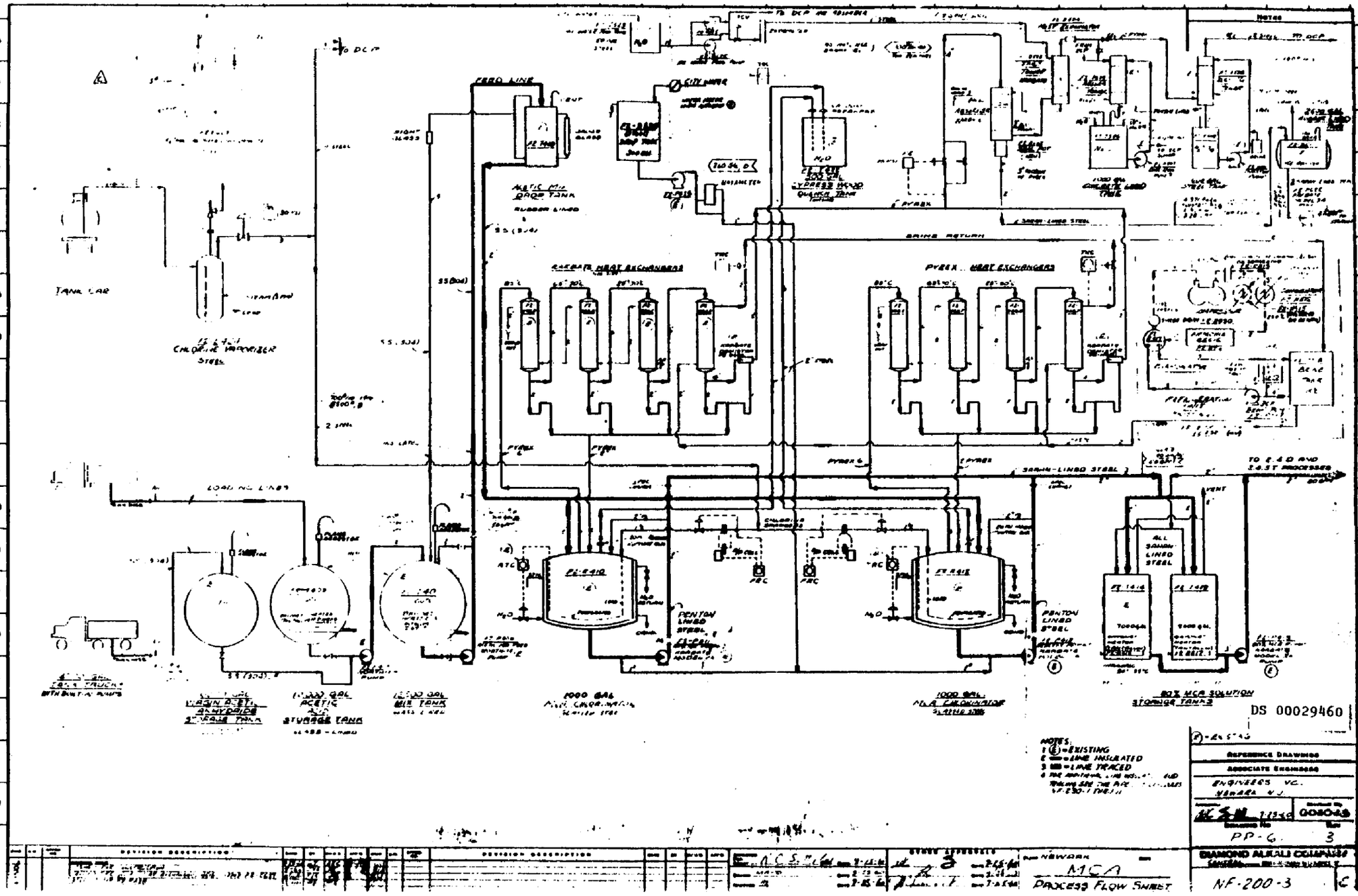
NS-918-6 - Warehouse Maintenance Building

NS-918-11 - Maintenance - Storage Areas - Equipment Plan (Warehouse)

NU-366-1 - Outside Electrical Utilities

NU-368-2 - Plant Power Distribution

NU-933-1 - Outside Utilities Plan



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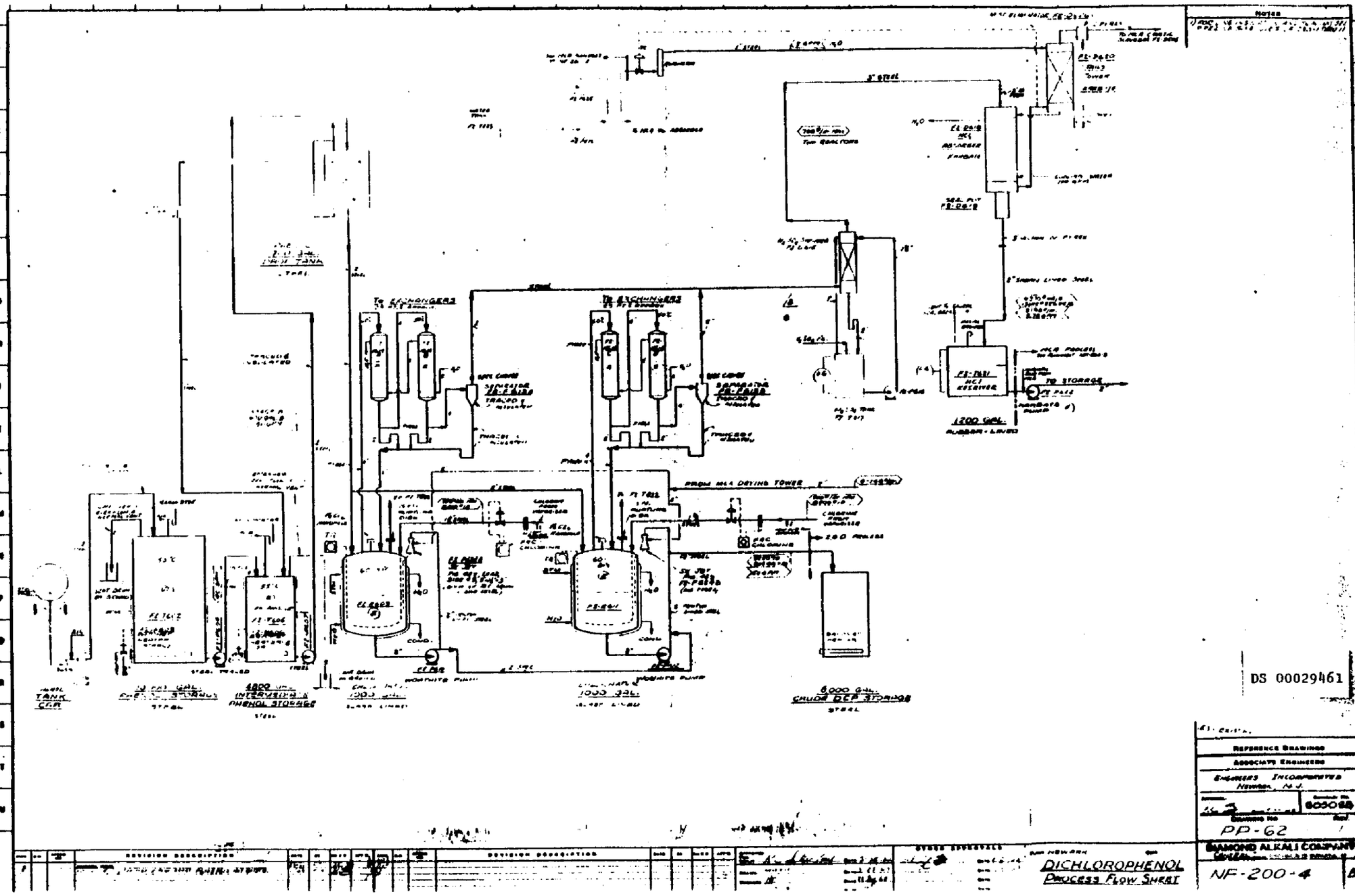

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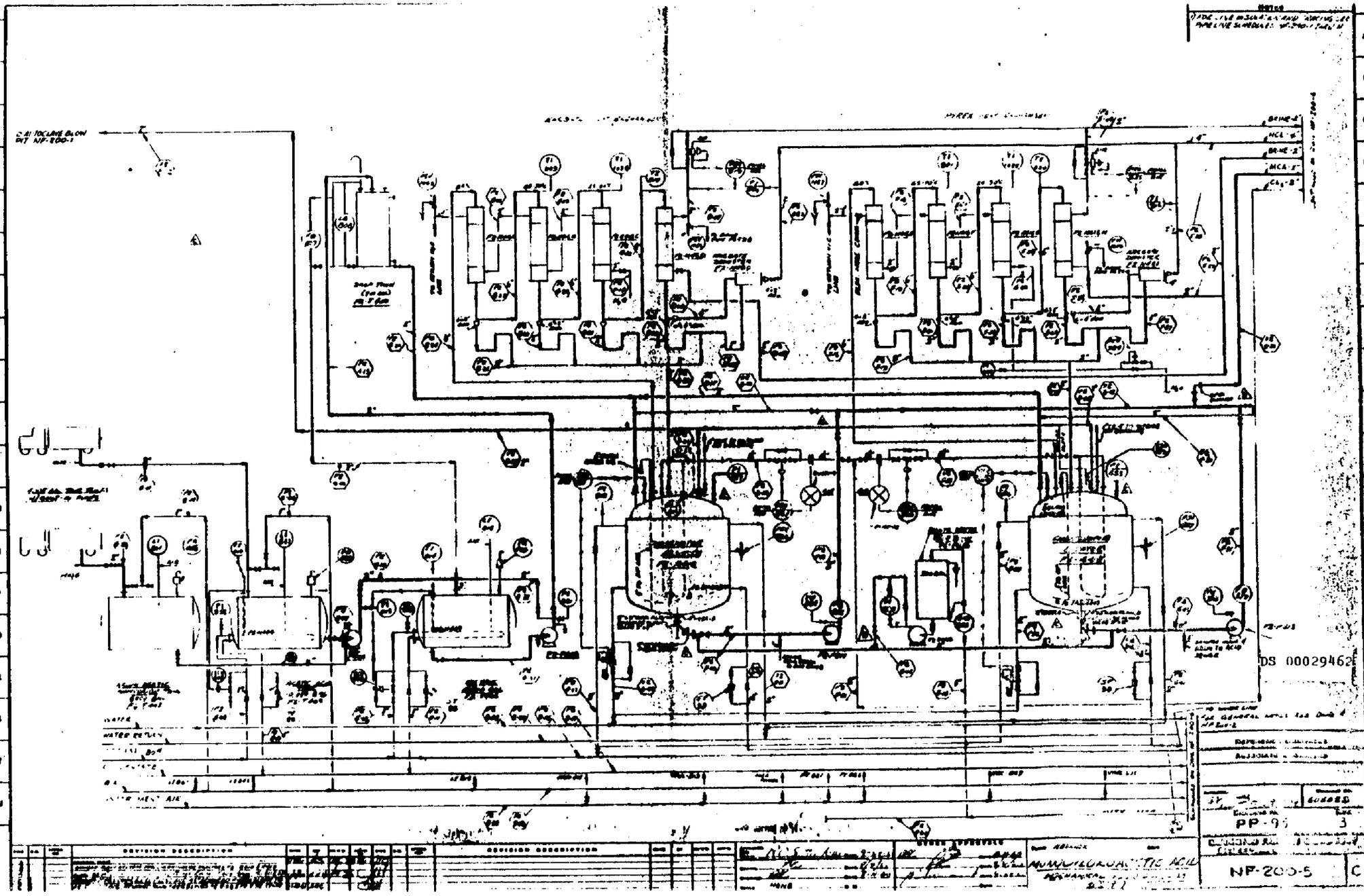
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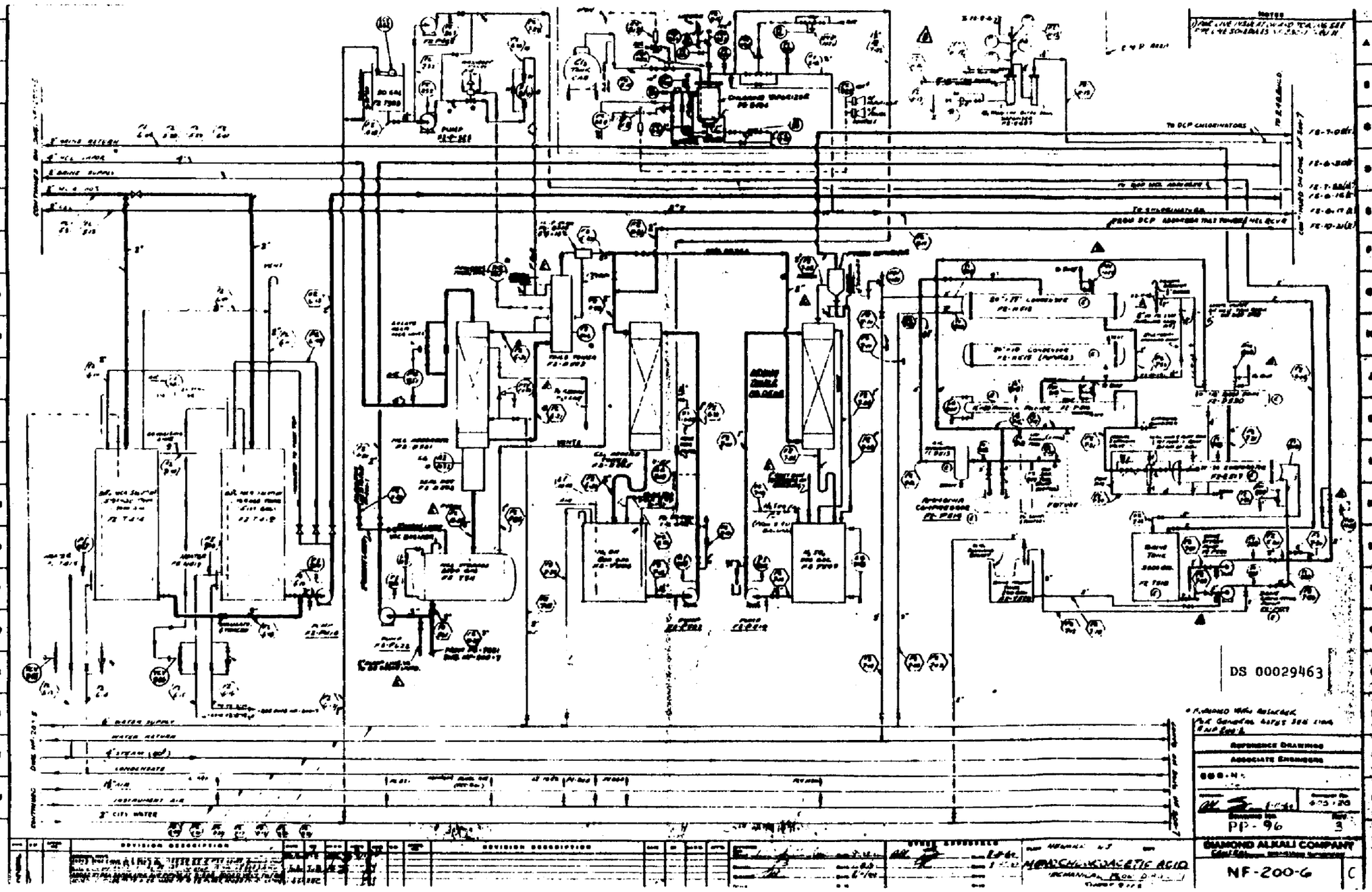
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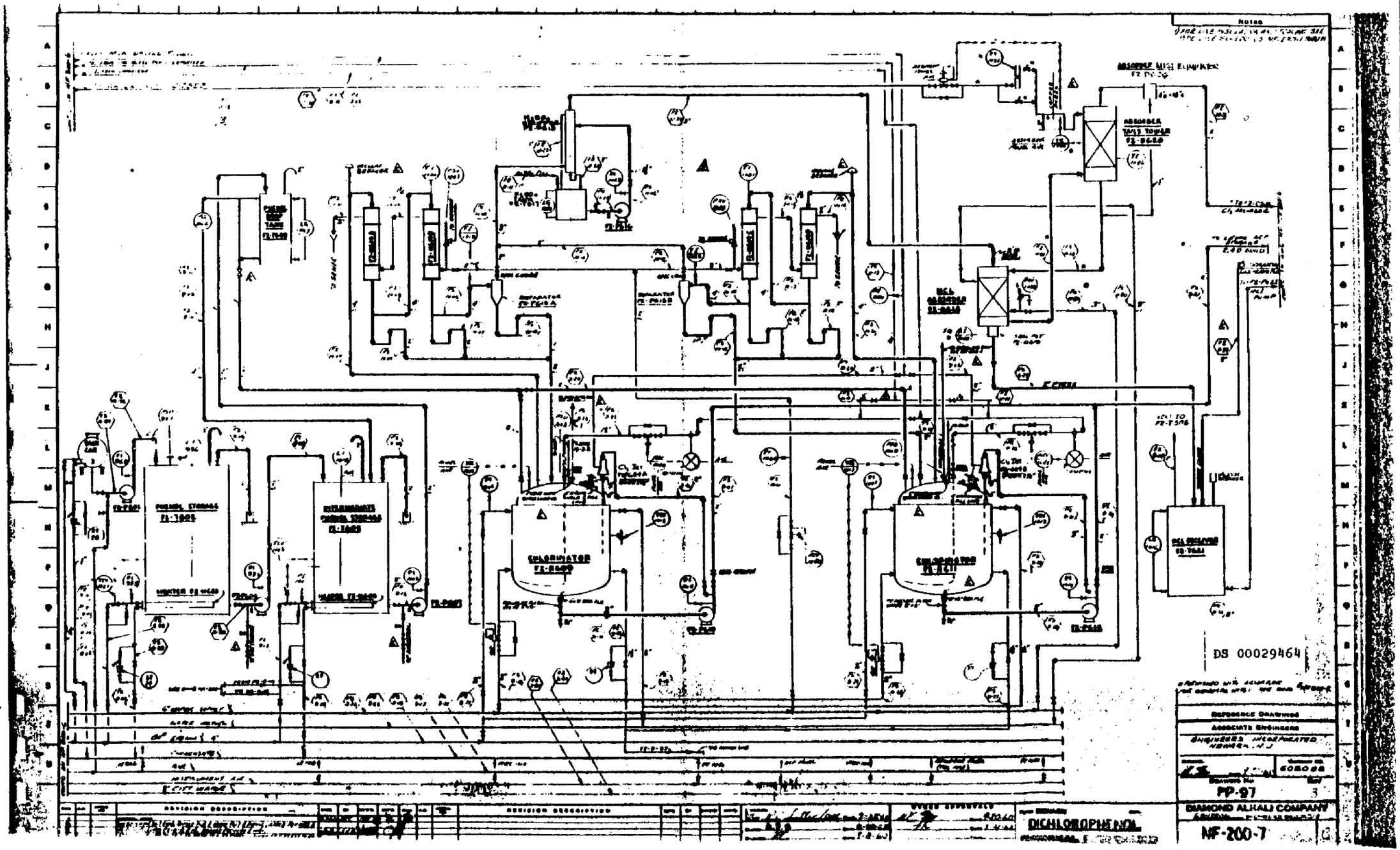
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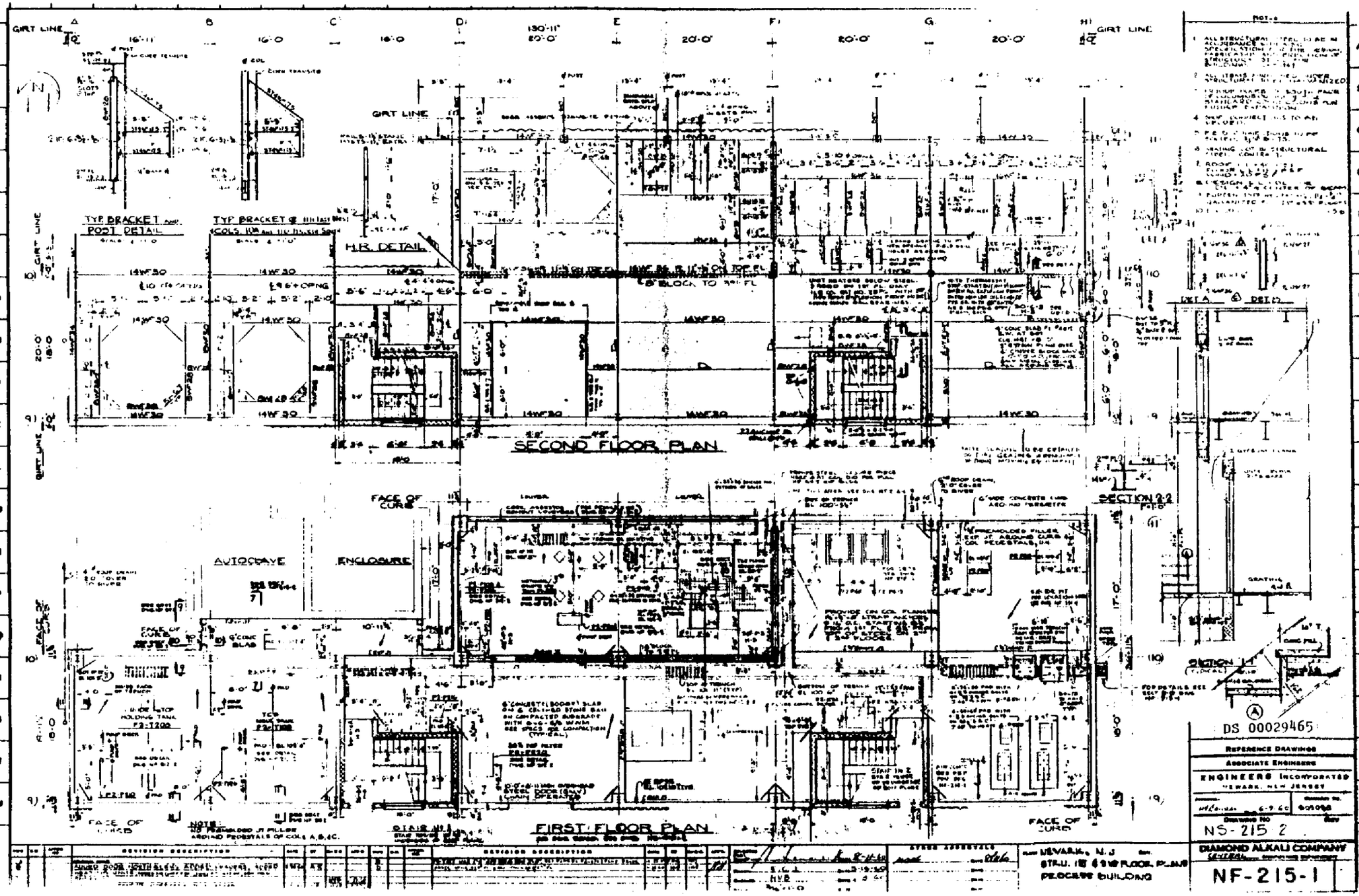

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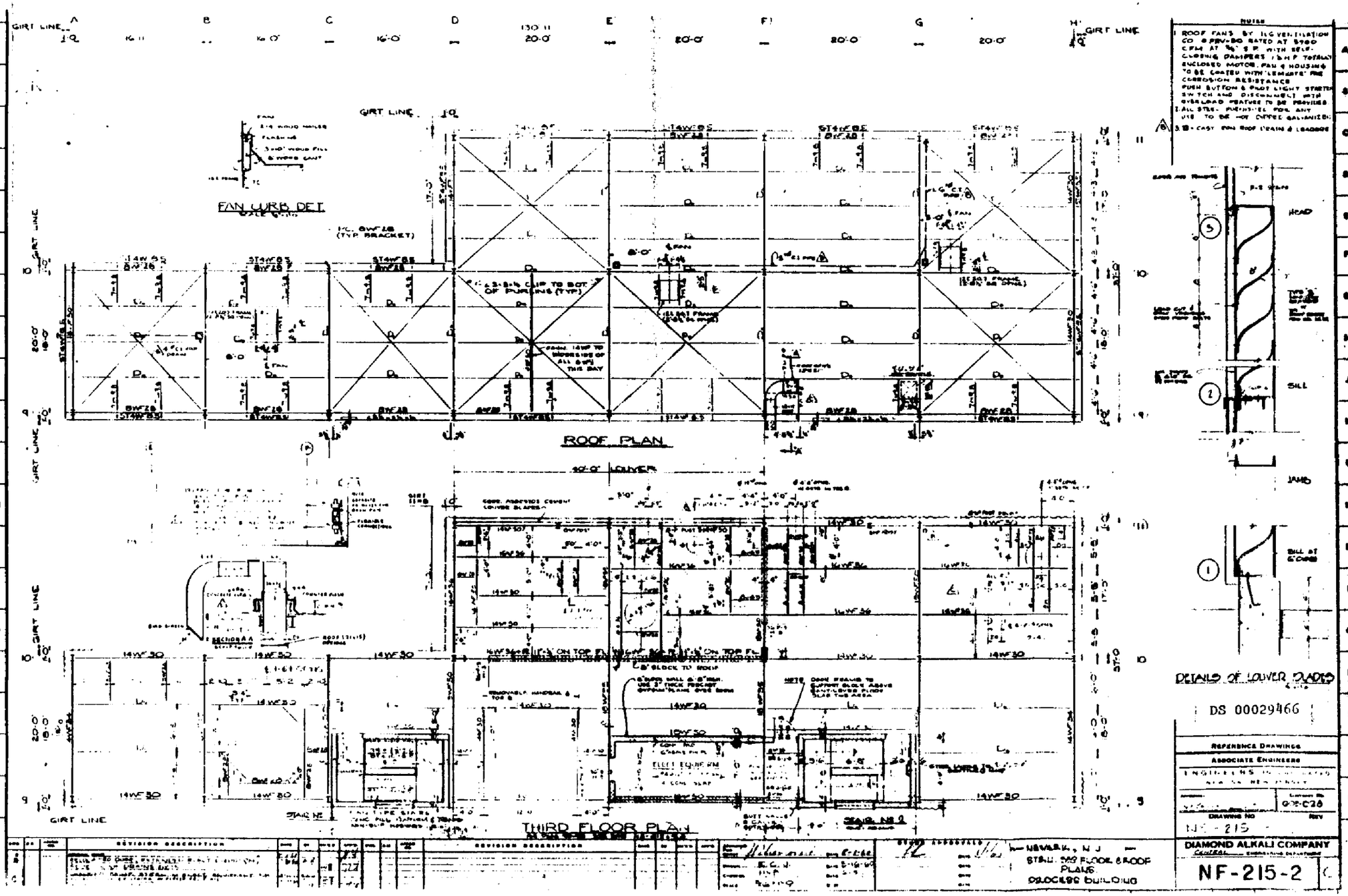
NF-215-2



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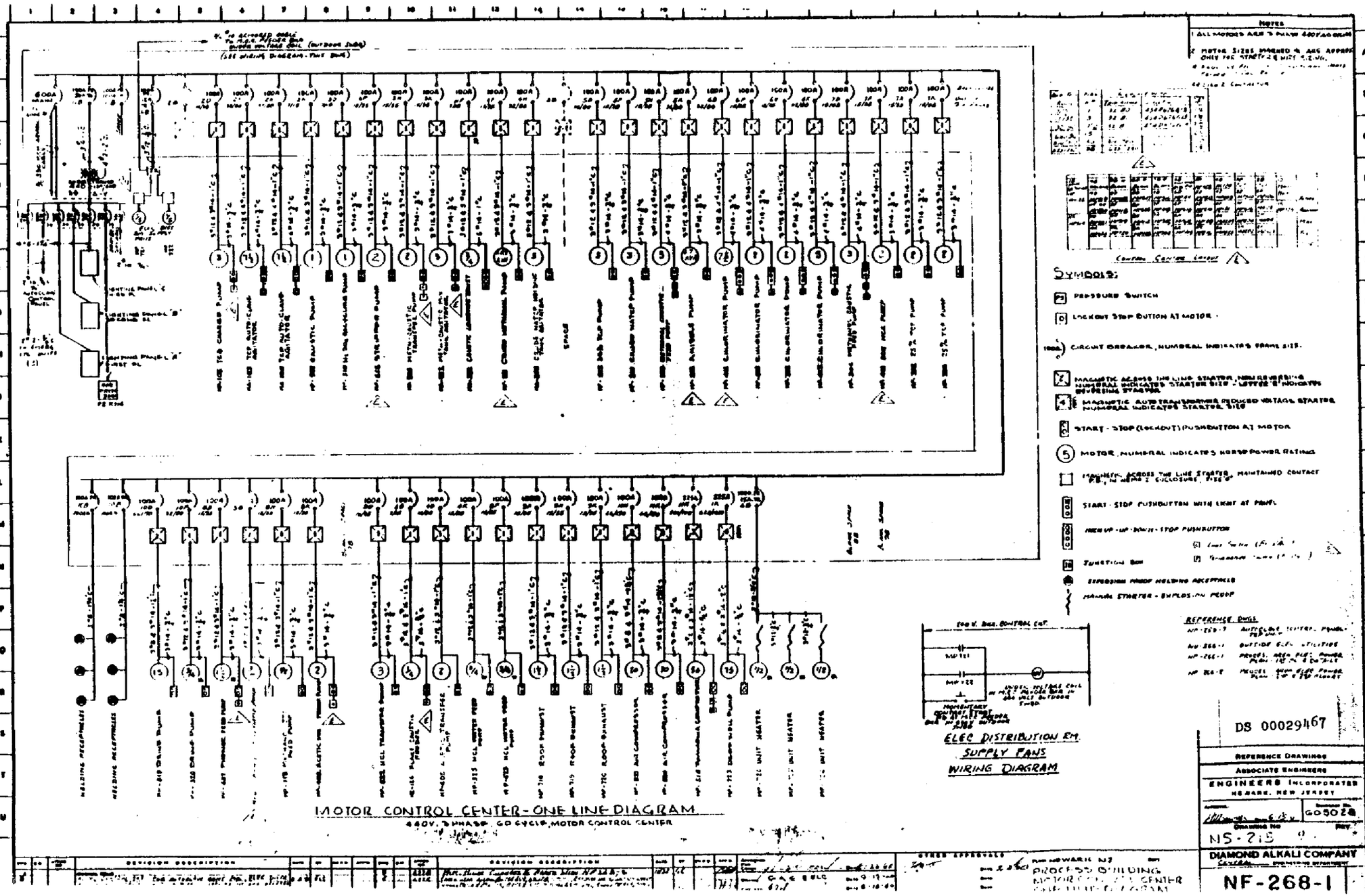

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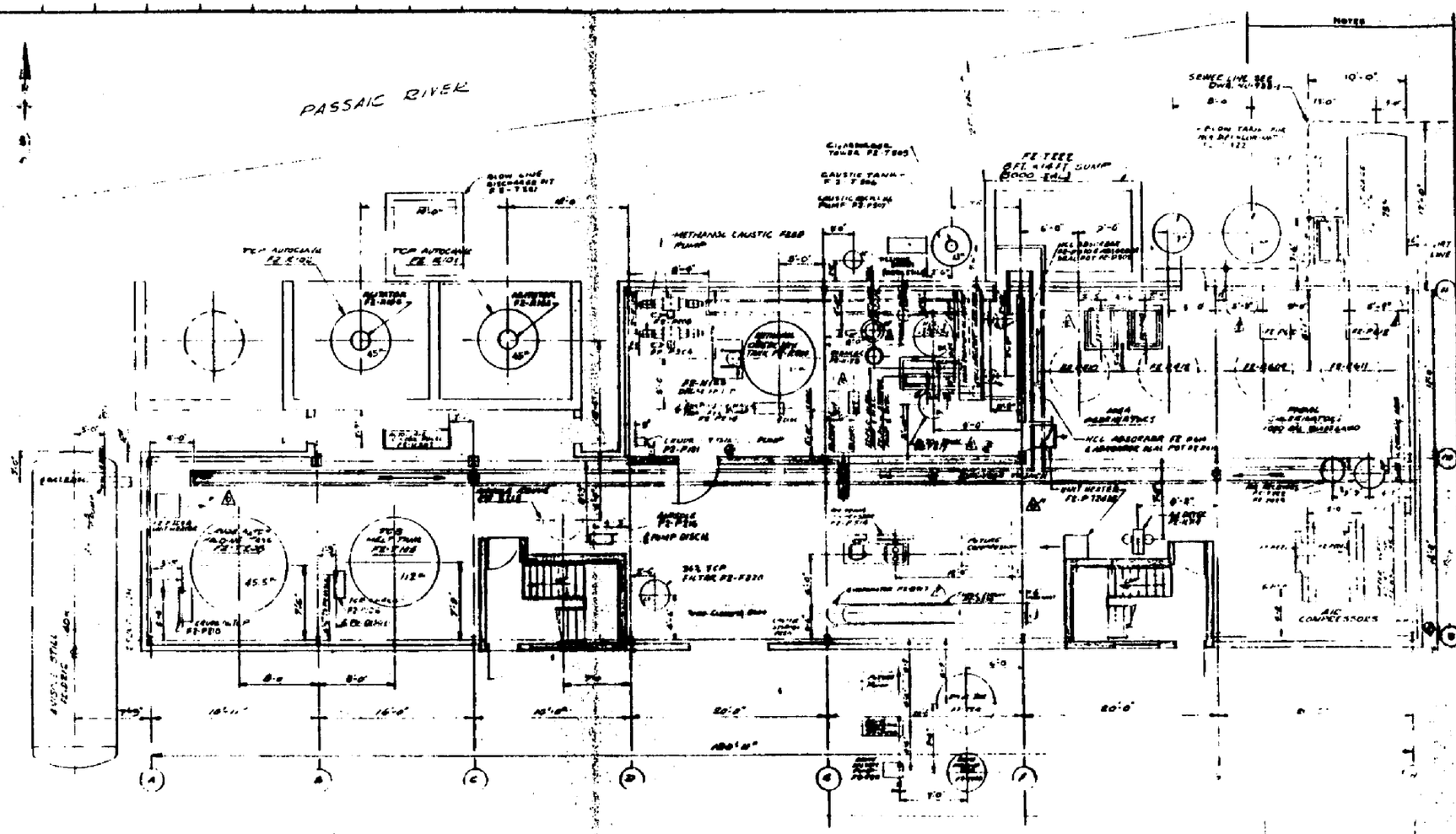

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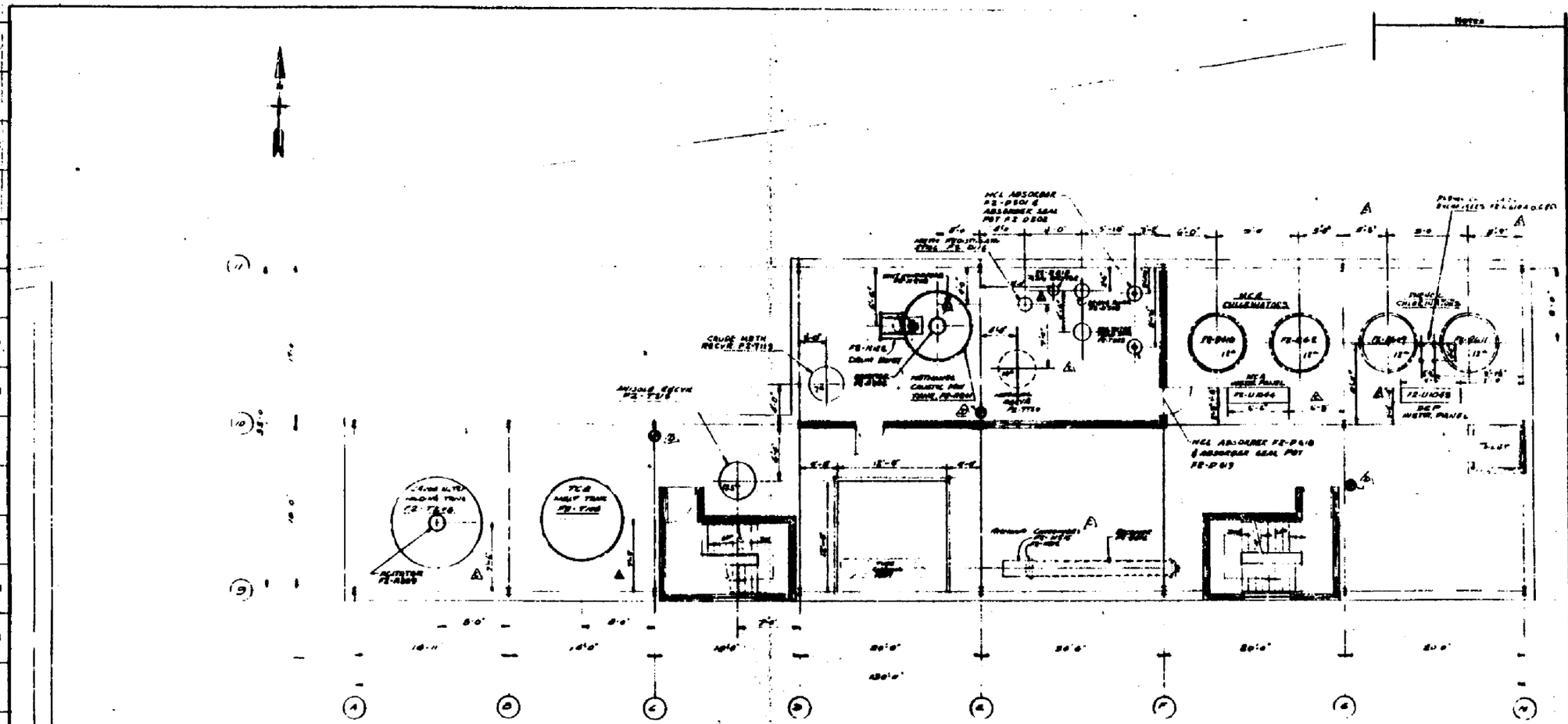

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REFERENCE DRAWINGS	
ASSOCIATE ENGINEERS	
ENGINEERS INTERNATIONAL NEWARK NEW JERSEY	
605026	
PP-57	4

DIAMOND ALKALI COMPANY

NEWARK, N.J.

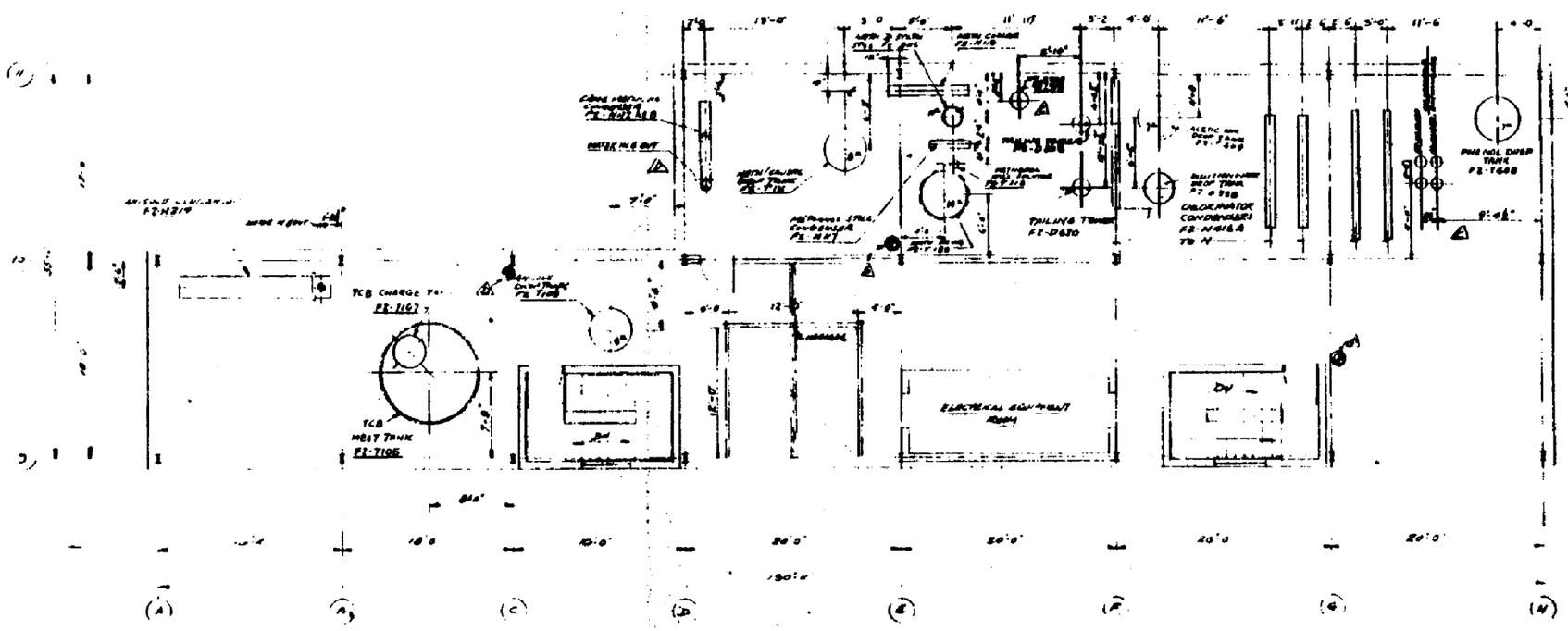
TCP-MCA-DCP EQUIPMENT LAYOUT 2ND FLOOR

NF-282-2

NF-282-2

MAXUS0998161

NF-282-3



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REFERENCE DRAWINGS

ASSOCIATE ENGINEERS

ENGINEERS INCORPORATED
NEWARK, NEW JERSEY

Drawing No. PP-58 Rev. 4

DIAMOND ALKALI COMPANY

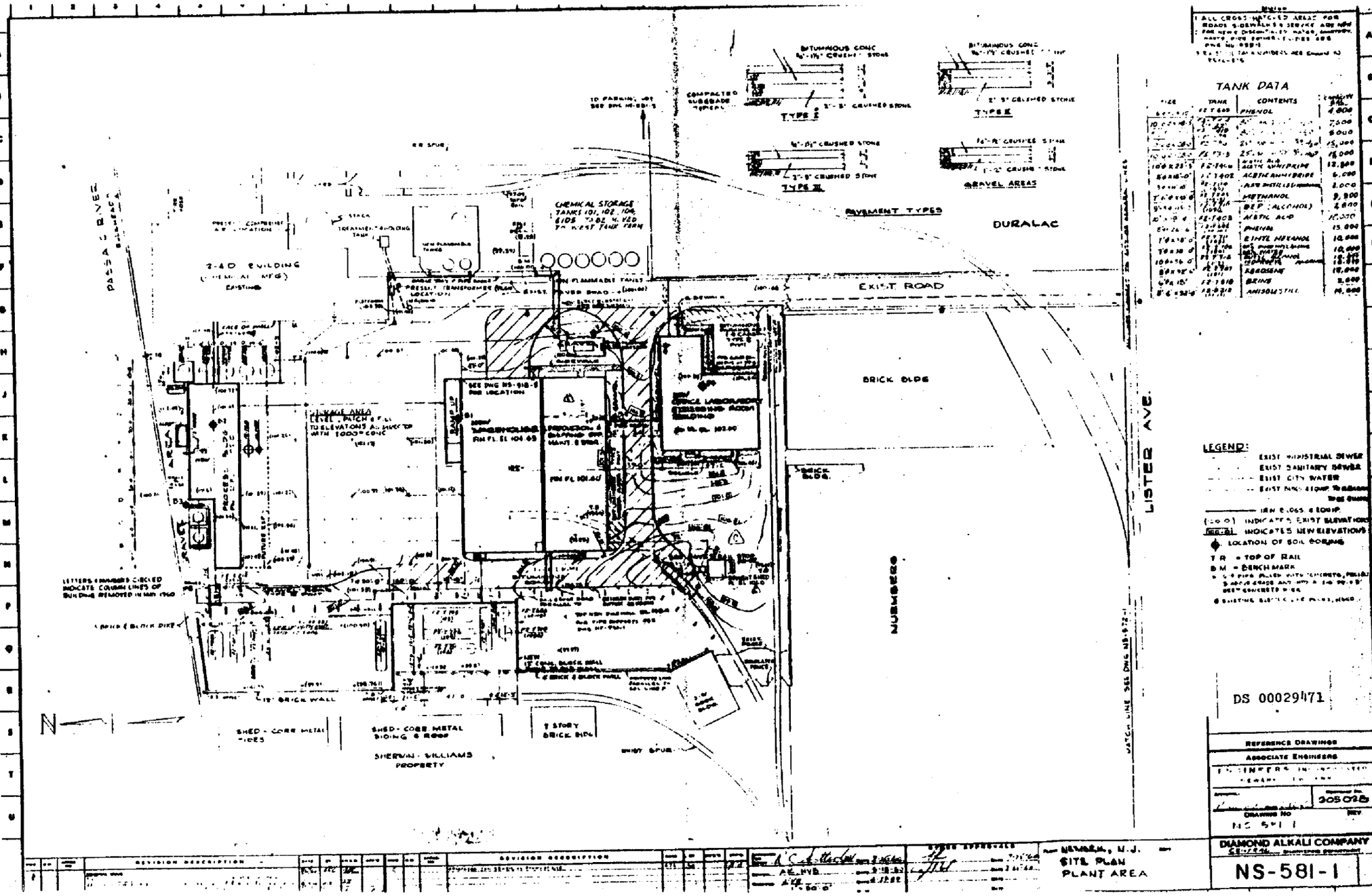
NEWARK, N.J.

TCP-MCA-DCP
EQUIPMENT LAYOUT
3RD FLOOR

NF-282-3

REVISION DESCRIPTION

MAXUS0998162



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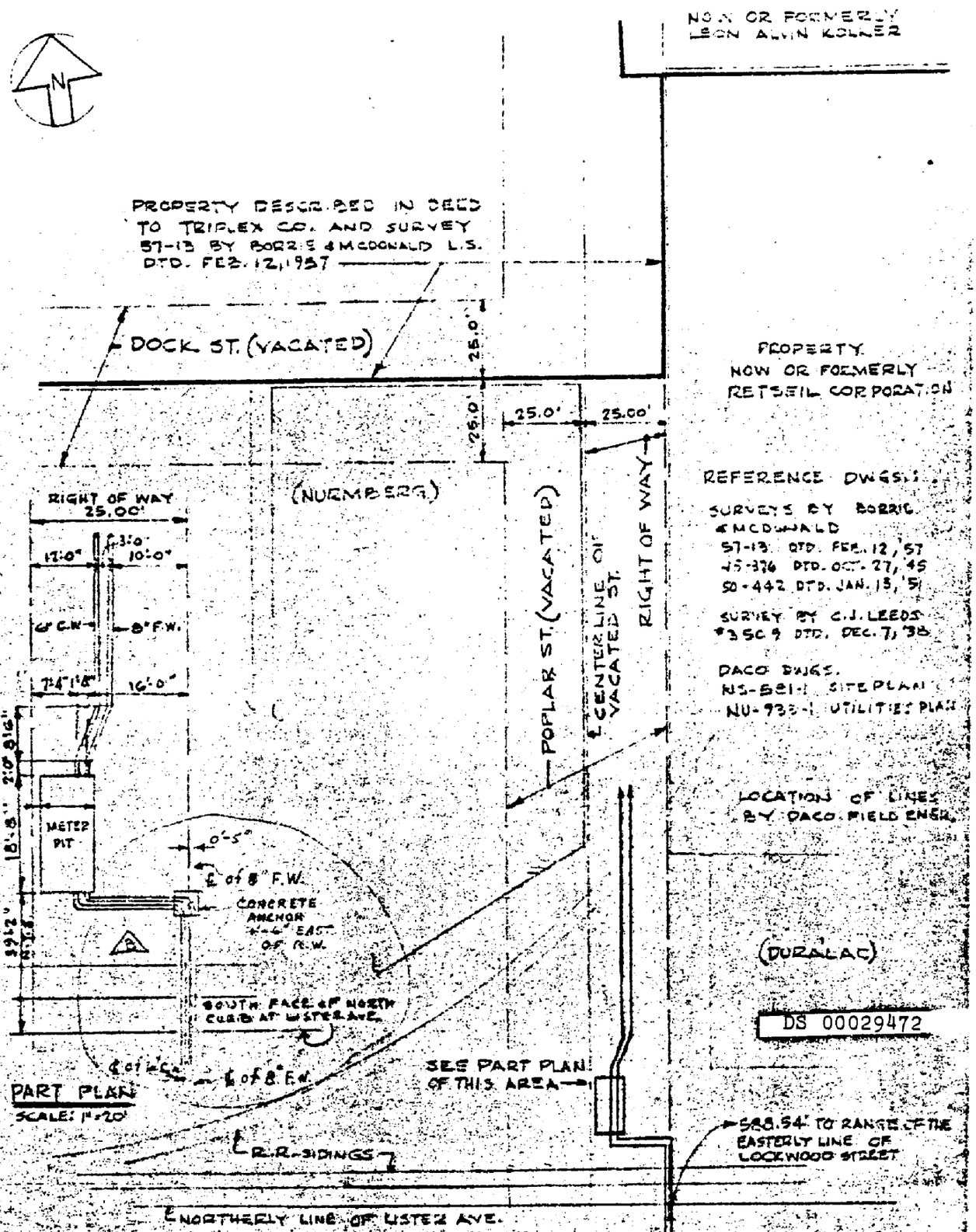
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6" C.W.
8" F.W.
7'-4"
1'-8"
16'-0"
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METER PIT
0'-5"
℄ of 8" F.W.
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OF R.W.
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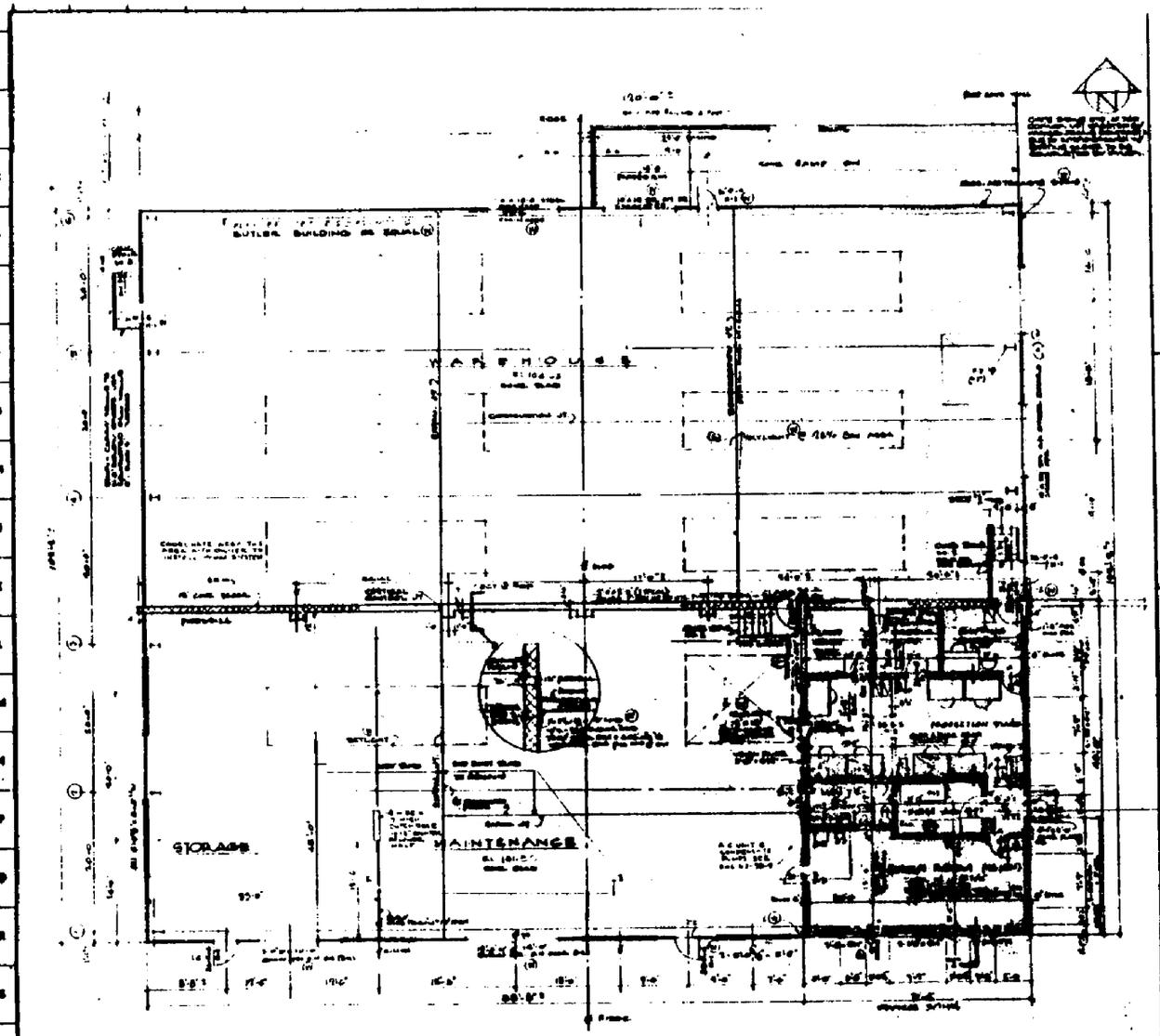
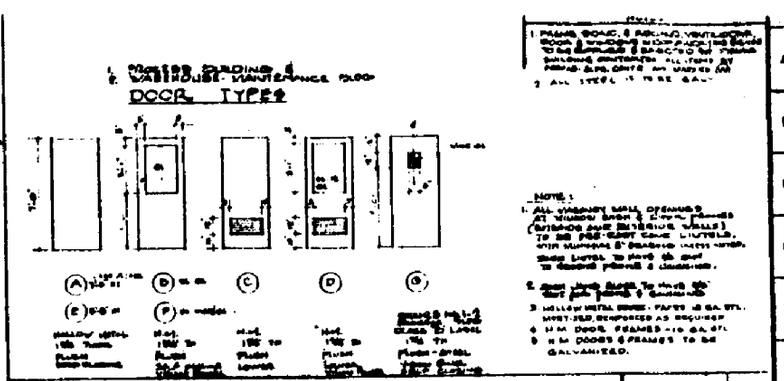
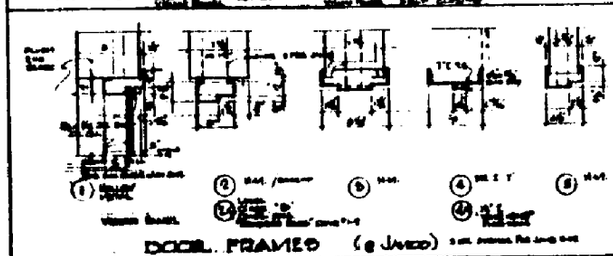
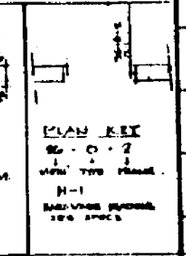
REFERENCE DWGS.:
SURVEYS BY BORRIS
& MCDONALD
57-13 DTD. FEB. 12, '57
45-376 DTD. OCT. 27, '45
50-442 DTD. JAN. 15, '51
SURVEY BY C.J. LEEDS
#3509 DTD. DEC. 7, '38
DACO DWGS.
NS-501-1 SITE PLAN
NU-938-1 UTILITIES PLAN
LOCATION OF LINES
BY DACO FIELD ENGR.
(DURALAC)
DS 00029472
SOUTH FACE OF NORTH
CURB AT LISTER AVE.
℄ of 6" C.W.
℄ of 8" F.W.
SEE PART PLAN
OF THIS AREA
PART PLAN
SCALE: 1"=20'
℄ R.R. SIDINGS
588.54' TO RANGE OF THE
EASTERLY LINE OF
LOCKWOOD STREET
℄ NORTHERLY LINE OF LISTER AVE.
CLIENT DIAMOND ALKALI CO.
PROJECT NO. 60502
SUBJECT LOCATION OF C.W. & F.W. LINES IN RIGHT OF WAY
PREPARED BY HVB DATE DEC. 27, 1960
DACO DWG. NO. NS-501-4 &
ENGINEERS INCORPORATED
NEWARK, N. J.
PAGE 1 OF 1

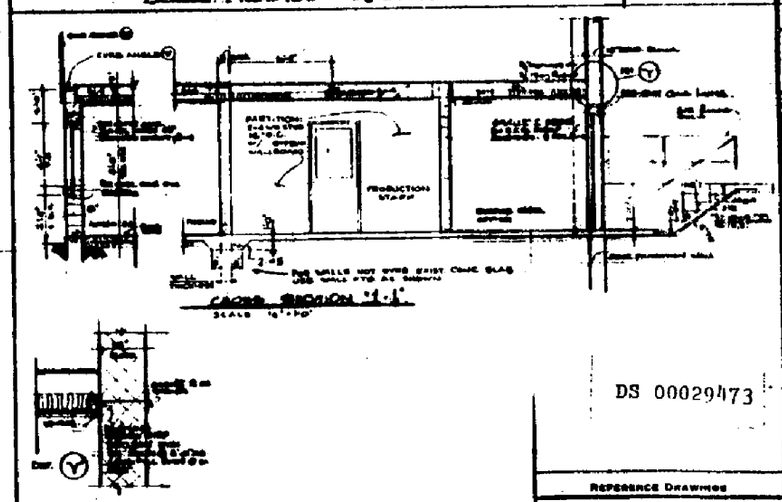
NS-918-3











DS 00029473

REFERENCE DRAWINGS	
ASSOCIATE ENGINEERS	
DRAWING NO	REV
NS-418	2

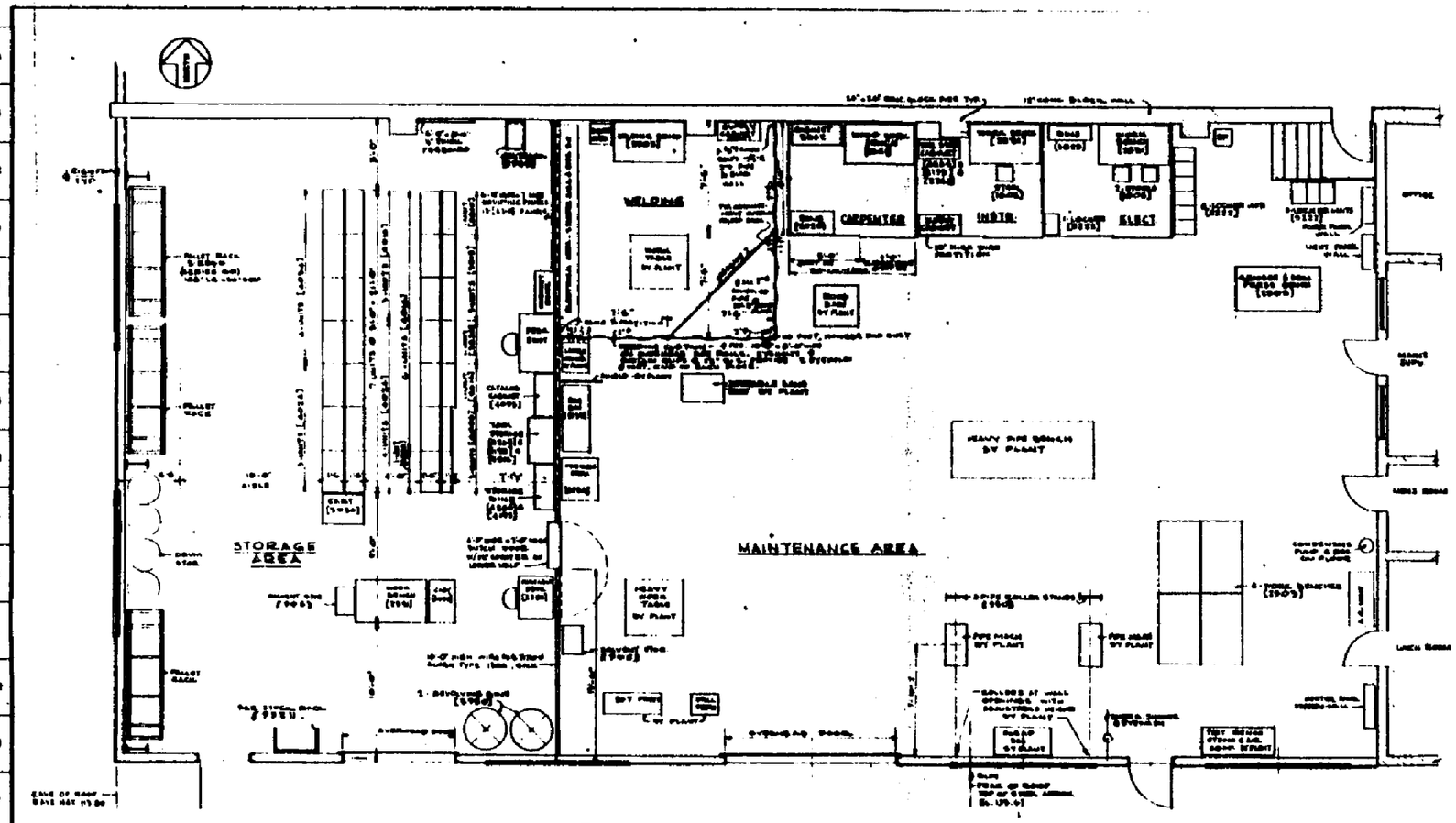
DIAMOND ALKALI COMPANY

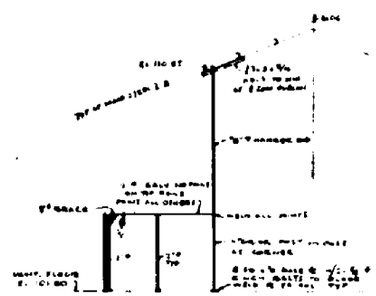
NEWARK, N.J.

ARCH. FLOOR PLAN

NS-918-6

MAXUS0998165





NOTES

1. EQUIPMENT MARKED ( ) ARE DISTRIBUTED BY: (SEE CATALOG NO.) "PALMER SHILE CO." 75 WEST STREET, NEW YORK 6, N.Y.
2. EQUIPMENT MARKED [ ] ARE MANUFACTURED BY: [SEE CATALOG NO.] "LYON METAL PRODUCTS, INC."
3. EQUIPMENT MARKED { } ARE MANUFACTURED BY: "STANDARD EQUIPMENT COMPANY"
4. EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE ONLY.
5. WELDING BUSTINGS ARE PLANBFORM TREATED HEAVYWEIGHT CANVAS AS DISTRIBUTED AND FABRICATED BY: WINGMUTTS INC. 500 MARKET ST., NEWARK, N.J.

NOTE: LAYOUT AS PER DISCUSSION WITH & APPROVAL OF H. SMITH OF NEWARK PLANT

DS 00029474

NS-761-1 MAIN MAINT. BLDG. LIGHTING PLAN
NS-918-2 MAIN MAINT. BLDG. ELEVATIONS
NS-918-10 MAIN MAINT. BLDG. PLUMB. PLAN

REFERENCE DRAWINGS

ASSOCIATE ENGINEERS
ENGINEERS INCORPORATED
NEWARK, NEW JERSEY

APPROVAL 12-14-60 | CHANGE NO. 605028

DRAWING NO. NS-918-11 | REV.

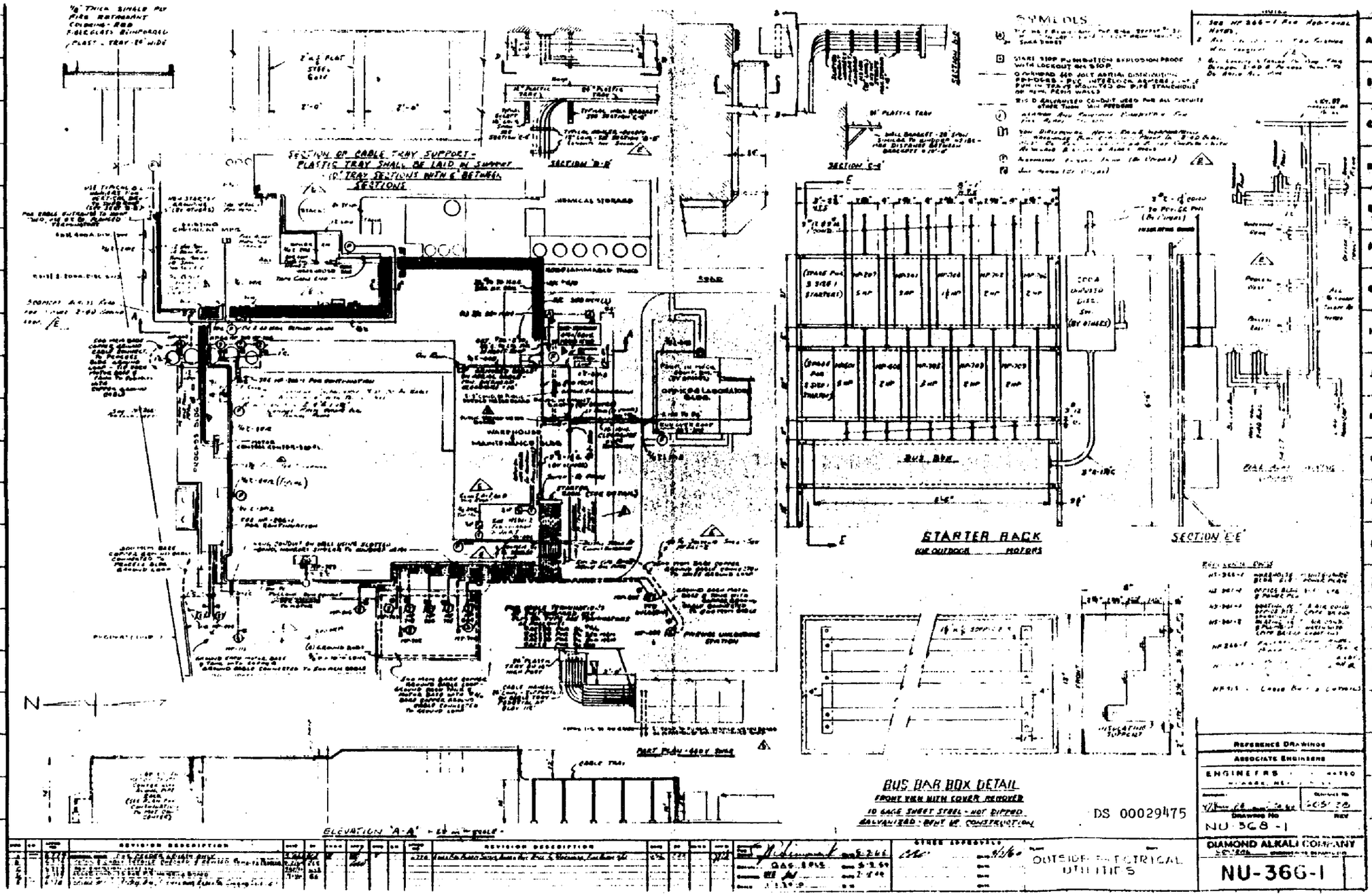
REVISION DESCRIPTION | REVISION DESCRIPTION | OTHER APPROVALS

PLANT: WAREHOUSE-MAINT. BUILDING
MAINTENANCE-STORAGE AREAS
EQUIPMENT PLAN

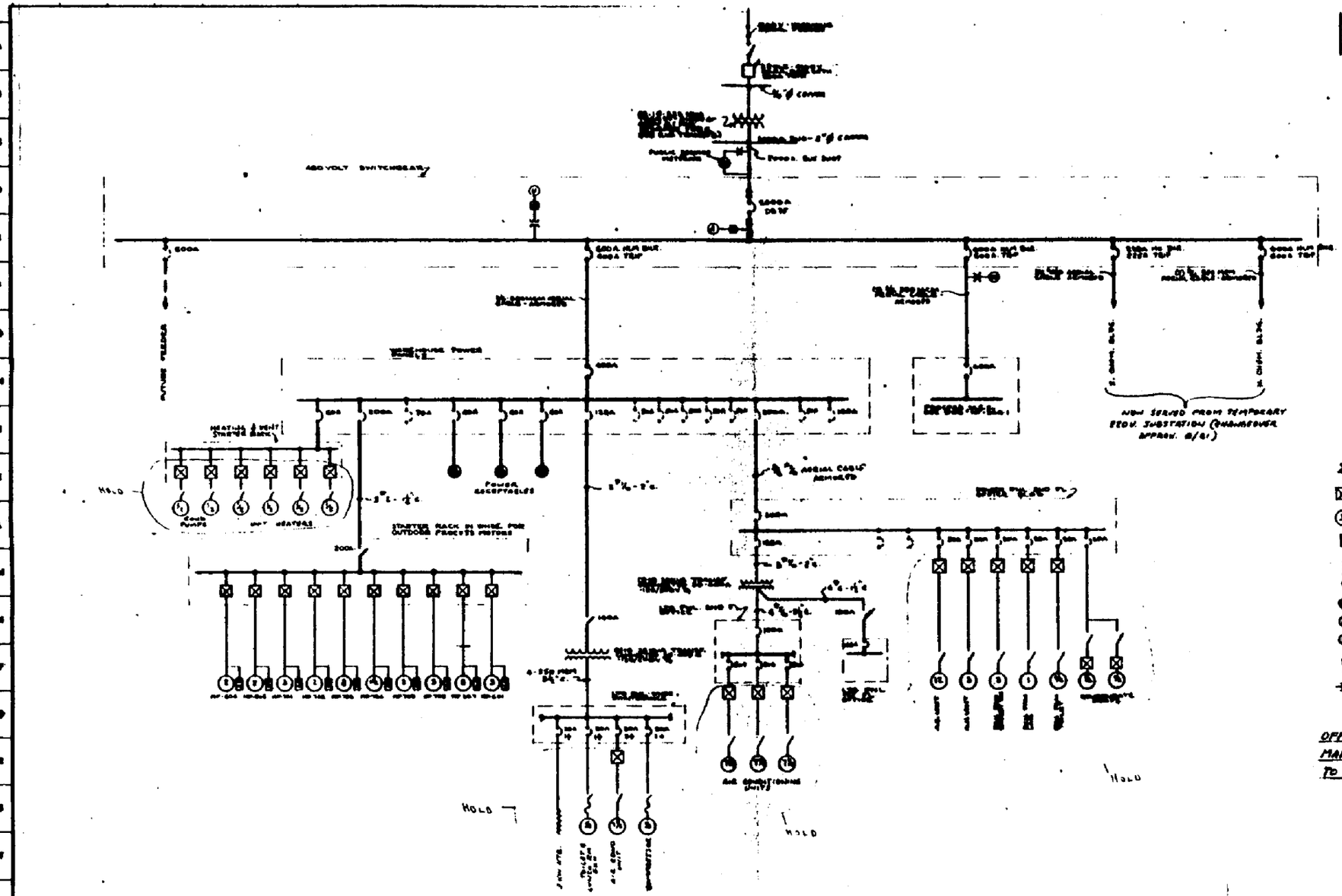
DIAMOND ALKALI COMPANY

NS-918-11 | A

MAXUS0998166



MAXUS0998167



SYMBOL LIST

OFFICE-WAREHOUSE DETAILS MARKED 'HOLD' ARE SUBJECT TO LATER REVISIONS

DS 00029476

REFERENCE DRAWINGS

ASSOCIATE ENGINEERS

ENGINEERS INCORPORATED
NEWARK, NEW JERSEY

605028

NF-268-2

DIAMOND ALKALI COMPANY

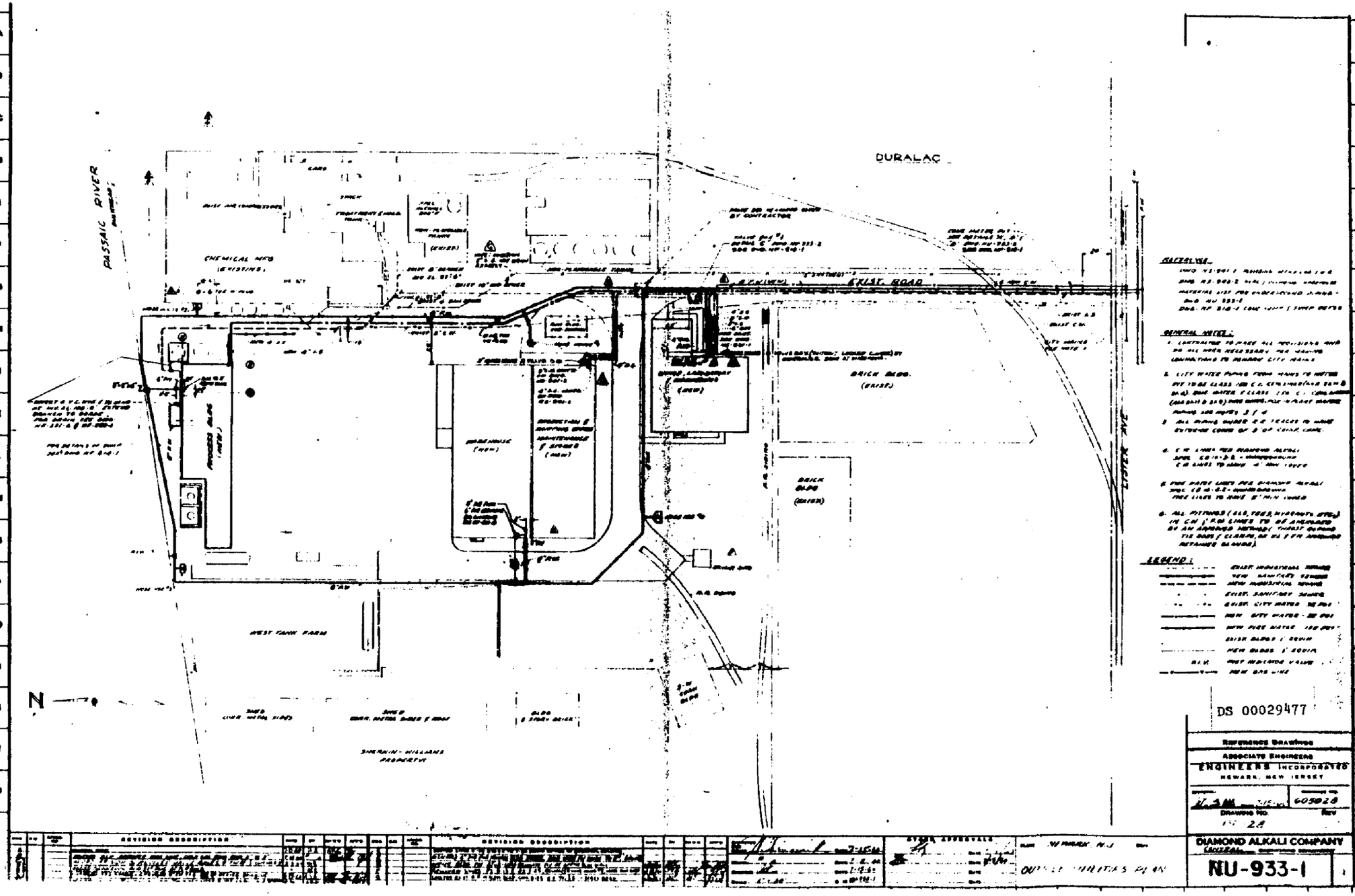
NU-368-2 A

PLANT POWER DIVISION

ONE LINE DIAGRAM

NU-368-2

MAXUS0998168



MAXUS0998169

DRAWING RECORD

Drawings By
ENGINEERS Incorporated
Newark, New Jersey

APPROPRIATION NO.
00-03-6774

PAGE 1 OF

TITLE NEWARK PLANT REHABILITATION

DACR 1223

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN. DIST.	PURCH.	CONSTR.	OFFICE REV.	PRELIM.	START DATE	COMPTD. DATE	BY
NF 200-1	Sodium TCP Unit Mechanical Flow Diagram - Sheet #1											
NF 200-2	Sodium TCP Unit Mechanical Flow Diagram - Sheet #2											
NF 200-3	MCA Flow Diagram - Process											
NF 200-4	DCP Flow Diagram - Process											
NF 200-5	MCA Flow Diagram - Mechanical Sh. #1											
NF 200-6	MCA Flow Diagram - Mechanical Sh. #2											
NF 200-7	DCP Flow Diagram - Mechanical											
NF 200-8	TCP Material Balance Sheet											
NF 201-1	TCP Equipment List - Sheet #1											
NF 201-2	TCP Equipment List - Sheet #2											
NF 201-3	TCP Equipment List - Sheet #3											
NF 201-4	MCA Equipment List - Sheet #1											
NF 201-5	MCA Equipment List - Sheet #2											
NF 201-6	DCP Equipment List - Sheet #1											
NF 201-7	Miscellaneous Equipment List											
NF 201-8	MCA Unit - Instrument List											
NF 201-9	MCA Unit Instrument List											
NF 201-10	MCA Unit - Instrument List								DS 00029478			
NF 212-1	Process Bldg. Fdn. & Pile Plan											

DRAWING RECORD

TITLE

DACO 1293

APPROPRIATION NO. 03-00-6774

PAGE 2 OF

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN DIST	PURCH.	CONSTR.	OFFICE CHECK	PRELIM	START DATE	COMPTD. DATE	BY
NF 212-2	Process Building - Foundation Details											
NF 212-3	Anchor Bolt Plan - Process Bldg. - Sheet #1				Vendor Drawing (Belmont Iron Works)							
NF 213-1	Process Bldg. - Autoclave Enclosure											
NF 214-1	Conc. Sump and Pit Details											
NF 215-1	Process Bldg. - Ist & 2nd Floor Plan											
NF 215-2	Process Bldg. 3rd Flr. & Roof Plans											
NF 215-3	Process Bldg. - Structural Elvs.											
NF 215-4	Process Bldg. - Struct. Elevs. & Dets.											
NF 215-5	Process Bldg. - Steel Erection Plan				Vendor Drawing (Belmont Iron Works)							
NF 215-6	Process Bldg. - Steel Erection Plan				Vendor Drawing (Belmont Iron Works)							
NF 215-7	Process Bldg. - Steel Erection Plan				Vendor Drawing (Belmont Iron Works)							
NF 215-8	Process Bldg. - Steel Erection Elev. and Details				Vendor Drawing (Belmont Iron Works)							
NF 215-9	Process Bldg. - Steel Stairs & Dets.				Vendor Drawing (Belmont Iron Works)							
NF 215-10	Process Bldg. - Steel Shop Details Sh. #1				Vendor Drawing (Belmont Iron Works)							
NF 215-11	Process Bldg. - Steel Shop Details #2				Vendor Drawing (Belmont Iron Works)							
NF 215-12	Process Bldg. - Steel Shop Details #3				Vendor Drawing (Belmont Iron Works)							
NF 215-13	Process Bldg. - Steel Shop Details #4				Vendor Drawing (Belmont Iron Works)							
NF 215-14	Process Bldg. - Steel Shop Details #5				Vendor Drawing (Belmont Iron Works)							
NF 215-15	Process Bldg. - Steel Shop Details #6				Vendor Drawing (Belmont Iron Works)							

DRAWING RECORD

TITLE

DACO 1293

APPROPRIATION NO. 03-00-6774

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN. DIST.	PURCH.	CONSTR.	OFFICE TECH.	PRELIM.	START DATE	COMPTD. DATE	BY
NF 215-16	Process Bldg. - Steel Shop Details #7				Vendor Drawing (Belmont Iron Works)							
NF 215-17	Process Bldg. - Steel Shop Details #8				Vendor Drawing (Belmont Iron Works)							
NF 215-18	Process Bldg. - Steel Shop Details #9				Vendor Drawing (Belmont Iron Works)							
NF 215-19	Process Bldg. - Steel Shop Details #10				Vendor Drawing (Belmont Iron Works)							
NF 215-20	Process Bldg. - Steel Shop Details #11				Vendor Drawing (Belmont Iron Works)							
NF 215-21	Process Bldg. - Steel Shop Details #12				Vendor Drawing (Belmont Iron Works)							
NF 215-22	Process Bldg. - Steel Shop Details #13				Vendor Drawing (Belmont Iron Works)							
NF 215-23	Process Bldg. - Steel Shop Details #14				Vendor Drawing (Belmont Iron Works)							
NF 215-24	Process Bldg. - Steel Shop Details #15				Vendor Drawing (Belmont Iron Works)							
NF 215-25	Process Bldg. - Grating 1st Fl. and Autoclaves				Vendor Drawing (Klemp Metal Gratings Corp.)							
NF 215-26	Process Bldg. - Grating 2nd Floor				Vendor Drawing (Klemp Metal Gratings Corp.)							
NF 215-27	Process Bldg. - Grating 3rd Floor				Vendor Drawing (Klemp Metal Gratings Corp.)							
NF 215-28	Process Bldg. - Railing - Sheet #1				Vendor Drawing (Vulcan Company)							
NF 215-29	Railing, Process Bldg. - Sheet #2				Vendor Drawing (Vulcan Company)							
NF 218-1	Process Bldg. - Architec. Elevations											
NF 218-2	Struct. & Arch. Plans and Details, 2,4-D Building											
NF 220-1	Emergency Vent Sched. - Existing Tanks											
NF 221-1	Tank Alterations - F2-T608											
NF 221-2	Base Plate for H_2SO_4 Tower F2-T508	(VOID)										

DS 00029480

DRAWING RECORD

TITLE

DACO 1293

APPROPRIATION NO. 03-00-6774

PAGE 4 OF

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN. DIST.	PURCH.	CONSTR.	OFFICE CHECK	PRELIM.	START DATE	COMPTD. DATE	BY
NF 221-3	HCl Feed Water Tank F2-T523											
NF 221-4	Methanol Caustic Drop Tank T-111											
NF 221-5	Nozzles for Tank F2-T120											
NF 221-6	Nozzles for TCB Charge Tank T-107											
NF 221-7	Nozzles for Anisol Receiver T-215											
NF 221-8	Nozzles for Methanol Receiver T-120											
NF 221-9	Nozzles for 25% TCB Storage Tank T-303											
NF 221-10	Nozzles for 25% TCB Storage Tank T-301											
NF 221-11	Nozzles for T-215											
NF 229-1	Equipment Insulation Schedule - Sh. #1											
NF 229-2	Equipment Insulation Schedule - Sh. #2											
NF 230-1	TCP, Pipe Line Schedule #1											
NF 230-2	TCP, Pipe Line Schedule #2											
NF 230-3	TCP, Pipe Line Schedule #3											
NF 230-4	MCA, Pipe Line Schedule #1 Yard											
NF 230-5	MCA Pipe Line Schedule #1 - Yard and MCA											
NF 230-6	MCA Pipe Line Schedule											
NF 230-7	MCA Pipe Line Schedule											
NF 230-8	MCA Pipe Line Schedule											

DS 00029481

DRAWING RECORD

TITLE

DACO 1283

APPROPRIATION NO. 03-00-6774

PAGE 5 OF

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN. DIST.	PUNCH	CONSTR.	OFFICE CHECK	PRELIM.	START DATE	COMPTD. DATE	BY
NF 230-9	DCP Pipe Line Schedule											
NF 230-10	DCP Pipe Line Schedule											
NF 230-11	Miscellaneous Pipe Line Schedule											
NF 231-1	TCP, West Plan, 1st Fl. Piping											
NF 231-2	TCP, West Plan, 2nd Fl. Piping											
NF 231-3	TCP, West Plan, 3rd Fl. Piping											
NF 231-4	TCP, West Elev. A-A West Plan Piping											
NF 231-5	TCP, Elev. B-B West Plan Piping											
NF 231-6	TCP, MCA, DCP East Plan 1st Floor Piping											
NF 231-7	TCP, MCA, DCP East Plan 2nd Floor Piping											
NF 231-8	TCP, MCA, DCP East Plan 3rd Floor Piping											
NF 231-9	TCP, MCA, DCP Elev. A-A East Plan Piping											
NF 231-10	TCP, Det. Sheet #1 Process Piping											
NF 231-11	TCP, Det. Sheet #2 Process Piping											
NF 231-12	MCA, DCP, Detail Sheet #1 Process Piping	(NOT USED)										
NF 231-13	Foam System Layout											
NF 231-14	Steam Tracing Sched. & Det., Page 1											

DS 00029482

MAXUS0998174

DRAWING RECORD

TITLE

DACO 1293

APPROPRIATION NO. 03-00-6774

PAGE 61 OF

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN. DIST.	PURCH.	CONSTR.	OFFICE CHECK	PRELIM.	START DATE	COMPTD. DATE	BY
NF 231-15	Steam Tracing Sched. & Det., Page 2											
NF 231-16	Steam Trap List Sched. Sheets, Sh. #1											
NF 231-17	Steam Trap List Sched. Sheets, Sh. #2											
NF 231-18	Steam Trap List Sched. Sheets, Sh. #3											
NF 231-19	Steam Trap List Sched. Sheets, Sh. #4											
NF 231-20	Steam Tracing Summary MCA & DCP											
NF 231-21	List of Steam Traps MCA & DCP											
NF 231-22	Piping 2,4-D Bldg. Plan & Details											
NF 231-23	Cooling Water Waste Lines, MCA & DCP											
NF 241-1	2,4-D Bldg. Ventilation Plan	(NOT ISSUED FOR CONSTRUCTION)										
NF 241-2	2,4-D Bldg., Ventilation, Sections, Elevations, and Details	(NOT ISSUED FOR CONSTRUCTION)										
NF 241-3	Process Bldg. Unit Heaters Type #25521S				Vendor Drawing (Ilg Electric Ventilating Co.)							
NF 241-4	Proc. Bldg. Elect. Equip. Rm. FA Intake Fans Type B 15 CW05				Vendor Drawing (Ilg Electric Ventilating Co.)							
NF 241-5	Proc. Bldg. Elect. Equip. Rm FA Intake Fans Type B 15 CW06				Vendor Drawing (Ilg Electric Ventilating Co.)							
NF 241-6	Emergency Shower & Eyewash - Process Bldg.											
NF 255-1-3	MCA & DCP Chlorinator Dets. Sheets											
NF 259-1	TCP Unit - Instrument List											
NF 259-2	TCP Unit - Instrument List											

DS 00029483

DRAWING RECORD

TITLE

APPROPRIATION NO. 03-00-6774

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FACO 1293

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M RED'ND.	REV. & ISSUE DATE: GEN. DIST.	PURCH.	CONSTR.	OFFICE CHECK	PRELIM	START DATE	COMPTD. DATE	BY
NF 259-3	TCP Unit - Instrument List											
NF 259-4	Sodium TCP Unit - Instrument List											
NF 259-5	Sodium TCP Unit - Instrument List											
NF 259-6	Sodium TCP Unit - Instrument List											
NF 259-7	Autoclave Control Panel TCP Unit											
	MCA, DCP Instrument Summary Sheets	(VOID)										
NF 259-9	MCA, DCP Control Panels											
NF 259-10	Instrument Detail Sheet Temp.											
NF 259-11	Instrument Detail Sheet Press.											
NF 259-12	Instrument Detail Sheet Level											
NF 259-13	Instrument Detail Sheet Misc.											
NF 261-1	Process Bldg. - Elec. Lighting 1st and 2nd Floors - Details											
NF 261-3	Lighting Plan, 2,4-D Bldg.											
NF 264-1A	2,4-D											
NF 265-1	Motor Location, 2,4-D Bldg.											
NF 265-2	Motor Schedule, 2,4-D Bldg.											
NF 265-3	Motor Schedule, 2,4-D Bldg.											
NF 266-1	Process Bldg. Elec. Process Wiring Plan - 1st Fl. and Details											

DS 00029484

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TITLE

DACO 1293

APPROPRIATION NO. 03-00-6774

PAGE 8 OF

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN. DIST.	PURCH.	CONSTR.	OFFICE CHECK	PRELIM.	START DATE	COMPTD. DATE	BY
NF 266-2	Process Bldg. Elec. Process Wiring Plan 2nd and 3rd Floors											
NF 266-3	Rev. Wiring & Elec. Equip. Loc. Plan											
NF 268-1	Proc. Bldg. Elec. 1 Line Distrib. Motor Control Center											
NF 268-2	Process Wiring Diagrams											
NF 268-3	Motor Control Center											
NF 268-4	One Line Diagram											
	Removal & Relocation of Equipment on Roof. Ester Area Vent	(VOID)										
NF 281-2	2,4-D Process Bldg. - Structural Revisions											
NF 282-1	TCP, Equip., Layout 1st Floor Including MCA, DCP											
NF 282-2	TCP, Equip. Layout 2nd Floor Including MCA, DCP											
NF 282-3	TCP Equip. Layout 3rd Floor Including MCA, DCP											
NF 282-4	TCP, Equipment Elevations											
NF 913-1	Tank Fdns. & Misc. Supports											
NF 913-2	Fdns. & Misc. Supports											
NF 913-3	Misc. Supports & Details											
NF 916-1	Misc. Platforms & Stairs											

DS 00029485

MAXUS0998177

DRAWING RECORD

TITLE

DACO 1293

APPROPRIATION NO. 03-00-6774

PAGE 9 OF

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M RECOND.	REV. & ISSUE DATE: GEN. DIST.	PURCH.	CONSTR.	OFFICE ENGR.	PRELIM	START DATE	COMPTD. DATE	
NF 931-1	Yard Piping Plan and West Tank Farm Plan and Sec. Sheet #1											
NF 931-2	Yard Piping Plan and West Tank Farm Plan and Section Sheet #2											
NS 261-2	Lighting Layout, 3rd Floor Process Bldg. E. End Process Bldg. West Tank Farm											
NS 511-1	Piles and Anchor Rods for Bulkhead											
NS 531-3	Survey Office and Warehouse											
NS 581-1	Site Plan, Plant Area											
NS 581-2	Site Plan (Part) Newark Plant Area											
NS 581-3	Location of R. R. Gates											
NS 581-4	Location of CW & FW Lines at Lister Avenue											
NS 644-1	Lab. Furniture and Details - Floor Plan				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-2	Lab. Furniture and Details - Soap stone Tops SS-1				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-3	Lab. Furniture and Details - Soap-stone Tops SS-2				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-4	Lab. Furniture and Details - Soap-stone Tops SS-3				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-5	Lab. Furniture and Details - Soap-stone Tops SS-4				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-6	Lab. Furniture and Details - Bench Details				Vendor Drawing (Kewaunee Manufacturing Co.)							

DS 00029486

MAXUS0998178

DRAWING RECORD

TITLE

DACO 1293

APPROPRIATION NO. 03-00-6774

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#	DWG. TITLE	B/M	B/M TO STORES	B/M RED'ND.	REV. & ISSUE DATE: GEN. DIST	PURCH.	CONSTR	OFFICE CHECK	PRELIM	START DATE	COMPTD. DATE	BY
NS 644-7	Lab Furniture and Details - Fume Hood Details				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-8	Lab Furniture and Details - Schedule				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-9	Lab Furniture and Details - Bench Item 1				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-10	Lab Furniture and Details - Bench Item 2				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-11	Lab Furniture and Details - Bench Item 2 (cont'd)				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-12	Lab Furniture and Details - Bench Item 2 (cont'd)				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-13	Lab Furniture and Details - Bench Item 3				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-14	Lab. Furniture and Details - Bench Item 4				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-15	Lab. Furniture and Details - Fume Item 5				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-16	Lab. Furniture and Details - Distillation Table Item 5A				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-17	Lab. Furniture and Details - Bench Item 6				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-18	Lab. Furniture and Details - Item 7 and 8				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-19	Lab. Furniture and Details - Titration Table Item 9				Vendor Drawing (Kewaunee Manufacturing Co.)							

DS 00029487

MAXUS0998179

DRAWING RECORD

APPROPRIATION NO. 03-00-6774

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DWG. NO.	TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN. DIST.	PURCH.	CONSTR.	OFFICE CHECK	PRELIM	START DATE	COMPTD. DATE	BY
NS 644-20	Lab. Furniture and Details - Tables Item 10, 11, 16 and 17				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-21	Lab. Furniture and Details - Cabinets Item 12				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-22	Lab. Furniture and Details - Titration Table Item 17				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-23	Lab. Furniture and Details - Utility Tables Items 18 and 19				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-24	Lab. Furniture and Details - Wall Assembly Items 20 and 23				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-25	Lab. Furniture and Details - Wall Table Item 24				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 644-26	Lab. Furniture and Details - Wall Table Item 25				Vendor Drawing (Kewaunee Manufacturing Co.)							
NS 912-1	Office Bldg. Fdn. & 1st Fl. Reinf.				Vendor Drawing (Igoe Bros., Inc.)							
NS 912-2	Whse. Bldg. Fdn. Reinf. Plan				Vendor Drawing (Igoe Bros., Inc.)							
NS 914-1	Anchor Bolt Setting Plan				Vendor Drawing (American Steel Bldg., Co., Inc.)							
NS 914-2	Anchor Bolt Setting Plan				Vendor Drawing (American Steel Bldg., Co., Inc.)							
NS 915-1	Office Bldg. Misc. Steel				Vendor Drawing (Buie Steel Corporation)							
NS 915-2	Office Bldg. Misc. Steel				Vendor Drawing (Buie Steel Corporation)							
NS 915-3	Office Bldg. Misc. Steel Sheet #1				Vendor Drawing (Buie Steel Corporation)							
NS 915-4	Office Bldg. Misc. Steel Sheet #2				Vendor Drawing (Buie Steel Corporation)							
NS 915-5	Warehouse Misc. Steel Sheet #3				Vendor Drawing (Buie Steel Corporation)							

DS 00029488

MAXUS0998180

DRAWING RECORD

TITLE

DACO 1293

APPROPRIATION NO. 03-00-6774

PAGE 12 OF

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN. DIST	PURCH.	CONSTR.	OFFICE CHECK	PRELIM.	START DATE	COMPTD. DATE	
NS 915-6	Warehouse Misc. Steel Sheet #4				Vendor Drawing (Buie Steel Corporation)							
NS 915-7	Warehouse Misc. Steel Sheet #5				Vendor Drawing (Buie Steel Corporation)							
NS 915-8	Warehouse - Arch Plan Steel				Vendor Drawing (American Steel Bldg. Co., Inc.)							
NS 915-9	Arch. Elevations				Vendor Drawing (American Steel Bldg. Co., Inc.)							
NS 915-10	Erection Plan				Vendor Drawing (American Steel Bldg. Co., Inc.)							
NS 915-11	Erection Plan and Elevations				Vendor Drawing (American Steel Bldg. Co., Inc.)							
NS 915-12	Cross Section				Vendor Drawing (American Steel Bldg. Co., Inc.)							
NS 916-1	Office Bldg. Exterior Stair Sheet #1				Vendor Drawing (Buie Steel Corporation)							
NS 916-2	Sheet P1 - Bridge Steel - Office Bldg. to Warehouse				Vendor Drawing (Buie Steel Corporation)							
NS 916-3	Bridge Steel Details - Office Bldg.				Vendor Drawing (Buie Steel Corporation)							
NS 918-1	Office Bldg. - Fdn. & Pile Plan											
NS 918-2	Office Bldg. - 1st Floor Plan											
NS 918-3	Office Bldg. - 2nd Floor Plan											
NS 918-4	Office Bldg. - Elevs. & Sections											
NS 918-5	Warehouse - Maint. Bldg. Fdn. and Pile Plan											
NS 918-6	Warehouse Maint. Bldg. Architect Floor Plan											
NS 918-7	Warehouse Maint. Bldg. - Elevations											
NS 918-8	Solvent Shed & Misc. Details											

DS 00029489

DRAWING RECORD

TITLE

DACO 1293

APPROPRIATION NO. 03-00-6774

PAGE 13 OF

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN. DIST.	PURCH.	CONSTR.	OFFICE CHIEF	PRES. IN.	START DATE	COMPTD. DATE	
NS 918-9	Metal Signs											
NS 918-10	Warehouse - Maint. Bldg. Wire Partition											
NS 918-11	Warehouse - Maint. Bldg. - Equipment Plan Maint. - Stg. Area											
NS 918-12	Office Bldg. - Coping and Sills				Vendor Drawing (American Art Stone Co.)							
NS 918-13	Warehouse & Office Bldg. Door and Frame - General Notes Sheet #1				Vendor Drawing (Williamsburg Steel Products Co.)							
NS 918-14	Warehouse & Office Bldg. - Door and Frame Schedule Sheet #2				Vendor Drawing (Williamsburg Steel Products Co.)							
NS 918-15	Warehouse & Office Bldg. - Door and Frame Details Sheet #3				Vendor Drawing (Williamsburg Steel Products Co.)							
NS 918-16	Hardware Sched. - Office and Warehouse Bldg.				Vendor Drawing (New Jersey Hardware Co.)							
NS 918-17	Wire Fence Partition Sheet #1 Warehouse Bldg.				Vendor Drawing (Acorn Wire and Iron Works)							
NS 918-18	Warehouse Siding & Roof for Am. Steel Bldg. Co.				Vendor Drawing (Coastal Asbestos and Specialty Co.)							
NS 918-19	Exhaust Fans - Roof Openings & Curb Details - Office Bldg.											
NS 918-20	Lockers - Office Building											
NS 918-21	Toilet Partitions - Office and Warehouse											
NS 918-22	Lobby Door - Office Building											

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DRAWING RECORD

TITLE

DACO 1283

APPROPRIATION NO. 03-00-6774

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DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN. DIST.	PURCH.	CONSTR.	OFFICE CHECK	PRELIM	START DATE	COMPTD. DATE
NS 931-4	Office Bldg. Plumbing										
NS 941-1	Office Bldg. HVAC. Plumbing										
NS 941-2	Whse. Maint. Bldg. HVAC Plumbing										
NS 941-3	Warehouse Bldg. - Duct Layout				Vendor Drawing (A and P Sheet Metal Co.)						
NS 941-4	440/60/3 Water Cooled AC Unit, Office Layout Bldg. Nominal 10/t				Vendor Drawing (Trane Air Conditioning Co.)						
NS 941-5	Office Bldg. 1st Floor Duct Layout				Vendor Drawing (A and P Sheet Metal Co.)						
NS 941-6	Office Bldg. 2nd Floor Duct Layout				Vendor Drawing (A and P Sheet Metal Co.)						
NS 941-7	TWC Condensate Pumps Office Bldg. and Warehouse				Vendor Drawing (Weil Pump Co.)						
NS 941-8	Schedule - Order No. 5802 Whse. and Office Bldg.				Vendor Drawing (Universal Diffuser Co.)						
NS 941-9	Vulcan-Linorector & Enclosure Sched. Office Bldg.				Vendor Drawing (Vulcan Company)						
NS 941-10	Vertical Steam Unit Heater Nos. 124, VI and 224 VI, Whse. & Office Bldg.				Vendor Drawing (Ilg. Elec. and Ventilating Co.)						
NS 941-11	Centrifugal Fan #BC245 Direct Drive Office Bldg. Basket Room				Vendor Drawing (Ilg Elec. and Ventilating Co.)						
NS 941-12	600 V. Non-fused Switch Safety Bldg. Exhaust Fans				Vendor Drawing (Westinghouse Electric)						
NS 941-13	Ventilator #L-CRF182-Off. Bldg. Toilet Exhaust				Vendor Drawing (Ilg Elec. and Ventilating Co.)						
NS 941-14	UT11-A-Set BU & FU 1225 Whse. Toilet Exhaust				Vendor Drawing (Ilg Elec. and Ventilating Co.)						

DS 00029491

MAXUS0998183

DRAWING RECORD

TITLE

DACO 1293

APPROPRIATION NO. 03-00-6774

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN. DIST.	PURCH.	CONSTR.	OFFICE CHECK	PRELIM.	START DATE	COMPTD. DATE
NS 941-15	Exhaust Duct Layout Whse.				Vendor Drawing (Ilg. Elec. and Ventilating Co.)						
NS 941-16	Equip. Layout in Equip. Rm. Office Bldg.				Vendor Drawing (Desesa Engineering Company)						
NS 941-17	Filter Regulator Type 67 FR Office Bldg. Steam Line				Vendor Drawing (Fischer Governor Company)						
NS 941-18	14" Pilot Operated Reducing Valve Type 92B Steam Line				Vendor Drawing (Fischer Governor Company)						
NS 941-19	1" Pilot Operated Reducing Valve Type 92B - Steam Line				Vendor Drawing (Fischer Governor Company)						
NS 941-20	AR-3 Diffuser Office Bldg. - Basket Room				Vendor Drawing (Anemostat Corp. of America)						
NS 941-21	Equalizing Deflector Office Bldg. Basket Room				Vendor Drawing (Anemostat Corp. of America)						
NS 941-22	Whse. Bldg. - Exhaust Duct Layout				Vendor Drawing (A and P Sheet Metal Company)						
NS 941-23	Office Bldg. - Control Manual				Vendor Drawing (Minneapolis Honeywell)						
NS 941-24	Office Bldg. - Lab Hood Exhaust Fans				Vendor Drawing (Ilg. Elec. Vent. Co. - AN 5137)						
NS 941-25	Office Bldg. - Steam Supply and Return Layout				Vendor Drawing (DeSesa Eng. Co. - No. 759-4)						
NS 941-26	Office Bldg. - H and V Cabinet Model "O"				Vendor Drawing (Buffalo Forge Company)						
NS 941-27	Office Bldg. Sprinklers				Vendor Drawing (Viking Sprinkler Co. - Contract No. B 14602)						
NS 961-1	Office Bldg. - Lighting and Power										
NS 961-2	Whse. Maint. Bldg. - Elec. Lighting										
NS 961-3	Power & Lighting Panels - Office and Warehouse Bldgs.				Vendor Drawing (Federal Pacific Electric Co.)						

DS 00029492

DRAWING RECORD

TITLE

DACO 1293

APPROPRIATION NO. 03-00-6774

DWG. NO.	DWG. TITLE	B/M	B/M TO STORES	B/M REQ'ND.	REV. & ISSUE DATE: GEN. DIST.	PURCH.	CONSTR.	OFFICE CHECK	PRELIM.	START DATE	COMPTD. DATE	
NS 961-4	Outline Dimensions - Office and Warehouse Building				Vendor Drawing (Niagara Transformer)							
NS 961-5	Transformer Cuts. - Office and Warehouse Building				Vendor Drawing (Niagara Transformer)							
NS 961-6	Lighting Fixture Brochure - Office Building				Vendor Drawing (N. Yeager, Inc.)							
NS 961-7	Lighting Fixture Brochure - Warehouse Building				Vendor Drawing (N. Yeager, Inc.)							
NS 966-1	Warehouse Maintenance Building Electrical Power											
NU 364-1	Diamond Alkali Co. - Outdoor Bldg. Type Distribution Switchgear 440 V. 3PH, Assy. and Single Line				Vendor Drawing (Westinghouse Elec. Corp.)							
NU 364-2	DACo. Outdoor Bldg. Type Distrib. Switchgear 440 V., 3 PH, 60N Floor Plan and Plan View				Vendor Drawing (Westinghouse Elec. Corp.)							
NU 366-1	Outside Electrical Utilities											
NU 368-1	Main 1 Line Elec. Distrib. and Substation Details											
NU 368-2	One Line Diagram - Plant Power Distribution											
NU 368-3	DACo. Outdoor Bldg. Type Distrib. Switchgear, 440 V., 30 Wiring Dia.				Vendor Drawing (Westinghouse Elec. Corp.)							
NU 933-1	Outside Utilities Plan											
NU 933-2	Outside Utilities Details											

DS 00029493

SPECIFICATIONS

VI. SPECIFICATIONS

A. Major Equipment Soecifications

B. Standards

1. Applicable Diamond Piping Standards

2. Special Piping Standards

3. Painting Specification

DS 00029494

VESSEL SPECIFICATIONS

DACO 470-A

SPEC. NO.	APPROP. NO.
NFS-221-1A	03-20-4774
REQ. NO. EG-3295	S. M. NO.
ENGINEER	DATE 4/6/60

NAME OF ITEM: ANISOL DROP TANK 300 GAL.

ITEM NO'S.	NUMBER REQUIRED	LOCATION
F2-T109	1	NEAR [illegible]

NOMINAL SIZE	CODE
3'-0" DIA. × 6'-0" ST. STRAIGHT SIDE	ASME TEMA NO STAMP

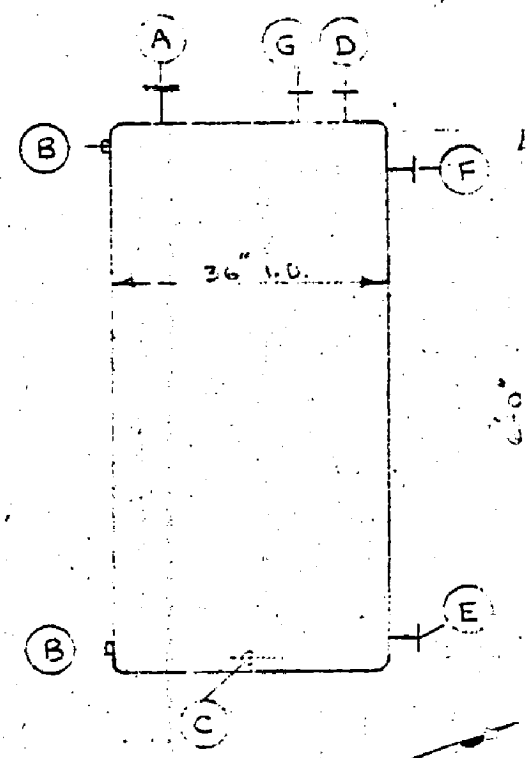
OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
ATMOS. PSIG	ATMOS. PSIG	100 °F	°F

SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
NO SUPPORTS REQUIRED	NO	NO

COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL	ASTM-A285-C	1/8"	5/16" MINIMUM
HEAD (BOTTOM)	ASTM-A285-C	1/8"	3/8" MINIMUM
SKIRT OR SUPPORT			
HEAD (TOP)	ASTM-A285-C	1/8"	5/16" MINIMUM

ANCHOR BOLTS: | INSULATION: NO

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
1	MANHOLES	A	18"	API-12C
	SAFETY VALVES			
	LEVEL CONTROL			
2	GAGE GLASS	B	3/4"	3000# F.S. COUPLING
	THERMOCOUPLES			
1	DRAINS	C	1"	3000# F.S. COUPLING
1	INLET	D	2"	150# ASA R.F. FORGED STEEL
1	OUTLET	E	2"	150# ASA R.F. FORGED STEEL
1	OVERFLOW	F	2"	150# ASA R.F. FORGED STEEL
1	VENT	G	2"	150# ASA R.F. FORGED STEEL



DS 00029495

WT. VESSEL (LBS.)		
EMPTY	FULL WATER	FULL PRODUCT

REMARKS

1) BOTH HEADS TO BE FLANGED ONLY
2) ALL FLANGED NOZZLES TO PROJECT 6" FROM VESSEL WALL.
3) SEAL WELD INSIDE LAP ON HEADS
4) NOZZLE ORIENTATION WILL BE FURNISHED WHEN VENDOR SUBMITS APPROVAL DRAWINGS
5) ALL FLANGED NOZZLES TO HAVE SCH. 80 PIPE WITH SLIP ON FLANGES.

REVISION A - CHANGED ITEM NUMBER F2-T110 TO F2-T109

MAXUS0998187

VESSEL SPECIFICATIONS

DACO 479-A

SPEC. NO. NFS-221-3	APPROP. NO. 03-00-6774
REQ. NO. E G-3302	B. M. NO.
ENGINEER H.T. ARC	DATE 7 JUNE 60

NAME OF ITEM: METHANOL-CAUSTIC DROP TANK

ITEM NO'S.	NUMBER REQUIRED	LOCATION
F2-T111	1	NEWARK, N.J.

NOMINAL SIZE: 4'-0" DIA x 7'-0" STRAIGHT SIDE

CODE: ASME VIII 1959 No STAMP

OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
ATMOS PSIG	FULL OF LIQUID 8.4 LBS/GAL. PSIG	150 °F	175 °F

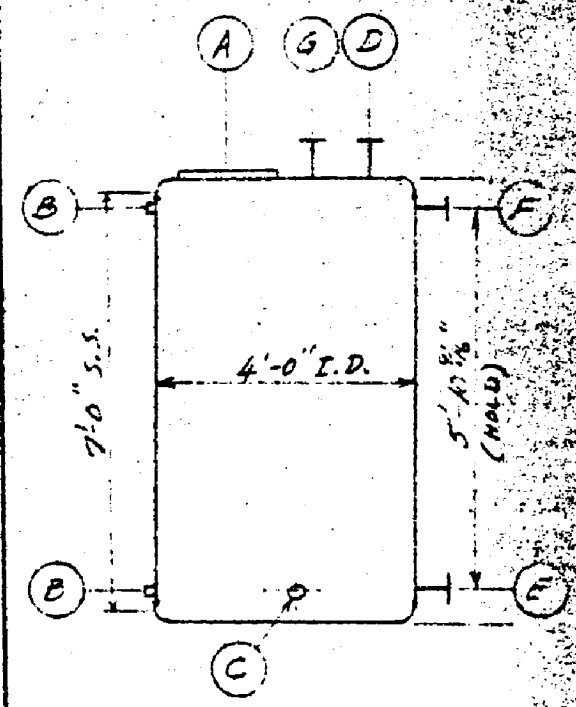
SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
NO SUPPORT REQUIRED	No	No

COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL	ASTM-A285C Flg. Quality	1/8"	3/8" MINIMUM
HEADS (2)	ASTM-A285C Flg. Quality FLANGED ONLY	1/8"	3/8" MINIMUM
SKIRT OR SUPPORT	NONE		

ANCHOR BOLTS

INSULATION

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
1	MANHOLES	A	18"	API-12C
	SAFETY VALVES			
	LEVEL CONTROL			
2	GAGE GLASS	B	3/4"	3000# F.S. COUPLINGS
	THERMOCOUPLES			
1	DRAINS	C		3000# F.S. COUPLING
1	INLET	D	2"	150# ASA 1/16 R.F.; AISI Gr 1, F.S.
1	OUTLET	E	2"	150# ASA 1/16" R.F.; AISI Gr 1, F.S.
1	OVERFLOW	F	2"	150# ASA 1/16 R.F.; AISI Gr 1, F.S.
1	VENT	G	2"	150# ASA 1/16 R.F.; AISI Gr 1, F.S.



DS 00029496

WT. VESSEL (LBS.)

EMPTY	FULL WATER	FULL PRODUCT

TRAY OR MISC. DETAILS

REMARKS

1) NOZZLE ORIENTATION DETERMINED LATER
2) BOTH HEADS TO BE FLANGED ONLY
3) SEAL WELD INSIDE LAP OF HEADS IF DOUBLE WELDED BUTT JOINT IS NOT USED.
4) ALL FLANGED NOZZLES TO PROJECT 6" FROM WALL AND SHALL BE SCH. 80 WITH SLIP-ON FLANGES

MAXUS0998188

VESSEL SPECIFICATIONS

DACO 679-A

SPEC. NO.	NFS-321-2
APPROP. NO.	03-00-6774
REQ. NO.	EG-3296
B. M. NO.	
ENGINEER	HN
DATE	4/29/60

NAME OF ITEM: Crude Methanol Receiver

ITEM NO'S.	NUMBER REQUIRED	LOCATION
F2-T-113	1	NEWARK

NOMINAL SIZE	CODE
4'-0" DIA x 5'-0" ST. SIDE	ASME VIII 1959 NO STAMP

OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
ATMOS. PSIG	FULL OF LIQUID SP.G. .78 PSIG	150 °F	175 °F

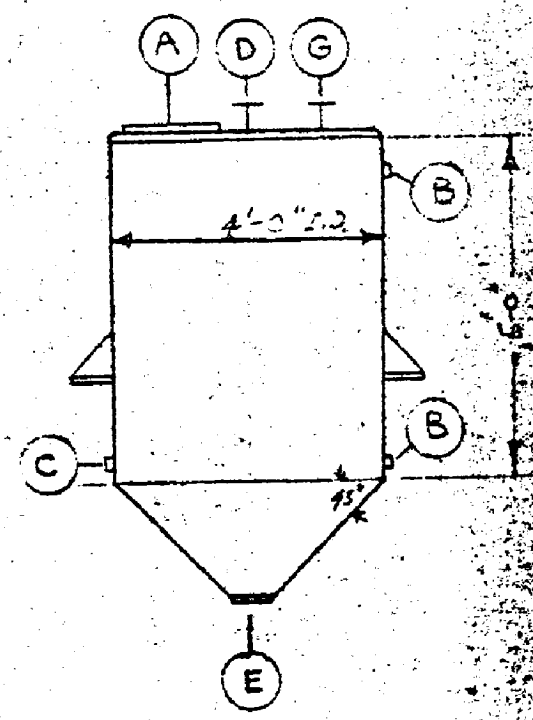
SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
YES	NO	NO

COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL	ASTM-A285C F.B.	1/8"	3/8" MINIMUM
HEAD - TOP	ASTM-A285C F.B. FLANGES ONLY	1/8"	3/8" MINIMUM
SKIRT OR SUPPORT	STEEL LUGS - VENDOR TO SPECIFY SIZE	1/8"	3/8" MINIMUM
BOTTOM HEAD	ASTM-A285C F.B. CONICAL DISHED 90° INCLUDED ANGLE	1/8"	3/8" MINIMUM

ANCHOR BOLTS

INSULATION

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
1	MANHOLES	A	18" OPENING	API-12C
	SAFETY VALVES			
	LEVEL CONTROL			
2	GAGE GLASS	B	3/4"	3/4" 3000# F.S. COUPLINGS
1	THERMOCOUPLES	C	3/4"	3/4" 3000# F.S. COUPLING
	DRAINS			
1	LIQUID INLET	D	2"	150# ASA R.F., A-181 Gr 1
1	LIQUID OUTLET	E	2"	150# ASA R.F., A-181 Gr 1
~~1~~	~~HEATER NOZZLE~~	~~F~~	~~12~~	~~150# ASA R.F. A-181 Gr 1~~
1	VENT	G	2"	150# ASA R.F., A-181 Gr 1



DS 00029497

WT. VESSEL (LBS.)

EMPTY	FULL WATER	FULL PRODUCT

REMARKS

(1) NOZZLE ORIENTATION DETERMINED LATER

(2) PROVIDE FOUR SUPPORT LUGS SHIP LOOSE

TRAY OR MISC. DETAILS

MAXUS0998189

CENTRIFUGAL PUMP SPECIFICATIO

SPL. NO.	NFS-25F-10
APPROP. NO.	03-00-6774E
NAME OF ITEM	METHANOL STILL FEED PUMP
REQ. NO.	EG-3309
B.M. NO.	

ITEM NO'S	NUMBER REQUIRED	LOCATION	ENGINEER	DATE
F2-P115	1	NEWARK, N.J.	H.T.	7 JUNE 60

LIQUID PUMPED: METHANOL / WATER

CONCENTRATION: 90% METHANOL

SPECIFIC GRAVITY: 0.82 @ 60 °F

VISCOSITY: 0.7 @ 60 °F

OPERATING TEMPERATURE: NORMAL 60 °F MAX. 100 °F

CHARACTER OF LIQUID (Slurry, Gritty, Clear, Etc.): CLEAR

SUSPENDED MATERIAL (Approx. Max. Size And Qty.): NONE

PUMP PERFORMANCE

	FT. OF LIQUID PUMPED	
	TOTAL DYNAMIC HEAD	SUCTION HEAD
NORMAL	45 FT.	FLOODED
MAXIMUM		
MINIMUM		

GPM: 1.0

DAILY HRS. SERVICE: 24

OPERATING SPEED: 3500

DIRECTION OF ROTATION (Viewed From Outboard End Opp. Coupling): ☐ CLOCK-WISE ☐ COUNTER CLOCK-WISE

PUMP CONSTRUCTION

TYPE: ☒ CENTRIFUGAL ☐ AXIAL FLOW ☐ MIXED FLOW ☐ OTHER

STAGES: ☒ SINGLE ☐ MULTI-STAGE

SUCTION: ☒ SINGLE ☐ DOUBLE

MOUNTING: ☒ HORIZONTAL ☐ VERTICAL

IF VERTICAL: ☐ SUCTION ☐ SUBMERGED

IMPELLER: ☒ OPEN ☐ CLOSED ☐ SEMI-CLOSED ☐ NON-CLOG

DISCHARGE NOZZLE POSITION (Viewed From Outboard End Opp. Coupling): UP

MATERIALS

CASINGS	SHAFT	IMPELLER
C.I.	316 STAINLESS	316 STAINLESS
GLANDS	RINGS	PACKING
		NONE

SPECIAL REQUIREMENTS

PUMP SHALL BE A CANNED ROTOR TYPE WITH 316 STAINLESS ROTATING UNIT AS MADE BY CHEMPUMP, TYPE CF 34.

VENDOR SHALL DETERMINE IF A RECIRCULATING COOLING STREAM BACK TO SUPPLY TANK IS NECESSARY.

DRIVE DETAILS

TYPE OF DRIVE (Direct Connected, V-Belt, Etc.)	BED PLATE FURNISHED	MOTOR FRAME NO.
DIRECT CONNECTED	WITH PUMP	

TYPE OF COUPLING	MAKE	FURNISHED
NONE	CHEMPUMP 34 CF	WITH PUMP

TYPE OF DRIVER	HP	JO	REQ.	FURNISHED
MOTOR 440/220 V, 3φ CLASS I GR. D	3/4			WITH PUMP

GENERAL REQUIREMENTS

Quotations shall include 3 copies of characteristics and descriptive literature including dimensional drawings, sectional views, and complete parts list. If no delay is incurred thereby, it will be desirable to indicate on the above characteristic curves, the head-capacity and the horsepower curves obtained with maximum and minimum size impellers for the pump casing recommended.

Vendor to supply _____ certified copies of above upon receipt of order.

The Vendor shall select and specify construction on items not checked in the above specifications.

DS 00029498

REMARKS:

VESSEL SPECIFICATIONS

DACO 470-A

SPEC. NO.	NFS-255-1
APPROP. NO.	02-00-6774
REQ. NO.	EG-3298
B. M. NO.	
ENGINEER	JFM
DATE	May 2, 1960

NAME OF ITEM: Methanol Rectification Still

ITEM NO'S.	NUMBER REQUIRED	LOCATION
E2-D116	1	Newark New Jersey

NOMINAL SIZE: 1'-2" I.D. x 16'-0" T/T

CODE: ASME Sec VIII

OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
3 PSIG	50 PSIG	205 °F	255 °F

SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
Note (1)		

COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL	Steel-ASME SA-285-C	1/8"	(2)
HEAD	Steel-ASME SA-285-C	1/8"	(2)
SKIRT OR SUPPORT	None		

ANCHOR BOLTS:

INSULATION: By Others

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
4	MANHOLES	A	6"	150# RF ASTM A-181 Grade 1
1	SAFETY VALVES	B	2"	150# RF " " " "
	LEVEL CONTROL			
	GAGE GLASS			
2	THERMOCOUPLES	C	3/4"	3000# FS Coupling
	DRAINS			
1	Feed	D	1 1/2"	150# RF ASTM A-181 Grade 1
1	Vapor Outlet	E	4"	150# RF ASTM A-181 Grade 1
1	Reflux	F	1 1/2"	150# RF ASTM A-181 Grade 1

Note: Nozzle necks made of A-53A Seamless Pipe sch 30 for 6" and smaller; standard wt for 8" and larger. Nozzle projection shall be 8" for sizes 6" and smaller, and 10" for sizes 8" and larger unless otherwise noted.

See Page 2 of this specification for sketch of Still.

DS 00029499

WT. VESSEL (LBS.)		
EMPTY	FULL WATER	FULL PRODUCT
(2)	(2)	

REMARKS

(1) Vessel to be supported by manway still bottom assembly per dwg. NFS-255-1

(2) Lind. design

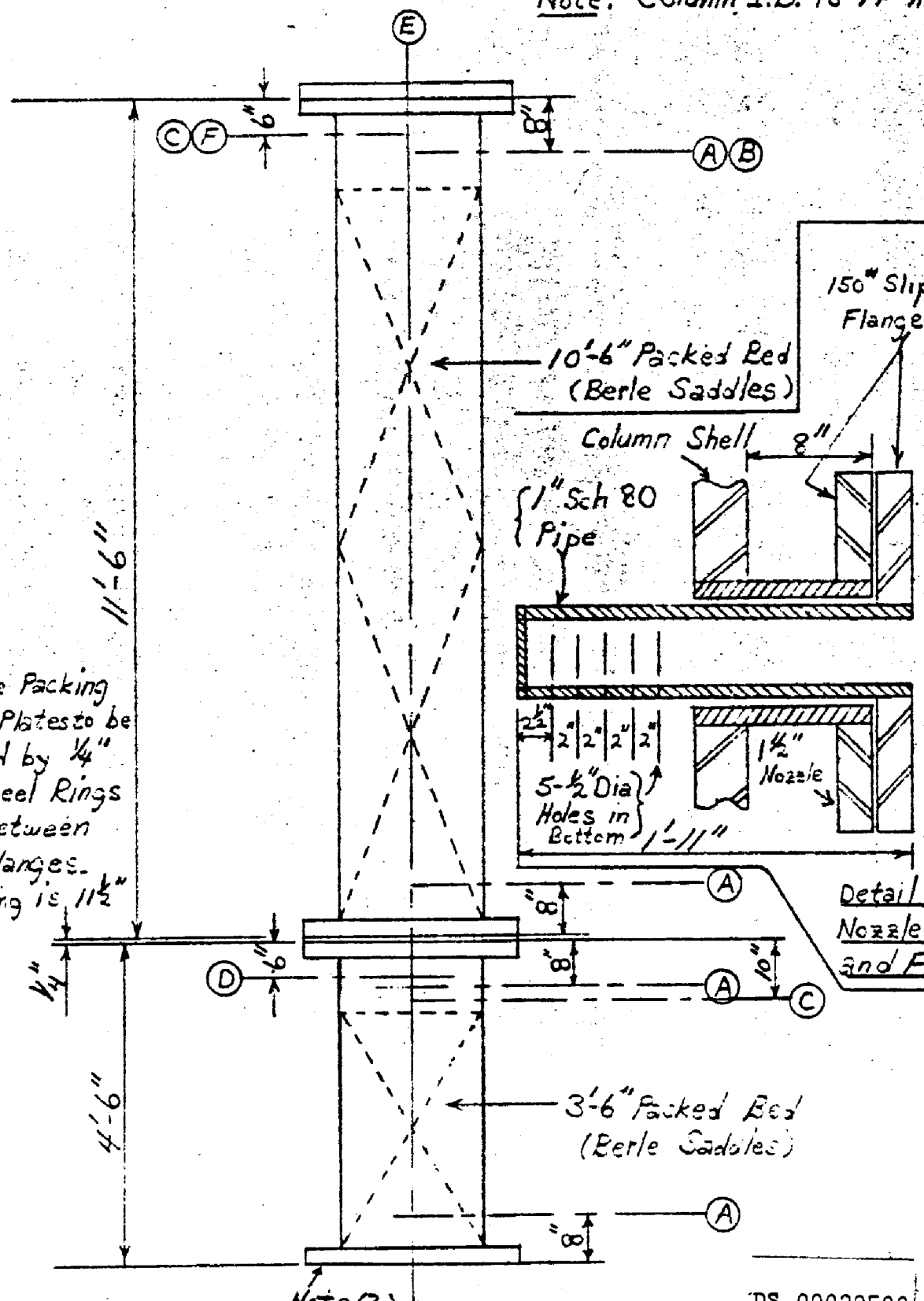
(3) Column Flanges to be specified by vendor

TRAY OR MISC. DETAILS

Ceramic Berle Saddles to be used 1/2" size.

Two U.S. Stoneware Weir-Type Support Plates are reqd. These are made from Ceratherm 550 Chemical Stoneware and are one-piece const.

BY JFM DATE 5-2-60 SUBJECT Methanol Redistillation Still F2-D116 SHEET NO. 2 OF 3
CHKD. BY _____ DATE _____ JOB NO. _____
DACC Specification MFS-255-1



DS 00029500

MAXUS0998192

VESSEL SPECIFICATIONS

DACO 176-A

SPEC. NO.	NFS-255-2
APPROP. NO.	03-00-6774
REQ. NO.	EG-3298
S. M. NO.	
ENGINEER	J.F. Mesaros
DATE	May 23, 1960

NAME OF ITEM: Methanol Still Bottoms Receiver

ITEM NO'S.	NUMBER REQUIRED	LOCATION
F2-D116	one	Newark, New Jer.

NOMINAL SIZE: 2'-6" I.D x 3'-4" T/T

CODE: ASME - Section VIII

OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
3 PSIG	50 PSIG	205 °F	255 °F

SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
Yes		

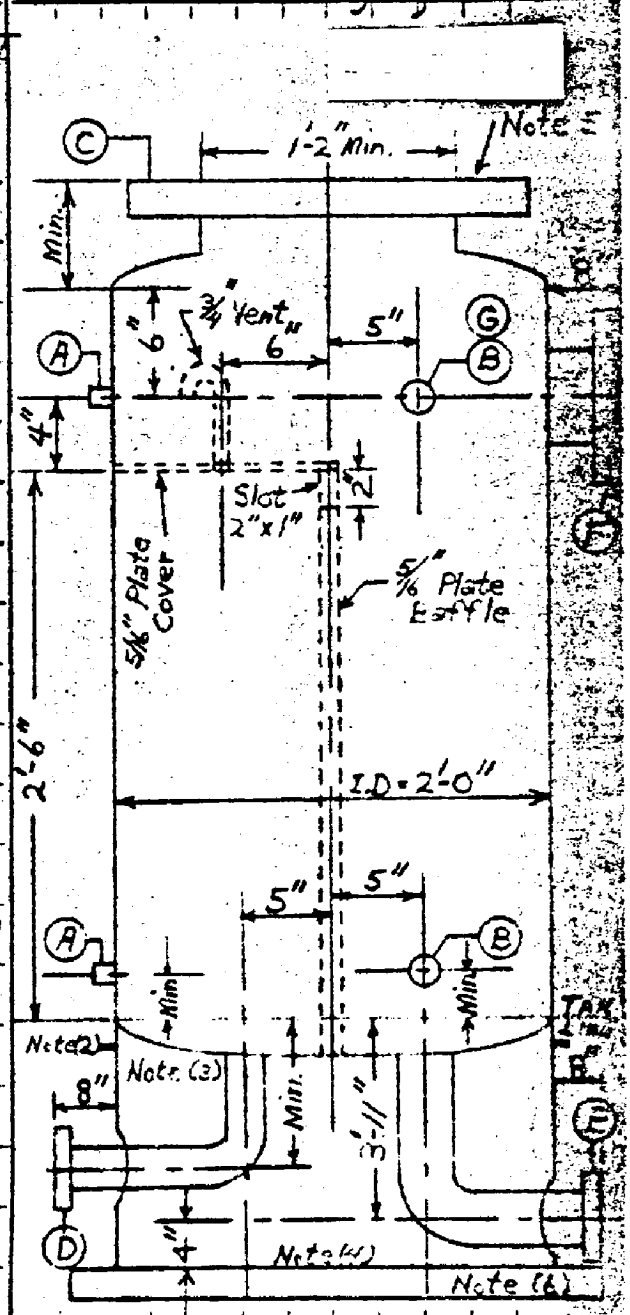
COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL Steel	ASTM SA285 Grade C Fb Qual.	1/8"	(1)
HEAD Steel	ASTM SA285 Grade C Flange Quality	1/8"	(1)
SKIRT OR SUPPORT Steel	ASTM SA283 Grade C	1/16"	(1)

ANCHOR BOLTS: Steel

INSULATION: By Others

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
	MANHOLES			
	SAFETY VALVES			
	LEVEL CONTROL			
2	GAGE GLASS	A	3/4"	6000 # FS Coupling
2	THERMOCOUPLES	B	3/4"	6000 # FS Coupling
1	VAPOR OUTLET	C	Min ID 1'-2"	Nozzle must match bottom flange of still. See spec. No. NFS-255-1. 150# RF ASTM A-181 Grade 1
1	BOTTOM LIQUID OUTLET	D	2"	150# RF ASTM A-181 Grade 1
1	LIQUID TO REBOILER	E	2"	150# RF ASTM A-181 Grade 1
1	VAPOR FROM REBOILER	F	4"	150# RF ASTM A-181 Grade 1
1	PRESSURE	G	3/4"	6000 # FS Coupling

Note: Orientation of all Nozzles to be determined later.



WT. VESSEL (LBS.)		
EMPTY	FULL WATER	FULL PRODUCT
(1)	(1)	

REMARKS

(1) Vendor Specify
(2) Provide 1/4" x 1 1/2" Insulation Support Ring 4" below Tangent Line.
(3) Provide 2-3" Vent Holes at top of Column Skirt. Vent Holes Located at Ends of a Dia.
(4) Provide 1-8" Vent Hole at Bottom of Col. Skirt
(5) Nozzle will Support 14" I.D x 16'-0" Packed Col
(6) Skirt Base Ring to be Specified by Vendor
(7) Nozzle Necks made of A-53A Seamless Pipe Sch 80.

DS 00029501

MAXUS0998193

HEAT EXCHANGER SPECIFICATIONS
DIAMOND ALKALI COMPANY

DACO 119-A

SPEC. NO.	NFC-251-1
APPROPRIATION NO.	00-00-6714E
NAME OF ITEM	Methanol Still Condenser
REQ. NO.	EG-3299
B/M NO.	
ITEM NO.	F2-H117
LOCATION	Newark, New Jersey
ENGINEER	JFM
DATE	5/5/60

SIZE (1) TYPE (1) CONNECTED IN

DESCRIPTION Horizontal Shell & Tube Condenser

SURFACE PER UNIT (1) SHELLS PER UNIT One SURFACE PER SHELL (1)

PERFORMANCE OF ONE UNIT

	SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED	Methanol		Water	
TOTAL FLUID ENTERING	912	LB./HR.	144000	LB./HR.
VAPOR	912	LB./HR.	0	LB./HR.
LIQUID	0	LB./HR.	144000	LB./HR.
STEAM	0	LB./HR.	0	LB./HR.
NON-CONDENSABLES	0	LB./HR.	0	LB./HR.
FLUID ~~VAPORIZED~~ OR CONDENSED	912	LB./HR.	0	LB./HR.
STEAM CONDENSED	0	LB./HR.	0	LB./HR.
GRAVITY-LIQUID	0.746 at 153°F		1.0 at 60°F	
VISCOSITY-LIQUID (CENTIPOISE)	0.35 at 140°F		0.55 at 104°F	
MOLECULAR WEIGHT-VAPORS	32			
SPECIFIC HEAT-LIQUIDS	0.61-0.62	B.T.U./LB./°F	1.0	B.T.U./LB./°F
LATENT HEAT-VAPORS	472	B.T.U./LB.		B.T.U./HR.
TEMPERATURE IN	155	°F	95	°F
TEMPERATURE OUT	153	°F	115	°F
OPERATING PRESSURE (INLET GAGE)	0.5	LB./SQ.IN.		LB./SQ.IN.
NUMBER OF PASSES	1		(1)	
VELOCITY		FT./SEC.	(1)	FT./SEC.
PRESSURE DROP	(1)	LB./SQ.IN.	3	LB./SQ.IN.
FOULING FACTOR	0.001		0.002	

HEAT EXCHANGED-B.T.U./HR. 430,500 M.T.D.(CORRECTED) (1)

TRANSFER RATE-SERVICE (1) CLEAN (1)

CONSTRUCTION

DESIGN PRESSURE	75	LB./SQ.IN.	75	LB./SQ.IN.
TEST PRESSURE (2)	125	LB./SQ.IN.	125	LB./SQ.IN.
DESIGN TEMPERATURE	200	°F	200	°F

TUBES Tube 430 stainless steel NO. (1) O.D. 3/4" BWG 14 LENGTH 10'-0" (1) PITCH (1)

SHELL Steel - ASME SA-53 or SA-285 O.D. (1) THICKNESS (1)

SHELL COVER Steel - ASME SA-285-C FLOATING HEAD COVER Steel - ASME SA-285-C

CHANNEL Steel - ASME SA-285-C CHANNEL COVER Steel - ASME SA-285-C

TUBE SHEETS-STATIONARY Steel - ASME SA-285-C FLOATING Steel - ASME SA-285-C

BAFFLES-CROSS Segmental TYPE (1) THICKNESS (1)

BAFFLE-LONG " " TYPE (1) THICKNESS (1)

TUBE SUPPORTS " " " THICKNESS (1)

IMPACT PLATE None

GASKETS: TUBESIDE (1) SHELLSIDE (1)

CONNECTIONS—SHELL-IN (1) OUT (1) SERIES 150# F.F.

CONNECTIONS—CHANNEL-IN (1) OUT (1) SERIES 150# F.F.

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

CODE REQUIREMENTS Standard ASME (1) 1956

WEIGHTS-EACH SHELL (1) BUNDLE (1) FULL OF WATER (1)

REMARKS (1) Vendor's drawing

(2) U.S. Substitute test must be tested for use at 25 psig using ammonia - Refer to Hydrostatic Test

DS 00029502

MAXUS0998194

SPECIFICATION NO. NFS-257-1

SPECIFICATION

FOR

FLAKE CAUSTIC DRUM SKIP-HOIST DUMPER F2-N122

NEWARK PLANT, NEWARK, N. J.

DIAMOND ALKALI COMPANY

CENTRAL ENGINEERING DEPARTMENT

CLEVELAND, OHIO

APPROPRIATION NO. 03-00-1631-6774-57-20

12 JULY 1960

FOR DIAMOND ALKALI COMPANY

APPROVED FK DATE 7/12/60

APPROVED JPA DATE 7-12-60

APPROVED _____ DATE _____

SUBMITTED BY:

ENGINEERS Incorporated

J. Lawson DATE 7/12/60

DS 00029503

ENGINEERS COMPANY
Subsidiary of
ENGINEERS Incorporated
Diamond Alkali Company
Project No. 605028

CAUSTIC DRUM SKIP-HOIST F2-N122

GENERAL:

This Specification covers the design and fabrication of a Drum Skip-Hoist Dumper, Essex Conveyors, Inc. (Newark 3, N. J.) Junior Model E J, or equal, to handle metal flake caustic drums 21" overall diameter by 35" high, 471 lb. gross and 450 lb. net weights.

DESIGN:

Hoist shall make 10 trips per hour (min.), and shall have limit switches at both ends of its trajectory and an "inching" button. Drum shall have a final tilt of 45°.

Dumper frame shall be stationary and provided with anchor bolt holes. Height of receiver to be dumped into is 16' - 11". Distance from pour point to dumper frame is 6½". Overhead clearance available is 20' - 8". It is assumed for layout purposes that the overall horizontal dimensions of the dumper frame will be close to 4 ft. wide by 3 ft. in the dumping plane and at base.

The skip shall be provided with non-sparking wheels, pulleys, and pivots of brass or other suitable materials.

Drive shall be explosion-proof Class I, Group D, 220/440 V, 3 Phase, 60 Cycle, 3 Wire. Controls shall be explosion-proof NEMA VII enclosed, 440 V, single phase. Motor starter will be furnished by others, but vendor shall specify type and size required. Up, down and stop buttons shall be furnished by Hoist Manufacturer. Motor shall be chemical type. All wiring shall be brought to a terminal block.

HEAT EXCHANGER SPECIFICATIONS
DIAMOND ALKALI COMPANY

DACO 119-A

SPEC. NO.	APPROPRIATION NO.
NES-251-2	[illegible]-6774-F

NAME OF ITEM	REQ. NO.	B/M NO.
Methanol Still Reboiler	FG-3297	

ITEM NO.	LOCATION	ENGINEER	DATE
F2-H123	Newark, New Jersey	JFN	5/2/56

SIZE (1) TYPE (2) CONNECTED IN

DESCRIPTION Vertical U-Tube Thermo-Syphon with Fixed Tube Sheets and Stationary Tube Bundle on Outside Packed Floating Head

SURFACE PER UNIT (1) SHELLS PER UNIT One SURFACE PER SHELL (1)

PERFORMANCE OF ONE UNIT

	SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED	Steam Vapor		Liquid Methanol-Water Mixture	
TOTAL FLUID ENTERING	532	LB./HR.	N/A (3) (4)	LB./HR.
VAPOR		LB./HR.	0	LB./HR.
LIQUID		LB./HR.	[illegible] (6)	LB./HR.
STEAM	532	LB./HR.	0	LB./HR.
NON-CONDENSABLES		LB./HR.	0	LB./HR.
FLUID VAPORIZED OR CONDENSED		LB./HR.	650	LB./HR.
STEAM CONDENSED	532	LB./HR.		LB./HR.
GRAVITY-LIQUID			Entering 0.91 at 192°F	
VISCOSITY-LIQUID (CENTIPOISE)			0.5 centipoise at 192°F	
MOLECULAR WEIGHT-VAPORS			24	
SPECIFIC HEAT-LIQUIDS		BTU/HR/°F	0.9	BTU/LB/°F
LATENT HEAT-VAPORS	939	BTU/LB		BTU/HR
TEMPERATURE IN	259	°F	178	°F
TEMPERATURE OUT	259	°F	205	°F
OPERATING PRESSURE (INLET GAGE)	60	LB./SQ.IN.	3	LB./SQ.IN.
NUMBER OF PASSES	One		One	
VELOCITY		FT./SEC.	(1)	FT./SEC.
PRESSURE DROP	Neg	LB./SQ.IN.	(1)	LB./SQ.IN.
FOULING FACTOR	None		0.002	

HEAT EXCHANGED-B.T.U./HR. 500,000 M.T.D. (CORRECTED) (1)

TRANSFER RATE-SERVICE (1) CLEAN (1)

CONSTRUCTION

	SHELL SIDE		TUBE SIDE	
DESIGN PRESSURE	75	LB./SQ.IN.	15	LB./SQ.IN.
TEST PRESSURE (7)	125	LB./SQ.IN.	125	LB./SQ.IN.
DESIGN TEMPERATURE	325	°F	325	°F

TUBES Monel-Metal NO. (1) O.D. 1" BWG. 16 LENGTH 5'-0" Max. PITCH 1 1/4" Square

SHELL Steel-ASME SA-53 or SA-285 O.D. (1) THICKNESS (1)

SHELL COVER Steel-ASME SA-225-C FLOATING HEAD COVER

CHANNEL Steel-ASME SA-285-C CHANNEL COVER Steel-ASME SA-285-C

TUBE SHEETS-STATIONARY 20% Monel Clad FLOATING 20% Monel Clad

BAFFLES-CROSS Commercial quality steel TYPE (1) THICKNESS (1)

BAFFLE-LONG None TYPE THICKNESS (1)

TUBE SUPPORTS Commercial quality steel THICKNESS (1)

IMPACT PLATE " " "

GASKETS: TUBESIDE: (1) SHELLSIDE: (1)

CONNECTIONS—SHELL-IN (1) OUT (1) SERIES 150# R.F.

CONNECTIONS—CHANNEL-IN (1) OUT (1) SERIES 150# R.F.

CORROSION ALLOWANCE-SHELL SIDE 1/8" TUBE SIDE [illegible] (5)

CODE REQUIREMENTS Standard ASME (VIII) 1956

WEIGHTS-EACH SHELL (1) BUNDLE (1) FULL OF WATER (1)

REMARKS (1) [illegible] (2) [illegible] (3) [illegible] (4) Condensation in [illegible] 16 Wire [illegible] (5) [illegible] (6) [illegible] at 5 psig (7) [illegible] and Chemical Industries [illegible]

DS 00029505

MAXUS0998197

VESSEL SPECIFICATIONS

DACO 476-A

SPEC. NO.	NFS-255-2A
APPROP. NO.	03-00-6774
REQ. NO.	EG-3291
B. M. NO.	
ENGINEER	[illegible]
DATE	4/8/60

NAME OF ITEM: METHANOL - CAUSTIC MIX TANK 2250 GAL.

ITEM NO'S.	NUMBER REQUIRED	LOCATION
TANK — F2-R201 AGITATOR - F2-A202	1	NEWARK

NOMINAL SIZE: 6'-6" O.D. x 7'-9" B.L. TO B.L.

CODE: ASME VIII STAMPED

OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
ATMOS. PSIG	JACKET PRESS - 30 PSIG	100 °F	150 °F

SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
YES	NO	NO

COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL	ASTM - A285 - C	1/8"	
HEADS ASME F&D	ASTM - A285 - C	1/8"	
SKIRT OR SUPPORT	PIPE OR STRUCTURAL STEEL LEG. VENDOR TO SPECIFY		

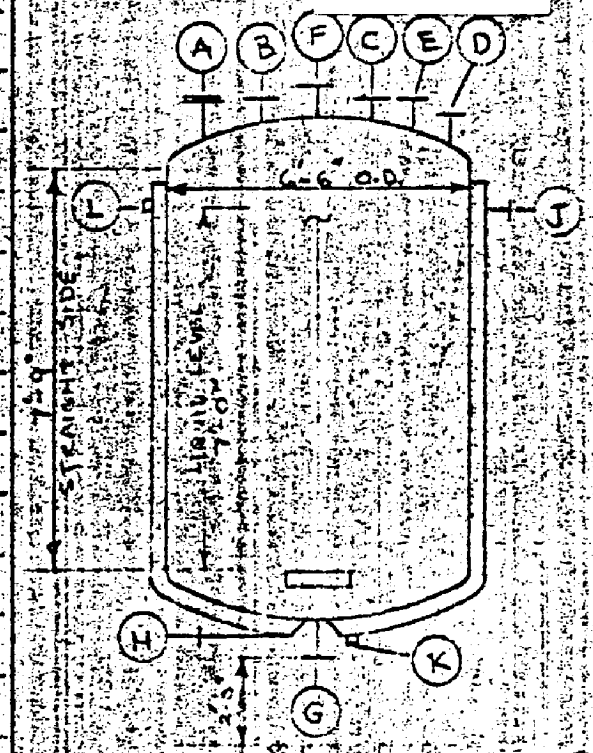
ANCHOR BOLTS:

INSULATION: NO

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
1	MANHOLES	A	18"	150# ASA R.F. FORGED STEEL
1	~~SAFETY VALVE~~ VENT	B	3"	150# ASA R.F. FORGED STEEL
1	~~REFUX CONDENSER~~ METHANOL INLET	C	2"	150# ASA R.F. FORGED STEEL
1	GAGE GLASS			
1	THERMOCOUPLES	D	2"	150# ASA R.F. FORGED STEEL
1	~~BAKER~~ CAUSTIC INLET	E	6"	150# ASA R.F. FORGED STEEL
1	AGITATOR NOZZLE	F	VENDOR TO SPECIFY	150# ASA R.F. FORGED STEEL
1	OUTLET	G	3"	150# ASA R.F. FORGED STEEL

JACKET CONNECTIONS

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
1	WATER INLET	H	2"	150# ASA R.F. FORGED STEEL
1	WATER OUTLET	J	2"	150# ASA R.F. FORGED STEEL
1	DRAIN	K	1"	3000# F.S. COUPLING
1	SAFETY VALVE	L	2"	3000# F.S. COUPLING



NOTE 1.
DESIGN AGITATOR TO FURNISH ADEQUATE AGITATION FOR HEAT EXCHANGE. SOLUTION IS 25% SOLUTION OF FLAKE CAUSTIC IN METHANOL. CAUSTIC IS ADDED TO METHANOL WITH AGITATOR RUNNING.

VENDOR TO SPECIFY TYPE OF AGITATOR & IMPELLER, STUFFING BOX NEEDED TO PREVENT ESCAPE OF METHANOL VAPOR.

MOTOR TO BE [illegible] VOLT, [illegible] GROUP D, [illegible] PHASE, 60 CYCLE.

WT. VESSEL (LBS.)		
EMPTY	FULL WATER	FULL PRODUCT

REMARKS

1) NOZZLE ORIENTATION WILL BE FURNISHED WHEN VENDOR SUBMITS APPROVAL DRAWINGS.
2) ALL FLANGED NOZZLES TO BE SCH. 40 PIPE WITH SLIP ON FLANGES.

TRAY OR MISC. DETAILS

REVISION A - CHANGED ITEM NUMBERS:
~~F2-R100~~ TO F2-R201
~~F2-A100~~ TO F2-A202.

DS 00029506

HEAT EXCHANGER SPECIFICATIONS
DIAMOND ALKALI COMPANY

DACO 118-A

SPEC. NO.		APPROPRIATION NO.	
NAME OF ITEM		REQ. NO.	B/M NO.
ITEM NO.	LOCATION	ENGINEER	DATE
F2-H203	NEWARK, NEW JERSEY	HT	JUNE

SIZE [illegible] TYPE CONNECTED IN

DESCRIPTION VERTICAL SHELL & TUBE CONDENSER FIXED TUBE SHEETS, MANUFACTURER'S STANDARD

SURFACE PER UNIT [illegible] SHELLS PER UNIT ONE SURFACE PER SHELL [illegible]

PERFORMANCE OF ONE UNIT

	SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED	WATER		METHANOL	
TOTAL FLUID ENTERING	—	LB./HR.	[illegible]	LB./HR.
VAPOR	—	LB./HR.	[illegible]	LB./HR.
LIQUID	4500	LB./HR.		LB./HR.
STEAM	—	LB./HR.	—	LB./HR.
NON-CONDENSABLES	—	LB./HR.	—	LB./HR.
FLUID VAPORIZED OR CONDENSED	[illegible]	LB./HR.	[illegible]	LB./HR.
STEAM CONDENSED	—	LB./HR.	—	LB./HR.
GRAVITY-LIQUID	1.0 @ [illegible] °F		0.746 @ 152 °F	
VISCOSITY-LIQUID (CENTIPOISE)	0.4 @ [illegible] °F		0.35 @ 140 °F	
MOLECULAR WEIGHT-VAPORS	—	LB.	32	LB.
SPECIFIC HEAT-LIQUIDS	[illegible]	BTU/LB/°F	0.62	BTU/LB/°F
LATENT HEAT-VAPORS		BTU/LB	[illegible]	BTU/LB
TEMPERATURE IN	85	°F	155	°F
TEMPERATURE OUT	115	°F	150	°F
OPERATING PRESSURE (INLET GAGE)	50	LB./SQ.IN.	[illegible]	LB./SQ.IN.
NUMBER OF PASSES	1		1	
VELOCITY		FT./SEC.		FT./SEC.
PRESSURE DROP	[illegible]	LB./SQ.IN.	[illegible]	LB./SQ.IN.
FOULING FACTOR	0.002		0.001	

HEAT EXCHANGED-BTU/HR 160,000 M.T.D. (CORRECTED) [illegible]

TRANSFER RATE SERVICE [illegible] CLEAN [illegible]

CONSTRUCTION

DESIGN PRESSURE	75	LB./SQ.IN.	75	LB./SQ.IN.
TEST PRESSURE	125	LB./SQ.IN.	125	LB./SQ.IN.
DESIGN TEMPERATURE	[illegible]	°F	500	°F

TUBES [illegible] NO. [illegible] O.D. [illegible] BWG [illegible] LENGTH [illegible] PITCH

SHELL STEEL [illegible] O.D. [illegible] THICKNESS [illegible]

SHELL COVER [illegible] FLOATING HEAD COVER —

CHANNEL [illegible] CHANNEL COVER —

TUBE SHEETS-STATIONARY [illegible] FLOATING —

BAFFLES-CROSS [illegible] TYPE [illegible] THICKNESS [illegible]

BAFFLE-LONG — TYPE — THICKNESS —

TUBE SUPPORTS [illegible] THICKNESS [illegible]

IMPACT PLATE [illegible]

GASKETS TUBESIDE [illegible] SHELLSIDE [illegible]

CONNECTIONS—SHELL-IN [illegible] OUT [illegible] SERIES [illegible]

CONNECTIONS—CHANNEL IN [illegible] OUT [illegible] SERIES [illegible]

CORROSION ALLOWANCE-SHELL SIDE [illegible] TUBE SIDE [illegible]

CODE REQUIREMENTS [illegible]

WEIGHTS-EACH SHELL [illegible] BUNDLE [illegible] FULL OF WATER [illegible]

REMARKS [illegible] TUBE [illegible]

DS 00029507

MAXUS0998199

Specification NFS-254-1

SPECIFICATION

FOR

SALT FILTER ITEM F2-F220

NEWARK PLANT, NEWARK, N. J.

DIAMOND ALKALI COMPANY

CENTRAL ENGINEERING DEPARTMENT

CLEVELAND, OHIO

APPROPRIATION NO. 03-00-6774

24 JUNE 1960

FOR DIAMOND ALKALI COMPANY

APPROVED _____ DATE _____

APPROVED _____ DATE 7-11-60

APPROVED _____ DATE _____

SUBMITTED BY:

ENGINEERS Incorporated

J H Bowen, PE DATE 7-11-60

DS 00029508

ENGINEERS COMPANY
Subsidiary of
ENGINEERS Incorporated
Diamond Alkali Company
Project No. 605028

FILTER SPECIFICATION

GENERAL:

This Specification covers the design and fabrication of a vertical pressure leaf slurry filter.

OPERATION:

Filter 955 gallons of an organic-water slurry/solution containing 600 lbs. of NaCl crystals. The initial feed rate will be 40 GPM as supplied by a centrifugal pump. Filtration will terminate with an air blow to remove liquid in tank. No precoat or cake wash is necessary since the cake will be redissolved and discharged to the sewer. A complete filtration cycle shall not exceed one hour.

PROPERTIES:

1. Specific gravity of clear liquid at operating temperature of 60 ≈ 100° C = 1.4.

2. Viscosity at operating temperature = 0.5 centistokes.

3. Bulk density salt (dry) - 50 lbs/ft^3.

4. The salt cake is composed of coarse crystals; no plugging material is present.

DESIGN:

1. The filter shall consist of a vertical shell with vertical leaves.

2. The design shall be manufacturer's standard to conform to ASME Section VIII; an ASME code stamp is required.

3. Materials -
   Shell - steel, with 1/8" corrosion allowance,
   Leaves - all light gage parts of filter such as leaves, shall be monel; expanded metal construction acceptable.
   Screens - monel wire, 70 mesh.
   Leaf sockets - monel

4. The filter leaves shall fit into sockets in a horizontal filtrate manifold. O-Ring seals shall be used.

DS 00029509

DESIGN: Continued -

5. The tank shall be fitted with leaf spacers.

6. The tank shell shall have a 2" wash water connection for redissolving the salt cake. Sluicing nozzles are not required.

7. The tap head shall be flanged and shall have quick opening bolts. A head lift shall be provided to permit swinging the head away for access to the leaves.

8. The vessel shall be designed for a maximum operating pressure of 75 psig and a maximum temperature of 250° F.

9. A 30 psig pressure drop across the filter leaves has been provided. The bidder shall advise if a higher pressure drop is required for the lowest cost unit.

10. The filter shall be similar to Durco Type 24V45 or Sparkler Type VF-105.

PUMP SPECIFICATION

NAME OF SERVICE: METHANOL - CAUSTIC FEED PUMP		REQ. NO.: ES-9326	
TYPE: FZ-F50B	NUMBER REQUIRED: 1	LOCATION: NEWARK TCP	ENGINEER: H. DATE: 14 JUL 60

LIQUID PUMPED: CAUSTIC SOLUTION IN METHANOL — CONCENTRATION: 20% NaOH

SPECIFIC GRAVITY: 1.1 @ 60°F — VISCOSITY: 3 cp @ 151°F — OPERATING TEMPERATURE: NORMAL 75°F — MAX. 170°F

CHARACTER OF LIQUID (Slurry, Gritty, Clear, Etc.): CLEAR — SUSPENDED MATERIAL (Approx. Max. Size And Qty.): NONE

PUMP PERFORMANCE

FT. OF LIQUID PUMPED		
	TOTAL DYNAMIC HEAD	SUCTION HEAD
NORMAL		
MAXIMUM	500 PSIG	FLOODED
MINIMUM		
NORMAL	37GPH NORMAL	DAILY HRS. SERVICE: 12

PUMP CONSTRUCTION

TYPE: ☐ CENTRIFUGAL ☐ AXIAL FLOW ☐ MIXED FLOW ☑ PROPORTIONING PUMP

STAGES: ☐ SINGLE ☐ MULTI-STAGE — SUCTION: ☐ SINGLE ☐ DOUBLE

MOUNTING: ☑ HORIZONTAL ☐ VERTICAL — IF VERTICAL: ☐ SUCTION ☐ SUBMERGED

IMPELLER: ☐ OPEN ☐ CLOSED ☐ SEMI-CLOSED ☐ NON-CLOG

OPERATING SPEED: 1725 — DIRECTION OF ROTATION (Viewed from outboard end of coupling): ☐ CLOCKWISE ☐ COUNTERCLOCKWISE

STROKE NORMAL: 3" STROKE, 22" PLUNGER, 41 STROKES/MIN.

CASING BODY: STEEL	SHAFT: —	IMPELLER: NONE	
BEARINGS/BUSHINGS: CAST IRON	RINGS: SS 316	BACKING: LINVE 430 TEFLON	TWO FEED HEADS

SPECIAL REQUIREMENTS: MAKE CHANGES 274 GPH, ADJUSTABLE SPEED 14/1

SEAL SEATS, SS 440 BALLS

EQUIP TO HOLD MCS-1 X34-2E (FEED 3, 2 FEED)

TYPE OF DRIVE (Direct Connected, V Belt, Etc.): DIRECT	BED PLATE FURNISHED BY: WITH PUMP		MOTOR FRAME NO.:
TYPE OF COUPLING: RIGID FLANGE GEAR HEAD	MAKE: JAMES		FURNISHED BY: WITH PUMP
TYPE OF DRIVER: TEFC 1/4 HP, 3 PH, 60 CYCLE, 440	HP: 1/4	JO:	HTG: FURNISHED BY: WITH PUMP

Quotations shall include 3 copies of characteristics and descriptive literature including dimensional drawings, performance curves, and complete parts list. If no delay is incurred thereby, it will be desirable to indicate on the above characteristic curves, the head-capacity and the horsepower curves obtained with maximum and minimum size impellers for the pump casing recommended.

DS 00029511

Vendor to supply _____ certified copies of above upon receipt of order.

The vendor shall select and specify construction on items not checked on the above specifications.

REMARKS:

MAXUS0998203

Specification NPS-259-2

SPECIFICATION

FOR

AUTOCLAVE CONTROL PANEL ITEM F2-U307

NEWARK PLANT, NEWARK, N. J.

DIAMOND ALKALI COMPANY

CENTRAL ENGINEERING DEPARTMENT

CLEVELAND, OHIO

APPROPRIATION NO. 03-00-6774

24 JUNE 1960

FOR DIAMOND ALKALI COMPANY

APPROVED _____ DATE 7/25/60

APPROVED _____ DATE 7-25-

APPROVED _____ DATE _____

SUBMITTED BY:

ENGINEERS Incorporated

_____ DATE 7/25/60

DS 00029512

ENGINEERS COMPANY
Subsidiary of
ENGINEERS Incorporated
Project No. 605028
Diamond Alkali Company
Specification No. NFS-259-2

AUTOCLAVE CONTROL PANEL

This specification shall cover the fabrication of a Control Panel for the Autoclaves F2-R101 & F2-R102.

SCOPE:

1. The panel shall be furnished fully fabricated including all piping, wiring and testing in accordance with the following Diamond Alkali Company Drawing:

   NF 259-7 - Autoclave Control Panel

2. Diamond Alkali will furnish the two temperature recorders, TR-225 and TR-226 (filled thermal system type) and the two receiver type pressure recorders, PR-332 and PR-333 and pressure indicators PI-108, PI-111 and temperature indicators TI-222, TI-223. Instruments will be furnished with spring wound chart drives.

3. The panel fabricator shall furnish all labor and material required in the fabrication of the panel, mounting of the instruments and accessories, electrical components, terminals, explosion proof enclosures, conduit, condulet, seals, wiring, purging of instrument cases and testing.

4. The fabricator shall provide the following equipment as noted in this specification and drawing No. NF 259-7:

   All electrical relays.
   Annunciators.
   Clock.
   All Bullseye lights.
   All pushbuttons.
   All disconnect switches.
   All fuses.
   All explosion proof enclosures with terminal strips.
   All Nameplates.
   Air Pressure gauge.
   Air Pressure Regulating Stations.

CODES:

5. Electrical wiring shall conform to the U.S. National Electrical Code, latest revisions. The panel shall be suitable for Class I, Division 2, Group D, Hazardous areas.

CONSTRUCTION: 8/23/60

6. The control panel shall be of the freestanding cubicle type totally enclosed front, back, top, and sides, for mounting on customer's concrete curb. Gasketed access doors not exceeding 21" in width are to be provided on back. Construction is to be suitable for air purging with a 1/2" N.P.T. steel coupling provided at the top for this purpose.

7. Dimensions are to be as shown on Diamond Alkali Drawing No. NFS-259-7. Height is to be 80" by 6' - 6" wide by 20" deep or manufacturer's nearest standard unit. Panel front shall be fabricated of steel plate minimum thickness 3/16". Remainder of cubicle to be fabricated of steel plate of 1/8" minimum thickness reinforced as required to provide a rigid unit. No bolting through the panel face shall be permitted.

8. The joints at the bottom of the unit shall be even and flat to within 1/16".

PAINTING:

9. The panel and framing shall be properly surfaced and painted with a suitable primer and two finish coats of corrosion resistant paint suitable for use in an atmosphere containing HCl and chlorine. Color shall be light green.

NAMEPLATES:

10. Engraved nemeplates shall be provided on the front of control panel in accordance with schedule on Drawing No. NF 259-7.

11. Nameplates are to be mounted as shown on Drawing No. NF 259-7.

12. All wiring shall be as indicated on Diamond Alkali Drawing No. NF 259-7.

13. All wiring indicated as connected to field mounted switches, relays, solenoid valves, etc., shall be terminated at terminal strips contained within explosion proof enclosures or condulets and mounted behind the panel at top.

14. Wiring shall be Type TW, Stranded 600 volt rating, 14 A.W.G. minimum and enclosed in rigid conduit.

SHIPPING:

15. The complete panel shall be properly crated and protected against damage from handling and weather conditions.

ENGINEERS COMPANY
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Diamond Alkali Company
Project No. 605028
Specification No. NFS-259-2

ELECTRICAL ACCESSORIES FOR INSTRUMENT CONTROL PANEL FOR AUTOCLAVES

All Items to be furnished by PANEL FABRICATOR

DESCRIPTION: A. C. relays Square "D" Class 8501, Type A with minimum one N.O. and two N.C. contacts and Coil for 115 volt, 60 cycle service.

DESCRIPTION: Alarm units with hermetically sealed plug-in relays mounted in relay chassis for remote bullseye indication, sequence as below for N.O. trouble contacts, Tigerman or equal.

LIGHT	HORN	CONDITION
Off	Off	Normal
On (Flashing)	On	Off-Normal
On (Steady)	Off	Silenced (acknowledged)
Off	Off	Cleared (Normal)

DESCRIPTION: 24 Hour Spring Wind clock with hour, minute and sweep second hands, 10" diameter for flush panel mounting.

DESCRIPTION: Bullseye explosion proof alarm lights for flush panel mounting. Color red. For operation on 115 volt, 60 cycle power in Class I, Group D, Division 2 hazardous locations. Crouse-Hinds.

DESCRIPTION: Explosion proof start - stop momentary contact pushbuttons with green running light, 440 volts, for flush panel mounting - both buttons black. Furnish with guards. Crouse-Hinds Type #EGP.

DESCRIPTION: Momentary contact pushbutton, 440 volt, normally open, for lamp test - Crouse-Hinds Type #EGP.

DESCRIPTION: Momentary contact pushbutton, 440 volt, normally closed for acknowledge. Crouse-Hinds Type #EGP.

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Project No. 605028
Diamond Alkali Company
Specification No. NFS-259-2

DESCRIPTION: D.P.S.T. toggle - operated disconnect switch, two pole, 440 volt. Complete with explosion proof enclosure for Class I, Group D, Division 2 hazardous locations. Crouse-Hinds.

1 [illegible] 1/23/60

DESCRIPTION: Explosion proof enclosure for Class I, Group D, Division 2 hazardous locations to accommodate annunciator & auxiliary relays. Hope Electric series H-6000 NBC.

DESCRIPTION: Explosion proof enclosures to accommodate relays, terminal strips, alarm units.

VESSEL SPECIFICATIONS

DACO 426-A

SPEC. NO. NFS-221-5	APPROP. NO. 03-00-677
REQ. NO. EG-3337	S. M. NO.
ENGINEER	DATE 7-25-60

NAME OF ITEM: ACETIC ACID STORAGE TANK

ITEM NO'S.	NUMBER REQUIRED	LOCATION
F2-T403	1	NWK

NOMINAL SIZE: 10,000 GAL. CODE: NONE

OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
ATMOS. PSIG	25 PSIG	100 °	125 °

SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
LEGS	No	No

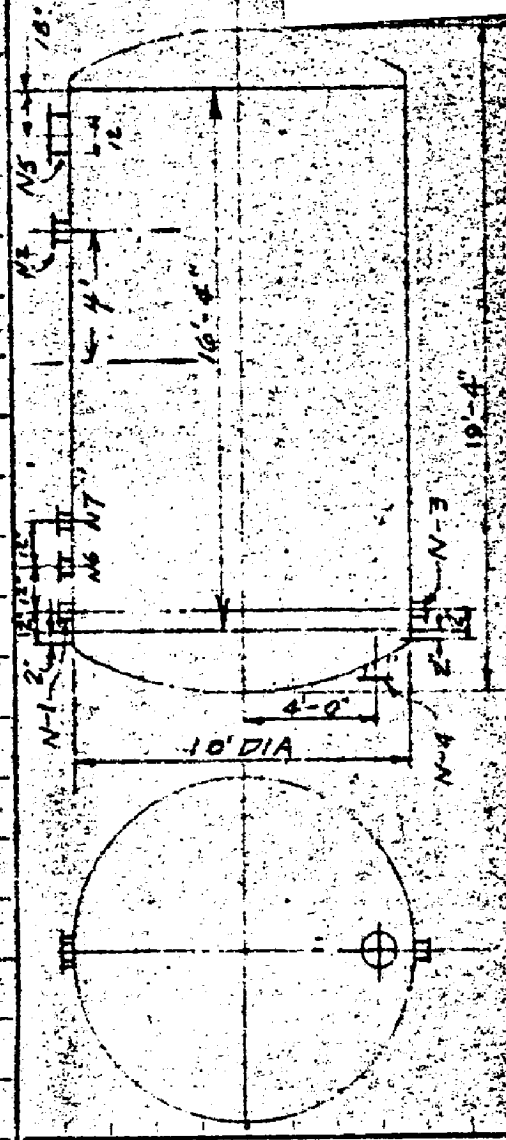
COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL	GLASS-LINED STEEL	—	MFR'S STD.
HEAD	do	—	do
SKIRT OR SUPPORT	LEGS	—	—

ANCHOR BOLTS: PROVIDE HOLES

INSULATION: NONE

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
1	MANHOLES	N-5	12"x16"	
	SAFETY VALVES			
1	LEVEL CONTROL	N-7	3"	
	GAGE GLASS			
1	THERMOCOUPLES	N-6	3"	
	DRAINS			
1	HEATER	N-4	3"	
1	INLET	N-1	3"	
1	OUTLET	N-3	3"	
1	VENT	N-2	3"	

NOTE: ALL NOZZ. TO BE 150# RATING.



WT. VESSEL (LBS.)

EMPTY	FULL WATER	FULL PRODUCT
16,300		

TRAY OR MISC. DETAILS

REMARKS: GLASS LINING TO BE RESISTANT TO OFF-SPEC ACETIC ACID WITH TRACES OF ORGANIC IODINE

DS 00029518

MAXUS0998210

VESSEL SPECIFICATIONS

DACO 470-A

SPEC. NO. NFS-221-4	APPROP. NO.
REQ. NO. EG-5335	S. M. NO.
ENGINEER S.V.N. JR	DATE 6-29-60

NAME OF ITEM: STORAGE TANK (MCA)

ITEM NO'S.	NUMBER REQUIRED	LOCATION
E1-T416	1	NWK

NOMINAL SIZE: 5000 gals. CODE: None

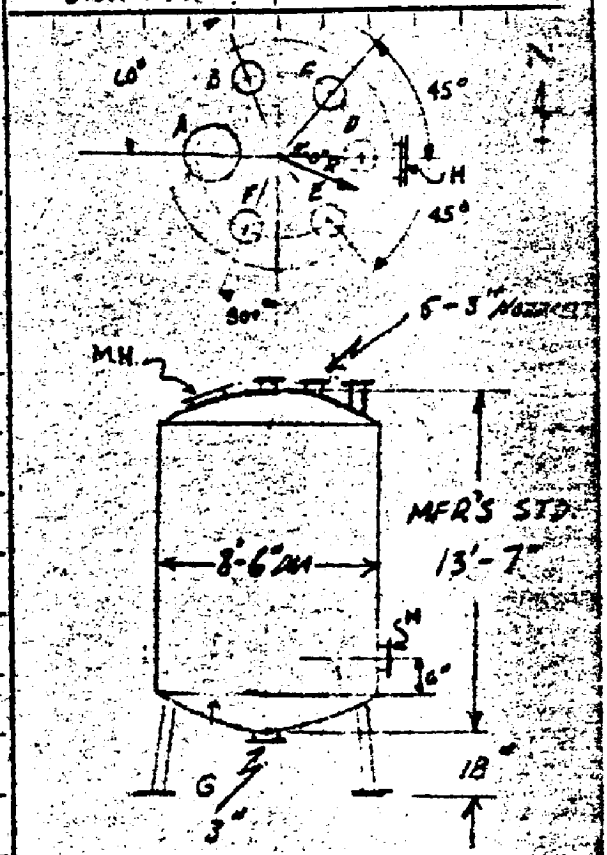
OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
14.7 PSIG	14.7 PSIG	95 °F	125 °F

SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
Yes	No	No

COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL	GLASS LINED		
HEAD	" " F&D		
SKIRT OR SUPPORT			

ANCHOR BOLTS | INSULATION

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
1	MANHOLES	A	12"x16"	
	SAFETY VALVES			
	LEVEL CONTROL			
	GAGE GLASS			
	THERMOCOUPLES			
	DRAINS			
1	NOZ. 150#	B	3"	FILL
1		C	3"	TRANSFER
1		D	3"	VENT
1		E	3"	THERMOMETER
1		F	3"	BUBBLER
1		G	3"	PUMP SUCTION
1		H	3"	HEATER



ALL NOZZLES 150# ASA RATING.

DS 00029519

WT. VESSEL (LBS.)		
EMPTY	FULL WATER	FULL PRODUCT

REMARKS

TANK AND TANK OPENINGS TO BE GLASS LINED. LINING TO RESIST 80% MONOCHLORACETIC ACID

TRAY OR MISC. DETAILS

MAXUS0998211

VESSEL SPECIFICATIONS

DACO 476-A

SPEC. NO. NFS-251-A	APPROP. NO. 03-00-677[illegible]
REQ. NO. EG-3340	B. M. NO.
ENGINEER H.T. S	DATE 17 AUG 63

NAME OF ITEM: CHLORINE VAPORIZER

ITEM NO'S.	NUMBER REQUIRED	LOCATION
FC-E424	1	NEWARK

NOMINAL SIZE: 20" OD x 8'-0" S.S.

CODE: ASME VIII STAMPED

OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
105 PSIG	300 PSIG	100 °F	250 °F

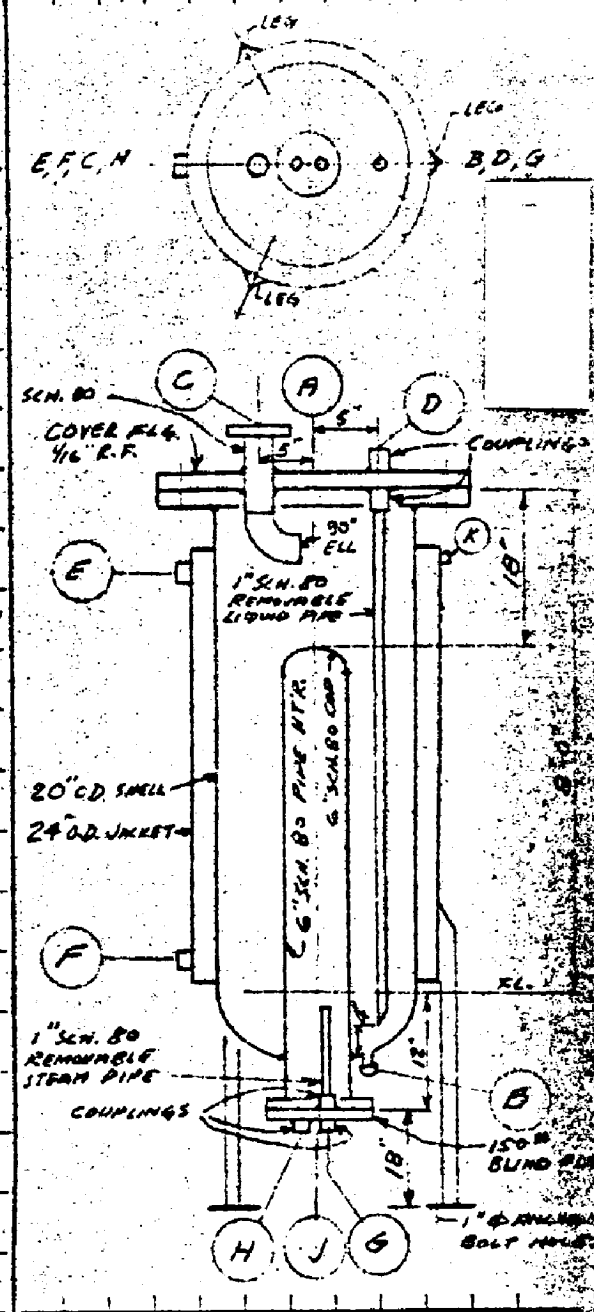
SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
YES	NO	NO

COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL - SEAMLESS PIPE	ASTM-A106 Gr.A	1/8 & 1/16	1/2"
HEAD - PIPE CAP	ASTM-A106 Gr. A	1/8 & 1/16	1/2"
~~SKIRT OR~~ SUPPORT LEGS	MFG. STANDARD		
JACKET	PIPE - ASTM A53-A or PLATE - ASTM A285 A	1/16"	3/8"

ANCHOR BOLTS

INSULATION

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
1	MANHOLES	A	20"	300# R.F, ASA, S.O., A181 Gr.1
	SAFETY VALVES			
	LEVEL CONTROL			
	GAGE GLASS			
	THERMOCOUPLES			
1	DRAINS	B	1"	SCH. 80 SMLS. Nipple, capped
1	VAPOR OUT	C	3"	300# R.F, ASA, A181 Gr.1
1	Cl_2 INLET	D	1"	3000# F.S. COUPLING
1	STEAM INLET	E	2"	3000# F.S. COUPLING
1	COND. OUT	F	1"	3000# F.S. COUPLING
1	STEAM INLET	G	1"	3000# F.S. COUPLING
1	COND. OUT	H	1"	3000# F.S. COUPLING
1	HEATER	J	6"	150# R.F, ASA, A181 Gr.1
1	VENT	K	3/4"	3000# F.S. COUPLING



WT. VESSEL (LBS.)

EMPTY	FULL WATER	FULL PRODUCT

REMARKS

(1) APPLY ONE OUTSIDE SHOP COAT OF PRIMER PER PAINTING SPECIFICATION DATED JUNE 17, 1960.

(2) PROVIDE LIFTING LUG AT CENTER OF COVER FLANGE.

(3) JACKET DESIGN: 100 PSIG AT 350°F.

TRAY OR MISC. DETAILS

DS 00029520

MAXUS0998212

LIBRARIAN'S NOTE: DUPLICATE TO PREVIOUS SHEET WITH NOTES.

VESSEL SPECIFICATIONS

DACO 470-A

SPEC. NO. NFS-251-4	APPROP. NO. 03-00-6774
REQ. NO.	S. M. NO.
ENGINEER H.T.	DATE 17 AUG '60

NAME OF ITEM: CHLORINE VAPORIZER

ITEM NO'S.	NUMBER REQUIRED	LOCATION
F2-E424	1	NEWARK

NOMINAL SIZE: 20" OD x 8'-0" S.S. — CODE: ASME VIII STAMPED

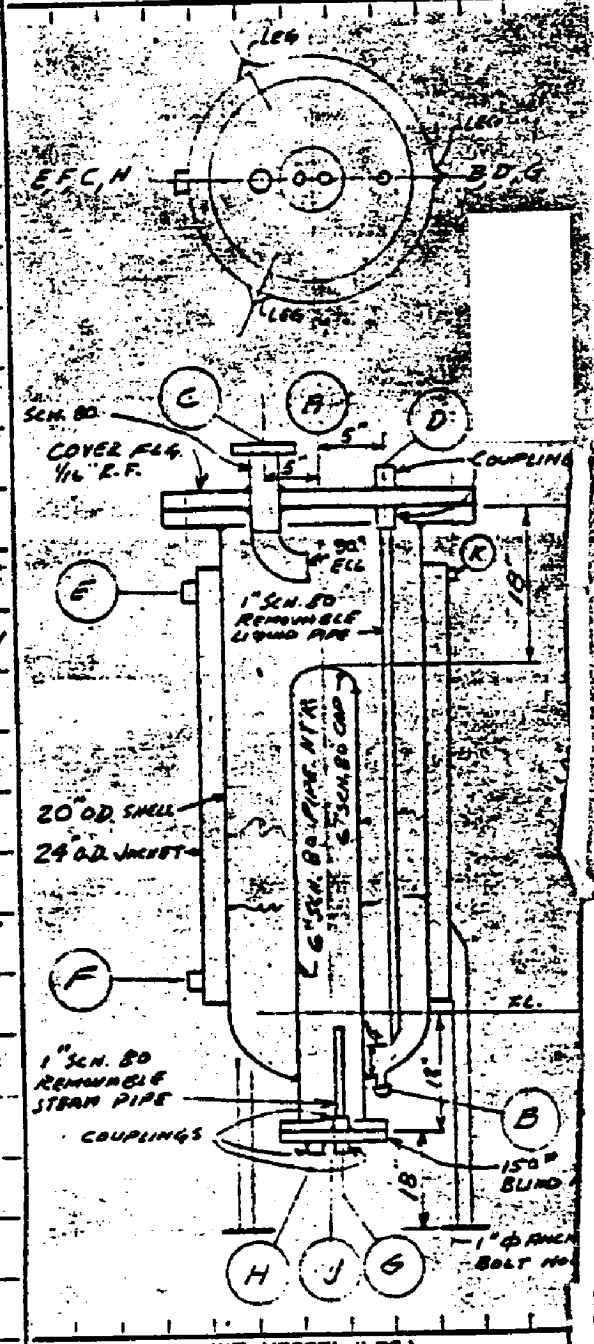
OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
105 PSIG	300 PSIG	100 °F	250 °F

SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
YES	NO	NO

COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL — SEAMLESS PIPE	ASTM-A106 Gr.A	1/16	1/2"
HEAD — PIPE CAP	ASTM-A106 Gr.A	1/8 & 1/16	1/2"
~~SKIRT~~ OR SUPPORT LEGS	MFG. STANDARD		
JACKET	PIPE - ASTM A53-A or PLATE - ASTM A285A	1/16"	3/8"

ANCHOR BOLTS — INSULATION

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
1	MANHOLES	A	20"	300# R.F. ASA, S.O., AISI Gr.1
	SAFETY VALVES			
	LEVEL CONTROL			
	GAGE GLASS			
	THERMOCOUPLES			
1	DRAINS	B	1"	Sch. 80 Smls. Nipple, capped
1	VAPOR OUT	C	3"	300# R.F., ASA, AISI Gr.1
1	Cl_2 INLET	D	1"	3000# F.S. COUPLING
1	STEAM INLET	E	2"	3000# F.S. COUPLING
1	COND. OUT	F	1"	3000# F.S. COUPLING
1	STEAM INLET	G	1"	3000# F.S. COUPLING
1	COND. OUT	H	1"	3000# F.S. COUPLING
1	HEATER	J	6"	150# R.F., ASA, AISI Gr.1
1	VENT	K	3/4"	3000# F.S. COUPLING



WT. VESSEL (LBS.)

EMPTY	FULL WATER	FULL PRODUCT

TRAY OR MISC. DETAILS:

REMARKS

(1) APPLY ONE OUTSIDE SHOP COAT OF PRIMER PER PAINTING SPECIFICATION DATED JUNE 11, 1960.

(2) PROVIDE LIFTING LUG AT CENTER OF COVER FLANGE.

(3) JACKET DESIGN: 100 PSIG AT 350°F.

DS 00029521

MAXUS0998213

VESSEL SPECIFICATIONS

DACO 470-A

SPEC. NO. NFS-221-9	APPROP. NO. 03-00-6774
REQ. NO. EG-3355	S. M. NO.
ENGINEER	DATE ~~4-19-60~~ REVISED 10-26-60

NAME OF ITEM: CAUSTIC TANK - MCA UNIT

ITEM NO'S.	NUMBER REQUIRED	LOCATION
F2-T506	1	NEWARK

NOMINAL SIZE: 4 ϕ × 6'H - 500 GAL. CODE: —

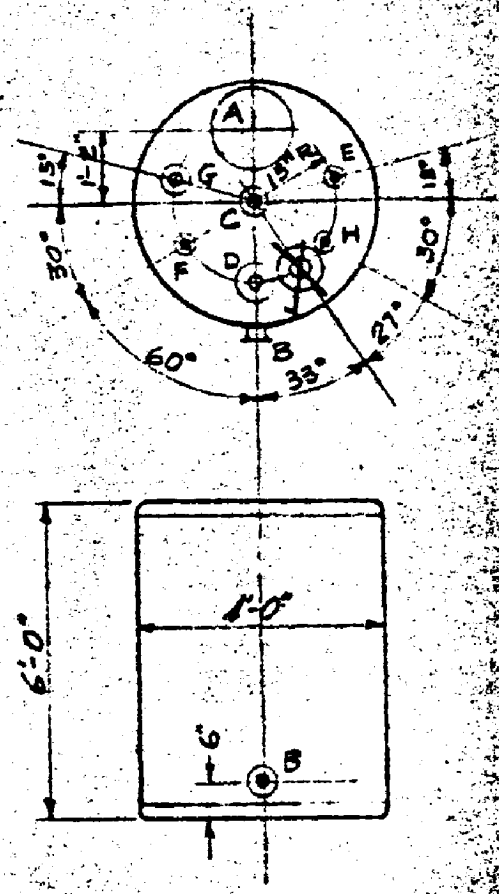
OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
0 PSIG	0 PSIG	150 °F	150 °F

SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
YES	NO	NO

COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL	1/4" ASTM A7	LINED	1/4" + 3/16"
HEAD - TOP & BOTTOM	1/4" FLANGED ONLY, ASTM A7	"	"
SKIRT OR SUPPORT	—		

ANCHOR BOLTS: — INSULATION: —

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
1	MANHOLES	A	16"	LIGHT WEIGHT MFR'S STD. OR API 12C TYPE
	SAFETY VALVES			
	LEVEL CONTROL			
	GAGE GLASS			
	THERMOCOUPLES			
	DRAINS			
1	OUTLET	B	2"	150#
1	INLET	C	2"	150#
1	SPARGE (Cl_2)	D	3"	150# WITH 2" SOLID PENTON DIP PIPE TO WITHIN 12" OF BOTTOM
1	FILL	E	2"	150#
1	WATER	F	2"	150#
1	MANOMETER	G	2"	150# WITH 1/2" SOLID PENTON BUBBLER PIPE TO WITHIN 3" OF BOTTOM
1	VENT	H	2"	150#
~~1~~	~~DCP~~	~~J~~	~~4"~~	~~150#~~



DS 00029522

WT. VESSEL (LBS.)		
EMPTY	FULL WATER	FULL PRODUCT

TRAY OR MISC. DETAILS

REMARKS

LINE COMPLETE INTERIOR OF TANK & ALL NOZZLES WITH DOW "SARALOY 89B", 3/16" TH. DIP PIPES ARE TO BE SOLID PENTON PIPE, WITH PENTON LAP JT. FLG. RINGS.

VESSEL SPECIFICATIONS

DACO 470-A

SPEC. NO. NFS-221-7	APPROP. NO. 03-00-6774
REQ. NO. EG-3341	B. M. NO. —
ENGINEER H.T.	DATE 15 AUG. 60

NAME OF ITEM: DILUTION WATER DROP TANK

ITEM NO'S.	NUMBER REQUIRED	LOCATION
F2-T528	1	MCA NEWARK

NOMINAL SIZE: 36" DIA. x 6'-0"

CODE: NONE

OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
ATMOS. PSIG	— PSIG	ATMOS. °F	— °F

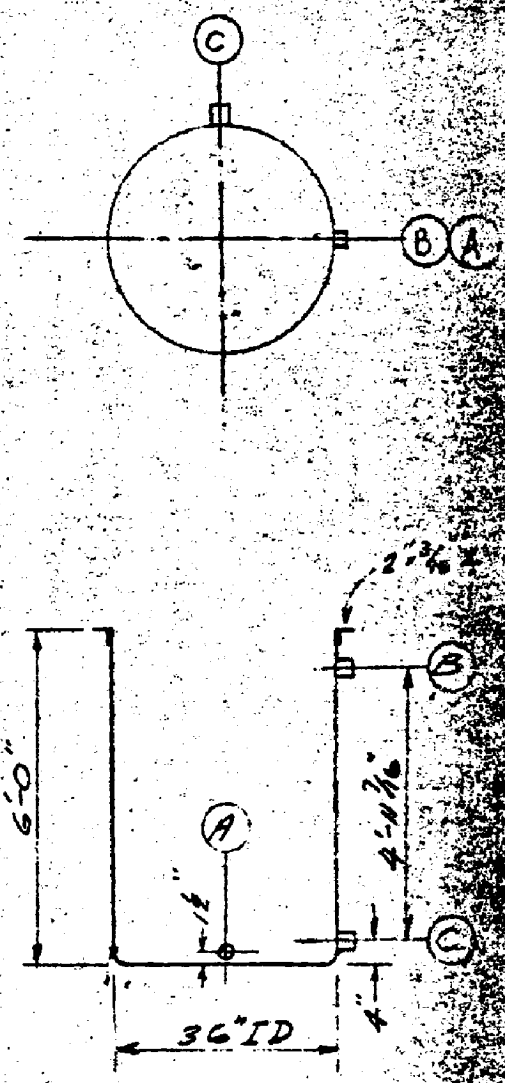
SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
—	No	No

COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL	ASTM-A283 Gr. C		1/4" MIN.
HEAD FLANGE ONLY	ASTM-A283 Gr. C		1/4" MIN.
SKIRT OR SUPPORT			

ANCHOR BOLTS

INSULATION

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
	MANHOLES			
	SAFETY VALVES			
	LEVEL CONTROL			
	GAGE GLASS			
	THERMOCOUPLES			
	DRAINS	A	3/4"	3000# F.S. COUPLING
	OVERFLOW	B	2"	3000# F.S. COUPLING
	OUTLET	C	1 1/2"	3000# F.S. COUPLING



DS 00029523

WT. VESSEL (LBS.)

EMPTY	FULL WATER	FULL PRODUCT

REMARKS: (1) SEAL WELD INSIDE LAP OF BOTTOM HEAD IF DOUBLE WELDED BUTT JOINT IS NOT USED.

(2) THE TANK SHALL BE GIVEN ONE SHOP COAT OF PRIMER, INSIDE & OUTSIDE, AFTER FABRICATION

TRAY OR MISC. DETAILS

MAXUS0998215

VESSEL SPECIFICATIONS

DACO 276-A

SPEC. NO. NFS-221-8	APPROP. NO. 03-00-6774
REQ. NO. FG-3341	S. M. NO.
ENGINEER H.K.	DATE 16 AUG. 60

NAME OF ITEM: BRINE MAKE UP TANK

ITEM NO'S.	NUMBER REQUIRED	LOCATION
F2-T-529	1	N/CA

NOMINAL SIZE	CODE
4'-0" DIA. x 2'-8" HIGH	NONE

OPER. PRESS.	DESIGN PRESS	OPER. TEMP.	DESIGN TEMP.
ATMOS. PSIG	— PSIG	ATMOS °F	— °F

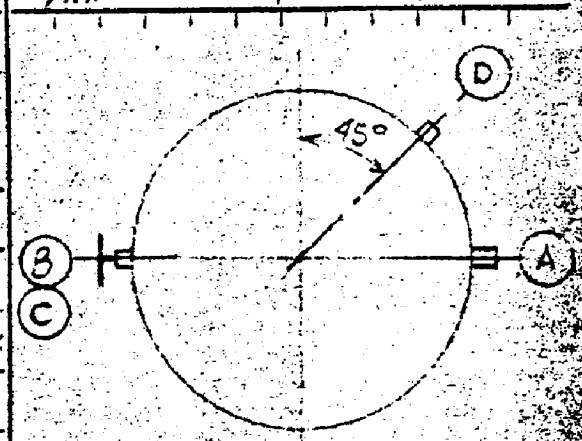
SELF SUPPORTING	STRESS RELIEVE	RADIOGRAPH
—	No	No

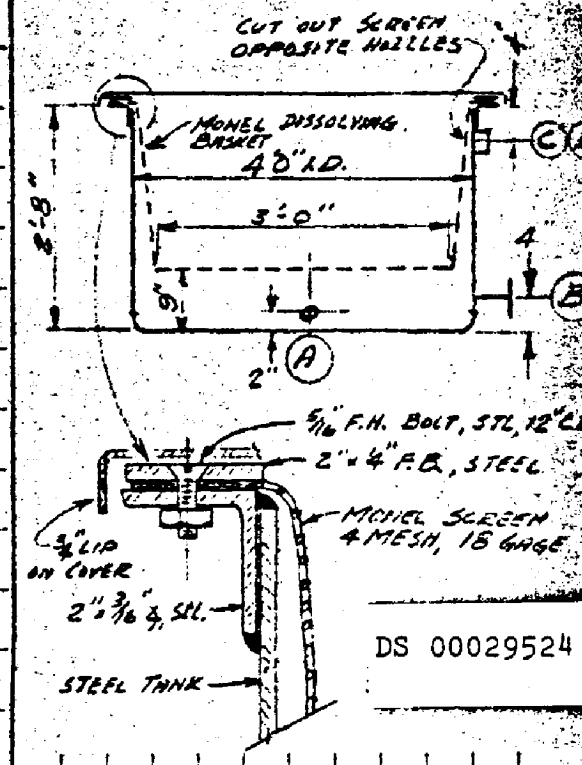
COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL	ASTM-A283 Gr. C		5/16" MIN.
HEAD FLANGE ONLY	ASTM-A283 Gr. C		5/16" MIN.
SKIRT OR SUPPORT			
COVER	ALUMINUM		12 GA.

ANCHOR BOLTS

INSULATION

QUAL.	NOZZLE	MK.	SIZE	DESCRIPTION
	MANHOLES			
	SAFETY VALVES			
	LEVEL CONTROL			
	GAGE GLASS			
	THERMOCOUPLES			
	DRAINS	A	3/4"	3000# F.S. COUPLING
	OUTLET	B	3"	150# ASA, R.F., A-181 Gr. 1
	INLET	C	2"	3000# F.S. COUPLING
	WATER	D	2"	3000# F.S. COUPLING





WT. VESSEL (LBS.)		
EMPTY	FULL WATER	FULL PRODUCT

REMARKS

SEAL WELD INSIDE LAP OF BOTTOM HEAD IF DOUBLE WELDED BUTT JOINT IS NOT USED.

THE TANK SHALL BE GIVEN ONE SHOP COAT OF PRIMER, INSIDE & OUTSIDE AFTER FABRICATION

TRAY OR MISC. DETAILS

MAXUS0998216

CENTRIFUGAL PUMP SPECIFICATION

NF5-258-33

NAME OF PUMP: DCP CHLORINATOR PUMPS		REQ. NO. EG-3370	S.R. NO.
ITEM NO.: F2-P610 & P612	NUMBER REQUIRED: 2	LOCATION: NWK	ENGINEER: 3	DATE: 9-15-60

LIQUID PUMPED: DICHLOROPHENOL — CONCENTRATION: 100%

SPECIFIC GRAVITY: 1.38 @ 68 °F — VISCOSITY: > H_2O @ °F — OPERATING TEMPERATURE: NORMAL 140 °F MAX. 200 °F

CHARACTER OF LIQUID (Corrosive, Gritty, Clear, Etc.): TRACE OF HCl — SUSPENDED MATERIAL (Approx. Max. Size And Qty.): —

PUMP PERFORMANCE

	FT. OF LIQUID PUMPED	
	TOTAL DYNAMIC HEAD	SUCTION HEAD
NORMAL	50	FLOODED
MINIMUM	—	
MAXIMUM	—	

RPM: 50 — DAILY HRS. SERVICE: 1

PUMP CONSTRUCTION

TYPE: [X] CENTRIFUGAL [ ] AXIAL FLOW [ ] MIXED FLOW [ ] OTHER

STAGES: [X] SINGLE [ ] MULTI-STAGE — SUCTION: [ ] SINGLE [ ] DOUBLE

MOUNTING: [X] HORIZONTAL [ ] VERTICAL — IF VERTICAL: [ ] SUCTION [ ] SUBMERGED

IMPELLER: [ ] OPEN [ ] CLOSED [ ] SEMI-CLOSED [ ] NON-CLOG

OPERATING SPEED — DIRECTION OF ROTATION (Viewed From Outboard End Opp. Coupling): [ ] CLOCKWISE [ ] COUNTER CLOCKWISE

DISCHARGE NOZZLE POSITION (Viewed From Outboard End Opp. Coupling): VERTICAL

MATERIALS

CASING	SHAFT	IMPELLER
WORTHITE	WORTHITE	WORTHITE
GLANDS	RINGS	PACKING

SPECIAL REQUIREMENTS

DRIVE DETAILS

TYPE OF DRIVE (Direct Connected, V-Belt, Etc.): DIRECT	BED PLATE FURNISHED BY: PUMP MFR.		MOTOR FRAME NO.: 224
TYPE OF COUPLING: FLEXIBLE	MAKE: FALK		FURNISHED BY: PUMP MFR.
TYPE OF DRIVER: XP MOTOR, 440v, 3φ, 60~	NO. 2	JO —	REQ — FURNISHED BY: PURCHASER

GENERAL REQUIREMENTS

Quotations shall include 3 copies of characteristics and descriptive literature including dimensional drawings, sectional views, and complete parts list. If no delay is incurred thereby, it will be desirable to indicate on the above characteristic curves, the head-capacity and the horsepower curves obtained with maximum and minimum size impellers for the pump casing recommended.

Vendor to supply _____ certified copies of above upon receipt of order.

The vendor shall select and specify construction on items not checked in the above specifications.

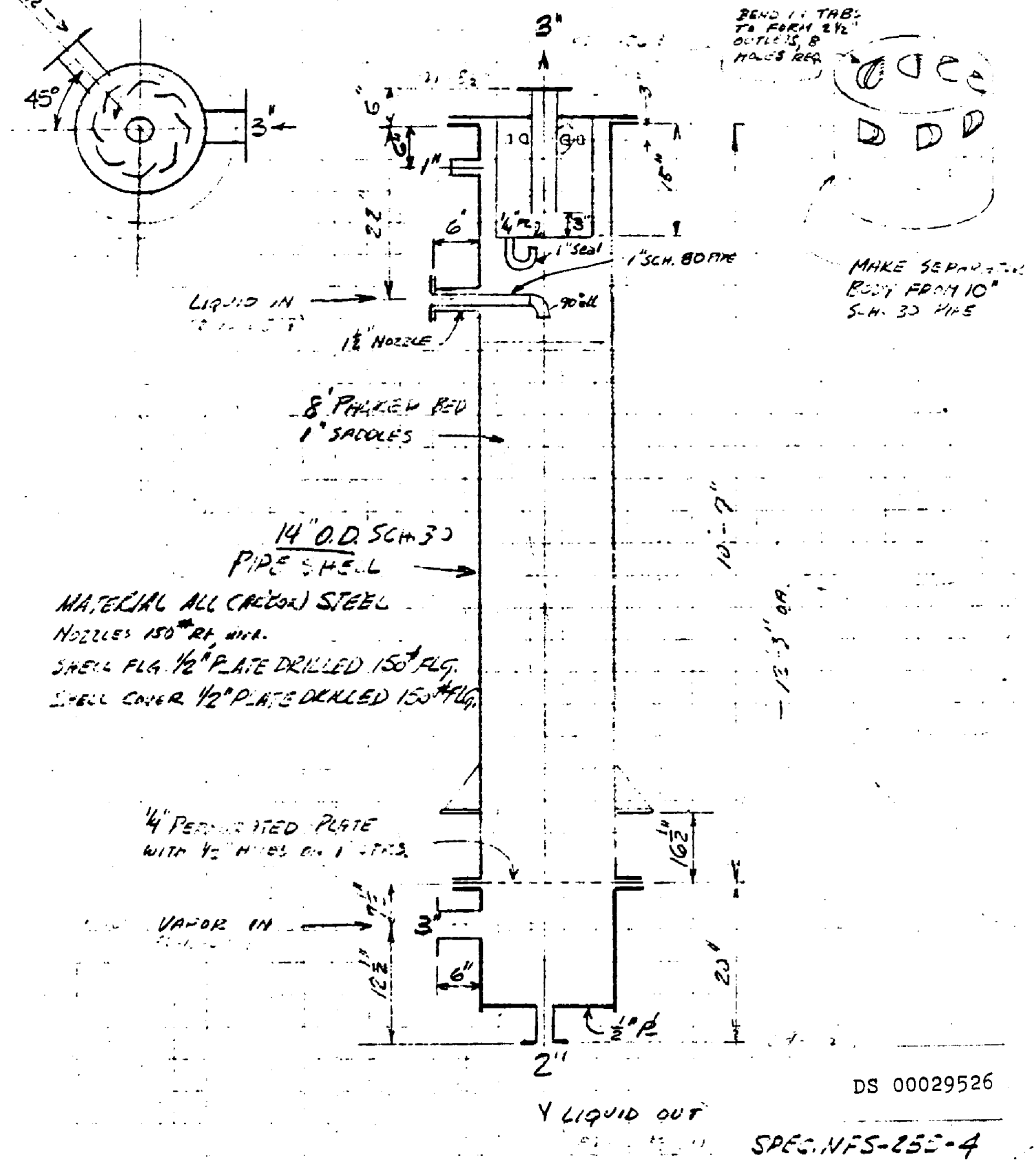
DS 00029525

REMARKS

MAJORITY OF PLANT PUMPS ARE WORTHINGTON.

MAXUS0998217

STRIPPER - F2-D615



DS 00029526

SPEC. NFS-252-4

PP.105

PREPARED BY [illegible]

DATE 5 OCT 60

PROJECT NO. [illegible]

SUBJECT DCP

ENGINEERS INCORPORATED 487 ORANGE STREET, NEWARK 7, N. J. HU 2-7040 PAGE ____ OF ____

MAXUS0998218

SPECIFICATION
FOR
440 VOLT
MOTOR CONTROL CENTER
NEWARK PLANT, NEWARK, N. J.

DIAMOND ALKALI COMPANY

CENTRAL ENGINEERING DEPARTMENT

CLEVELAND, OHIO

APPROPRIATION NO. 03-00-6774-64-10

28 June 1960

FOR DIAMOND ALKALI COMPANY

APPROVED _____ DATE 6/29/60

APPROVED _____ DATE 6/29/60

APPROVED _____ DATE _____

SUBMITTED BY:

ENGINEERS Incorporated

_____ P.E. DATE 6-29-60

DS 00029527

ENGINEERS COMPANY
Subsidiary of
ENGINEERS Incorporated
Diamond Alkali Company
Project No. 605028
Specification NPS-264

ELECTRICAL SPECIFICATIONS

440 VOLT, 3 PHASE MOTOR CONTROL CENTER

MOTOR CONTROL CENTER

A. The motor control center shall be free standing floor mounted, front operated. The enclosure shall be standard code gauge steel as approved for Nema I construction. The unit structure shall contain the necessary incoming line bus and mechanical supporting members for easy installation of individual control units. The main incoming 440 volt, three phase 600 Amp. feeder shall enter the top, standard structure height shall be 90" above finished floor. The control center shall contain Westinghouse type starters and circuit breakers, Nema type A, class I wiring installation, size and rating of circuit breakers and starters shall be as indicated on drawings. Each starter shall be provided with an additional one (1) normally closed contact and one (1) normally open contact. The unit shall be provided with a horizontal wiring trough top and bottom. The unit shall be provided with ground bus.

B. The main horizontal 3 phase bus in the top of the incoming line structure shall be equipped with short lug adapter plates to facilitate connecting cables from the main circuit breaker. The bus shall be copper bar, silver plated at connections to vertical bus, minimum 1/4 inch thick for a current carrying capacity of 600 amperes and shall be locked in place by bus supports of a non-tracking, glass reinforced polyester resistant to moisture, acid and alkali. The bus supports shall be braced to withstand fault currents of 25,000 RMS symmetrical amperes.

C. For distribution of power, the main bus to starter units shall have 3 phase vertical bus of 1/4 inch thick, round edge, silver plated copper. The vertical bus shall be supported by arc-resistant, non-tracking, glass-reinforced polyester insulators and shall have insulators to withstand 25,000 RMS symmetrical amperes from a short circuit at the bottom of the bus.

D. Individual control starter doors shall have rolled edges and neoprene gasket to provide a dust resistant unit. There shall be no sharp corners to injure personnel. The circuit breaker handle must be turned to "off" position before the door can be opened, the breaker handle shall have cam type fasteners. The door shall not open more than 90 degrees, each door shall be equipped with a bakelite name plate engraved to show circuit designation as designated and indicated on drawings, to be furnished later.

ELECTRICAL SPECIFICATIONS

440 VOLT, 3 PHASE MOTOR CONTROL CENTER

MOTOR CONTROL CENTER (CONT'D.)

E. Each starter compartment shall be completely isolated from the other compartments in the structure. The starter units shall have plug-in stabs on the rear of each starter for power connection to the vertical bus, the stabs shall be fabricated of high spring strength, high conductivity Cupaloy, tin plated and mounted on a Rosite insulating base. The guide rails shall assure accurate horizontal and vertical alignment of each starter to eliminate any possible damage to bus-or stabs. The starter units shall be provided with a slide lever for padlocking in the "tilt-out" position (starter disengaged from bus) isolating the starter unit from the power circuit.

F. All size 5 starter units shall be non-removable unit, these units shall have an enclosure of heavy gauge, front removable, sheet steel panel mounted to the structure and covered by a hinged door.

G. Minimum size breakers for size 1 & 2 starters shall be Westinghouse De-ion "F" Circuit breaker, size 3 & 4 starters Westinghouse De-ion "J" curciut breaker. All breakers shall be molded case. Motor starter breakers shall have instantaneous trips only. Heaters shall not be provided with starters.

H. The motor control center steel structure shall be thoroughly cleaned inside and out after fabrication, then given a rust inhibiting primer coat and shall be applied with two finishing coats of both interior and exterior of corrosive resistant medium light gray ASA standard #61.

The Unit shall be shipped in no greater than 5 ft. lengths; back to back starters.

I. Quantity and size of circuit breakers and starters as following:

1 - 600 Amp. main breaker
4 - 100 Amp. breakers "F" frame, 100 Amp. trip
34 - size 1 with "F" frame breakers
4 - size 2 with "F" frame breakers
1 - size 3 with "J" frame breaker
1 - size 4 with "J" frame breaker
4 - size 1 spaces

DS 00029529

SPECIFICATION ~~NFS-264~~
NUS 364-1A

SPECIFICATION

FOR

OUTDOOR 440 VOLT

ELECTRICAL SWITCHBOARD

NEWARK PLANT, NEWARK, N. J.

DIAMOND ALKALI COMPANY

CENTRAL ENGINEERING DEPARTMENT

CLEVELAND, OHIO

APPROPRIATION NO. 03-00-6774-64-10

30 June 1960

FOR DIAMOND ALKALI COMPANY

APPROVED [signature] DATE 6/30/60

APPROVED [signature] DATE 6-30-60

APPROVED [signature] DATE 7/5/60

SUBMITTED BY:

ENGINEERS Incorporated

HV Bowser, P.E. DATE 6-30-60

DS 00029530

ENGINEERS COMPANY
Subsidiary of
ENGINEERS Incorporated
Diamond Alkali Company
Project No. 605028
Specification ~~NFS-264~~
NUS 364-1A

ELECTRICAL SPECIFICATIONS

OUTDOOR 440 VOLT ELECTRICAL SWITCHBOARD

MAIN 440 VOLT OUTDOOR DISTRIBUTION BOARD

A. The Switchboard will be Westinghouse Series II construction. The 440 Volt Switchboard shall be free standing self contained, metal enclosed, self supporting metal structure, of the required number of formed and welded vertical panel sections, incorporating circuit breakers and other associated equipment as herein specified. ~~and/or as indicated on drawings~~. All fastenings between vertical panel sections shall be bolted. All screwed on front covers shall be flanged on all four sides and shall be not less than 12 gauge. Top, side and rear closing sheet steel plates shall be removable, shall be not less than 12 gauge and shall be furnished with openings for proper ventilation. Bolted frames and insulating blocks shall be provided to support and brace the main horizontal bus for short circuit stresses up to 75,000 RMS amperes. Main horizontal busses and bus connections between main bus and switching devices shall consist of 2000 Amp. copper sized to limit temperature rise to 50° C over an average air temperature outside the enclosure of 25° C. The switchboard shall be finished with a light gray interior and exterior over all steel surfaces. All sheet steel parts shall be rust and corrosion-proofed prior to painting. The buses will consist of high conductivity bare bars mounted on heavy micarta supports. The main bus joints and all tapped connections will be silver plated and tightly clamped with through bolts to insure maximum conductivity. Cleats will be mounted on support members for securing out going cables. Barriers shall be provided between each section of the board and between the main circuit breaker and current transformer metering compartment. The switchboard shall be suitable for 440 volt maximum service and will receive a dielectric test for that voltage class in accordance with Nema standards. It will be designed in accordance with the latest standards of AIEE and Nema. The switchboard will be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to assure accuracy of the wiring and functioning of the equipment. The main circuits will be given a dielectric test of 2200 volts for one minute between line parts and ground and between opposite polarities. The switchboard shall have provisions for cables entering at the top side. The switchboard will be entirely bus bar installation, no cable will be permitted to or for bus bar connections. The switchboard shall be provided with throat connected 2000 amp. bus to the transformer sub-station. The incoming bus to the switchboard will be weather proof side mounted, ~~as indicated on drawing~~. Provide a black, engraved circuit designation plate 1-1/4 inches high and 3-1/2 inches long at each circuit breaker.

ENGINEERS COMPANY
Subsidiary of
ENGINEERS Incorporated
Diamond Alkali Company
Specification ~~NFS-267~~ NUS 364-1A

ELECTRICAL SPECIFICATIONS

OUTDOOR 440 VOLT ELECTRICAL SWITCHBOARD

B. The first section of the switchboard will contain an electrically operated, 3 pole, 2000 amp. 75000 AIC, stationary, front operated circuit breaker. This breaker shall be Westinghouse type DB-75 De-ion arc interruption. Also in this first section (top) will be current transformers. Metering shall be furnished by the Utility Co. The remainder of the sections will contain a self-contained ammeter 0-3000 amp., and a self-contained voltmeter 0-600 V, three (3) Mark 75, Westinghouse type HLM, 600 Amp. circuit breaker, one (1) Mark 75, Westinghouse type HK, 225 amp. circuit breaker and provisions for one (1) future Mark 75, Westinghouse type HLM, 600 amp. circuit breaker. Should there be other space available in the make up of this switchboard for the above breakers, then the remaining space shall be suitable for future Mark 75, Westinghouse type HK, 225 amp. circuit breakers. The circuit breakers will be Westinghouse principal "De-ion" arc interruption. The breaker will incorporate a circuit interruption devices for interrupting efficiency and minimize the formation of arc flame and gases. The air circuit breakers will be of arc resisting tungste alloy. The breaker will be equipped with De-ion arc chutes, which will effectively enclose the arcing contacts and confine the arc to reduce the disturbance caused by short circuit interruption.

C. A metal clad weather-proof outdoor housing shall contain the switchboard. The housing shall include front and rear doors, end trims, a sloping roof and an interior floor raised above the concrete mat. Ventilation shall be provided through louvers in the doors backed by disposable filters to prevent entry of water and foreign matter. Heating elements shall be provided so that the unit will be free of condensation. Provide full height doors equipped with quick-acting latches and locking provisions. An enclosed aisle will be provided in front of the switchboard. Provide lighting and two (2) 120 volt convenience outlets. The housing steel structure shall be rust-proofed prior to painting and shall be finished with light gray corrosion resistant paint.

D. The manufacturer of this outdoor switchboard shall submit a front view arrangement of the circuit breakers prior to final approval of the switchboard.

Specification NUS 364-2

SPECIFICATION

FOR

OUTDOOR 4160 VOLT CIRCUIT BREAKER CUBICLE

NEWARK PLANT, NEWARK, N. J.

DIAMOND ALKALI COMPANY

CENTRAL ENGINEERING DEPARTMENT

CLEVELAND, OHIO

APPROPRIATION NO. 03-00-6774

22 JULY 1960

FOR DIAMOND ALKALI COMPANY

APPROVED _____ DATE 7/25/60

APPROVED _____ DATE 7-25-60

APPROVED _____ DATE _____

SUBMITTED BY:

ENGINEERS Incorporated

H W Bausch, P.E. DATE 7-25-60

DS 00029533

ENGINEERS COMPANY
subsidiary of
ENGINEERS Incorporated
Project No. 605028
Diamond Alkali Company
03-00-1631-6774
Specification No. NU 364-2

SPECIFICATION
FOR
OUTDOOR 4160 VOLT CIRCUIT BREAKER CUBICLE

A. Cubicle shall serve in the incoming 4160 Volt Service Lines of the Public Service Electric & Gas Company, and the entire unit shall meet all requirements of the Utility Company for this application.

B. Housing shall be weather-proof outdoor type, free standing metal enclosed structure with weather-proof hinged doors on both front and rear. Doors shall contain ventilating louvers backed by disposable, standard commercial sized filters. Housing shall have a sloping roof and an interior floor raised above the concrete slab. All metal surfaces, inside and out, shall be rust proofed and finished with light gray corrosion resistant paint. The housing shall contain all equipment specified herein and as required for a complete, approved incoming line cubicle.

C. The Oil Circuit Breaker shall be 600 Amp - three pole, manually operated, mechanical and electrical trip free mechanism with three trip coils having inverse time limit attachments, equal to Westinghouse #124A. Circuit Breaker shall be frame mounted with panel mounted cover plate. The Circuit Breaker shall be rated 50 M.V.A. interrupting capacity.

D. Disconnect switch for isolating the Oil Circuit Breaker shall be 600 Amp. 5KV, 3 Pole single throw, gang operated, equal to Westinghouse Class"A-20". Switch shall be mechanically interlocked with Oil Circuit Breaker. Panel shall have a window so that switch blades can be seen in the open position.

E. Current transformers for Circuit Breaker Tripping shall be rated 200 to 5 Amps.

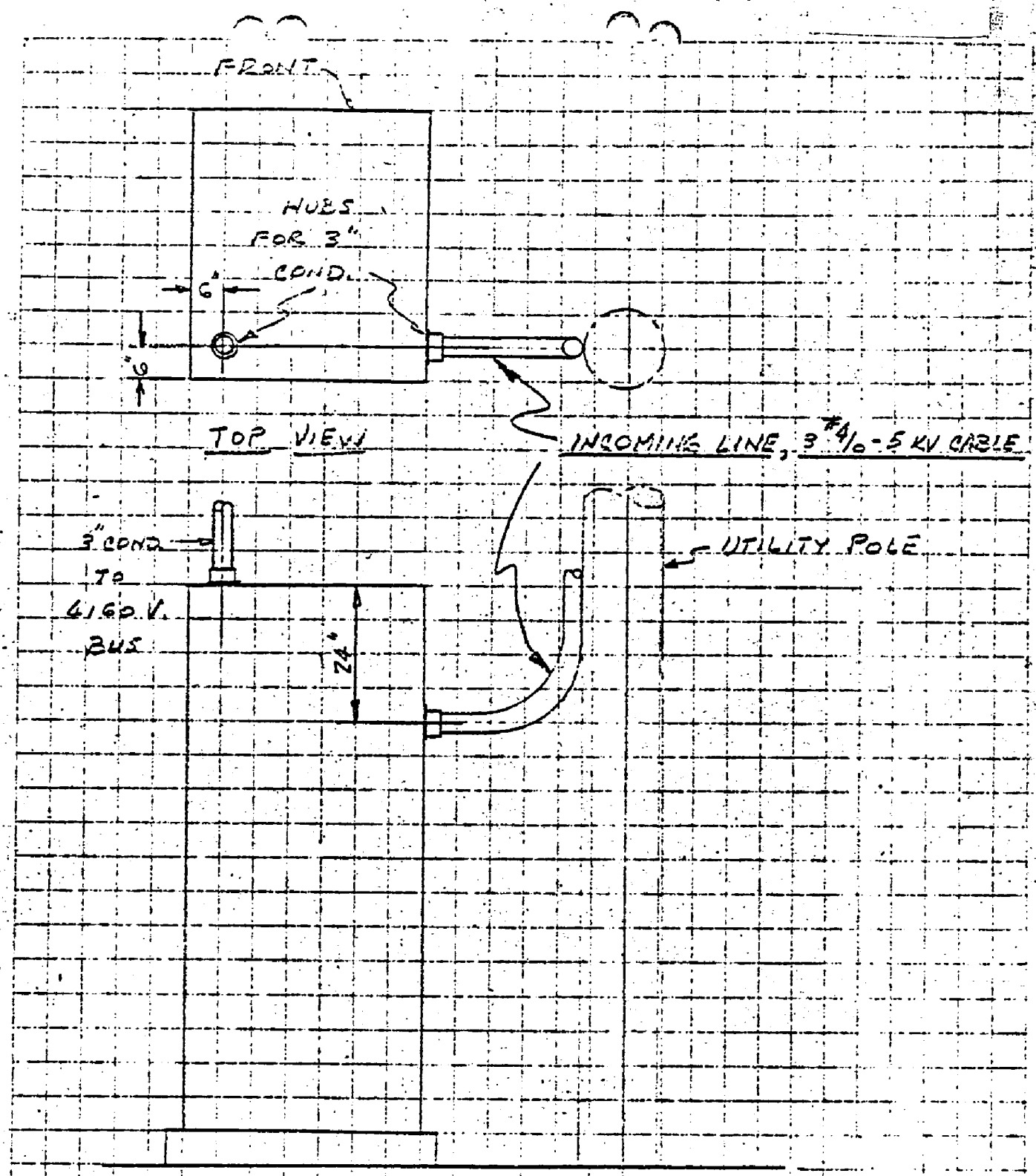
F. Front panel shall contain test terminals and removable test links.

G. Cubicle shall be completely bussed with bus rated a minimum of 600 Amps.

H. Panel shall be provided with two threaded hubs for 3" conduit, one in the top and one in the side, located approximately as shown on the Sketch, page 3. Solderless lugs for #4/0 cable shall be provided for line and load side cables.

I. Panel shall contain a 1/4 x 2" copper ground bus with a lug for connection of a #4/0 ground cable.

J. Before fabrication, provide three (3) sets of Shop Drawings for Utility Company approval



4160 VOLT INCOMING LINE CUBICLE

DS 00029536

PREPARED BY E. CROWE

DATE 7-22-60

PROJECT NO. 605028

SUBJECT NUS-364-2

ENGINEERS INCORPORATED 487 ORANGE STREET, NEWARK 7, N. J. HU 2-7040

PAGE 3 OF 3

MAXUS0998228

VI SPECIFICATIONS

B. Standards

1. Applicable Diamond piping standards were listed opposite each line of the pipe line schedules, DACo. drawings number NF 230-1 through NF 230-11, but are not included in this report. Summary specifications are attached for the MCA and DCP sections.

2. Special Piping Standards

Special piping standards were issued for the ammonia refrigeration section of MCA, and are attached.

3. Painting Specifications

In addition to the attached General Painting Specifications and Shop Coat Painting Specifications, non-insulated pipe lines were taped. The material consisted of a PVC butyl rubber laminate identified as Plicoflex 340-25. The outside laminate consisted of 10 mils of PVC and the inside layer of 15 mils Butyl rubber. A Number 105 Plicoflex Primer was applied to the pipe prior to taping. The taping or wrapping was accomplished by machine prior to installation of the pipe. The pipe ends were left open for welding and later the pipe ends and fittings were painted.

	PROCESS EQUIPMENT and STRUCTURAL STEEL	R (RED)	G (GREEN)	Y (YELLOW)	O (ORANGE)	B (BLUE)	LG (LIGHT GRAY)	MG (MEDIUM GRAY)	BK (BLACK)		
A	<u>All Structural Steel</u> All structural steel, misc. iron, platforms, pipe supports, brackets, poles, etc., except as noted below.							X			
B	<u>All Handrails</u>								X		
C	Poles and other supports next to roadways which might be rammed by a vehicle shall be painted light grey as above, except for first 6 ft. of height which shall have diagonal (or spiral) alternate 2" wide stripes of yellow and black.										
D	<u>Autoclaves</u> (Paint Insulation Only) TCP - R-101 & 102				X						
E	<u>Chlorinators</u> ~~(Paint Insulation Only)~~ MCA - R-410 & 412 DCP - R-609 & 611			X X							
F	<u>All Vessels</u> (Not Insulated)						X				
G	<u>All Insulated Vessels & Equipment</u> (Hot) Metal Insulation						 X				
H	<u>All Insulated Vessels & Equipment (Below 50°F.)</u> Metal (Paint Std. 3-coat system before insulating) Insulation						 X X				
I	<u>All Other Equipment</u> Exchangers, Pumps, Filters, Hoists, Towers, Motors, etc., except Glass Equipment						X				

NOTE: (1) All painting for above to be per Diamond General Painting Specification dated July 29, 1960.

(2) Painting of Insulation to be in accordance with attached addendum to above specification dated 9-8-60.

REV.	DATE	DESCRIPTION	BY	APP'VD.
A	9/2/60	Original Issue		

TITLE: Color Coding Specification Equipment & Steel

PREPARED BY _____ DATE 9/2/60 CLIENT Diamond

APPROVED BY _____ DATE 9-9-60 PROJ. NO. 605028

NFS-978-1

ENGINEERS Incorporated, Newark, N. J.

PAGE 1 OF

DS 00029538

MAXUS0998230

	PIPING SERVICES	RED R	GREEN G	YELLOW Y	ORANGE O	BLUE B	LT. GREY LG	MED GREY MG	BLACK BK				SPECIAL S	NO PAINT U
A	**Fire Water** Hydrants, hose houses, & piping above ground	X												
B	**Foamite** All piping, tanks, equipment, & hydrants & hose carts	X												
C	**All Water Piping** (Above Ground) WW, RW & CW		X											
D	**Water Return Piping**		X											
E	Chlorine*, Hcl, H2SO4 & NaOH			X										
F	**All Solvents**				X									
G	**Air** (Plant & Instrument)		X											
H	**All Process Piping** (Except for above)						X							
I	**All Insulated Piping** (except brine)													X
J	Brine Piping (Galvanize & Paint Std. Spec. before insulating)		X										X	
K	**Electric Conduit** All electric conduit in the Process Bldgs. Bays D&F, 10-11 is to be painted								X					

NOTE: All above piping except J-to be primed with Plicoflex #105 and taped with Plicoflex #340-25 tape.

*All Chlorine piping is to have a black band over the yellow every 10 ft.

REV.	DATE	DESCRIPTION	BY	APPRVD.
A	9/2/60	Original Issue		

TITLE: **Color Coding Specification**

Piping

PREPARED BY [illegible] DATE 9/2/60 CLIENT Diamond

APPROVED BY [illegible] DATE 9-9-60 PROJ. NO. 605028

ENGINEERS Incorporated, Newark, N. J.

DS 00029539

NFS-978-1

PAGE 2 OF 2

Ammonia (Refrigeration)

PIPING SPECIFICATION

PIPING - AMMONIA REFRIGERATION
PRESSURE - 300 PSIG
TEMPERATURE - 300° F

1. CONSTRUCTION

1.1. 1/2" & smaller shall be screwed joints & fittings

1.2 3/4" not used

1.3 1" and larger shall be welded pipe joints and fittings and flanged ammonia valves.

2. PIPE

2.1 1¼" and smaller

2.1.1 Steel (ASTM-A83 certified to ASTM-A106 properties) Grade B seamless tube, I.P.S. Schedule 80, plain end (Material List No. CA2-2)

2.2 2" only

2.2.1 Steel (ASTM-A53) Grade B, seamless pipe, Schedule 80, beveled ends. (Material List No. CA 2-2)

2.3 3" thru 10"

2.3.1 Steel (ASTM-A53 Grade B, seamless, Schedule 40 (Material List No. CA 2-2)

3. VALVES

3.1 Gate Valves - not used

3.2 Globe and Angle Valves

3.2.1 ¾" and smaller - 300 lb. ammonia working pressure, screwed, semi-steel globe or angle valve, plug type disk, union bonnet, inside screw rising stem, all iron or steel construction. Equal to Crane 1504½ (Globe) or Crane 1505½ (Angle)

PREPARED BY [illegible]

DATE [illegible]

PROJECT NO. 605028 DS 00029540

Dwg. No. NPM-231-2

APPROVAL [illegible]

ENGINEERS Incorporated
Newark, N. J.

Ammonia (Refrigeration)

PIPING SPECIFICATION

3. VALVES - continued

3.2.2 1" and larger - 300 lb. ammonia working pressure, semi-steel globe valve, flanged tongue and groove, lead faced loose disk, bolted bonnet, inside screw rising stem, all iron or steel construction. Equal to Crane No. 1501.

3.3 Check Valves

3.31 2" and smaller - 300 lb. ammonia working pressure, semi-steel lift check valve, screwed, piston type disk, bolted bonnet, all iron or steel construction. Equal to Crane 1507½.

3.4 Plug Cock Valves - not used

4. FITTINGS

4.1 1/2" and smaller

4.1.1 3000 lb. forged steel (ASTM-A105) screwed fittings. (Material List No. CA 3-2)

4.2 1", 1½" and 2"

4.2.1 Carbon steel (ASTM-A234) Grade B, seamless, butt-weld fittings (ASA_B 16.9) Schedule 80 (Material List No. CA 3-2)

4.3 3" thru 10"

4.3.1 Carbon steel (ASTM A234) Grade B, seamless, butt-weld fittings (ASA-B 16.9) Schedule 40 (Material List No. CA 3-2)

5. FLANGES

5.1 3" and smaller

5.1.1 300 lb. ammonia working pressure, forged steel (ASTM-A105), tongue and groove, screwed, equal to Crane No. 1547 and 1545. (Rockwell)

PREPARED BY [illegible]

DATE [illegible]

PROJECT NO. 605028

Dwg. No. NFC-231-2

APPROVALS [illegible]

DS 00029541

ENGINEERS Incorporated
Newark, N. J.

Ammonia (Refrigeration)

PIPING SPECIFICATION

5. FLANGES - continued

5.2 4" only

5.2.1 300 lb. ammonia working pressure, malleable iron, tongue and groove, screwed, equal to Crane No. 1547 and 1545

6. UNIONS - Not Used

7. GASKETS

7.1 1/16" thick, lead ring, tongue & groove gaskets to fit standard ammonia tongue and groove flanges.

8. BOLTING

8.1 Alloy steel (ASTM-A193) Grade B7, bolt studs, continuous thread, heat treated, Class 2 Fit
(Material List No. AA 18-6)

9. NUTS

9.1 Steel (ASTM-A194 cold punched, semi-finished, heavy hexagonal nut, Class 2H, Class 2 Fit
(Material List No. AA 18-6)

PREPARED BY [illegible]

DATE 12 July 50

PROJECT NO. 605028

Dwg. No. WFS-231-2

APPROVALS [illegible]

ENGINEERS Incorporated
Newark, N. J.

DCP Unit
Piping Specifications

1.	Phenol	CB15-3.2
2.	Chlorine Gas, Dry	CB7-2.2
3.	H_2SO_4	CB2-3.2
4.	HCL Solution (Muriatic Acid)	CB2-2.5 except use Saran diaphragm valves with Teflon diaphragm
5.	Dichlorophenol	
	a. Recirculating line around chlorinator	CB2-2.5 except use Penton-lined pipe and fittings and 125# glass-lined, semi-steel, diaphragm valves with Teflon diaphragm
	b. Pumpout line	CB15-3.2
6.	Chlorine Gas, Wet HCL Gas, Wet Chlorinator Vents & Off-Gases	CB7-2.3 except use Pyrex for all sizes and 125# glass-lined semi-steel diaphragm valves, Teflon diaphragm. See Note 2.
7.	100 PSIG Steam	CB15-3.2
8.	Condensate	CB9-2.3
9.	Air, Plant & Instrument	CB8-2.2
10.	Water (Cooling, Process & City)	CB16-3.2

Copper tubing per Par. 3.1.2 with solder joint fittings. Finish joints with Plicoflex tape and adhesive primer under tape.

Plicoflex tape - 25 mils thick, laminated, 10 mils pvc and 15 mils black Butyl rubber.
Plicoflex primer - No. 105.

NOTE 1 - All valves at vessel nozzles shall be flanged. For specifications indicating valves other than flanged, a flanged valve of equal rating and material shall be selected.

NOTE 2 - Use Spec CB 15-3.2 for Chlorinator Condenser Line after Separator F2-FG13A & B.

BY: [illegible]

DATE: 9/23/60

PROJECT NO. 605028,

SPECIFICATION NO. NFS-231-3

APPROVALS - [illegible]

ENGINEERS Incorporated, Newark, N. J.

DS 00029543

M C A

PIPE LINE SPECIFICATIONS

1.	ACETIC ACID ACETIC ANHYDRIDE ACETIC MIXTURE	.....CB 12-100.3.4 (Stainless Steel Only)
2.	CHLORINE VAPOR, DRY	CB 7-2.2
3.	CHLORINE VAPOR, MOIST REACTOR VENTS & OFF-GASES HCl VAPOR	.....CB 7-2.3 except use pyrex in all sizes, and valves per item #4.
4.	REACTOR EFFLUENT (PUMPOUT) (*) EXCEPT AFTER SPEC. BREAK, SEE SARAN LINED.	CB 2-2.5 ——— 1" & larger, use Penton lined (*). Valves shall be glass lined semi steel diaphram valves with teflon diaphram, hand wheel operated, F.F. ends. Piping less than 1" shall not be used.
5.	80% M C A SOLUTION	CB 2-2.5 (valves per item 4)
6.	HCl LIQUID (MURIATIC ACID)	CB 2-2.5
7.	NaOH (SODIUM HYDROXIDE)	CB 6-2.3
8.	H_2SO_4 (SULFURIC ACID)	CB 2-3.2
9A.	AMMONIA-REFRIGERATION	SPECIAL SPEC. SEE PAGE 3.
9B.	BRINE-REFRIGERATION	CB 4-2.2 (Except all pipe and fitting to be galvanized)

PREPARED BY A. CARTER PROJECT NO. 605028

DATE SEPTEMBER 1960 Dwg. No. NFS-231-2 DS 00029544

ENGINEERS Incorporated
Newark, N.J.

APPROVALS

M C A

PIPE LINE SPECIFICATIONS

M C A (Continued)

10. 100# STEAM CB 15-3.2

11. CONDENSATE CB 9-2.3

12. AIR CB 8-2.2

13. WATER (Cooling, Process & City Water) CB 16-3.2

Copper tubing per Par. 3.1.2 with solder joint fittings. Finish joints with Plicoflex tape and adhesive primer under tape.

Plicoflex tape - 25 mils thick, laminated, 10 mils pvc and 15 mils black Butyl rubber.
Plicoflex primer - No. 105.

NOTE: - All valves at vessel nozzles shall be flanged. For specifications indicating valves other than flanged, a flanged valve of equal rating and material shall be selected.

PREPARED BY A. CARTER PROJECT NO. 605028

DATE 19 July 1960 DWG. NO. NFS-231-2

ENGINEERS Incorporated
Newark, New Jersey

APPROVALS-

GENERAL PAINTING SPECIFICATIONS

NEWARK PLANT REHABILITATION

DIAMOND ALKALI COMPANY

APPROPRIATION 03-00-6774

JULY 29, 1960

PREPARED BY: S. W. McIlrath

APPROVED BY: J. R. Siemoneit

DS 00029546

I. Work Specified

This specification covers the surface preparation and application of protective coatings to galvanized structural steel, piping, and equipment for corrosion protection.

II. Materials Specified

Nu-Pon Cote #5964 Primer
Nu-Pon Cote #5965 Converter

Nu-Pon Cote #69995 High Build Gray
Nu-Pon Cote #69996 High Build Converter

Nu-Pon Cote Type III #6529 Lt. Gray
Nu-Pon Cote Type III #6530 Converter.

Supplier: The Glidden Company
Cleveland, Ohio

III. Surface Preparation

A. Field Painting at Site

1. Galvanized Metal

All galvanized metal to be painted shall be free from soil, chemicals and grease. Degreasing shall be in accordance with Diamond Standard DE 4-2.8, "Solvent Cleaning." Welded galvanized metal shall have the weld area sandblasted before painting.

2. Unpainted Metal

All unpainted metal to be painted shall be sandblasted in accordance with Diamond Standard DE 4-2.5, "Commercial Blast Cleaning."

3. Shop Primed Metal

All shop primed or previously painted surfaces shall be clean and dry before painting. Abraded areas shall be cleaned to bare metal and spot primed with the specified primer.

IV. Coating Application

The steel or galvanized surface shall be clean and dry. Surfaces prepared by sandblasting shall have all dust blown of wiped off the surface before priming. Galvanized surfaces

shall be completely free of grease.

All coating shall be in accordance with the manufacturer's instructions and Diamond Standards DB 2-2.6 and DB 5-2.1.

V. Coating Systems

1. Galvanized Metal -- System BGS-131

Surface Preparation	-- Solvent Degreasing.
Surface Treatment	-- None
Primer	-- 1 mil Nu-Pon Cote #5964 plus converter
Intermate Coat	-- 3 mils Nu-Pon Cote #69995 plus converter
Finish Coat	-- 1 mil Nu-Pon Cote #6529 plus converter

2. Old or New Unpainted Metal -- System BWX-131

Surface Preparation	-- Commercial Sandblast
Surface Treatment	-- None
Primer	-- 1 mil Nu-Pon Cote #5964 plus converter
Intermate Coat	-- 3 mils Nu-Pon Cote #69995 plus converter
Finish Coat	-- 1 mil Nu-Pon Cote #6529 plus converter

3. Shop Primed Equipment -- System BHX-031

Surface Preparation	-- Hand clean to remove soil. Wire brush abraded areas to clean metal.
Surface Treatment	-- None
Primer	-- Spot Primer only with Nu-Pon Cote #5964 plus converter
Intermate Coat	-- 3 mils Nu-Pon Coat #69995 plus converter
Finish Coat	-- 1 mil Nu-Pon Cote #6529 plus converter.

SHOP COAT PAINTING SPECIFICATIONS

NEWARK PLANT REHABILITATION

Appropriation 03-00-6774

June 17, 1960

Prepared by: S.W. McIlrath

Approved by: J.R. Siemoneit

I. Work Specified

This specification covers the surface preparation and application of a shop coat primer to process equipment by the fabricator.

II. Material Specified

Nu-Pon Cote #5964 Primer
Nu-Pon Cote #5965 Converter

Supplier:
The Glidden Company
Cleveland, Ohio

III. Surface Preparation

All exterior metal shall be sandblasted in accordance with Diamond Standard DE 4-2.5, "Commercial Blast Cleaning."

IV. Coating Application

Steel surfaces shall be clean, dry and free of oil or grease. All dust from sandblasting shall be removed from the surfaces to be painted by vacuuming, blowing, or wiping.

The primer shall be applied in accordance with the manufacturer's instructions and Diamond Standards DE 2-2.6 and DE 5-2.1 in one or more coats to a minimum dried film thickness of .002 inches (2 mils).

V. Coating System

1. Shop Primed Equipment - System ECX-200

Surface Preparation	- Commercial Sandblast.
Surface Treatment	- None.
Primer	- 2 mils Nu-Pon Cote 5964 plus converter.
Intermediate Coat	- To be applied at site.
Finish Coat	- To be applied at site.

VII. EQUIPMENT AND MATERIAL

ITEM NO.	DESCRIPTION	SPEC. NO.	REF. DWGS.	REQUISITION NO.	REQUISITION DATE	PUR. ORDER NO.	PUR. ORDER DATE	VENDOR	REMARKS (E) EXISTING
F2-D501	HCL ABSORBER			EG-3311 1	7-14-60	G65592	8-4-60	NAT'L CARBON CO.	31-A
F2-D502	[illegible]			EG-3311 2	7-14-60	G65592	8-4-60	do	STD.
F2-D503	TAILS TOWER			EG-3311 3	7-14-60	G65592	8-4-60	do	
F2-H504	MIST ELIMINATOR			—					(E) 4"ø x 18"L KARBATE
F2-T505	CL_2 ABSORBER TOWER			—					(E) PYREX CA 6"ø x 5' O.A.
F2-T506	CAUSTIC TANK	NFS-221-9		EG-3311	9-23-60	N1468	10-27-60		500 GAL. - SARALOY LINED
F2-P507	RECYCLING PUMP CAUSTIC	NFS-258-29		—					(E) DURIRON 1"
F2-MP507	PUMP MOTOR	NFS-258-29		—					(E) 1 HP
F2-T508	DRYING TOWER			—					(E) PORCELAIN 12" I.D. x 9'-0" O.A.
F2-T509	H_2SO_4 TANK			—					(E) 500 GAL. - STEEL - 3/8"
F2-P510	H_2SO_4 PUMP RECYCLE	NFS-258-30		—					(E) DURIRON - 1" LIQUICHLOR
F2-MP510	PUMP MOTOR	NFS-258-30		—					(E) 1 HP
F2-T511	HCL RECEIVER			—					(E) 2500 GAL. - RUBER LINED 6'ø x 13'-0" HORIZ.
F2-H512	AMMONIA CONDENSER	INSTALLED BUT NOT PIPED		—					(E) 12"ø x 20' O.A.
F2-D513	OIL SEPARATOR			—					(E)
F2-P514 F2-MP514	AMMONIA COMPRESSOR COMPRESSOR MOTOR			—					(E) 7 x 7 VRE. 50 HP
F2-H515	AMMONIA CONDENSER			—					(E) 24" x 20' O.A.
F2-T516	AMMONIA RECEIVER			—					(E) 20"ø x 16' O.A.
F2-E517	EVAPORATOR			—					(E) 24"ø x 21'-6" O.A.
F2-T518	BRINE TANK			—					(E) 3000 GAL. 6'ø x 15' FLAT BOT.
F2-P519	BRINE CYCLING PUMP	NFS-258-28		—					(E)
F2-MP519	PUMP MOTOR	NFS-258-28		—					(E)
F2-P520	BRINE SYSTEM PUMP	NFS-258-23		—					(E) WORTHINGTON 1½ CF
F2-MP520	PUMP MOTOR	NFS-258-23		—					(E) 1 HP
F2-P521 F2-MP521	AIR COMPRESSOR COMPRESSOR MOTOR			—					(E) WORTHINGTON 7 x 7 20 HP
F2-T522	AIR RECEIVER			—					(E) 30"ø x 8'-1" O.A.
F2-T523	HCL WATER FEED TANK	NFS-221-6		—				FIELD TO ADD NOZZ.	55 GAL. DRUM PAINT INSIDE AND OUT
F2-P524 F2-MP524	AIR COMPRESSOR COMPRESSOR MOTOR			—				7½ x 5	(E) CHICAGO PNEUMATIC 20 HP
F2-P525	HCL WATER FEED PUMP	NFS-258-22		—					(E) WORTHINGTON 1½ CF
F2-MP525	HCL WATER FEED PUMP MOTOR	NFS-258-22		—					(E) 1 HP
F2-H526	AIR COMPRESSOR AFTER COOLER			—					(E) FOR COMP. P-521
F2-H527	AIR COMPRESSOR AFTER COOLER			—					(E) FOR COMP. P-524
F2-D528	DILUTION WATER DROP TANK	NFS-221-7		EG-3341	8-23-60	N1435	10-3-60		300 GAL. 36"ø x 6'-0"
F2-T529	BRINE MAKE-UP TANK	NFS-221-8		EG-3341	8-23-60	N1435	10-3-60		(NEW) 200 GAL. 4'ø x 2'-3" HIGH
F2-D530	SURGE DRUM			—					(E) 20" x 11' O.A.

DWG.	DATE	APPRO. NO.
A	7-20-60	3
B	8/11/60	2

APPROVED FOR CONST. C. M. Weinacht DATE 9-28-60

DRAWN LHC DATE 7-26-60

CHECKED [illegible] DATE 7-20-60

ASSOCIATE ENGINEERS
ENGINEERS Incorporated
NEWARK, NEW JERSEY

APPROVED [illegible] DATE

CONTRACT 65028

PLANT NEWARK DIV.

UNIT

EQUIPMENT LIST

DIAMOND ALKALI COMPANY
CENTRAL ENGINEERING DEPARTMENT

NF-201-5 DS 00029552

SHEET 2 OF 2

B

MAXUS0998244

ITEM NO.	DESCRIPTION	SPEC. NO.	REP. DWGS.	REQUISITION NO.	REQUISITION DATE	PUR. ORDER NO.	PUR. ORDER DATE	VENDOR	REMARKS (E) EXISTING
F2-P401	ACETIC ANHYDRIDE UNLOADING PUMP		(NOT REQUIRED-	PUMP IN TRUCK)					~~MONTITE 2 CG.~~
~~F2-MP401~~	~~PUMP MOTOR~~		(NOT	REQUIRED)					~~2 HP~~
F2-T402	VIRGIN ACETIC ANHYDRIDE STORAGE TANK			—				HORIZ. 8' DIA x 16'	(E) 6000 GAL. - ALUMINUM
F2-T403	ACETIC ACID STORAGE TANK	NFS-221-5		EG-3332	8-8-60	G66242	8-16-60	PFAUDLER P.I. 10,000 GAL.	-10' O.D. x 19'-4" O.A. GLASS LINED
F2-H404	TANK HEATER			—					(E) TANTALUM 2" x 5'-0"
F2-P405	ACETIC TRANSFER PUMP	NFS-258-18		—					(E) MONTITE 1½ CG.
F2-MP405	PUMP MOTOR	NFS-258-18		—					(E) 2 HP
F2-T406	ACETIC MIX TANK			—				HORIZ. 10'DIA x 20'-6"	(E) 12,500 GAL. - GLASS LINED-PFAUDLER
F2-H407	TANK HEATER			—					(E) TANTALUM 2" x 5'-0"
F2-P408	ACETIC MIX FEED PUMP	NFS-258-19		—					(E) MONTITE 1½ CG
F2-MP408	PUMP MOTOR	NFS-258-19		—					(E) 2 HP
F2-T409	ACETIC MIX DROP TANK			—				4'CD x 7'-6"	(E) 700 GAL. - RUBBER LINED
F2-R410	CHLORINATOR REACTOR 8900#			—				5'DIA. x 9'-2½" O.A.	(E) 1000 GAL. - GLASS LINED - PFAUDLER
F2-P411	REACTOR PUMP	NFS-258-26		—					(E) KARBATE - CA 7½
F2-MP411	PUMP MOTOR	NFS-258-26		—					(E) 5 HP
F2-R412	CHLORINATOR REACTOR 8900#			—				5'DIA. x 9'-2½" O.A.	(E) 1000 GAL. - GLASS LINED - PFAUDLER
F2-P413	REACTOR PUMP			—					(E) KARBATE - CA 7½
F2-MP413	PUMP MOTOR			—					(E) 5 HP
F2-T414	80% MCA SOLUTION STORAGE TANK			—				10'I.D. x 13'-0"	(E) 7000 GAL. - BRICK LINED
F2-H415	TANK HEATER			—					(E) TANTALUM 2" x 5'-0"
F2-H416-D	CHLORINATOR CONDENSERS			—					(E) KARBATE
F2-H416-H	CHLORINATOR CONDENSERS			EG-3336	8-2-60	G66941	8-31-60		PYREX
F2-H417	TANK HEATER 80% MCA (F2-T419)			EG-3335	8-2-60	G66241	8-16-60		- TANTALUM
F2-P418	80% MCA PUMP	NFS-258-27		—					(E) KARBATE
F2-MP418	PUMP MOTOR	NFS-258-27		—					(E) 1 HP
F2-T419	80% MCA SOLUTION STORAGE TANK	NFS-221-4		EG-3324	7-19-60	G64969	8-2-60	8'-6"x11'-0"SS PFAUDLER 11'-7" O.A.	- 5000 GAL. - GLASS LINED
F2-H420	DEMISTER			—					(E) KARBATE 4"
F2-H421	DEMISTER			—					(E) KARBATE 4"
F2-T422	WOOD TANK MCA CHLORINATOR HIGH TANK			—					(E) 500 GAL. CYPRESS 5'½ x 5'
F2-T423	AIR RECEIVER			—					(E) 36"¢ X 9'-9" O.A.
F2-E424	CHLORINE VAPORIZER	NFS-221-4		EG-3340	8-16-60	G60825	10-10-60		
F2-P425	WATER PUMP MCA CHLORINATOR								(E)
F2-MP425	PUMP MOTOR								(E)

DWG.	DATE	APPRO. NO.
A	9/20/60	MS
B	11/4/60	3

APPROVED FOR CONST. [signature] DATE 9-28-60

DRAWN AHC DATE 7-6-60

CHECKED [signature] DATE 9-20-60

ASSOCIATE ENGINEERS
ENGINEERS Incorporated
NEWARK, NEW JERSEY

APPROVED [signature] DATE 9-20-60

CONTRACT 405028

PLANT NEWARK DIV.

MCA UNIT

EQUIPMENT LIST

DIAMOND ALKALI COMPANY
CENTRAL ENGINEERING DEPARTMENT

NF-201-4

DS 00029553

H

MAXUS0998245

ITEM NO.	DESCRIPTION	SPEC. NO.	REF. DWGS.	REQUISITION NO.	REQUISITION DATE	PUR. ORDER NO.	PUR. ORDER DATE	VENDOR	REMARKS (E) EXISTING
F2-P601	PHENOL UNLOADING PUMP	NFS-258-24						WORTHINGTON	(E) STEEL-TRACED - 2 CF
F2-MP601	PUMP MOTOR	NFS-258-24							(E) 5 HP
F2-T602	PHENOL STORAGE TANK	—	EXIST. #6-10					8'-6"Ø x 26'-6"	(E) 10,000 GAL. - STEEL-INSULTD.
F2-H603	TANK HEATER (PHENOL) F2-T602	—							(E) BAYONET
F2-P604	PHENOL TRANSFER PUMP	NFS-258-20							(E) STEEL - TRACED 1½ CF
F2-MP604	PUMP MOTOR	NFS-258-20							(E) 2 HP
F2-T605	INTERMEDIATE PHENOL STORAGE TANK	—						6'DIA x 23'-10"	(E) 4300 GAL. - EX. POLYCH. & STEEL
F2-H606	TANK HEATER (PHENOL) F2-T605	—							(E) STEEL
F2-P607	PHENOL FEED PUMP	NFS-258-32							(E) STEEL 1 CF
F2-MP607	PUMP MOTOR	NFS-258-32							(E) 1½ HP
F2-T608	PHENOL DROP TANK	—						DISH. HD.	(E) 1000 GAL. - STEEL 4'Ø x 10'-0"
F2-H609	CHLORINATOR	—							(E) 1000 GAL. - GLASS LINED R66 PFAUDLER
F2-P610	CHLORINATOR PUMP	NFS-258-33							(E) ENG WORTHITE
F2-MP610	PUMP MOTOR	NFS-258-33							(E) 5 HP
F2-H611	CHLORINATOR	—							(E) 1000 GAL. GLASS LINED R66 PFAUDLER
F2-P612	CHLORINATOR PUMP	NFS-258-33		EG-3370	10/26/60	G-70382	11-3-60		WORTHITE
F2-MT612	PUMP MOTOR	NFS-258-33							(E) 2 HP XP NEMA 224
F2-F613A&B	SEPRATOR (2)	NFS-255-5							12"Ø x 2'-9" STL. CYCLONE (TO BE FABRICATED LOCALLY)
F2-DG26	MIST ELIMINATOR	—							(E) 4"Ø x 28" c KARBATE
F2-E627	Cl_2 CAR BLEED-DOWN VAPORIZER	—							(E) 6"Ø x 3' WITH OUTLET PIPER, VALVES & INSTR.
F2-H614	CHLORINATOR EXCHANGERS A, B, C, D	—						6"IN-2"OUT - 5' LONG	(E) TOT. (25 SQ. FT.) FINED TUBE SHELL
F2-T615	H_2SO_4 STRIPPER	NFS-255-4							14"Ø x 12' PACKED STL. COL. WITH R.O. POT
F2-P616	STRIPPER PUMP	NFS-258-34						WORTHINGTON	(E) 1½ CF.
F2-MP616	PUMP MOTOR	NFS-258-34							(E) 1½ HP
F2-T617	H_2SO_4 TANK	—							(E) REVISED BY PLANT
F2-D618	HCL ABSORBER	—		EG-3311	7-14-60	G-65592	8-4-60	NATIONAL CARBON	KARBATE - SIMILAR TO MGA
F2-D619	HCL ABSORBER	—		EG-3311	7-14-60	do	do	do	do
F2-D620	ABSORBER TAIL TOWER	—		EG-3311	7-14-60	do	do	do	do
F2-T621	HCL RECEIVER	—						6'6x6'	(E) 1200 GAL. - RUBBER LINED
F2-P622	HCL RECEIVER TRANSFER PUMP	NFS-258-31							(E) KARBATE 3 CF
F2-MP622	PUMP MOTOR	NFS-258-31							(E) KARBATE 3 HP
F2-D623	HCL VENT SCRUBBER	—		NOT REQUIRED		PER F. KENNEDY			
F2-P624A&B	CHLORINE JET (2)	—		EG-3371	9-14-60	668825	10-10-60	S. & K.	S&K. FIG. 489, SIZE 3, 3"x1½"
F2-P625	HCL WATER FEED PUMP	NFS-258-22							(E) WORTHINGTON 1½ CF
F2-MP625	PUMP MOTOR	NFS-258-22							(E) 1 HP

DWG.	DATE	APPRO. NO.
A	8/20/60	
B	11/1/60	3

APPROVED FOR CONST. [signature] DATE 10-14-60

DRAWN [illegible] DATE 7-26-60

CHECKED [illegible] DATE 9-20-60

ASSOCIATE ENGINEERS
ENGINEERS Incorporated
NEWARK, NEW JERSEY

APPROVED [illegible]
DATE 9-20-60

CONTRACT 605028

PLANT NEWARK DIV.

DGP UNIT

EQUIPMENT LIST

DIAMOND ALKALI COMPANY
CENTRAL ENGINEERING DEPARTMENT

MF-201-6 DS 00029554

SHEET 1 OF 1

MAXUS0998246

ITEM NO.	DESCRIPTION	SPEC. NO.	REF. DWGS.	REQUISITION NO.	REQUISITION DATE	PUR. ORDER NO.	PUR. ORDER DATE	VENDOR	REMARKS
F2-P701	B.F.P. TRANSFER PUMP	NFS-258-12						(E)	
F2-MP701	B.F.P. PUMP MOTOR	NFS-258-12						(E)	3 HP
F2-P702	ETHYL HEXANOL TRANSFER PUMP	NFS-258-13						(E)	30 GPM
F2-MP702	ETHYL HEXANOL PUMP MOTOR	NFS-258-13						(E)	2 HP
F2-P703	40% DIMETHYLAMINE TRANSFER PUMP	NFS-258-14						(E)	40 GPM 1½ CF
F2-MP703	40% DIMETHYLAMINE PUMP MOTOR	NFS-258-14						(E)	2 HP
F2-P704	ALCOHOL TRANSFER PUMP	NFS-258-15						(E)	5 GPM CHEMPUMP
F2-MP704	ALCOHOL PUMP MOTOR TRANSFER	NFS-258-15						(E)	1½ HP
F2-P705	KEROSENE TRANSFER PUMP	NFS-258-17						(E)	100 GPM
F2-MP705	KEROSENE PUMP MOTOR TRANSFER	NFS-258-17						(E)	5 HP
F2-T706	40% DIMETHYLAMINE STORAGE		EXIST. #106					(E)	7' DIA x 34' HORIZ. 10,000 GAL.
F2-T707	KEROSENE STORAGE		EXIST. #101					(E)	8' DIA. x 30' HORIZ. 12,000 GAL.
F2-T708	BUTYL & ISOPROPY ALCOHOL STORAGE Tank		EXIST. #102					(E)	10' DIA. x 34' - 20,000 GAL. - 2 COMPARTMENT TANK 10,000 GAL. EACH (A) BUTYL (B) ISOPROPYL
F2-P709	ALCOHOL TRANSFER PUMP	NFS-258-16						(E)	40 GPM
F2-MP709	ALCOHOL PUMP MOTOR TRANSFER	NFS-258-16						(E)	2 HP
F2-T710	B.I.P. STORAGE	EXIST.						EXIST. #030 (E)	9'-3" DIA. x 15'-7" VERT. 7800 GAL.
F2-T711	ETHYL HEXANOL STORAGE		EXIST. #105					(E)	7' DIA. x 34' HORIZ. 10,000 GAL.
F2-F712A&B	FOAMITE PROPORTIONERS (2)								
F2-T713	FOAMITE AIRFOAM LIQUID STORAGE TANK								Plant checking for Existing Equip 10-24
F2-K714	INSTRUMENT AIR DRYER & FILTER			EQ-3330	7-22-60	G66513	8-23-60	LECTRODRYER	
F2-J715	440V MOTOR CONTROL CENTER	NFS-264-1		EQ-3307	6-28-60	G64617	7-18-60	WESTINGHOUSE	
F2-J716	OUTDOOR 440V ELECTR. SWITCH BOARD	NUS-364-1		EQ-3327	6-29-60	G64617	7-18-60	do	
F2-J717	OUTDOOR 440V CIRCUIT BREAKER	NUS-364-2		EQ-3330	7-22-60	G65655	8-15-60	do	
F2-F718	EXHAUST FAN								
F2-MF718	EXHAUST FAN MOTOR								
F2-F719	EXHAUST FAN								
F2-MF719	EXHAUST FAN MOTOR								
F2-F720	EXHAUST FAN								
F2-MF720	EXHAUST FAN MOTOR			To be Furnished by General Contractor					
F2-F721	ELECTRIC DIST. ROOM FAN								
F2-MF721	ELECTRIC DIST. ROOM FAN MOTOR								
F2-F722	ELECTRICAL DIST. ROOM FAN								
F2-MF722	ELECTRICAL DIST. ROOM FAN MOTOR								
F2-P723									
F2-MP723	DEEP WELL PUMP AND MOTOR							(E)	Fairbanks - Morse
F2-P724A,B,&C	UNIT HEATERS AND MOTORS			To be Furnished by General Contractor					3-ILG Co. CAT. NO. 25F6 With 2H.P. 1140 RPM STEAM UNIT HEATERS EXP. PR.

DWG.	DATE	APPRO. NO.
A	6-20-60	
B	11/11/60	

APPROVED FOR CONST. [signature] DATE 8-1-60

DRAWN ABC DATE 6-17-60

CHECKED HT DATE 7-6-60

ASSOCIATE ENGINEERS
ENGINEERS Incorporated
Newark, New Jersey

APPROVED [signature] DATE 7-26-60

CONTRACT 605028

PLANT NEWARK DIV.

MISCELLANEOUS

EQUIPMENT LIST

DIAMOND ALKALI COMPANY
CENTRAL ENGINEERING DEPARTMENT

NF 201-7
SH. 1 OF 1

DS 00029555

B

MAXUS0998247

ITEM Nº	SYMBOL	DESCRIPTION	SERVICE	LOCATION	MANUFACTURER AND/OR VENDOR
PCU-801	LI	LEVEL INDICATOR	ACETIC ANHYDRIDE	PE-T402	Permanenting Corp.
802	TI TW	TEMP. INDICATOR THERMOWELL	HCl	PE-E-20 & PANEL	Jar Mfg. & Eng. Co.
803	PI	PRESS. INDICATOR	ACETIC ANHYDRIDE	PE-E-14	Lennox Instrument Co.
804	TI	TEMP. INDICATOR	ACETIC ACID	PE-T403	Jar Mfg. & Eng. Co.
806	TCV TW	TEMP. CONTROL VALVE THERMOWELL	STEAM ACETIC ACID	PE-E-08 (PE-T401) PE-T401	Leslie
808	TCV TW	TEMP. CONTROL VALVE	STEAM	PE-E-66 (PE-T-401)	Leslie
807	FG	FLOW GLASS	ACETIC ACID	PE-T402	Leslie
808	LG	GAUGE GLASS	ACETIC ANH.	PE-T402	Brooks Inst. Co.
809	PI TI	PRESS. INDICATOR TEMP. INDICATOR	HCl MAKE	PE-E-07	Jerguson
810	TI TW	THERMOWELL	HCl MAKE	PE-E-21	Jar Mfg. & Eng. Co.
811	TRC	TEMP. RECORDER CONTROLLER	INST. AIR	PE-E-20 (PANEL)	Jar Mfg. & Eng. Co.
	VTRC	DIAPHRAGM CONTROL VA.		PE-E-21	Foxboro
812	PI	PRESS. INDICATOR	STEAM	PE-E-17 (PE-E-10)	American Gauge
813	LI	LEVEL INDICATOR	ACETIC ANH.	PE-T406	Lennox Instrument Co.
814	TI	TEMP. INDICATOR			Permanenting Corp.
815	PCV	PRESSURE CONTROL VALVE	STEAM	PE-E-03	Jar Mfg. & Eng. Co.
816	PI	PRESSURE INDICATOR		PE-E-03	Leslie
817	PI	PRESS. INDICATOR	HCl & Cl₂	PE-E-12 (PANEL)	Lennox Instrument Co.
818	TRC	TEMP. RECORDER CONTROLLER	INST. AIR	PANEL (PE-E-02)	Foxboro
	VTRC	CONTROL VA.	BRINE	PE-E-12	
820	PI TI	PRESS. INDICATOR THERMOWELL	HCl	PE-E-12 & PANEL	American Gauge
821	FRC	FLOW RECORDER CONTROLLER		PANEL	Jar Mfg. & Eng. Co.
	VFRC	CONTROL VA.	Cl₂	PE-E-12	Foxboro
	FE	ORIFICE FLANGES	Cl₂		American Gauge
	FO	ORIFICE PLATE			Brooks
	FT	FLOW TRANSMITTER			Foxboro
	PCV	COMB. FILTER & REGULATOR	INST. AIR	PCU-821-FT	Foxboro
822	FCV	CHECK VALVE	WATER	PE-E-10	Jar Instrument
824	PI	PRESS. INDICATOR	MCA	PE-P411	Lennox Instrument Co.
825	FG	FLOW GLASS	MCA	PE-P411	Brooks Instr. Co.
826	FRC	FLOW RECORDER CONTROLLER		PANEL	Foxboro
	VFRC	CONTROL VA.	Cl₂	PE-E-12	Foxboro
	FE	ORIFICE FLANGES	Cl₂		American Gauge
	FO	ORIFICE PLATE			American Gauge
	FT	FLOW TRANSMITTER			Foxboro
	PCV	COMB. FILTER & REGULATOR	INST. AIR	PCU-826-FT	Foxboro
827	FI	FLOW INDICATOR (ROTAMETER)	WATER	PE-E-08	American Gauge
828	LCV	FLOW CONTROL VALVE		PE-E-12	Jar Mfg.
829	TRC	TEMP. RECORDER CONTROLLER	INST. AIR	PE-E-02 (PANEL)	Foxboro
	VTRC	CONTROL VA.	STEAM	PE-E-02	
830	PI	PRESS. INDICATOR	STEAM	PE-E-20	Lennox Instrument Co.
832	PSD	RUPTURE DISC	MCA	PE-R402	Continental Disc
833	PI	PRESS. INDICATOR	HCl & Cl₂	PE-E-02 (PANEL)	Lennox Instrument Co.
834	TI	THERMOWELL	HCl VAPOR	PE-E-08	Jar Mfg. & Eng. Co.
836	TRC	TEMP. RECORDER CONTROLLER	INST. AIR	PANEL (PE-E-02)	Foxboro
	VTRC	CONTROL VA.	BRINE	PE-E-08	American Gauge
837	CV	CHECK VALVE	WATER	PE-R401	Jar Instrument Co.
838	PI	PRESS. INDICATOR	MCA	PE-P402	Lennox Instrument Co.
839	FG	FLOW GLASS	MCA	PE-E-02	Brooks Instr. Co.
840	LI	LEVEL INDICATOR	MCA	PE-T402 & PANEL	
841	TI	THERMOWELL	HCl	PE-E-02 & PANEL	Jar Mfg. & Eng. Co.
842	LI	LEVEL INDICATOR	ACETIC ACID	PE-T402	Permanenting Corp.
843	PSD	RUPTURE DISC	MCA	PE-R402	Continental Disc
844	TCV TW	TEMP. CONTROL VALVE THERMOWELL	STEAM MCA	PE-T410 (PE-E-10)	Leslie
846	TCV TW	TEMP. CONTROL VALVE THERMOWELL	STEAM MCA	PE-T412 (PE-E-10)	Leslie
847	PI	PRESS. INDICATOR	STEAM	PE-E-13 (PE-P410)	Lennox Instrument Co.
848	PI			PE-E-11 (PE-T412)	
849	PI		MCA	PE-E-16 (P-410)	
850	PI		HCl	PE-E-22 (P-410)	
851	PC	PRESS. CONTROLLER	HCl	PANEL (PE-E-22)	American Gauge
	VPC	CONTROL VALVE	HCl	PE-E-22	
852	LCV	LEVEL CONTROL VALVE	C.T.T. WATER	PE-T423 (P-410)	
853	PI	PRESS. INDICATOR		PE-E-26 (P-420)	Fisher Governor
854	FI	FLOW INDICATOR (ROTAMETER)		PE-E-26 (P-420)	Lennox Instrument Co.

REVISION DESCRIPTION

INSTRUMENT LIST

DS 00029556

REFERENCE DRAWINGS

ASSOCIATE ENGINEERING

ENGINEERS INCORPORATED
NEWARK, NEW JERSEY

DRAWING NO
PP-71

NF201-1

C

ITEM No	SYMBOL	DESCRIPTION	SERVICE	LOCATION
901	TRC	Temp Recording Controller	Dry Air	Panel (D-501)
	VTRC	" Control Valve	Water	"
902	TI	Temp Indicator	WC	P2-6-31
903	[illegible]	[illegible]	H2 Off	P2-6-32
904	PI	Press. Indicator	"	P2-6-33 (A-507)
905	PI	" "	H2 [illegible]	P2-7-01 (A-508)
906	LG	Gauge Glass	"	P2-T509
907	TI	Temp. Indicator	Water	P2-[illegible]
908	TI	" "	"	"
909	PSV	Relief Valve	Ammonia	P2-D510
911	LG	Gauge Glass	Ammonia	P2-T516
912	PI	Press. Indicator	"	P2-7-15
913	PS	Press. Switch	"	P2-7-16
914	PSV	Relief Valve	"	P2-T516
915	PI	Press. Indicator	"	"
916	PI	~~Press. Indicator~~		~~P2-[illegible]~~
917	PS	Press. Switch	"	"
918	PI	Press. Indicator	"	P2-T52[illegible]
919	TI	Temp. Indicator	Brine	P2-7-28
920	PSV	Relief Valve	"	P2-7-26
921	PI	Press. Indicator	"	P2-7-30 ([illegible])
922	PC	" "	"	P2-5-12 ([illegible])
923	TC	Temp. Indicator	"	P2-7-29 ([illegible])
924	PCV	Flow Control Valve	Cl2	P2-8-17
925	PS	Press. Switch	Cl2	P2-8-17
926	PI	Press. Indicator	Water	P2-T713 ([illegible])
927	PI	" "	"	"
928	PI	" "	"	"
929	PI	" "	"	"
930	PI	" "	City Water	[illegible]
931	PC	" "	Acetic Acid	P2-6-18 ([illegible])
932	PC	" "	Steam	P2-5-46 ([illegible])
933	PC	" "	"	P2-5-46 ([illegible])
934	PCV	Press. Reducing Valve	Water	P2-6-46
935	PI	Press. Indicator	Steam	P2-6-08
936	LI	Level Indicator	Phenol	P2 T603
937	PSD	Emergency Vent	"	P2 T60[illegible]
938	PSD	" "	[illegible] (Acc)	P2-T710
939	LI	Level Indicator	" "	P2-T710
940	PSD	Emergency Vent	[illegible]	P2-T707
941	FA	Flame Arrester	"	P2-T717
942	LI	Level Indicator	"	P2-T712
943	PSD	Emergency Vent	[illegible]	P2-T711
944	FA	Flame Arrester	"	P2-T711
945	PSD	Emergency Vent	[illegible]	P2-T706
946	FA	Flame Arrester	"	P2-T706
947	LI	Level Indicator	"	P2-T706
948	FA	Flame Arrester	[illegible]	P2-T708 B
949	LI	Level Indicator	[illegible]	P2-T708 A&B
950	FA	Flame Arrester	[illegible]	P2-T708 A
951	PSD	Emergency Vent	[illegible] -	P2-T708 B
952	PSD	" "	[illegible] "	P2-T708 A
953	PCV	Flow Control Valve	Cl2 (liquid)	P2-8-15
954	[illegible]	[illegible] Tank	Steam	P2-8-18
955	PI	Press. Indicator	Steam	"
956	PSV	Relief Valve	Steam	"
957	~~[illegible]~~	~~[illegible]~~	Air	~~[illegible]~~
958	PI	Press. Indicator	Cl2	P2-8-16 ([illegible])
959	PI	" "	Cl2	P2-8-17
960	PI	" "	Cl2	P2-8-17
961	PC	" "	Air	PCV 286 [illegible]
962	PSD	Rupture Disc	Cl2	P2-8-16
963	PSV	Relief Valve	Cl2	P2-8-16
964	~~[illegible]~~	~~[illegible]~~	[illegible]	[illegible]
965	PI	Press. Indicator	Water	P2-7-32 ([illegible])
966	PG	Sight Glass	Phenol	P2-T610
967	LG	Gauge Glass	Phenol	P2-T6[illegible]
968	PI	Press. Indicator	Phenol	P2-D6[illegible] ([illegible])
971	PI	Press. Indicator	Phenol	P2-9-01 ([illegible])

REVISION DESCRIPTION

REFERENCE DRAWINGS

ASSOCIATE ENGINEERS

ENGINEERS INCORPORATED
NEWARK, NEW JERSEY

PP-68

DIAMOND ALKALI COMPANY

NEWARK

INSTRUMENT LIST
MCA-DCP UNITS

NE 201-9

DS 00029557

ITEM NO.	SYMBOL	DESCRIPTION	SERVICE	LOCATION	REFERENCE DRAWING FLOW SHEET	REFERENCE DRAWING LOCATION	REFERENCE DRAWING INSTALLATION	REQUIRED	NUMBER	DATE	SHEET	SUBSTITUTE	NUMBER	MFR	MAKE/DL VENDOR	MARKING PLATE	PRICE	LIST NO.
1001	PI	PRESS INDICATOR	STEAM	P-9-11														
02	PI	" "	PRESSURE	P-6-9 (P-9-10)														
03	PCV	PRESS CONTROL VALVE	STEAM	P-9-13 (P-8-8)														
04	PCV	PRESSURE CONTROL VALVE	STEAM	P-2-9-18														
05	PI	PRESSURE INDICATOR	STEAM	P-2-9-18														
06	PI	PRESS INDICATOR	STEAM	P-6-9 (P-9-11)														
07	PI	" "		P-6-11 (P-9-10)														
08	PD	RUPTURE DISC	DCP	P-6-9														
09	PSD	" "		P-6-11														
1010	TRC	TEMP RECORDER CONTROLLER	DRY AIR	PANEL														
	VTRC	" " " VALVE	WATER	P-6-9 (P-9-11)														
11	TRC	" " " VALVE	DRY AIR	PANEL														
	VTRC	" " " VALVE	WATER	P-6-11 (P-9-10)														
12	PSV	RELIEF VALVE	STEAM	P-6-9														
13	PSV	" "		P-6-11														
14	PI	PRESS INDICATOR	DCP	P-6-12 (P-6-11)														
15	PI	" "		P-6-12 (P-6-11)														
16	LG	GAUGE GLASS	HCl	P-6-11														
17	LI	LEVEL INDICATOR	PANEL	P-6-9														
18	LI	LEVEL INDICATOR	HCl	PANEL (P-10-10)														
1020	LI	" "		P-6-9 (P-10-10)														
21	LI	" "		P-6-11 (P-10-11)														
22	LI	" "		PANEL (P-10-10)														
23	PI	PRESS. INDICATOR	HCl	P-6-12 (P-10-10)														
24	TRC	TEMP. RECORDER CONTROLLER	HCl	P-7-11 (P-8-8)														
	VTRC	" " " VALVE	WATER	P-8-8 (P-7-11)														
25	FI	FLOW INDICATOR (ROTAMETER)		P-8-8 (P-7-11)														
26	TCV	TEMP. CONTROL VALVE	STEAM	P-8-8 (P-7-11)														
27	PCV	PRESS CONTROL VALVE	AIR	P-8-8 (P-7-11)														
1030	LG	GAUGE GLASS	HCl	P-7-11														
31	LI	SPECIFIC GRAVITY INDICATOR	HCl	P-8-8														
32	FI	FLOW INDICATOR	HCl	P-8-8														
33	FI	" "	HCl	P-8-8														
34	LI	SPECIFIC GRAVITY INDICATOR	HCl	P-8-8														
35	FRC	FLOW RECORDER CONTROLLER	DRY AIR	PANEL														
	VFRC	" " " VALVE	CHLORINE GAS	P-8-11														
	FP	ORIFICE FLANGES																
	FI	" PLATE																
	FI	FLOW TRANSMITTER																
1040	FRC	FLOW RECORDER CONTROLLER	DRY AIR	PANEL														
	VFRC	" " " VALVE	CHLORINE GAS	P-8-11														
	FP	ORIFICE FLANGES																
	FI	" PLATE																
	FI	FLOW TRANSMITTER																
1041	LI	LEVEL INDICATOR		P-7-10														
1042	PI	PRESS INDICATOR	CL2	P-7-10														
43		PANEL - HCA																
44		PANEL - DCP																
45	TI	TEMP INDICATOR	HCl	ABSORBER ADDA														
46	PSV	RELIEF VALVE	WATER	P-1-8														
47	PSV	" "	WATER	P-1-11														
48		WHISTLE	CL2 GAS-DRY	P-8-16														
1049	LG	GAUGE GLASS	HCl	P-7-19														
50	FA	FLAME ARRESTOR	DCP	P-2-7-10														
51	FA	FLAME ARRESTOR	CHLORINE	P-2-7-10														
52	PSV	RELIEF VALVE	WATER	P-7-12 (P-8-8)														
53	PSV	" "	WATER	P-8-8														
54	PSV	" "	WATER	P-7-12 (P-8-8)														
55	PSV	" "	BRINE	P-2-7-20 (P-8-8)														
57	PSV	" "	WATER	P-8-18 (P-8-8)														
58	PSV	" "	WATER	P-10-20 (P-8-8)														
59	PCV	PRESS CONTROL VALVE	WATER	P-10-11														
1060	LI	LEVEL INDICATOR	CL2	P-2-7-3														
61	PSV	RELIEF VALVE	WATER	P-1-16 (P-8-8)														
62	PSV	" "	BRINE	P-2-7-7 (P-8-8)														
63	PI	PRESS INDICATOR	WATER	P-1-11 (P-8-8)														
64	PI	" "	WATER	P-8-8														
65	PSV	RELIEF VALVE	BRINE	P-2-7-20														

DS 00029558

MAXUS0998250

VIII. OPERATING PROCEDURES

A. Unit Operations

B. Instructions For Operation of New Electrical Equipment

DS 00029559

VIII OPERATING PROCEDURES

A. Unit Operations

Since the installation of the new TCP, MCA, and DCP units involved reconstruction of existing operating units, the operating instructions for these units were written by plant personnel. Copies of these instructions are available through the plant.

B. Instructions For Operation Of New Electrical Equipment

With the installation of a completely new electrical substation and associated facilities, instructions for operation were written and are attached.

ELECTRICAL OPERATING PROCEDURE

1. TRANSFORMER BREAKER

1. The operating procedure is:

    1. To close - normal - green light is on.

        a. Open all feeder breakers.

        b. Turn "circuit breaker control" switch clockwise to "close" position. Red flag should show above switch handle, green light should go off and red light should come on.

    2. To open - normal - red light is on.

        a. Turn "circuit breaker control" switch counter-clockwise to "trip" position. Green flag should show above switch handle, red light should go off and green light should come on.

    3. To close - emergency - green light is on.

        a. Open all feeder breakers.

        b. Insert pipe handle (in rack to left of breaker and behind operator) in opening and operate breaker. Green light should go off and red light should come on.n

    4. To open - emergency - red light is on.

        a. Push button at bottom of unit marked "Push to Trip".

2. PROCESS BUILDING FEEDER BREAKER

The operating procedure is as follows:

1. To close:

    a. Close breaker in motor control center unit 6B.

    CAUTION: There are two breakers in this unit, one serves the unit heaters.

    b. Place one of the "hand-off auto" fan starter switches in the "hand" position.

DS 00029561

2. PROCESS BUILDING FEEDER BREAKER (cont'd)

c. Check to make sure the main transformer breaker is closed.

d. Simultaneously press the "undervoltage by-pass" button and move the breaker operating handle to "on" position.

e. Hold interlock pushbutton closed for a slow count of 10 before releasing.

2. To Open:

a. Move breaker operating handle to "off" position.

b. Undervoltage coil will trip breaker automatically if power goess off for any reason.

3. 2,4-D BUILDING FEEDER BREAKER

1. To close:

a. Close 600 ampere disconnect switch.

b. Move breaker operating handle to "on" position.

2. To open, move breaker operating handle to "off" position.

IX. SPARE PARTS

SPARE PARTS

DS 00029563

IX SPARE PARTS

Vendor's instructions for operation and maintenance of equipment and recommended spare parts lists were forwarded to the plant with requisitions and purchase order information on applicable items such as agitator drives, hoists, pumps, air drier, sprinkler systems, HCl absorbers, etc. Copies of the instructions and spare parts lists are retained with the requisition files in Central Engineering.

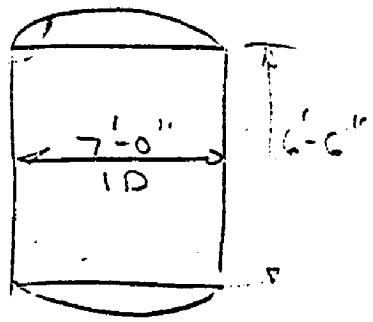
X CALCULATIONS

CALCULATIONS

DS 00029564

METHANOL CAUSTIC – MIX

2250 GALS REQUIRED



DISSOLVE 4200 # FLAKE NaOH IN 1650 GALS (→ EQU. TO 410 GALS) OF METHANOL.

Sp. G. METHANOL = .775 = 6.45 #/GAL

H_s = 650 BTU/# CAUSTIC

Q = 4200 × 650 = 2,720,000 BTU.

ASSUME PROCESS @ 100°F
VP CH3OH = 300 mm Hg.

C.W. = 50 GPM = 25,000 #/HR

FOR 4 HOURS $\frac{2,720,000}{4}$ = 680,000 BTU/HR

RISE = $\frac{680,000}{25,000}$ = 27°F

60 → 87°F

ΔT_m = 100 / 40 / 87 / 23

$\Delta T_m = \frac{40-23}{\ln \frac{40}{23}}$

= $\frac{17}{.55}$

= 30.9

DS 00029565

$A = \frac{680,000}{30.9 \times 50} = 440$ FOR $V = 50$

$A = 220$ FOR $V = 100$

ACTUAL AREA ABOUT 170.

FOR $A = 170$

$V = \frac{680,000}{30.9 \times 170} = \underline{130}$

DS 00029566

VESSEL THICKNESS — ABOUT 1/2-9/16" WITH 1/8" CORR ALL.

JACKET THICKNESS — ABOUT 5/16" WITH 1/8" CORR. ALL.

NEWARK PLANT REPORT

When charging CH_3OH - Caustic to reactor, tank trucks to 70°C with jacket water on.

Assume ambient = 77°F = 25°C

$\Delta T = 70 - 25 = 45°C = 81°F$

Sp Ht. CH_3OH = .625
Sp. g. " = .777

CH_3OH = 350 gal = 3560 #
NaOH = 1400 #

1400 × 650 = 910,000 BTU.

$(3650)(.81)(.625) = 256{,}000$ BTU IN SENS. HT.

1400
5050

910
256
659,000 BTU TAKEN UP IN JACKET & VENT COND.

DS 00029568

SLURRY TANK CALCS.

CALCULATE THICKNESSES FOR 30 PSI JACKET PRESS.

CONDITIONS

INTERNAL PRESS — 0 PSIG.
EXTERNAL PRESS — 30 PSIG.
O.D. ——— 84"
LENGTH ——— 87"

ASSUME 1/2" WALL THICKNESS

$D_o/T = \frac{84}{.5} = 168$ B = 10,000

$L/D_o = \frac{87}{84} = 1.035$

$P_{allowable} = 10{,}000/168 = \underline{59.5 \text{ psig.}}$

TRY 3/8" WALL THICK

$D_o/T = \frac{84}{.375} = 224$ B = 6500

$L/D_o = 1$

$P_{all.} = \frac{6500}{224} = 29$ psig. OK

TOTAL VESSEL THICKNESS = 3/8 + 1/8 = 4/8 = 1/2" OR 9/16"

JACKET THICKNESS

$t = \frac{PR}{SE - 0.6P}$ EFF. = 0.7

$t = \frac{(30)(44.75)}{(13750)(.7) - 18} = .14'' = 3/16''$

.14 + .125 = .265 = 5/16" WITH COLL ALL.

DS 00029569

[illegible] = [illegible] = 7 + 3.5 + 3.4

90.9

SLURRY TANK — CONTINUED

JACKET AREA

ST. SIDE	=	$(\pi)(7)(3.67)$	= 146 ft²
HEAD	=	$\frac{(\pi)(7.55)^2}{4}$	= 44.5
TOTAL			= 190.5 ft²

COOL DOWN 2000 GAL LIQUID FROM 120°C — 40°C

$80 \times 1.8 = 144°F$ ΔT

Sp. G. = 1.30

Sp Ht. = 1.0 (CONSERVATIVE)

$Q = wc\Delta t = (2000)(8.33)(1.3)(144)(1) = 3{,}100{,}000$ BTU

HEAT OF CRYSTALLIZATION OF SALT

$H_c = 40$ BTU/#

FOR 375 #

$40 \times 375 = 15{,}000$

TOTAL Q = 3,100,000 + 15,000 = 3,115,000 BTU

FOR UNSTEADY STATE HEAT TRANSFER

$$\ln \frac{T_1 - t_1}{T_2 - t_1} = \frac{wc}{MC}\left(\frac{K_2 - 1}{K_2}\right)\theta$$

$$K_2 = e^{UA/wc}$$

T_1, T_2 = TEMP OF BATCH

t_1 = TEMP COLD FLUID

w = COLD FLUID #/HR

M = WT HOT FLUID

C = SP. HT HOT FLUID

K_2 = CONSTANT

c = SP. HT. COLD FLUID

θ = TIME HOURS

U = heat trans coeff

A = jacket area.

$A = 190.5$

$W = 50$ gpm $=$ 25,000 #/hr (ASSUME)

$\theta = 4$ hours (assume

$$\ln \frac{T_1 - t_1}{T_2 - t_1} = \frac{WC}{MC}\left(\frac{K_2 - 1}{K_2}\right)\theta$$

$$\ln \frac{\overset{190}{250 - 60}}{\underset{44}{104 - 60}} = \frac{(25{,}000)(1)(4)}{(21{,}600)(1)} \frac{K_2 - 1}{K_2}$$

$$1.46 = 4.64\left(\frac{K_2 - 1}{K_2}\right)$$

$$\frac{K_2 - 1}{K_2} = \frac{1.46}{4.64} = .315$$

$$K_2 - 1 = .315 K_2$$

$$K_2 = \frac{1}{.685} = 1.46$$

$$K_2 = e^{UA/WC} = e^{50A/25{,}000}$$

$$1.46 = e^{50A/25{,}000}$$

$$2.3 \log 1.46 = 50A/25{,}000$$

$$.377 = 50A/25{,}000$$

$$50A = 9400$$

$A = 188$ ft VS 190.5 ft AVAILABLE

CAUSTIC MIX.

30 PSIG JACKET PRESS

SOL VESSEL

OD = 78"
L = 87"

FOR 3/8" WALL

$D_o/t = \frac{78}{.375} = 208$

$L/D_o = \frac{87}{78} = 1.115$

B = 6300

$P_{all} = \frac{6300}{208} = 30.2$ check

SO WALL = 3/8" + 1/8" CORR ALL. = 1/2" TOTAL

FOR JACKET

$t = \frac{PR}{SE - 0.6P} = \frac{(30)(41.75)}{(13,750).7 - 18} = .13" = 3/16"$

5/16" WITH CORR ALL.

DS 00029572

MAXUS0998265

SURFACE FOR CRYSTALLIZER ASSUMING U = 50

LIQUID TO BE COOLED = 21,600 #
COOLING TIME = 4 HR
INLET COOLANT TEMP. = 60°F
COOLANT RATE = 25,000 #/HR

$$T_2 - t_1 = (T_1 - t_1)\, e^{-b\theta}$$

$$104 - 60 = (250-60)(2.718)^{-240\,b}$$

$$44 = (190)(e)^{-240\,b}$$

$$\ln 44 = \ln 190 + \frac{1}{e^{240\,b}}$$

$$3.785 = 5.25 + 0 - 240\,b$$

$$-240\,b = -1.465$$

$$b = .0061$$

SOLVE FOR T_2 AT VARIOUS VALUES OF θ

$\theta = 60$

$$T_2 - 60 = (250 - 60)\, e^{-(.0061)(60)}$$

$$T_2 - 60 = \frac{190}{e^{.366}}$$

$$\ln(T_2 - 60) = 5.25 - .366 = 4.884$$

$$T_2 - 60 = 132$$

$$T_2 = 192$$

$\theta = 120$

$$T_2 - 60 = 190\, e^{-(.0061)120} = 190\, e^{-.732}$$

$$\ln(T_2 - 60) = 5.25 - .732 = 4.518$$

$$T_2 - 60 = 92 \qquad T_2 = 152$$

DS 00029573

$\phi = 180$

$$T_2 - 60 = 190\, e^{-.0061(180)} = 190\, e^{-1.1}$$

$$\ln(T_2 - 60) = 5.25 - 1.1 = 4.15$$

$$T_2 - 60 = 64$$

$$T_2 = 124$$

$\phi = 240$

$$T_2 - 60 = 190\, e^{-.0061(240)} = 190\, e^{-1.46}$$

$$\ln(T_2 - 60) = 5.25 - 1.46 = 3.79$$

$$T_2 - 60 = 44$$

$$T_2 = 104$$

SUMMARY

ϕ	T_2	S	C.W. OUT.	Q INS.	LMTD
60	192	.805	102°	17,400	110
120	152	.560	96°	12,100	73
180	124	.390	78°	8420	56
240	104	.268	74°	5,800	36.8

DS 00029574

SLOPE OF CURVE

$dT/d\theta = -b(T_2 - t_1)$

60 min $= -.0061(192-60) = 0.805$ °F/min.

120 min $= .0061(152-60) = 0.560$ "

180 min $= .0061(124-60) = 0.390$ "

240 min $= .0061(104-60) = 0.268$ "

EXIT WATER TEMP G = 50 GPM

60 min — $(0.805)(2000)(8.33)(1.3) = (50)(8.33)(1)(t_2-60)$

$17{,}400 = 415\,t_2 - 25{,}000$

$t_2 = \frac{42{,}400}{415} = 102°F$

120 min — $.682/.805 \times 17{,}400 = 14{,}250 = 415\,t_2 - 25{,}000$

$t_2 = \frac{39{,}250}{415} = 196$

180 min — $390/805 \times 17{,}400 = \frac{8420 + 25{,}000}{415} = \frac{42{,}220}{415}$

$= 78°F$

240 min $268/805 \times 17{,}400 = \frac{5800 + 25{,}000}{415} = 74°F$

DS 00029575

INSTANTANEOUS RATE OF HT. TRANSFER

$$Q = SMg_1 Cp_1$$

60 min	$Q = (.805)(21{,}600)(1) =$	17,400 BTU/min
120		12,100
180		8,420
240		5,800

LMTD CALC

$$\Delta t_m = \frac{(T_2 - t_1) - (T_2 - t_2)}{2.3 \log \frac{T_2 - t_1}{T_2 - t_2}}$$

60 min $\Delta T_m = \dfrac{\overset{132}{(192-60)} - \overset{42}{(192-102)}}{2.3 \log \frac{90}{42}} = 110$

120 min $\Delta T_m = \dfrac{\overset{92}{(152-60)} - \overset{56}{(152-96)}}{2.3 \log \frac{36}{56}} = 73$

180 min $\Delta T_m = \dfrac{\overset{64}{(124-60)} - \overset{46}{(124-78)}}{2.3 \log \frac{18}{46}} = 56$

240 min $\Delta T_m = \dfrac{\overset{44}{(104-60)} - \overset{30}{(104-74)}}{\ln} = 36.8$

DS 00029576

ASSUMING U = 50

$Q = UA\Delta T_m$

$A = \frac{Q}{U\Delta T_m}$

$A = \frac{(12{,}400)(60)}{(50)(110)} = 190$

$A = 12{,}100 \times \frac{60}{50} \times \frac{1}{73}$ 199

$A = 8420 \times \frac{60}{50} \times \frac{1}{93} = 181$

$A = 5800 \times \frac{60}{50} \times \frac{1}{25.4} = 189$

BY [illegible] DATE [illegible] SUBJECT [illegible] SHEET NO. [illegible] OF [illegible]

CHKD. BY ____ DATE ____ Requirements NPL JOB NO. ____

1. 2,4 D Acid — 275 Tons/mo (Phone 3-19-80)

$$\left(\frac{275\ \text{tons}}{\text{mo}}\right)\left(\frac{2000\ \#}{\text{ton}}\right)\left(\frac{\text{mo}}{30\ \text{days}}\right) = 18400\ \#/\text{day}$$

Uses* 1# Crude DCP/# 2,4-D Acid

0.6# MCA/# 2,4 D Acid

2. Dichlorophenol

from above 1# DCP/# 2,4-D Acid = 18,400 #/day

Plus 20% excess to allow for outages

(18,400)(.20) = 3680 #/day

Total required = 22080 #/day

Say 22,000 #/day

3. 2,4,5 T Acid — 80 Tons/mo (Phone 3-19-80)

$$\left(\frac{80\ \text{Tons}}{\text{mo}}\right)\left(\frac{2000\ \#}{\text{ton}}\right)\left(\frac{\text{mo}}{30\ \text{days}}\right) = 5330\ \#/\text{day}$$

Uses* 1# TCP

0.7# MCA

DS 00029578

* John Barlow's Letter to R. Stoner (8-28-53)

MAXUS0998271

BY [illegible] DATE [illegible] SUBJECT [illegible] SHEET NO. [illegible] OF [illegible]
CHKD. BY ____ DATE ____ JOB NO. ____

4. TCP (Sodium Trichlorophenol)

$$\left(\frac{1\# \text{ TCP}}{\# \text{ 2,4,5TAcid}}\right)\left(\frac{5330\# \text{ 2,4,5TAcid}}{\text{day}}\right) = 5330\# \text{ TCP/day}$$

Plus 20% excess to allow for outages

(5330)(0.20) = 1066

6396

Say 6400 #'s TCP/day

5. MCA

from above

$$\left(\frac{0.6\# \text{ MCA}}{\# \text{ 2,4 D Acid}}\right)\left(\frac{18,400\# \text{ 2,4 D Acid}}{\text{day}}\right) = 11,000$$

$$\left(\frac{0.7\# \text{ MCA}}{\# \text{ 2,4,5TAcid}}\right)\left(\frac{5330\# \text{ 2,4,5T}}{\text{day}}\right) = 3730$$

Total MCA required = 14,730 #/day

Plus 20% excess for outages

(14,730)(0.20) = 2946

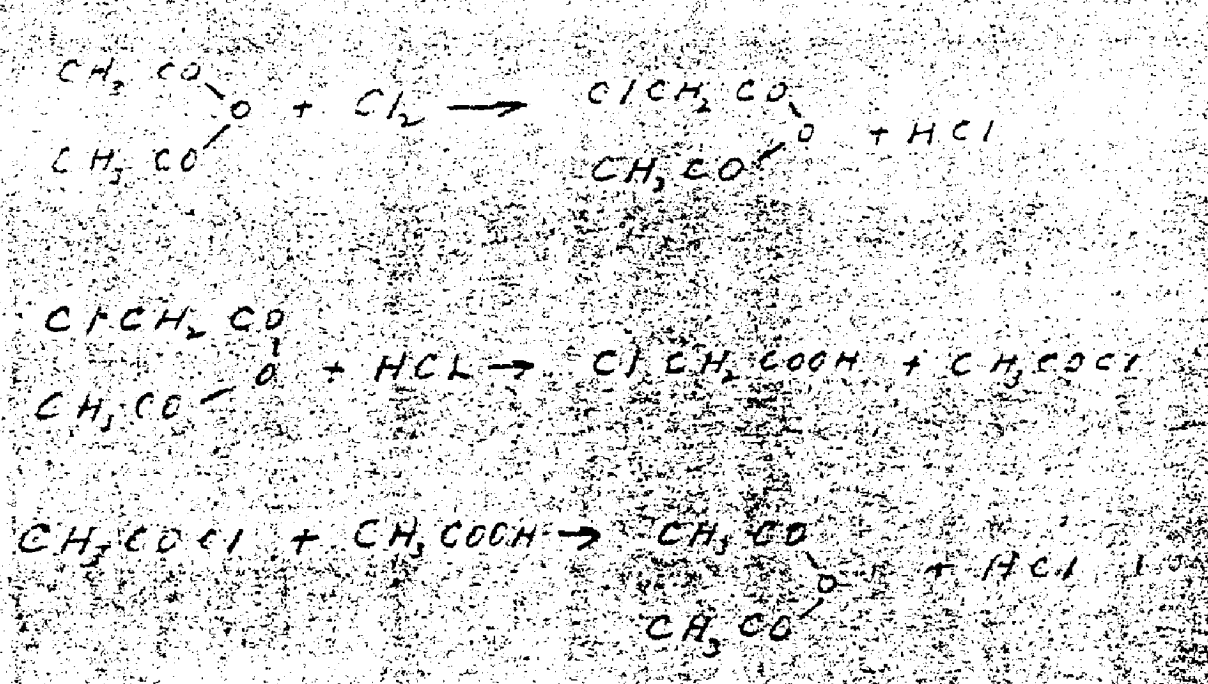
17,676

Say 17,500 #/day

DS 00029579

MAXUS0998272

BY [illegible] DATE 3/2/60 SUBJECT [illegible] SHEET NO. [illegible] OF [illegible]
CHKD. BY ____ DATE ____ JOB NO. ____



Analysis of Plant Sample of 80% MCA

	Percent on Dry Basis
MCA	93.3
Dichloroacetic	4.5
HCl	1.2
Acetic Acid	1.0
	100.0

DS 00029580

MAXUS0998273

Basis: 1 hr.

Process Bldg.	HP	KVA	KW	Office Bldg.	HP	KVA	KW	Whse Bldg.	HP	KVA	KW	2.4.0 Bldg.	HP	KW	General Facilities	HP
Lights		30		Lights		75		Lights		75					Water Well	75.0
Unit Htrs	0.25			Power	39.75			Power	13.05						R.Air Compr.	20.0
	0.75											Mfg. Rewind Mat'l		224		20.0
	0.75							Hot Water			3.0				Boiler Motors	35.2
Fans	1.5															
	1.5														Air Comp. for Boiler	5.0
	1.5															
	0.2											Less HP in Gen. Fac.	-110.2			
	0.2															
Misc.	3.0														River Water Pumps	30.0
																40.0
Totals	10.15	30			39.75	75			13.05	75	3		-110.2	224		225.2
→		17.2		→			48.6	→			40.4	→		170.0		123.6 KW/hr

Diversity factor from 2.4.0 Bldg. = 0.459

Use Diversity for Air Compressors and River Pumps only

$\left[\left(\frac{10.15}{10.3}\right)\frac{246}{1000} + 30\right] 0.459$ = 17.2 KW/hr

$\left[(39.75)\frac{246}{1000} + 75\right] 0.459$ = 48.6 KW/hr

$\left[(13.05)\frac{246}{1000} + 75 + 3\right] 0.459$ = 40.4 KW/hr

$\left[(170)\frac{246}{1000}\right] 0.459$ = 24.0 KW/hr

$(110.2)\frac{246}{1000}$ = 37.6 KW/hr

$(40)\frac{246}{1000} = 30.0$ KW/hr

24.0 + 30.0 = 54.0

224 − 54.0 = 170 KW/hr

$(115.2)\frac{246}{1000}$ = 28.6 KW/hr

37.6 + 86.0 = 123.6 KW/hr

BY ____ DATE ____ SUBJECT ____ SHEET NO. ____

CHKD. BY ____ DATE ____ JOB NO. ____

DS 00029581

MAXUS0998274

BY _____ DATE _____ SUBJECT [illegible] SHEET NO. [illegible]
CHKD. BY _____ DATE _____ 7CH, MEA, [illegible] JOB NO. [illegible]

I. ASSUMPTIONS

1. DIVERSITY FACTOR IS SAME AS FOR 2,4-D BUILDING

2. CONNECTED LOAD IN 2,4-D IS AS SHOWN ON ELEC.

MIN. COST EST. 2,4-D BLDG.

		HP MOTORS	KVA LIGHTS
2,4-D BOILER		443.80	15
BSW BOILER		99.50	5
LOCKER, ETC.			
PUMP HOUSE	14.5HP + 5KVA LIGHTS		
SM. HELL RM.	21.0HP + 3KVA "		
WHSE.	73.75HP "		
LOCKER RM.	1.5HP + 10KVA "	60.75	16
		604.05	36

3. USE PEAK MONTH DIVERSITY FACTOR

4. BASE DIVERSITY ON AVERAGE POWER CONSUMPTION

5. USE AVERAGE POWER CONSUMPTION ON 7DAY, 24HR.

II. PEAK MONTH DIVERSITY

1. FROM MINCO, [illegible] PLANT, METER READINGS WERE

	4/7/61	3/6/61
DAY	2893	2770
NIGHT	2766	2376

KWH = 240 × DIFF.

343(DAY) = [illegible]
321(NIGHT) = [illegible]
16,100 KWH.

DS 00029582

2. TOTAL HRS. 23 DAYS × 24HRS = 552 HRS / MONTH

MAXUS0998275

BY _____ DATE _____ SUBJECT _____ SHEET NO. 2 OF 5

CHKD. BY _____ DATE _____ JOB NO. 6774

3. AVERAGE POWER USAGE

161105 KWH/720H = 224 KW

4. CONNECTED LOAD IS

(604.05 HP)(746)/1000 + 36 = 451 + 36 = 487

5. DIVERSITY = (3/4)

224/487 = 0.459

III. TCP POWER USAGE

1. CONNECTED LOAD

	Motor No.	HP
	MP136	3.0
	207	5.0
	MA103	7.5
	104	7.5
	MP206	2.0
	204	2.0
	121	0.75
	115	0.5
	210	3.0
	MA 202	3.0
DRIMHOLT	MN 122	0.75
FEEDER	MC 124	0.25
	MA 201	5.0
	MP 212	5.0
	302	2.0
	301	2.0
	216	2.0
	108	3.0
	306	3.0
		57.25

DS 00029583

MAXUS0998276

BY _____ DATE _____ SUBJECT _____ SHEET NO. 3 OF _____

CHKD. BY _____ DATE _____ JOB NO. 6774

2. POWER USAGE - MOTORS ONLY

$730\left[(57.5)(HP)(746)/1000\right](0.459) = 14300$ KWH PER MONTH

IV. MCA POWER USAGE

1. CONNECTED LOAD

MOTOR NO.	HP
MP405	2.0
408	2.0
411	5.0
413	5.0
418	3.0
507	1.0
510	1.0
514	50.0
519	15.0
520	0.75
525	0.75
	85.5

2. POWER USAGE - MOTORS ONLY

$730\left[(85.5\ HP)(746)/1000\right](0.459) = 21200$ KWH PER MONTH

V. DCP POWER USAGE

1. CONNECTED LOADS

MOTOR NO.	HP
MP601	5.0
604	2.0
607	1.5
610	2.0
612	2.0
616	1.5

DS 00029584

MAXUS0998277

BY _____ DATE _____ SUBJECT _____ SHEET NO. ___ OF ___

CHKD. BY _____ DATE _____ JOB NO. 67-20

2. POWER USAGE - MOTORS ONLY

730 [(14.75 HP)(746)/(eff)] 0.049 = 3660 KWH PER MONTH

VI GENERAL FACILITIES

1. CONNECTED LOAD - DOES NOT INCLUDE MAINT. EQUIP.

DESCRIPTION		HP	KVA	KW
PROCESS	LIGHTS		30	
UNIT HTR.	MP 724	0.75		
" "	MP 725	0.75		
" "	MP 726	0.75		
FAN	MP 718	1.5		
"	MP 719	1.5		
"	MP 720	1.5		
"	MP —	0.2		
"	MP —	0.2		
PUMP	MP 723	75.0		
HCL PUMP	MP622	3.0		
AIR COMP.	MP521	20.0		
"	MP524	20.0		
WHSE	LIGHTS		75	
OFFICE	LIGHTS		75	
WHSE	POWER	13.05		
WHSE	HOT WATER			3.0
OFFICE	POWER	33.75		
	MP 701	3.0		
	704	1.5		
	702	2.0		
	705	5.0		
	703	2.0		
	[illegible]	2.0		
		193.45	180	3.0

DS 00029585

2. POWER USAGE

730 {[(193.45)(746)/(eff)] + 180 + 3.0} (0.049) = KWH PER MONTH

MAXUS0998278

BY _____ DATE _____ SUBJECT _____ SHEET NO. _____
CHKD. BY _____ DATE _____ JOB NO. 6774

VII SUMMARY

1. TOTAL POWER USAGE

2,4-D	161 100	KWH/Mo.
GEN'L. FAC.	110 000	KWH/Mo.
TCP	14 300	KWH/Mo
MCA	21 400	KWH/Mo
DCP	3680	KWH/Mo
TOTAL	310 480	KWH/Mo.

2. TRANSFORMER CAPACITY (AVERAGE, NOT PEAK DEMAND)

310480/730 = 425 KW

ASSUME 0.7 POWER FACTOR

425/0.7 = 608 KVA

3. TRANSFORMER CAPACITY (PEAK)

PEAK DEMAND MAR. 1961 (2,4-D)

~74 KW

DEMAND FACTOR ~74/~24 (AS. POWER USAGE - II 3)

1.~~44~~

608 X 1.~~44~~ = 745 KVA

4. INSTALLED TRANSFORMER CAPACITY

750 KVA

DS 00029586

MAXUS0998279

STEAM REQUIREMENTS (NEWARK)

300 PSI UNLESS NOTED
* REQ. BASED ON TANK FROZEN

EQUIPMENT	STEAM IN #/HR CONT. WAYS	INTERMITTENT	CONNECTED
ANTICLINE HEATERS 225 PSIG	94 ~~13~~	1810	1810
ICB MELT TANK (ALL PURPOSE)	65	* 208	208
ICB CHARGE TANK	10	* 32	32
ICB TANK CAR		* 835	835
METHANOL STILL RESIDUE		532	532
CRUDE MOTOR HOLDING TANK HEATER	13	~~65~~	65
ANISOLE STILL (HEATING)		~~43~~	1530
(FOR DISTILLATION)		1530	
ANISOLE RECEIVER	6		6
(2) 25% ATCP TANKS	(1) 74		74
ANISOLE DROP TANK TRUCK	~~25~~		~~25~~
CHLORINE JACKETS	~~650~~		~~650~~
ACETIC ACID STORAGE TANK	32		32
ACETIC MIX STORAGE TANK	32		32
ACETIC MIX DROP TANK	15	~~49~~	~~25~~
MCA CHLORINATORS	(2) ~~24~~	~~2000~~	~~2000~~
(2) 80% MCA TANKS	(2) 30		30
PHENOL STORAGE	40	~~125~~	~~40~~
PHENOL TANK CAR		~~600~~	~~600~~
PHENOL STORAGE INTERMEDIATE	20	~~406~~	~~20~~
DRP CHLORINATORS	(4) ~~22~~	~~2400~~	~~2400~~
STEAM TRACING EST.	255	85	340
OFFICE BUILDING	1500	1500	1500
WAREHOUSE	1060	1060	1060
TCP BLDG	1000	1000	1000
ZAP BLDG. (Assume 1000#/hr-for Bldg) (Total)	1500	2600	2600
Total Connected Load			13194

Boiler has Capacity of 13,000 #s/hr

Chrysler Green has Capacity of 4000 #s/hr

DS 00029587

PREPARED BY A. CARTER

DATE 20 SEPT. 1960

PROJECT NO. 60-5028

SUBJECT STM. REQ.

ENGINEERS

MAXUS0998280

PROCESS TOP INFS MCR 24 HRS DOP 10 HRS

STEAM REQUIREMENTS

AUTOCLAVE JACKETS – OPER TEMP MAX 338°F U=200 STM=392°F

ADDED METHANOL CARBOL @ 131°F SLOWLY $\Delta T = (392-320)+(392-338)/2 = 63$

TCB @ 320°F DROP

Q = UAT = 200(120) 63 = 1,510,000 BTU/HR / 834 = 1810 INT. | 1810#/HR

~~Q = UAT = .25(120) 338 = 101,400 / 834 = 12#~~ ON ERROR SHEET | 15#/HR

TCB MELT TANK – OPER TEMP MAX 320°F U=20 STM=328°F

TANK = 9' x 25'-6" = 730 SQ FT. T = ASSUME TANK FROZEN (328-0 + (328-32)/2

Q = UAT = 20(156) 168 = 524,000 BTU/HR / 890 T = 143°F

A = 2" Ø 300' COIL = 156 SQ FT. (174,000 / 890 = 196#/HR INTER. | 196#/HR

ROOF COIL

Q = UAT = 20 (7.5) 168 = 25,200 BTU/HR / 890 = 28#/HR INTER. | 28#/HR

A = 1/2" OF 60' COIL = 7.5 SQ FT. TOTAL 224#/HR

COILS

Q = UAT = .25 (730) 320 = 58,000 / 890 = 65#/HR CONT. | 65#/HR

TCB CHEESE TANK – OPER TEMP MAX 320°F ΔT = 328-0 = 328 INT.

8' x 22' = 670 TANK COIL = 100' x .13 = 13 SQ FT ΔT = 328-320 = 8 CONT.

Q = UAT = 20(13) 328 = 85,900 BTU/HR / 890 = 96#/HR INTER. | 96#/HR

CONT S = 20 = .25(67) 320 = 5360 BTU/HR / 890 = 6#/HR CONT. | 10#/HR

TCB TANK CAR – OPER TEMP = 328°F

EFC = 30 gal/hr x (18) = 54 BTU/# — 10,000 gal x 8#/gal = 114,000#

114,000# x .54 = 59,600 BTU / 8 HRS x 890 = 835# | 835#/HR

METH STILL REBOILER — AS ORDERED

| 532#/HR

CRUDE NaTCP HOLDING TANK – OPER TEMP MAX 131°F

Q = UAT = .25(330) 131 = 10,800 BTU/HR / 890 = 12.3#/HR | 75#/HR

ANISOLE STILL – ΔT = (328-131) + (328-204) / 2 = 304 — 152 F ΔT | 165#/HR

HEATING Q = UAT = 20 x 160 x 304 = 975,000 BTU / 890 = 1100#/8 HRS = | 131#/HR

DISTILLATION (FROM BH. SH. 9616) x 6 / 48-10.4 = 1530#/HR | 1530#/HR

2 HRS. FILLING — 8.4 HRS. HEATING — 37.6 HRS. DISTILLATION = 48 HR. CYCLE.

ANISOLE RECEIVER MAX = 140°F 4' x 10' = 150#

Q = UAT = 25(150) 140 = 5250 / 890 = 5.9 #/HR | 6#/HR

DS 00029588

PREPARED BY A CARTER PROJECT NO. 605008

DATE 2 SEPT 1960 SUBJECT STM. REQUIREMENTS

ENGINEERS

MAXUS0998281

STEAM REQUIREMENTS CONT.

25% FEP TANKS – MAIN. 131°F 10' x 27' = 997 ft²

Q = UAT = .25 (997) 131 = 32750 / 890 = 37 #/HR — 37 #/HR

STEAM TRACING (INCL. TCE TRACE)

EST 60 BTU/FT. x EST 5000 FT. = 300,000 BTU/HR / 890 = 340 #/HR. — 340 #/HR.

EST 25% OF LINES WILL BE DRAINED & TRACER SHUT-DOWN — 85 #/HR

CONT — 255 #/HR.

ANISOLE DROP TANK MAIN 140°F 3' x 6' = 72'

Q = UAT = .25 (72) 140 = 2520 / 890 = 3 #/HR — 5 #/HR

CHLORINE VAPORIZER 6" SCH. 80 = 1.6 x 6 = 9.6 ft² 20 = 5.2 x 6 = 31.0 ft²

SHELL – Q = UAT = 100 (40') 145 = 580000 BTU/HR / 890 = 650 #/HR

At max. 100 #/hr of Cl₂ – latent heat of vap. = 109.5 BTU/lb @ 87.8°F

(100 #/hr)(109.5) = 10950 BTU/hr / 890 BTU/lb = 12 #/hr = (240 #/hr) ok

ACETIC ACID STORAGE TANK – MAIN 145°F 10' x 20' = 780 ft²

Q = UAT = .25 (780) 140 = 27,400 / 890 = 30 #/HR — 31 #/HR

ACETIC MIX TANK MAIN 140°F 10' x 20.5' = 784 ft²

Q = UAT = .25 (784) 140 = 27,600 BTU/HR / 890 = 31 #/HR — 32 #/HR

ACETIC MIX DROP TANK (SAME AS ANISOL) — 5 #/HR

MCA CHLORINATOR – OPER. TEMP. MAX 194°F

ACETIC MIX @ 80°F ΔT = (328 - 80)(328 - 194) / 2 = 188 — Q 17 #/HR

Q = UAT = 200 (119) 188 = 4470000 / 890 = 5000 / 2 MS INTEG. — 2500 #/HR

Q = UAT = .25 (119) 328 = 9750 / 890 = 11 BTU/HR — CONT. — 12 #/HR

80% MCA STORAGE – MAIN 95% 10' x 13'

Q = UAT = .25 (564) 95 = 13400 BTU/HR / 890 = 15 #/HR — 15 #/HR

PHENOL STORAGE MAIN – 131°F (10' x 25.6')

Q = UAT = .25 (921) 131 = 33000 / 890 = 37 #/HR — 37 #/HR

INTER. PHENOL STORAGE MAIN – 131°F (6' x 23.6')

Q = UAT = .25 (495) 131 = 16200 / 890 = 18.2 #/HR — 20 #/HR

DS 00029589

PREPARED BY A. CARTER PROJECT NO. 605025

DATE 2 SEPT. 1960 SUBJECT STM. REQUIREMENTS

ENGINEERS

MAXUS0998282

BY [illegible] DATE 7-25-[illegible] SUBJECT [illegible] SHEET NO. 1 OF ___
CHKD. BY ___ DATE ___ MEAN Calculations JOB NO. ___

Basis: 1 batch – Heat from 80°F to 194°F in 1 hr.

Charge = 6160 Pounds/batch of Herbicide

$Q = W c_p \Delta t$

$= (6160)(0.465)(194 - 80°F)$

① $Q = 329,000$ BTU/hr (Required)

For 1000 gal. Pfaudler Vessel

Charge equivalent to 700 gals

Assume effective H.T. Area = 2/3 (119 ft²)

= 79 ft²

From Discussion with Pfaudler Representative best coef. through glass lining = 60 BTU/hr-ft² for Condensing Steam against Boiling Liquid.

Acetic Acid B.Pt. = 118.1°C } soln only
Acetic Anhydride B.Pt. = 140.0°C } heated to 90°C

With non boiling liquid Assume U = 25
85 psig Steam = 328°F
$\Delta t = (328-80 + 328-194) = 191°F$

$Q = U A \Delta T$

② $= (25)(79)(191°F) = 371,000$ BTU/hr

DS 00029590

Steam Usage = $\frac{371,000 \text{ BTU/hr}}{890 \text{ BTU/\# Steam}}$ = 417 #s/hr

MAXUS0998283

BY [illegible] DATE 2-25-81 SUBJECT Steam Requirements SHEET NO. ___ OF ___
CHKD. BY ___ DATE ___ PCP Chlorinators JOB NO. ___

Basis: 1 batch - Heat from 131°F to 158°F (70°C at start) in One (1) hour

$Q = W C_p \Delta t$

$= \left(\frac{5340\#}{hr}\right)(0.56)(158 - 131°F)$

$Q = 80{,}800$ BTU/hr

Maximum Coef. for Pfaudler Glass is $U = 60$ (Condensing Steam to Boiling Liquid)

Phenol Boils at 181.8°C ∴ Contents not Boiling

Assume $U = 25$

$Q = U A \Delta t$

$= (25)(79)(183°F)$

$Q = 362{,}000$ BTU/hr

$A = 119\ ft^2$ for 1000 gal reactor

Assume 2/3 used

$= 79\ ft^2$

Δt = Steam @ 100 psig

$\frac{(328 - 131) + (328 - 158)}{2}$

$\Delta t = 183°F$

$\left(362{,}000 \frac{BTU}{hr}\right)\left(\frac{1\ lb\ Steam}{890\ BTU}\right) = \underline{406\ \#/hr}$

Steam Usage

DS 00029591

MAXUS0998284

STEAM REQUIREMENTS CONT

DCP CHLORINATOR — OPER. TEMP. MAX. 158°F

PHENOL @ 131°F $\Delta T = (328-131)+(328-158)/2 = 183$

$Q = UA\Delta T = 200(119)183 = 4\,350\,000/890 = 4900\#/2\,\text{MIN}$

$xQ = .25(119)328 = 9750/890 = 11\#/\text{MIN}$

PHENOL TANK CAR — OPER. TEMP. MAX. 230°F

$\Delta h = 30\ \text{Kg-cal/Kg} \times (1.8) = 54\ \text{BTU}/\#$ 10,000 gal. x 9 = 90,000#

$90{,}000\# \times 54 = 4{,}850{,}000\ \text{BTU/BLOC} \times 890 = 680\#/\text{hr}$

Assume Car at 80°F

Heat Car to 60°C = 140°F in 8 hrs

$Q = W C_p \Delta t$ $C_p = 0.56$

$W = \frac{90000\#}{8\ \text{hrs}} = 11{,}250\#/\text{hr}$

$\Delta t = 140°F - 80°F$

$= 60°F$

$Q = (11250)(0.56)(60°F)$

$= 378{,}000\ \text{BTU/hr}$

$\frac{378{,}000}{2900} = 1{,}245\ \#\ \text{Steam/hr}$

$Q = UA\Delta T$ $\Delta t = \frac{(328-80)+(328-158)}{2}$

$= 218°F$

$A = \frac{378000}{(100)(218°F)} = 17.3\ ft^2$ required Assume U = 100

(This is reasonable for Tank Car)

Cont.

DS 00029592

PREPARED BY A. CARTER PROJECT NO. 605028

DATE 2 SEPT. 1960 SUBJECT STM. REQ.

ENGINEERS

MAXUS0998285

CONDENSATE RETURN ECONOMICS - ESTIMATE

PROCESS STEAM RETURNABLE - INCLUDES
TCP, MCA, DCP, YARD, 2-4D (EXIST)
ESTIM [illegible] YEAR — 3300 #/hr

HEATING STEAM RETURNABLE - INCLUDES
OFFICE, WAREHOUSE, MISC — 2300
5600 #/hr

VALUE OF RETURNED CONDENSATE
@ 120 BTU/# AVE. PER YEAR — $6400

BASED ON $1.25/10^6 BTU

ESTIMATED INITIAL COST OF CONDENSATE RETURN SYSTEM

PROCESS	300' OF 2" @ $2.50/LF INSTALLED	750	PROCESS RETURNS
YARD	300' OF 2" @ $2.50/LF INSTALLED	750	
HEATING	1000' OF 1" @ $2.00/LF "	2000	PUMPED RETURN
3 CONDENSATE RETURN PUMPING UNIT:		1500	
		$5000	

∴ INSTALLATION PAID OFF IN LESS THAN ONE YEAR.

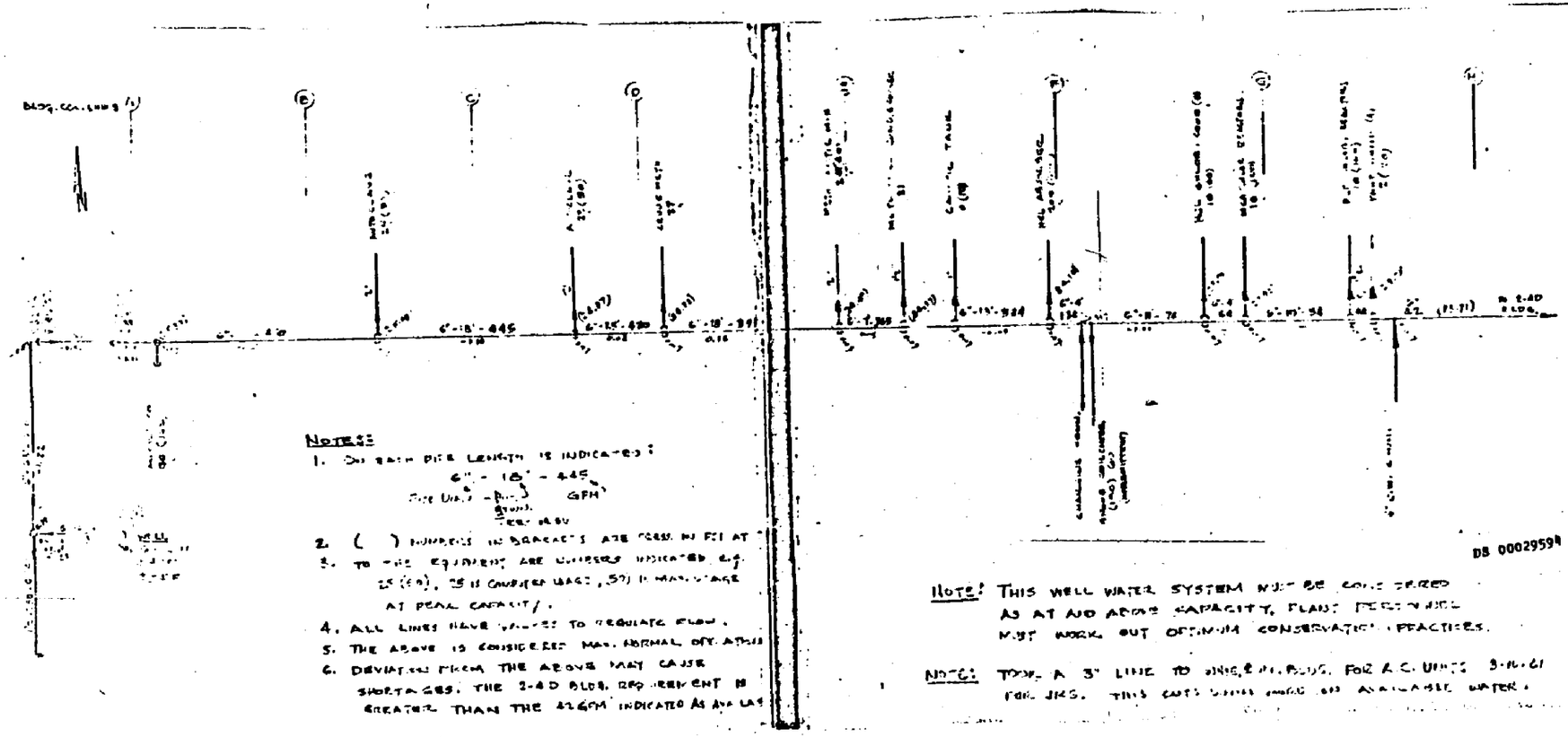
DS 00029593

CLIENT: DACO — PROJECT NO. 605028

SUBJECT: CONDENSATE RETURN ECONOMICS — PREPARED BY SS — DATE 6-9-65

ENGINEERS INCORPORATED — NEWARK, N. J. — PAGE 1 OF 1

MAXUS0998286



Client: Dunaway Airball Co.
Subject: Computing (Well) Water Heater
Engineers
Prepared by: HVB
Date: 2-14-61
Project No.: 6-2-6-6
17

DS 00029595

WATER REQUIREMENT – (COOLING ONLY)

		CONTINUOUS	INTERMITTANT
F2-R101	TCP REACTOR	25	50 ✓
F2-R102	TCP REACTOR	25	50 ✓
F2-HX2A	METHANOL COND.	27	27
F2-HX2B	METHANOL COND.		
F2-HX7	METH. STILL COND.	30	30 ✓
F2-HX7	METH. COOLER	1	1
F2-R201	METH-CAUSTIC MIX	28	28
F2-H203	MIX TANK VENT COND	9	9
F2-HX4	AMMONIA CONDENSER	130	130
F2-F220	FILTER		50
			375
H416A-C	KARBATE VENT CONDENSER	5	30
H416E-G	PHOS VENT CONDENSER	5	30
D501	HCL ABSORBER	100	100
H515	AMMONIA CONDENSER	–	60
H512	FEATHER CONDENSER	–	60
R410	MCA CHLORINATOR	5	25
R412	MCA CHLORINATOR	5	25
R609	DCP CHLORINATOR	5 ✓	25
R611	DCP CHLORINATOR	5 ✓	25
H614A-B	TANK VENT CONDENSER	1	10
H614C-D	TANK VENT CONDENSER	1	10
D618	HCL ABSORBER	100	100
		507 GPM	875 GPM

Office & Misc A.C. Units 52 gpm (Summer Only)

PP-106

PREPARED BY _____ PROJECT NO. _____

DATE _____ SUBJECT COOLING WATER REQUIREMENT

ENGINEERS INCORPORATED 487 ORANGE STREET NEWARK, N.J. PAGE 2 OF

MAXUS0998288

BY JRS DATE 3-12-[illegible] SUBJECT Water Requirements — Office Bldg. and Whse Bldg. Air Conditioning Units SHEET NO. ____ OF ____
CHKD. BY ____ DATE ____ JOB NO. ____

Cooling Load

3 - 5 Ton Units in Lab = 15 T
1 - 10 ton Unit General = 10 T
1 - 7½ ton Unit in Whse = 7½ T
32½ Ton

Basis: 1 Ton of Refrigeration

Ton of refrigeration = 12000 BTU/hr

15°F Temp. rise considered Normal for 54°F Well Water per H. Bennett (Engrs. Inc.)

$Q = W c_p \Delta T$

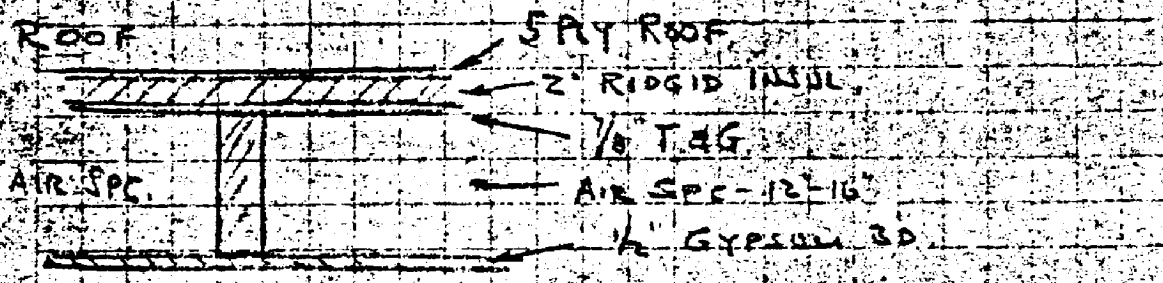
$W = \frac{Q}{c_p \Delta t} = \frac{12000 \text{ BTU/hr}}{1 (15°F)} = 800 \text{ lbs/hr}$

$\left(\frac{800 \text{ lbs}}{\text{hr}}\right)\left(\frac{\text{gal}}{8.3 \text{ lbs}}\right)\left(\frac{\text{hr}}{60 \text{ min}}\right) = 1.6 \text{ gpm/ton Refrig}$

$\left(\frac{1.6 \text{ gpm}}{\text{ton}}\right)(32.5 \text{ tons}) = \underline{\underline{52 \text{ gpm}}}$

DS 00029596

MAXUS0998289



HEAT TRANS. COEFICIENT - HEAT FLOW UPWARD

CONSTRUCTION	RESISTANCE (R)
OUTSIDE SURFACE	.17
ROOFING	.33
INSULATION 2"	5.26
WOOD DECK	.98
AIR SPACE	.85
GYPSUM BOARD	.32
INSIDE SURFACE	.61
TOTAL RESISTANCE	8.52

U = 1/8.52 = .118

HEAT TRANSFER = .118 × 55 = 6.45 BTU/FT/H. MAX.

HEAT TRANS. THRU GYPSUM ONLY

TOP SURFACE	.61
GYPSUM BD	.32
INSIDE SURF.	.61
TOTAL R =	1.54

U₁ = 1/1.54 = .65

TEMP. DIFF. @ 6.45 BTU/H. & .65 COEF = 6.45/.65 = 10.0°

∴ WITH 55° ROOM & 0° OUTSIDE, AIR SPACE IN PLENUM SHOULD BE 55 + 10 = 45°. SPRINKLER MAY BE APPLIED IN PLENUM, WITHOUT FREEZING, IF ROOM TEMPERATURE IS MAINTAINED 55 OR ABOVE.

DS 00029597

DACO

PREPARED BY H.M. BENNETT

PROJECT NO. 605028

DATE MAR. 2, 1961

SUBJECT HEAT TRANSFER

ENGINEERS, INCORPORATED

MAXUS0998290

BY [illegible] DATE 9/[illegible] SUBJECT _____ SHEET NO. ____ OF ____

CHKD. BY _____ DATE _____ JOB NO. _____

MATERIAL BALANCE FROM STD COSTS

FRESH CHARGE (WHOLE UNIT)

	PER MO.	PER BATCH
TETRACHLOROBENZENE	127,232 #	
METHANOL	11,350 GALS	
CAUSTIC SODA	62,160 #	

FOR ANISOLE BATCH

RECOVERED ANISOLE	8450	1175
CAUSTIC SODA	2880	400
METHANOL	755	105

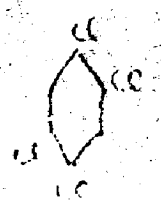
FOR TCP BATCH

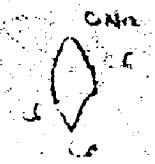
TCB	127,232	[illegible]
METHANOL	10,605	217
CAUSTIC SODA	65,300	[illegible]

TCP PRODUCED = 113,600 #/MO.

NaTCP EQU = 217.44/[illegible] × 113,[illegible] = 126,244

215.11 80 219.45 [illegible] 18



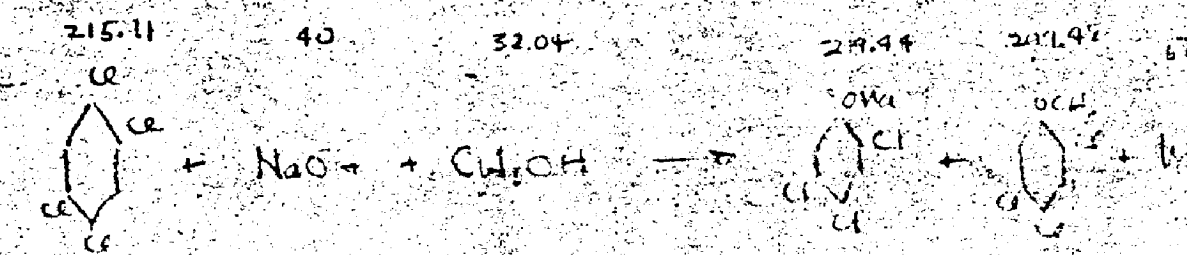
- 2 NaOH →  + NaCl + H_2O

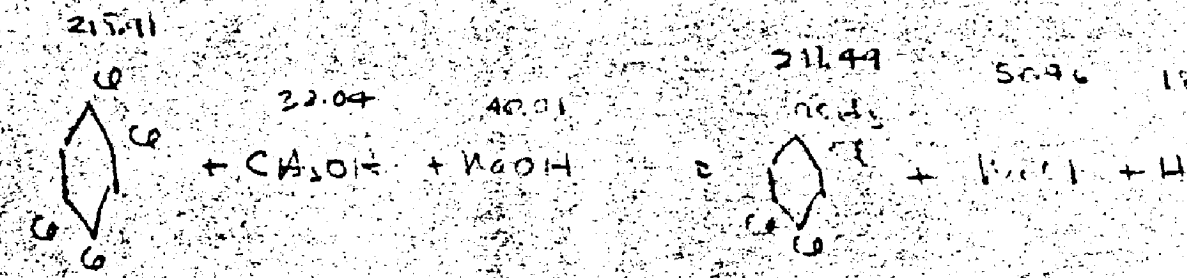
DS 00029598

MAXUS0998291

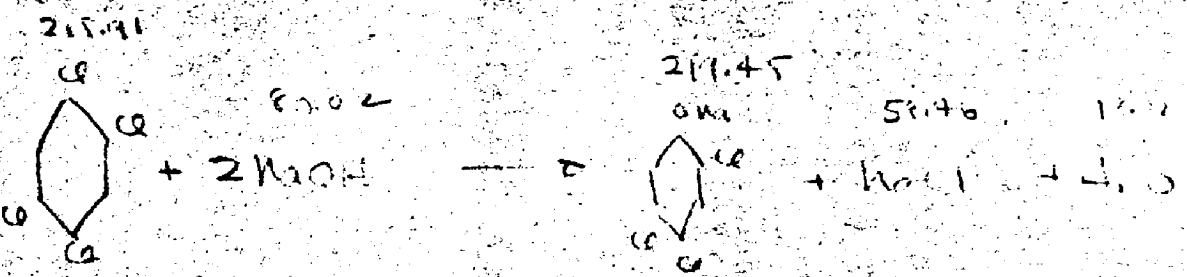
BY [illegible] DATE 4/27/[illegible] SUBJECT _____ SHEET NO. 2 OF ____

CHKD. BY _____ DATE _____ JOB NO. _____





174 26 32 170 47 15



2426 899 — 2466 657 202

TCB BATCH THEORY

CHARGE			YIELD		
TCB	—	2600	BATCH	—	2466
CH_3OH	—	26	NaCl	—	704
NaOH	—	931	H_2O	—	217
		2557	ANISOLE	—	170
					2557

ANISOLE BATCH THEORY

ANISOLE	—	170	BATCH	—	176
NaOH		32	CH_3OH		26

DS 00029599

MAXUS0998292

BY N. DATE 12/1/2 SUBJECT SHEET NO. 3 OF
CHKD. BY DATE JOB NO.

ASSUMING 7 TCB BATCHES / ANISOLE BATCH

OVERALL THEORY

CHARGE —		YIELD	
TCB	— 2600	NaTCP	— 2642
NaOH	— 963	NaCl	— 704
		H_2O	— 217
	3563		3563

$NaTCP/TCB = \frac{2642}{2600} = 1.018$ 17.5% EFF

ACTUAL $= \frac{12,324}{11,[illegible]} = 1.12$

ASSUME [illegible] AS TCB OVER IN AUTOCLAVE DISTILLATION

TCB BATCH MATERIAL BALANCE

ASSUME RECYCLE CH_3OH = 355 GAL

$355 \times 7.1 \times .8 \times .95 = 1920$ #

$H_2O = \frac{1920 \times .01}{.99} = 20$ #

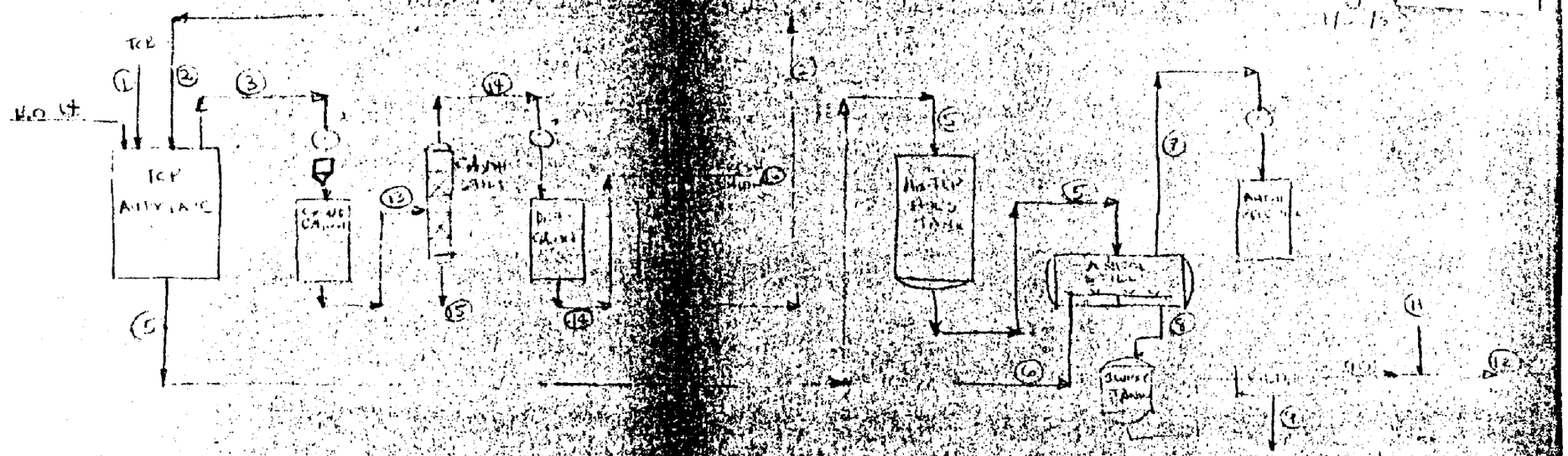
FRESH CH_3OH = 217 [illegible] = 19[illegible]

TCB BATCH

		CHARGE	REACTANTS	OFF IN DIST	TO NaTCP HOLD TANK
TCB	—	2600	65	65	
ANISOLE	—		170		170
NATCP	—		2404		2404
CH_3OH	—	3320	3292	20.10	1272
H_2O	—	20	232	232	
NaOH	—	1300	392		[illegible]
NaCl	—	[illegible]	685		63[illegible]
		7242	7240	3317	4[illegible]

DS 00029600

MAXUS0998293



	①	②	TOTAL FEED	TOTAL RECYCLE PRODUCT	③	④	⑤		⑥	⑦		⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰
METHANOL		3320	3320	3312	2020		1272		1272					2020	1920	100	1900				
WATER		20	20	232	232	1250	1250		6427	3384		3384	2732	6119	232	20	212				
TCE	2600		2600	65	65										65		65				
ANISOLE				170			170		170												
NaTCP				2904			2904			2904		2904		2904							
NaOH		1200	1200	392			392			392		392									
NaCl				625			625			625	125	500		625							
	2600	4640	7240	7240	2317	1250	6173		7669	6370	125	6745	2732	9600	2217	1940	277	1900			

DS 00029601

MAXUS0998294

BY _____ DATE _____ SUBJECT _____ SHEET NO. _____ OF _____

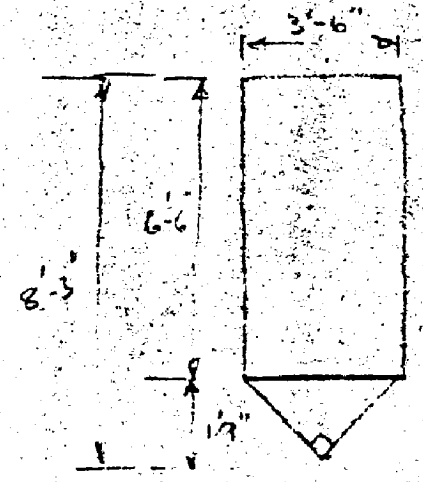
CHKD. BY _____ DATE _____ JOB NO. _____

TRY 3.5'

VOL. CONE = $\frac{(\pi)(3.5)^2(1.75)}{12}$ = 5.6 CF.

VOL CYL. = $(\pi)(3.5)^2$ = 9.64 CF/ft

$\frac{67-5.6}{9.64}$ = 6.37' = 6'-4.5" ∴ A = 6'-6"



TRY = 4'

VOL CONE = $\frac{(\pi)(4)^2}{12}(2)$ = 8.37 CF

VOL CYL = $\frac{(\pi)(4)^2}{4}$ = 12.6 CF/ft

$\frac{67-8.37}{12.6}$ = $\frac{58.63}{12.6}$ = 4.65' ∴ 5'

BY _____ DATE _____ SUBJECT _____ SHEET NO. ____ OF ____

CHKD. BY _____ DATE _____ JOB NO. _____

MATERIAL BALANCE

TCE FEED TO REACTORS

2600 #/BATCH SP. G. = [illegible] 10 #/GAL

2600 / 13 = [illegible] GALS/BATCH

REACTOR CYCLE — 16 HOURS

		HOURS	
4040 GALS / 595 GALS	CHARGE METHANOL	1/2	— 7.7 #/GAL
	HEAT UP		
2600 # / 260 GALS	CHARGE TCE	4	— [illegible]
	HOLD TIME		
	COOL DOWN		
2312 #/EACH	DISTILL METHANOL	2½-3	
	EMPTY	1/2	
	CLEAN		

METHANOL DISTILLATION AUTOCLAVE

WORST CASE

[illegible] = 2500 #/[illegible]

					SCF
$KAlO_2$	[illegible]	=	[illegible]	[illegible]	
H_2O	[illegible] .17	=	[illegible]	[illegible]	
TCB	[illegible]	=	7.5	0.4	
			[illegible]	[illegible]	35,0[illegible]

SCFM [illegible] / [illegible] = 13,200

DS 00029603

MAXUS0998296

BY _____ DATE _____ SUBJECT _____ SHEET NO. _____ OF _____

CHKD. BY _____ DATE _____ JOB NO. _____

NaTCN FROM KCN TO [illegible]

#/BATCH = 6173

TIME TO MIX = 30 MIN

#/HR = 6173 × 2 = 12346

ASSUME GALS = 650 (REHONITE)

GPM = 650/30 = 21.6

TCB FROM TANK CAR

15,000 GALS / 40 GPM

15,000 / 40 = 375 MIN = 6.25 HOURS

DS 00029604

MAXUS0998297

BY [illegible] DATE 4/[illegible] SUBJECT _____ SHEET NO. ____ OF ____

CHKD. BY ____ DATE ____ JOB NO. ____

TANK CALCULATIONS

CRUDE METHANOL RECEIVER
F2-T11

TO HOLD 1 AUTOCLAVE CHARGE

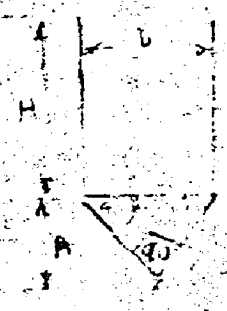
PRESENT AUTO CLAVE DRAIN = 355 GAL
= 47.5 CF

USE CONE BOTTOM TANK WITH STEAM COIL TO HELP PREVENT FREEZE-UP DURING WINTER

DESIGN FOR 500 GAL (INCLUDES HOLDUP) = 67 CF

VOLUME OF CONE = $\frac{\pi}{12} D^2 \times ALT$

USE 45° CONE



$V = \frac{\pi D^2 (H)}{12} + \frac{\pi}{12} D^2 A$

$A = \frac{1}{2} D$

SAY, H = 2D

$V = \frac{\pi D^2 (2D)}{12} + \frac{\pi D^2 (D)}{12}$

$= \frac{2\pi D^3}{9} + \frac{\pi D^3}{6} = \frac{12\pi D^3 + 9\pi D^3}{36} = \frac{16\pi D^3}{36} = \frac{\pi D^3}{1.5}$

$67 = \frac{\pi D^3}{1.5}$ $D^3 = 32$

$D = \approx 18'$

SAY 5' DIA

DS 00029605

VOL CONE = $\frac{(\pi 1 D^2)}{12} \times .5D = \frac{\pi 1 (1.5)}{12} = 3.5$

VOL CYL = $\frac{(\pi 1 D^2)}{4}$ = 7.07 CF

CT = 3.5 + 7.07 = 10.57 (63.47)

MAXUS0998298

BY _____ DATE _____ SUBJECT _____ SHEET NO. 1 OF ___

CHKD. BY _____ DATE _____ JOB NO. _____

HEAT EXCHANGER

FOR CONDENSING METHANOL FROM AUTOCLAVE DISTILLATION

	1/4 HOUR	#/HR
CH_3OH	2011	503
H_2O	425	106
TCB	72	18
	2510	626

DISCHARGE TCB IN MIXTURE

	#	MOLES	FRACT
CH_3OH	503	15.7	.73
H_2O	106	5.9	.27
		21.6	1.00

ASSUME PRESS - ATM

BUBBLE POINT

	X	ASSUME T = 10[illegible] F VP	(X)(VP)	ASSUME T = 1[illegible]	X
CH_3OH —	.73	[illegible]	3.36	15	[illegible]
H_2O —	.27	0.16	.26		1.[illegible]
			3.6[illegible]		1[illegible]

		ASSUME T = 170°F	X VP	ASSUME T = 16	X VP
CH_3OH	.73	23	16.[illegible]	18.5	13.5
H_2O	.27	6.1	1.7	4.[illegible]	1.3
			1[illegible]		14.[illegible]

∴ BUBBLE POINT = 160 F

DS 00029606

MAXUS0998299

BY _____ DATE _____ SUBJECT _____ SHEET NO. _____ OF _____

CHKD. BY _____ DATE _____ JOB NO. _____

DEW POINT

TOTAL PRESS. = π = 14.7

X VP = PP PP/π = 1 − PP/π X = PP/VP

@ 100°F π − VP

COMP.	%	VP	π − VP	PP	X
CH_3OH	.73	28	[illegible]	20.5	42
H_2O	.27	7.6	5.6	6.9	5
			.106		1.0

DEW POINT = 175°F

CONDENSER [illegible] 175 − [illegible] °F

C.W. TEMP. = 55 − [illegible] °F

SAT COND TEMP = 165 °F

165

105

55

$\Delta T_m = \frac{105 - 55}{\ln \frac{105}{55}}$ = 77°F

SAT U = 100

LOAD

L V CH3OH @ 165°F = [illegible] BTU/#

L H2O [illegible] = 1002

Q = 503 × [illegible] = [illegible]

106 × [illegible] = 106,000

[illegible] BTU/hr

A = [illegible] / [illegible] = 24 ft²

DS 00029607

MAXUS0998300

BY JFM DATE 4/26/60 SUBJECT Methanol Distillation Plant SHEET NO. 1 OF 10
CHKD. BY _____ DATE _____ Newark Plant JOB NO. _____

Design basis:

1. Assume feedes 80 wt% methanol & 20 wt% water
2. Methanol product to be 99 wt%
3. " recovery to be 95%.
4. Feed rate = 2016/.8 × 4.5 batches/day = 11340 lbs/day ≈ 472.5 cay
475 lbs/hr

Design distribution (neglecting TCP)

		Feed			Tops			
		wt%	moles	mol%	lbs	wt%	moles	mol%
32.04	MeOH	80	2.497	69.227	76	99	2.372	98.26
18.02	Water	20	1.110	30.773	0.76	1	0.042	1.74
		100	3.607	100.000	76.76	100	2.414	100.00
		M.W. = 27.72			M.W. = 31.80			

Feed dist	wt%	mol%
Tops	76.76	66.93
Bottoms	23.24	33.07
	100.00	100.00

Bottoms			
lbs	wt%	moles	mol%
4	17.21	0.125	10.48
19.24	82.79	1.068	89.52
23.24	100.00	1.193	100.00
	M.W. = 19.48		

Probable feed composition basis 2016/2222 = 90.32%

				Tops	
	wt%			lbs	wt%
MeOH	90.32			85.80	99
Water	9.68			.86	1
	100			86.66	100

Feed dist.	wt%	mol%		Bottoms lbs	
Tops	86.66		MeOH	4.52	33.88
Bottoms	13.34		Water	8.82	66.12
	100.00			13.34	100.00

Comparison of the two feed streams readily shows that the one with 20% wt water is more difficult to separate. The column will be designed on the basis of a feed stream containing 20% wt water. This will make the column conservative.

DS 00029608

MAXUS0998301

BY JFM DATE _____ SUBJECT _____ SHEET NO. _____ OF _____

CHKD. BY _____ DATE _____ JOB NO. _____

Dew point of top $P = 16$ PSIA ≈ 827 mm Hg

	y	P (T = 67°C)	K	x	P (T = 68)	K	x
MeOH	0.9826	824	1.008	0.9748	869	1.051	0.9349
Water	0.0174	205	0.248	0.0702	214	0.259	0.0672
	1.0000			1.0550			1.0021

Top temp = 68°C

Column $\Delta P = 1$ PSI

Bubble Point of bottoms $P = 17$ PSIA ≈ 880 mm Hg.

	x	P^o (T = 91°C)	K	y	P^o (T = 94°C)	K	y	P^o (T = 98)	K	y
MeOH	0.1048	1950	2.216	0.2322	2150	2.443	0.2560	2440	2.773	0.2906
Water	0.8952	546	0.620	0.5550	616	0.694	0.6213	707	0.803	0.7188
				0.7872			0.8773			1.0094

Bottom calc T = 98°C

Temp correction due to non-ideal behavior ≅ 6°C corrected temp = 98 − 6 = 92°C

DS 00029609

MAXUS0998302

BY FM DATE SUBJECT SHEET NO. OF
CHKD. BY DATE JOB NO.

Minimum reflux ratio

$$\frac{L}{V} = \frac{33.7-2.5}{77-2.5} = \frac{30.7}{74.5} = 0.4121$$

$$\frac{L}{L+D} = \frac{L_D}{L_D+H} = \frac{R}{R+1} = 0.4121$$

$$0.5879R = 0.4121$$

$$R_m = 0.701 \text{ to } 1$$

$$\frac{R_m}{R_m+1} = \frac{y_D - y_F^*}{y_D - x_F} = \frac{98.26-86.80}{98.26-69.23}$$

$$= \frac{11.46}{29.03} = 0.3948$$

$$R_m = \underline{\underline{0.652 \text{ to } 1}}$$

at 1.5 to 1 R.R

Basis: 100 Mlb of feed (D = 66.93 mole)

$L_R = 1.5D = 100.395$ mole

$V_R = L_R + D = 2.5D = 167.325$ mole

$L_R/V_R = \frac{1.5}{2.5} = 0.6$

$$y_{n+1} = \frac{L}{V}(x_n) + \frac{D}{V}(x_D)$$

$$y_{n+1} = 0.6x_n + 0.393$$

Estimation of Col dia for a bubble cap column

$$V_m = \frac{RT}{P} = \frac{10.73(614.4)}{16} = 412 \text{ cu ft/mol} \quad P = 16 \text{ PSIA}$$

$T = 68°C = 154.4°F$

$\frac{46.0}{614.4}$

$$\rho_V = \frac{31.80}{412} = 0.0772 \text{ lb/cu ft}$$

$\rho_L = 46.457$ lbs/cu ft

$\rho_V/(\rho_L - \rho_V) = 0.001660$

$\sqrt{\rho_V/(\rho_L - \rho_V)} = 0.0408$

For 1" seal 12" tray spacing (9.5" actual)

$$V_C(0.0408) = 0.09$$

$V_C = 2.2$ ft/sec allowable vap vel

Bottom temp = 88°C

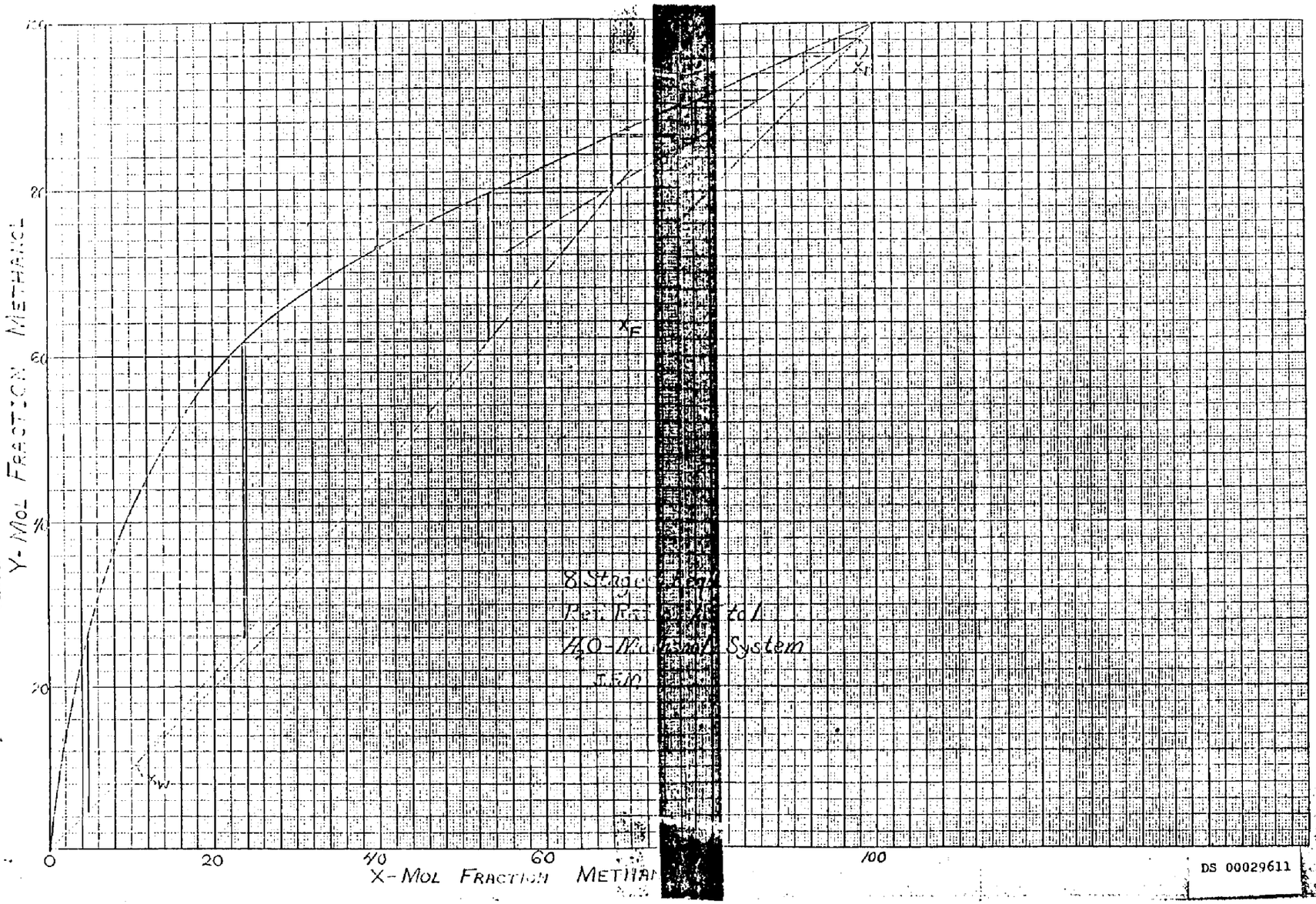
actual vapor rate

$$(475/100)(2.414)(2.5) = 28.67 \text{ mole/hr} \approx \frac{28.67(412)}{3600} = 3.28 \text{ cu ft/sec}$$

$$\text{area reqd} = \frac{3.28}{2.2} = 1.5 \text{ sq ft}$$

DS 00029610

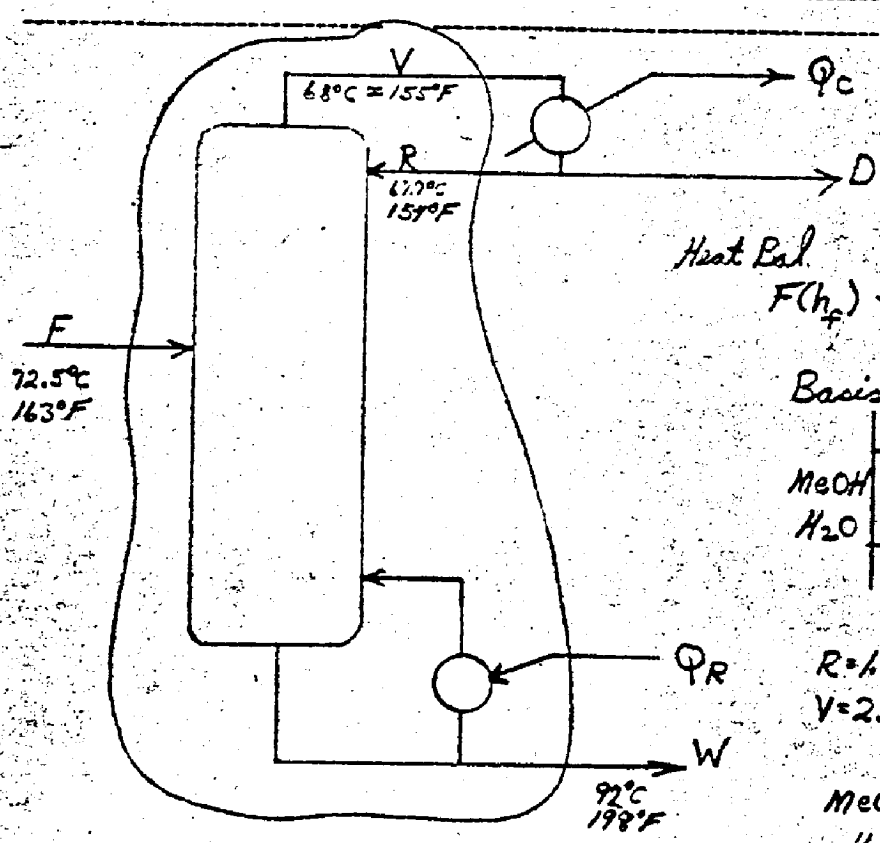
MAXUS0998303



DS 00029611

MAXUS0998304

BY JFM DATE SUBJECT SHEET NO. 5 OF
CHKD. BY DATE JOB NO.



Heat Bal.

$$F(h_f) + Q_R + Rh_R = VH_v + Wh_w$$

Basis: 100 lbs feed

	F	D	W	R
MeOH	80	76	4	114
H_2O	20	0.76	19.24	1.[illegible]
	100	76.76	23.24	115.[illegible]

R = 1.5D
V = 2.5D

	V
MeOH	190
H_2O	1.9
	191.9

Heat datum:

Liq H_2O at 32°F + 1 atm = 0
Liq MeOH at 64.5°C (148°F) = 0

Heat In

a. Feed — ΔT = 163 − 148 = 15

MeOH	80 (0.616)(15) =	739 BTU
H_2O	20 (131) =	2620 BTU
		3359 BTU

b. Reflux — ΔT = 154 − 148 = 6

MeOH	1.5(76)(0.616)(6) =	421 BTU
H_2O	1.5(76)(122) =	139 BTU
		560 BTU

c. Reboiler = Q_R BTU

Heat out — ΔT = 155 − 148 = 7°F

a. Column overhead vapor

(L) MeOH	190(0.616)(7) =	819.3
(V) MeOH	190(1.8)(261) =	89262.0
H_2O	1.9 (1127.6) =	2142.0
		92,223.3 BTU

b. Bottoms — ΔT = 198 − 148 = 50F

MeOH	4 (.617)(50) =	123.4 BTU
H_2O	19.24 (166) =	3193.8 BTU
		3317.2 BTU

$$3359 + 560 + Q_R = 92,223.3 + 3317.2 = 95,540.5$$

$$Q_R = 95541 - 3919 = 91,622 \text{ BTU}$$

DS 00029612

MAXUS0998305

BY JFM DATE _____ SUBJECT _____ SHEET NO. 6 OF 12
CHKD. BY _____ DATE _____ JOB NO. _____

Lbs vapor produced by reboiler

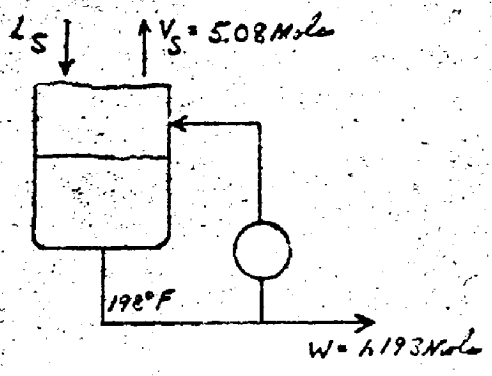
assume vapor is 40 mol % MeOH ≈ 54.2 wt % MeOH

0.40(32.04) = 12.816
0.60(18.02) = 10.812
23.628

Let x = lbs of vapor formed in reboiler at 198°F

MeOH 0.542x (1.8)(247.5) = 241.5x BTU
H_2O 0.458x (1144.1) = 524x BTU
765.5x BTU

765.5x = 91,622 x = 119.7 lbs of vapor say 120 lbs



		mole
lbs MeOH in vapor = .542 (120) =	65.04	2.03
" H_2O " " " .458 (120) =	54.96	3.05
	120.00	5.08

$L_S = V_S + W = 6.273$ mole

$\frac{L_S}{V_S} = \frac{6.273}{5.08} = 1.235$ (from heat balance)

By assuming constant molal liquid & vapor flow thru column we have:

D = 2.414 mole
L_R = 1.5(2.414) = 3.621 mole
V_R = 2.5(2.414) = 6.035 mole
F = 3.607 mole (liq at boiling point)
$L_S = L_R + F = 7.228$

4.75(7.228) = 34.33 mol/hr

DS 00029613

$V_S = V_R = 6.035$ $\frac{L_S}{V_S} = \frac{7.228}{6.035} = 1.198$ (graph L_S/V_S = 1.203)

---

at maximum feed rate of 11,370 lbs/day ≈ 475 lbs/hr

$V_S = \frac{475}{100}(5.08) = 24.13$ mole/hr
$L_S = \frac{475}{100}(6.273) = 29.80$ mole/hr
} Heat balance figures (no heat loss)

$\frac{L_S}{V_S} = 1.214$

Assume 10% heat loss $V_S = 1.1(24.13) = 26.54$ mole/hr $L_S = 32.21$ mole/hr
$W = 475(.192) = 5.87$ mole/hr

MAXUS0998306

BY JFM DATE _____ SUBJECT _____ SHEET NO. 1 OF 12

CHKD. BY _____ DATE _____ JOB NO. _____

Liquid rate at top of column

$L = \left(\frac{475}{100}\right)(76.76)(1.5) = 547$ lbs/hr

Density at 68°C = .745 = 46.49 #/cu ft

$\frac{547}{46.49} = 11.766$ cu ft/hr ≈ 5.65 cu in/sec

Liquid rate at bottom of column

	at 64.6°C	at 90°C
Terminal ΔH_v MeOH =	8,930	8004
Large Pitzer ΔH_v H_2O =	10,102	9835

cal/gm mol

$(120+23.24)4.75 = 680.4$ #/hr (no dist loss)

$(132+23.24)4.75 = 737.4$ #/hr (10% dist loss)

avg M.W liq = 22.83 ← $\frac{680.4}{29.8}$ (no dist loss)

$\frac{737.4}{32.21} = 22.89$ avg M.W (includes dist loss)

Large Pitzer ΔH_v H_2O = 10097 cal/gm mol at 64.6°C

= 9816 at 90°C

Large Pitzer ΔH_v MeOH = 8420 cal/gm mol at 64.6°C

$\frac{132}{120}(5.02)(4.75) = 26.543$ moles vap (includes 10% dist loss)

$4.75(1.193) = 5.667$ = liq bottoms

32.210 moles L_s

LVS — 5006

90 — 544

51 wt % H_2O

35 mol % hole (assumed that liq leaving bottom tray is equal to return bottom tray is 40 mol % MeOH)

B.P. of MeOH 64.6°C or 147.3°F

$35(32.04) = 112.14$

$65(18.02) = 117.13$ avg MW = 22.93

$\frac{229.27}{10} = 22.93$ this check is close to value of 22.23

DS 00029614

MAXUS0998307

Now consider packed col.

at Top of column: $L/V = \frac{4.75(1.5)(76.76)}{4.75(2.5)(76.76)} = 0.6$

at bottom of column: $L/V = \frac{4.75(132+23.24)}{4.75(132)} = \frac{737.39}{627} = 1.176$ (with ht loss)

$L/V = \frac{4.75(120+23.24)}{4.75(120)} = \frac{680.4}{570} = 1.194$ (no heat loss)

$L/V = \frac{7.228 \text{ mole}}{6.035 \text{ mole}} = 1.198$ (assumes no heat loss + constant molal overflow thru out column)

We shall design for $(L/V)_B = 1.17$

Bottom temp = 92°C ≈ 198°F ≈ 658

" Pressure = 880 mm Hg ≈ 17 PSIA

$V = \frac{RT}{P} = \frac{10.73(658)}{17} = 415$ cu ft

$\rho_V = \frac{23.6}{415} = 0.057$ #/cu ft

$\rho_L = 62.4(0.9) = 56.2$ lb/cu ft

$\Phi = 1.17(\rho_V/\rho_L)^{1/2} = 1.17(0.0319) = 0.0373$

$\beta = 0.185$

For ½" Berl saddles

$a/\epsilon^3 = 400$

$\frac{G_V^2}{3600} = 0.185\left(\frac{1}{400}\right)\left(\frac{0.057(56.2)(32.2)}{0.8705}\right)$

$\frac{G_V^2}{3600} = 0.0548$

$G_V^2 = 710{,}208$

$G_V = 843$ lbs/hr sq ft

at 80% of flood $0.8(843) = 674$ lbs/hr sq ft

area req'd $= \frac{627}{674} = 0.93$ sq ft

assume $\mu = 0.5$ cpt. $D = \sqrt{\frac{4A}{\pi}} = \sqrt{1.1847}$

$D = 1.09$ ft

$\mu^{0.2} = .2(9.6787\text{-}10)$ $D = 13$ inches

$1.939794\text{-}2 = 0.8705$

Use 14" I.D col

For 1" Berl saddles

$a/\epsilon^3 = 160$

$\frac{G^2}{3600} = 0.0548\left(\frac{400}{160}\right) = 0.137$

$G^2 = 1{,}775{,}520$

$G = 1332$ lbs/hr sq ft

at 80% of flood $0.8(1332) = 1065$ lbs/hr sq ft

area req'd $= \frac{627}{1065} = 0.589$ sq ft

$D = \sqrt{0.7503}$

$D = 0.866$ ft = 10.4 inches

DS 00029615

BY: JFM DATE _____ SUBJECT _____ SHEET NO. 7 OF 12

CHKD. BY _____ DATE _____ JOB NO. _____

Condenser surface reqd

153°F → 115°F

85

$\Delta T_1 = 68°F$

$\Delta T_2 = 48°F$

$\Delta T_m = 57°F$

$\Delta H_v = 472$ BTU/lb

Assume 85°F cooling water

115°F outlet water temp

Vapor condenser at 67°C ≈ 153°F

Duty = 912 (472) = 430,500 BTU/hr

$U_C = 140$ BTU/hr sq ft °F

$U_D = 100$ BTU/hr sq ft °F

$\frac{1}{U_C} + 0.003 = \frac{1}{U_D}$

$.007 + 0.003 = \frac{1}{U_D}$

$0.01 U_D = 1$

$U_D = \underline{\underline{100}}$

$A = \frac{430,500}{100(57)} = 75.5$ sq ft

GPM of H_2O reqd = $\frac{430,500}{500(30)} = 28.7$ gpm

In condenser use 3/4" O.D × 16 gage tubes

Feet of tubing reqd using outside surface of tube = $\frac{75.5}{0.1963} = 385$ ft

For 8 ft tube length; no of tubes reqd = $\frac{385}{8} = 48$ tubes

A 10" I.D shell for a two tube pass exchanger will provide 52 tubes, which will be satisfactory.

Water velocity thru tubes: $\frac{28.7(231)}{26(0.302)} = 844.3$ in/min = 1.17 ft/sec (too low)

For 10 ft tube length; no of tubes reqd = $\frac{385}{10} = 38.5$

A 10" I.D shell for a 4 tube pass exchanger will provide 40 tubes.

Water velocity thru tubes: $\frac{28.7(231)}{10(0.302)} = 2195.3$ in/min ≈ 3.05 ft/sec

okay

Recommend: 10" I.D shell exchanger with 4 tube passes.
Tube length 10 ft.

DS 00029616

Actual calc. U for exchanger = $\frac{430500}{57(78.52)} = 96.2$ BTU/hr/sq ft/°F

MAXUS0998309

Reboiler surface req'd

Assume 20 PSIG steam will be used for heating (sat temp = 259°F)
Assume avg boiling point in reboiler is 205°F

$\Delta T = 259 - 205 = 54°F$

Duty = 4.75(1.1(91,622)) = 478,724 BTU/hr say 479,000

We shall design for a max flux of 10,000 BTU/hr ft², then

$$U_D = \frac{10,000}{54} = 185 \text{ BTU/hr sq ft °F}$$

For an assumed dirt factor, $R_D = 0.002$ we get a clean coef. (U_c) of

$$\frac{1}{U_c} = \frac{1}{U_D} - 0.002$$

$$= 0.0054 - 0.002 = 0.0034$$

$U_c = 295$ BTU/hr sq ft °F which is reasonable for MeOH-water.

$$A = \frac{479,000}{185(54)} = \underline{\underline{47.9 \text{ sq ft}}}$$

Steam req'd: $S = \frac{479000}{939} = \underline{\underline{510}}$ lbs/hr

For thermosyphon reboiler use 1" O.D tubes x 14 gage and tube length of 5 ft

Feet of tubing req'd using inside tube surface $= \frac{47.9}{0.2183} = 219.4$ ft

No of tubes $= \frac{219.4}{5} = 44$ tubes

For 1-1 heat exchanger with tubes on a 1 1/4 inch square pitch layout, a 12" I.D shell will provide 48 tubes.

DS 00029617

CHECK FEASIBILITY OF ANISOLE DISTILLATION ON 24 hr. CYCLE

HEAT BATCH 8.4 HRS. — STEAM DISTILL 13.6 HRS. — FILTER - 2 HRS.

1) EXISTING HEATERS ABOUT 160°F

2) ASSUME U = 20

$C_p = 0.9$

STEAM = 300°F

3) $\ln\left(\frac{T_1 - t_1}{T_1 - t_2}\right) = \frac{UA\theta}{Mc}$

$2.3 \log\left(\frac{300-120}{300-221}\right) = \frac{20 \times 160 \times \theta}{37{,}100 \times 0.9}$

$\theta = 8.4$ hr

$\frac{53\,904}{1316} = 3970$ #/hr

$3970 \times 900 = 3{,}570{,}000$ BTU/hr

$\frac{3{,}570{,}000}{(140-85)(8.33 \times 60)} = 130$ GPM COOLING WATER

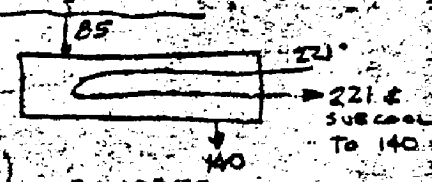
USE MTD = 105°

$Q = UA\Delta T$

A = 427 ft²

$3{,}570{,}000 = U(427)(105)$ CONDENSER

U = 80.0 REQD



SHOULD DO BETTER THAN THIS THEREFORE COND. OK AND WILL HANDLE SUB COOLING.

OPEN STEAM

$\frac{9616 \times 6}{13.6} = 4250$ #/hr MAX.

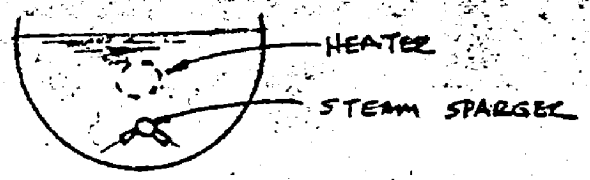
NOR. $\frac{9616 \times 6}{48-10.4} = 1520$ #/hr

3" STM. LINE → 2.7 psi/100' @ 100'/sec

USE STEAM SPARGER NOZZLES THAT WILL CIRCULATE CONTENTS THRU NOZZLES SEVERAL TIMES.

SK FIG. 314, 3/8", MODEL S.S.

20 NOZZLES @ 1.67' = 30 FT. SPARGER LINE



$\frac{4250}{20} = 213$ #/hr STEAM PER NOZZLE

DS 00029618

CLIENT DACO PROJECT NO. 605028

SUBJECT ANISOLE DISTILL. CHECK PREPARED BY HTilp DATE

ENGINEERS INCORPORATED

MAXUS0998311

CRUDE METHANOL CONDENSER H112B

QUOTATION FOR METHANOL STILL CONDENSER WAS BASED ON U OF 150

FOR CRUDE METHANOL CONDENSER USE U OF 100 BECAUSE OF CARRYOVER AND POSSIBILITY OF INCREASED FOULING

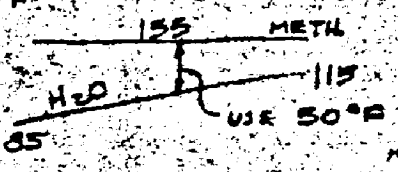
PER FLOW SHEET: 2252 lbs/hr. in 2½ hrs.

$\frac{2252}{2.5} = 900$ #/hr IF DISTILLATION IS UNIFORM.

USE 900 x 1.5 = 1350#/hr. AS MAX DISTILLATION RATE.

B.P. 100% MEOH = 150°

USE CONDENSING TEMP. = 155°F.



$Q = UA\Delta T$

$1350 \times 525 = 100 A \times 50$

$A = 142$ sq. FT. REQ'D.

$0.9 \times 472 = 425$
$0.1 \times 1000 = 100$
$\Delta h_v = 525$ BTU/lb.

EXISTING H112A

U TUBE, 144 HOLES, 5/8" I.D., MONEL, 2 PASS, 7 FT. SHELL.

FOR 5/8" TUBES — 0.1636 SQ.FT./FT, ASSUME TUBE 6 FT. LONG

$0.1636 \times 144 \times 6 = 141$ SQ.FT. ACTUAL

EXISTING UNIT IS ADEQUATE FOR CONDENSING BUT MAY NOT PROVIDE SUFFICIENT SUBCOOLING - FOR 60°F SUBCOOLING.

$Q = UA\Delta T$

$60 \times 0.61 \times 1350 = 50 A \times 50$

$A = 20$ SQ.FT.

DS 00029619

M-L N-624

CLIENT DACO

PROJECT NO. 605028

SUBJECT METHANOL CONDENSER - CHECK

PREPARED BY H. TILP DATE 10-28-64

ENGINEERS

MAXUS0998312

M-C VENT CONDENSER F2-H203

975 #/CAUSTIC PER HOUR

HEAT OF SOLUTION CAUSTIC IN H_2O = 420 BTU/lb.

HEAT OF SOLUTION CAUSTIC IN MeOH + H_2O per LAB TEST.

420 × 975 = SAY 420,000 BTU/hr.

ASSUME MeOH Δh_o = 470 BTU/lb.

$\frac{420,000}{470}$ = 900 # METHANOL/hr. IF JACKET WATER FAILS!

ASSUME COOLING WATER RISE 85-115°F = 30°ΔT.

$\frac{420,000}{30 \times 8.33 \times 60}$ = 28 GPM WATER (14,000 #/hr.)

ESTIMATE AREA → U = 200, ΔT = 50°F, Q = UAΔT

$A = \frac{420,000}{200 \times 50} = 42$ □'

DESIGN BASIS = 1/3 × 420,000 = SAY 160,000 BTU/hr.

WATER = $\frac{160,000}{30 \times 8.33 \times 60}$ = 9 GPM (4500 #/hr)

METHANOL = $\frac{160,000}{472}$ = 339 lbs/hr.

AREA 1/3 OF 42 = 14 SQ. FT. REQUIRED

DS 00029620

CLIENT DACO PROJECT NO. 60507.8

SUBJECT M-C VENT. CONDENSER PREPARED BY H. TILP DATE

ENGINEERS INCORPORATED NEWARK, N. J. PAGE 2 OF

MAXUS0998313

Computed Static Thrust in Relief Test pipe

$$\text{Thrust} = H_A = \frac{V^2}{2g} \qquad psi = H_A \cdot \rho_{liquid}$$

$$H_A = \frac{psi}{\rho}$$

$$psi = \frac{V^2 \rho}{2g}$$

6" pipe – area = 28.9 sq in → $\text{Thrust} = \frac{28.9 V^2 \rho}{2g}$

The V and ρ are for the point in the system at which static velocity is attained. Estimate pressure P' and outlet velocity V and same velocity V_o by method in Crane Technical Paper No. 410.

Assume 15' of 6" pipe and 5-90° elbows

pipe L/D = 15/.5 = 30

Elbows L/D = 5 × 30 = 150

Σ L/D = 180

$K = 0.014(180) + 0.5 = 3.0$

$K = 4.0$

Table pres A-22 for K = 4 → $\frac{\Delta P}{P'} = 0.67$

$\Delta P = 0.67 \times 565 = 379$

$P' = 565 - 379 = 186$ psia (outlet pressure)

$\rho = \frac{32}{R\,T} = \frac{4.0}{46.3 + 350} \times \frac{186}{15} = 5.94$ lb/ft³

$\bar{V} = \frac{5.94}{36} = 0.165$ ft³/lb

$psi = \sqrt{144\, k g P' \bar{V}}$ k = 1.2 (Air)

$= \sqrt{144(1.2)(32.2)(186)(0.165)}$

$V_o = 417$ ft/sec

$psi = \frac{(417)^2 (5.94)}{64.4} = 111$ psi

Force = 111 × 28.9 = 3200 lb

DS 0029621

PREPARED BY H. Tim

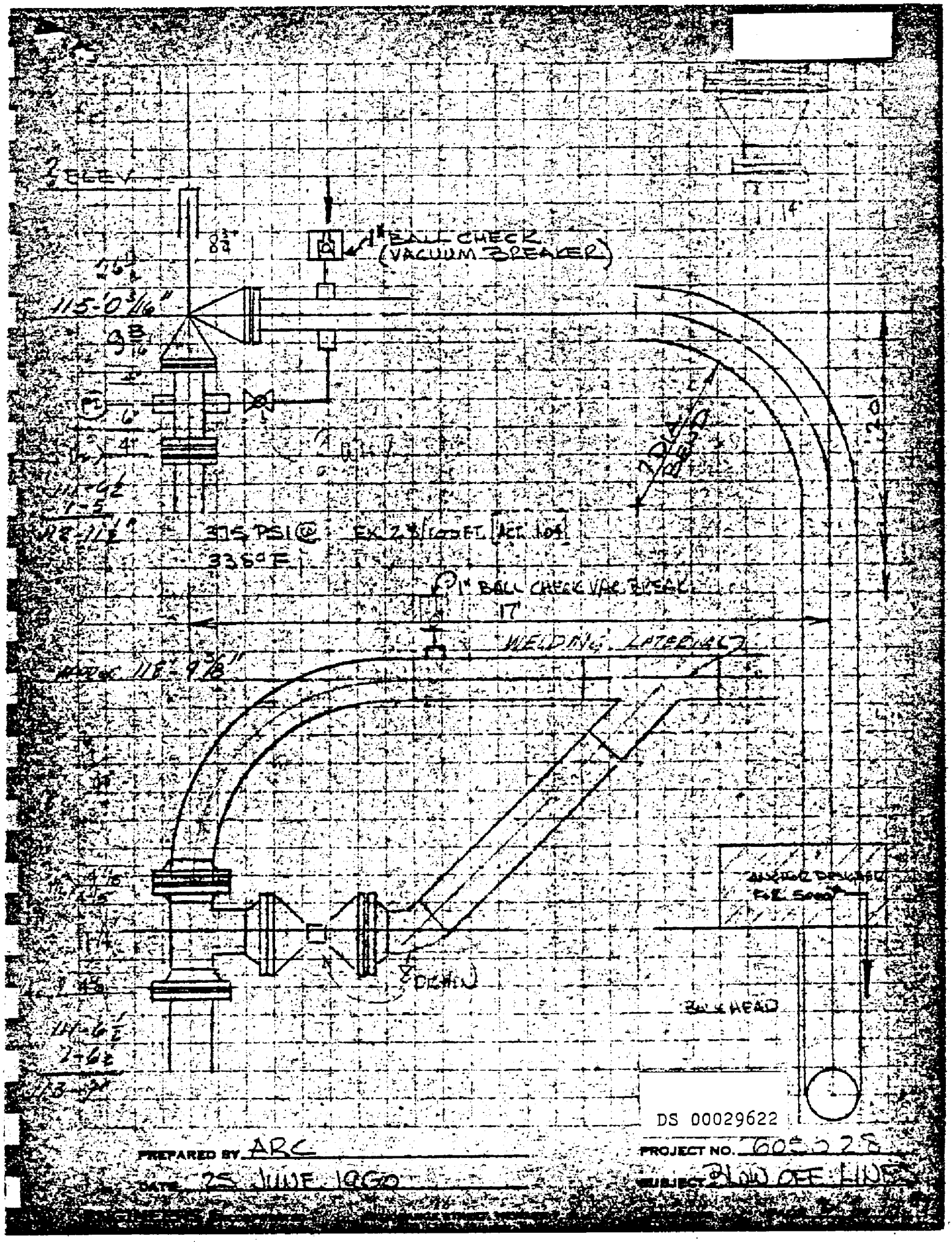
DATE 16 Feb 90

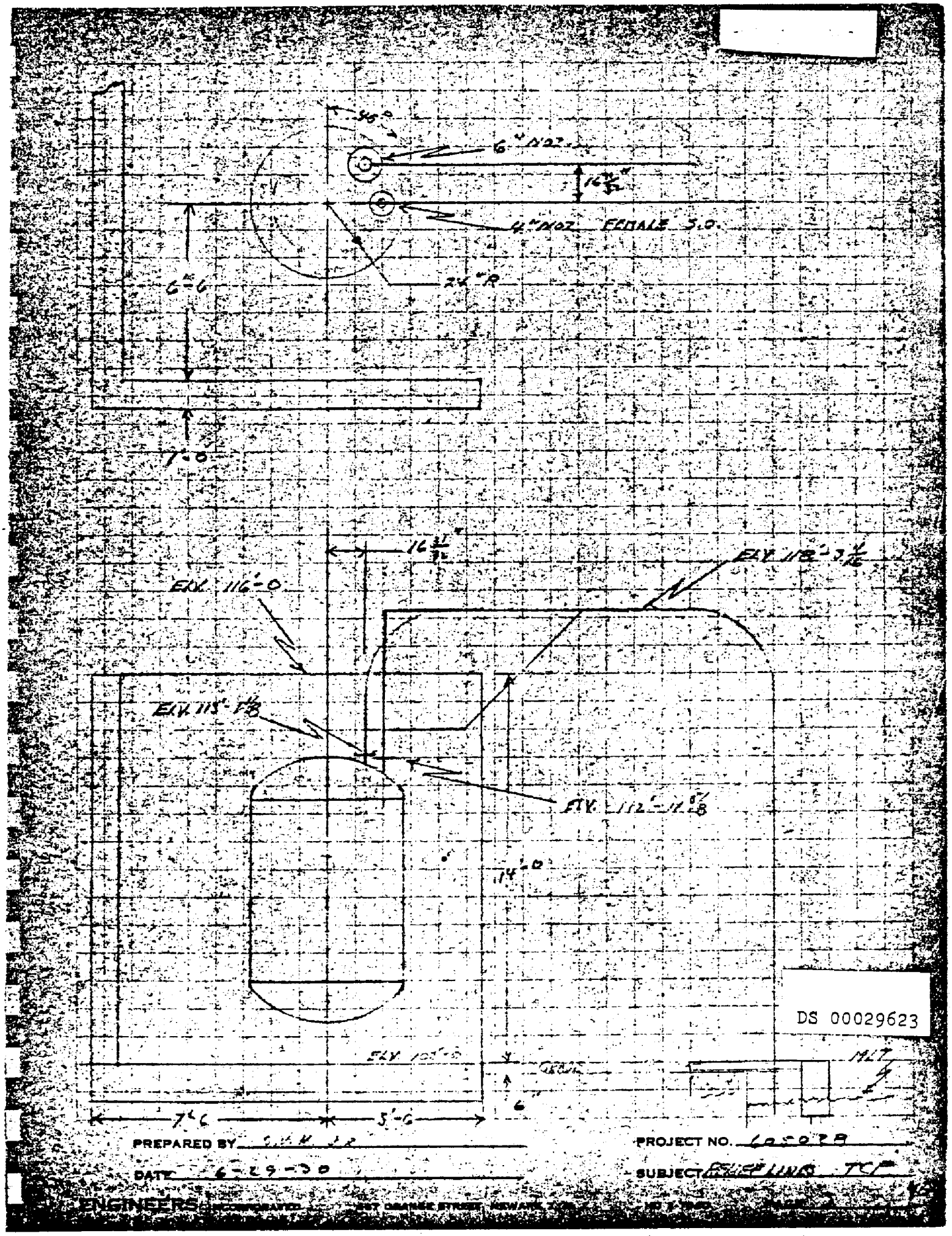
PROJECT NO. 6150E5

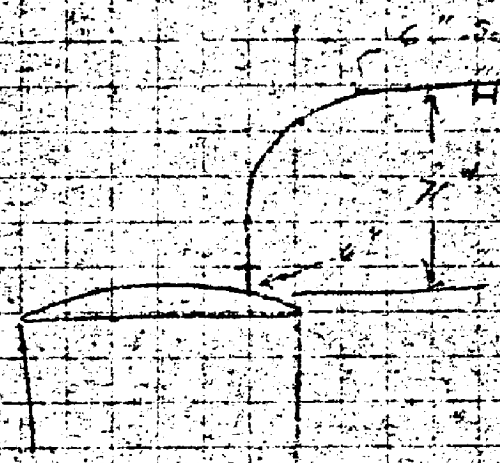
SUBJECT DIAMOND TCP

ENGINEERS

MAXUS0998314


ELEV
1" BALL CHECK (VACUUM BREAKER)
115-0 3/16"
6"
4"
335 PSI @ EX 23/100 FT. ACT. 105
335°F
1" BALL CHECK VAC. BREAK
17'
WELDING LATERALS
BULKHEAD
DS 00029622
PREPARED BY ARC
DATE 25 JUNE 1960
PROJECT NO. 60-028
SUBJECT BLOW OFF LINES


6" NOZ.
4" NOZ. FEMALE S.O.
24" R
6'-6
7'-0
ELV. 116'-0
ELV. 115'-1 1/8
ELV. 112'-11 5/8
14'-0
7'-6
5'-6
6"
DS 00029623
PREPARED BY
PROJECT NO.
DATE 6-29-90
SUBJECT
ENGINEERS INCORPORATED



$f = \frac{M}{S}$ If $f = 15{,}000$ psi

$S = I/c = 40.49 / 3.3 = 12.2$

$M = 15{,}000 \times 12.2 = PL$

$= 183{,}000$ in lbs

$\Delta_{Max} = \frac{PL^3}{3EI} = \frac{ML^2}{2EI}$

$= \frac{183{,}000 \times 72^2}{2 \times 30 \times 10^6 \times 40.49}$

$= .258$ "

If $f = 10{,}000$ psi

$M = 10{,}000 \times 12.2 = 122{,}000$ in lbs

$\Delta_{max} = \frac{122{,}000 \times 72^2}{3 \times 30 \times 10^6 \times 40.49} = .172$ "

DS 00029624

PREPARED BY A. V. K.

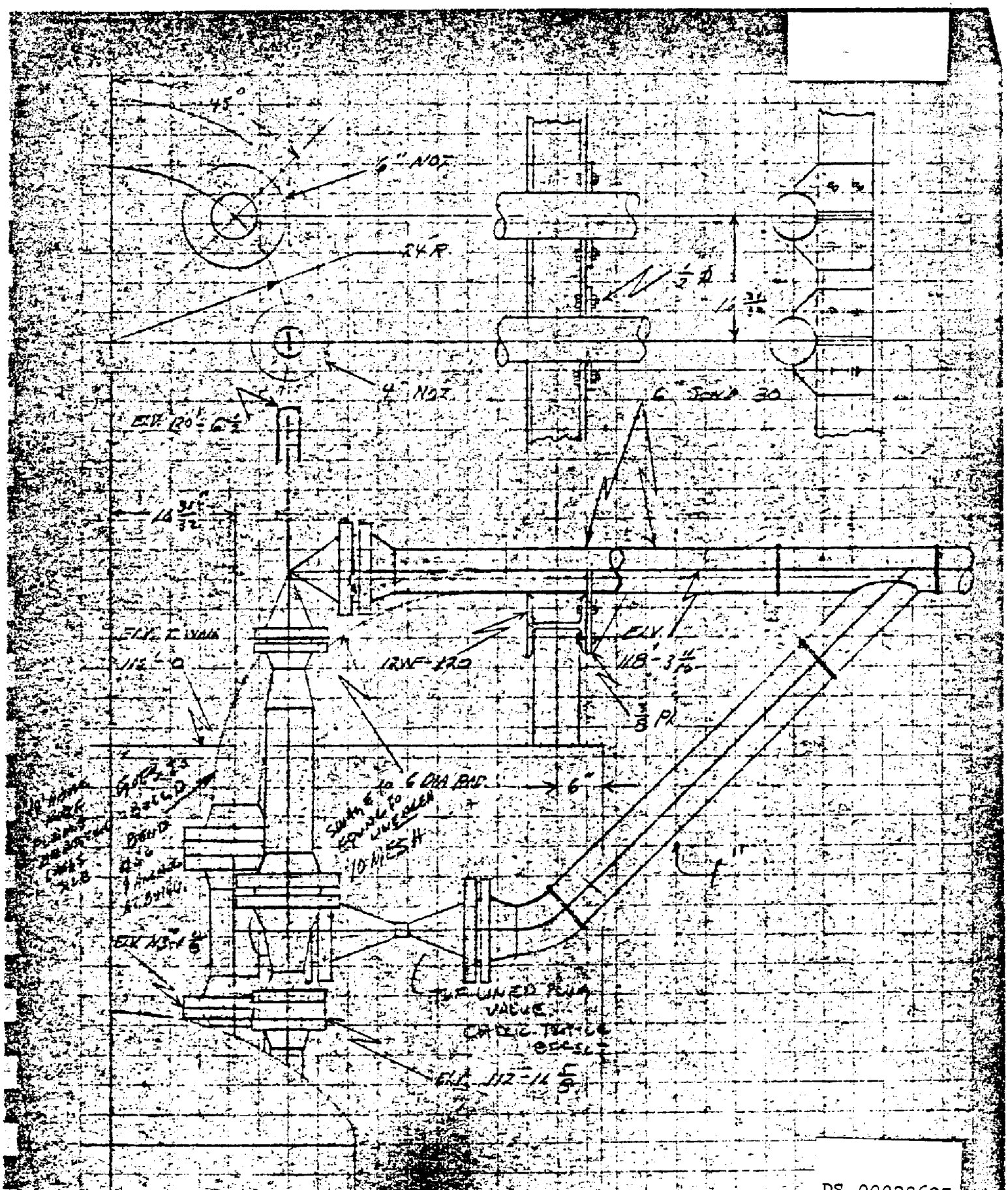
PROJECT NO. 105928

DATE 6-30-60

SUBJECT TCP

ENGINEERS

MAXUS0998317



DS 00029625

PREPARED BY S. V. H.

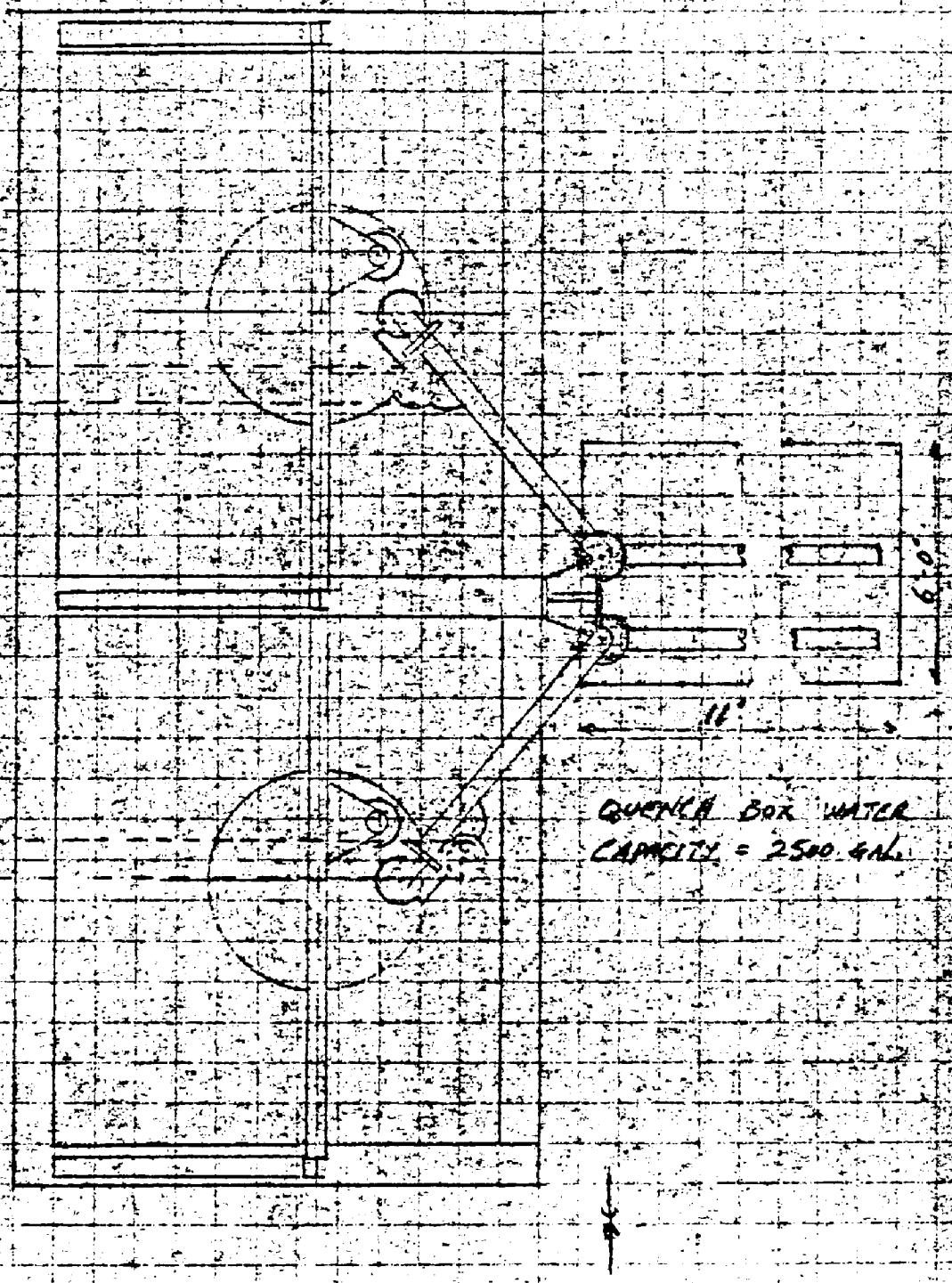
DATE 6-29-60

PROJECT NO. 60 50 28

SUBJECT RELIEF LINES TOP

ENGINEERS

MAXUS0998318



DS 00029626

PREPARED BY S.I.N.

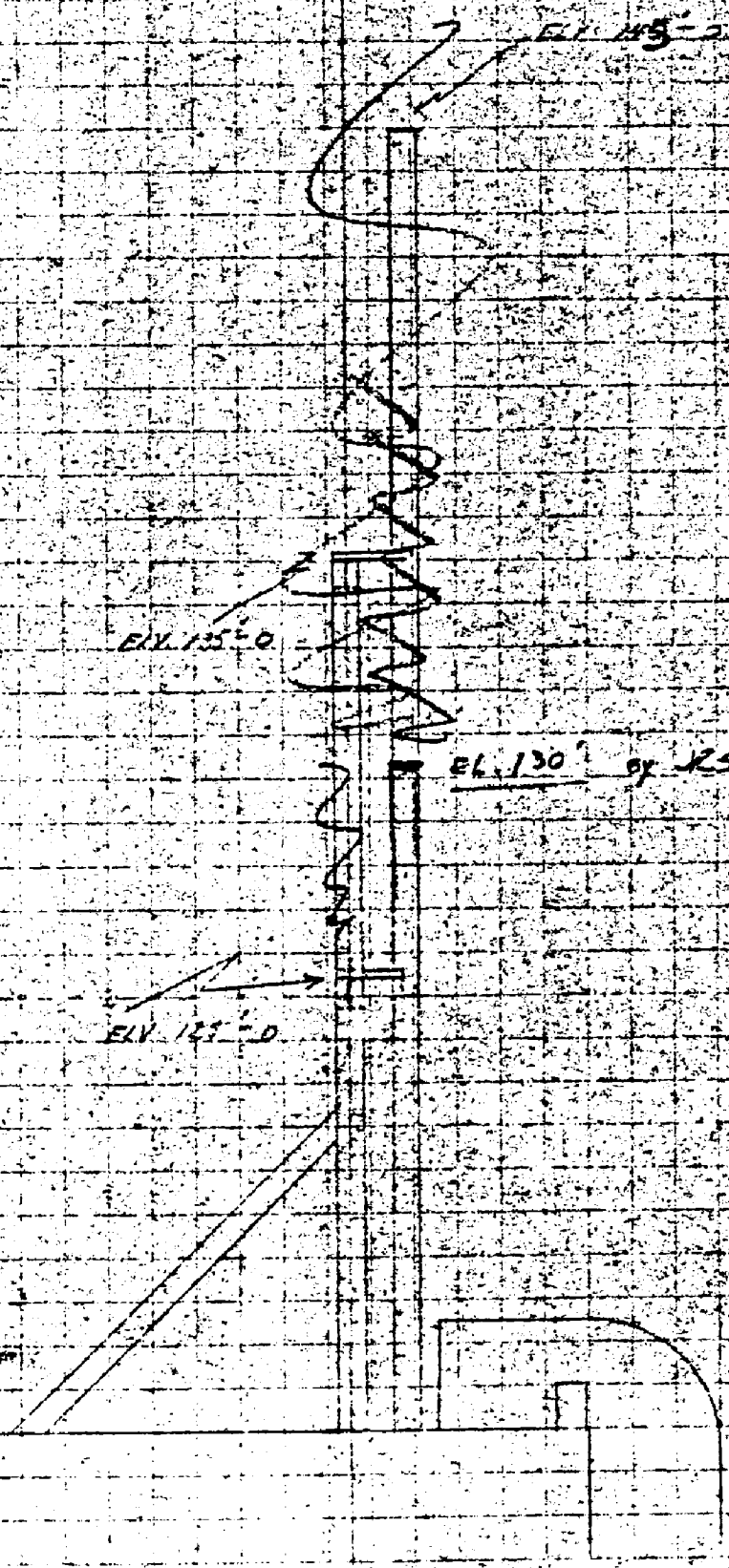
PROJECT NO. 605038

DATE 7-8-80

SUBJECT RELIEF PIPE

ENGINEERS INCORPORATED

MAXUS0998319



DS 00029627

PREPARED BY S.V.H. 22

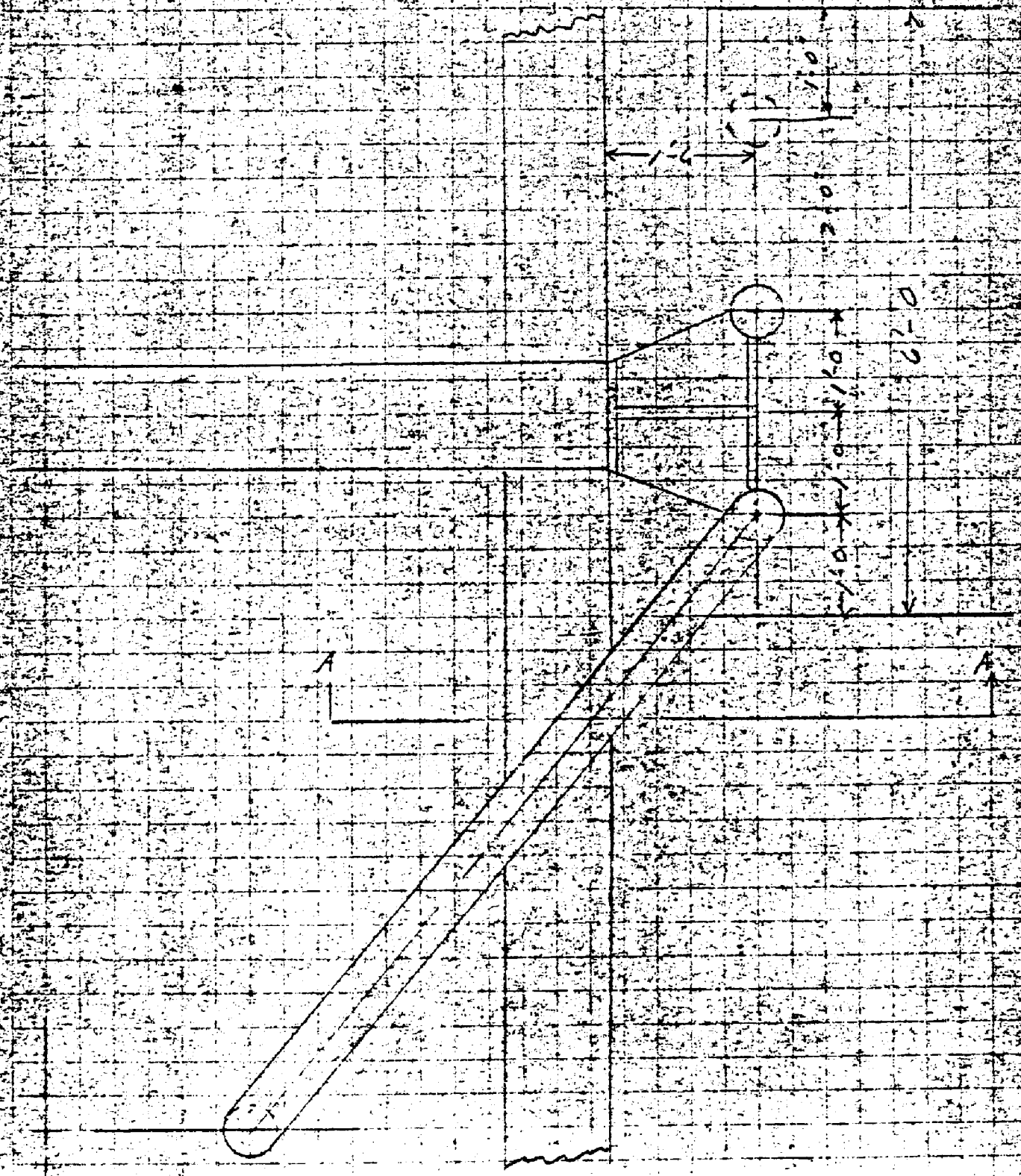
DATE 7-7-60

PROJECT NO. 600032

SUBJECT RELIEF DAM TOP

ENGINEERS

MAXUS0998320



DS 00029628

PREPARED BY

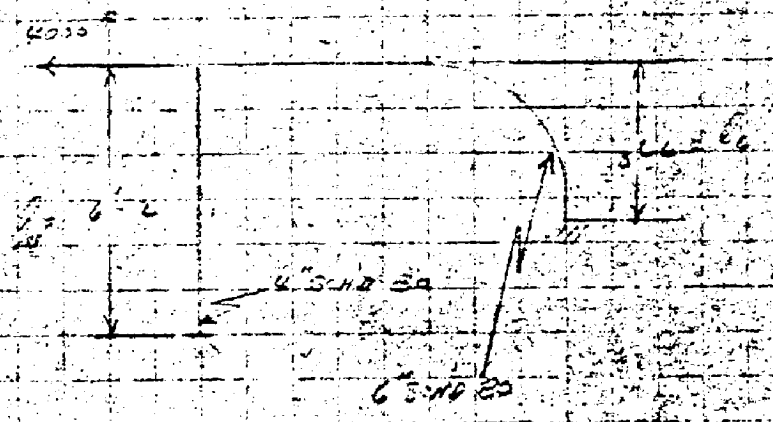
PROJECT NO.

DATE

SUBJECT

ENGINEERS

MAXUS0998321



S_4 FOR 4" $\frac{L}{r} = \frac{72}{7.25} = 9.93$

S_6 FOR 6 $\frac{L}{r} = \frac{49.17}{3.3} = 12.2$

$\frac{P_6 L_6^3}{3EI_6} = \frac{P_4 L_4^3}{3EI_4}$ $\quad P_6 + P_4 = 4000\#$

$\frac{P_6 \times 72^3}{42.49} = \frac{P_4 \times 72^3}{7.2}$

$1.696 P_6 = 7.200 P_4$

$P_6 = 2.9 P_4$

$P_4 + 2.9 P_4 = 4000$

$P_4 = 1017\#$

$f = \frac{M}{S} = \frac{1017 \times 72}{4.25} = 2,220$ psi max bending stress at mid span

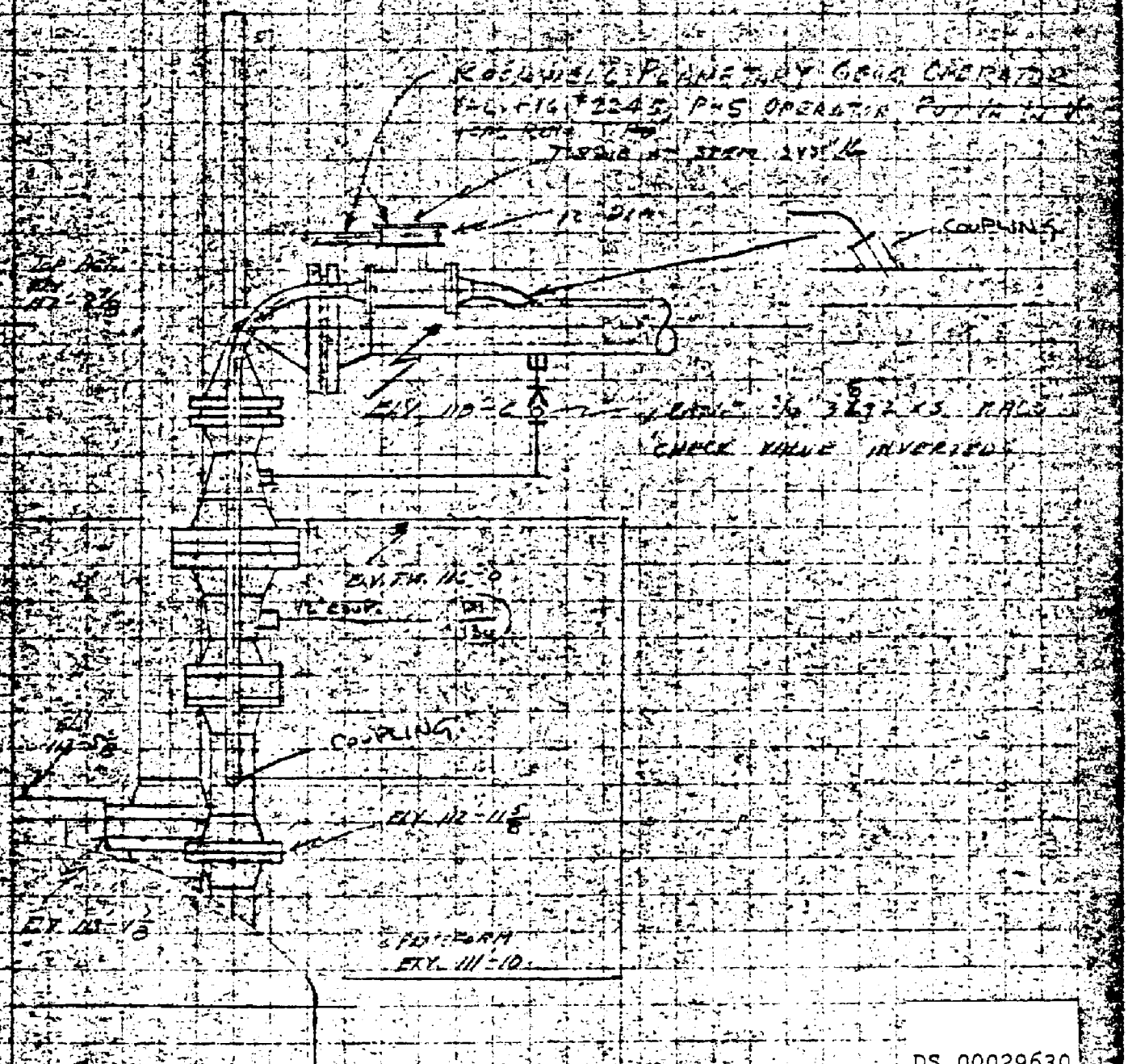
DS 00029629

PREPARED BY [illegible] PROJECT NO. [illegible]

DATE 7-7-60 SUBJECT [illegible]

ENGINEERS, INCORPORATED

MAXUS0998322

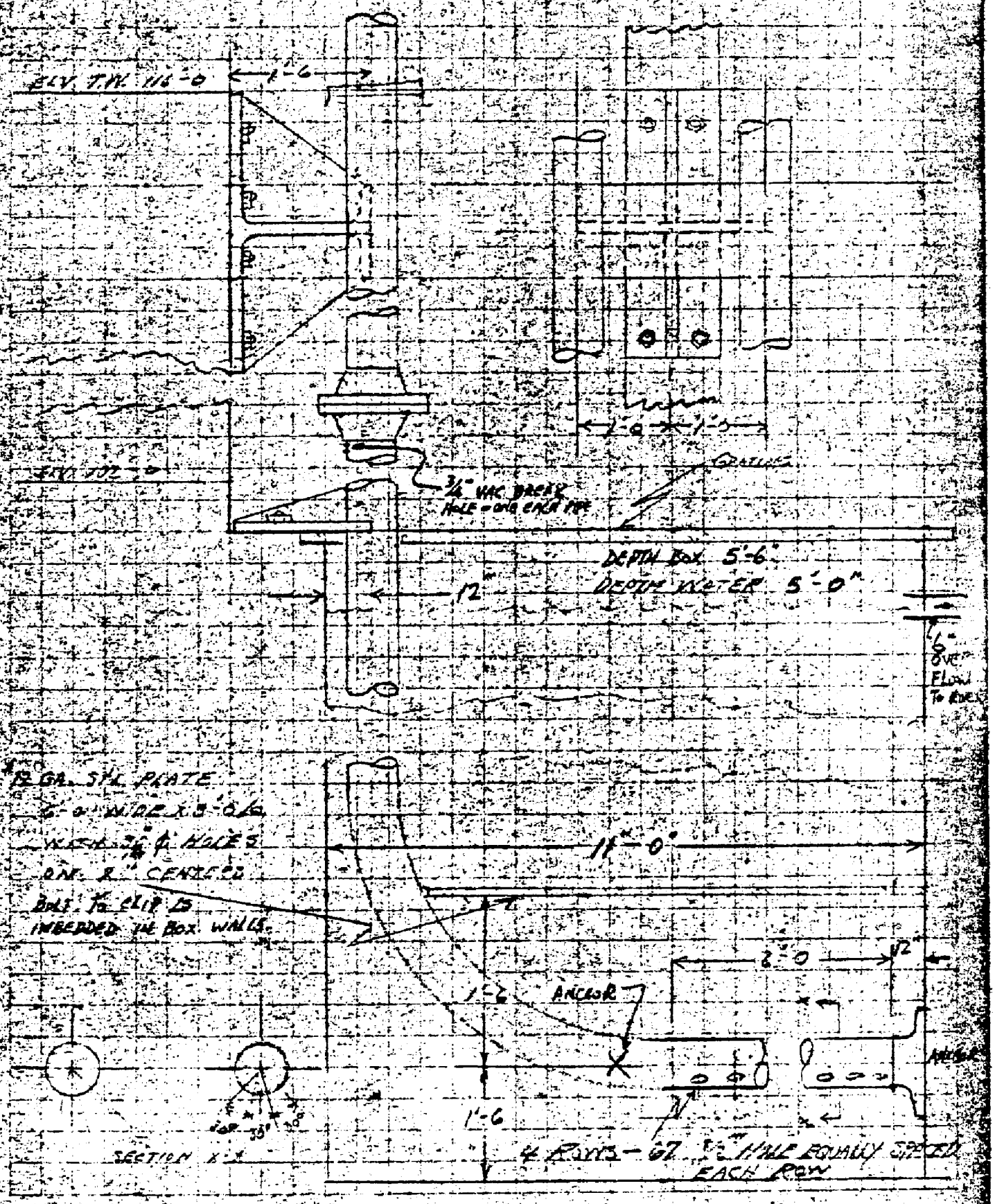


DS 00029630

PREPARED BY J. K. H. Jr. PROJECT NO. 60-3028

DATE 7-6-63 SUBJECT Relief Valve Ecl.

ENGINEERS INCORPORATED



PREPARED BY S.W.H. JR.

DATE 7-8-60

PROJECT NO. 605029

SUBJECT REVISED WEIRS SECTIONS A-B

DS 00029631

ENGINEERS

MAXUS0998324

TCP

ESTIMATE SUBMERGENCE OF AUTOCLAVE RELIEF LINES

Two factors involved: 1. Time for bubble of CH_3OH to dissolve
2. Rate at which bubble rises to surface

1. Time for bubble to dissolve involves the condensation of CH_3OH on the bubble surface (primarily heat transfer) and the diffusion of liquid CH_3OH into the body of water (mass & heat transfer). Data on hand indicate that condensation based on a heat transfer rate of 500 BTU/hr/ft² is reasonable. A 100°F ΔT is assumed between the methanol gas and the water; latent heat CH_3OH = 470

Condensing rate is: $\frac{lbs}{hr} = \frac{500 \times 100}{470}$ ft² = 0.09 lbs/hr/sq ft of bubble surface

Surface area of bubble = πD^2 ft²

Volume of bubble = $\frac{\pi}{6} D^3$ ft³

Density of CH_3OH bubble = $\frac{32}{359}\left(\frac{520}{100+32}\right)$ = 1.07 lbs/ft³

Condensing rate of bubble = $100 \pi D^2$ lbs/hr

Weight of bubble = $0.07 \frac{\pi}{6} D^3$ lbs

Used graphical solution - plot D vs. Time & this on LL paper

dia. in inches	Condensing rate lbs/hr	weight of bubble lbs
2"	24.8×10^{-4}	12.44×10^{-5}
1"	60.5×10^{-4}	2.15×10^{-5}
5/8	151×10^{-4}	0.922×10^{-5}
1/2	2.77×10^{-4}	0.074×10^{-5}
1/4	0.277×10^{-4}	0.0426×10^{-5}
1/8	0.263×10^{-4}	0.0055×10^{-5}

Stepwise integration for time:

Start with 2" bubble weighing 12.44×10^{-5} — Condensing time

in 1/100 sec. — 0.42×10^{-4} Condensing — 0.01

— 12.32 remains

new size (new cond. rate) = 1.72" @ 2.19×10^{-4} @ 1/100 sec. — 2.19 Condensing — 1/100 — 0.02

— 12.23

1.72" 12.32 1/100 — 1.97 continue with bubble is gone — 1/100 — .03

DS 00029632

PREPARED BY _____ PROJECT NO. _____

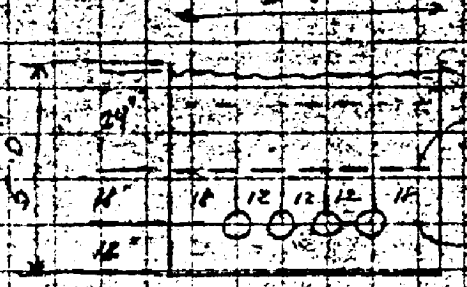
DATE 4 July 60 SUBJECT Autoclave Relief

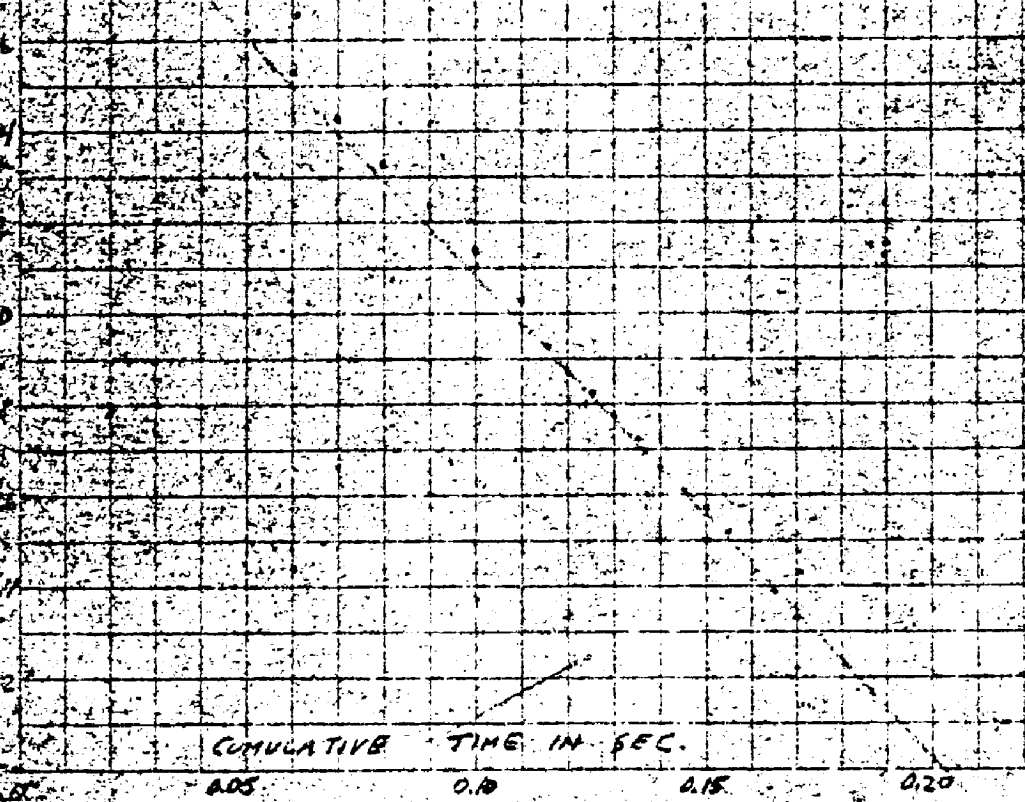
MAXUS0998325

Continue stepwise accumulation of time until bubble dia. and weight approach ZERO. This is plotted below and shows that bubbles 2" ϕ smaller condense in 1/5 sec. based on assumptions used. Even if a much lower condensing rate is used (or lower Δt) the 2" ϕ smaller bubbles should condense in a few sec. ballpark.

Since the methanol will be ejected in a downward direction, no bubbles should exist above 2" over the sparge pipe.

The design criteria are: the sparge system should insure that only small bubbles are generated and to guard against the tunneling of a steam/gas bubbles to the surface by installing an anti-channeling grid over the sparge pipe to guarantee that any large bubbles, if formed, will be broken.





DS 00029633

PREPARED BY _____ PROJECT NO. _____

DATE _____ SUBJECT _____

ENGINEERS

MAXUS0998326

Estimate order of magnitude of pressure increase due to explosion in closed container

Assume molar increase of gas as 15%.
or 1.15 mols combustion product per mol of mixture

Assume 3500°F gas temp. after explosion

Pressure increase (atm) = $1.15 \times \frac{3500+460}{530}$

= 8.4 atm

Pressure = 8.4 × 15 = 126 psi

DS 00029634

PREPARED BY H.T.

DATE 5/20/60

PROJECT NO. 60522

SUBJECT Dismissal

ENGINEERS INCORPORATED

MAXUS0998327

AUTOCLAVE BLAST BARRICADE MISSILE PENETRATION RESISTANCE

PETRY FORMULA: $D = K \cdot A_p \cdot \log_{10}\left(1 + \frac{V^2}{215{,}000}\right)$

D = DEPTH OF PENETRATION, FT.
K = COEFFICIENT OF PENETRATION, FT^3/LB
A_p = SECTIONAL PRESSURE, WEIGHT OF MISSILE DIVIDED BY ITS MAX. CROSS-SECTIONAL AREA, LB/FT^2
V = IMACT VELOCITY, FT/SEC

USE: K = .004 FOR 4000 PSI CONCRETE WITH 1.7% REINFORCEMENT
D = 0.333 FT. OR 1/3 WALL THICKNESS TO PREVENT PENETRATION

1. A_p WITH 2000 FPS MISSILE VELOCITY:

$$A_p = \frac{D}{K \log_{10}\left(1 + \frac{V^2}{215{,}000}\right)} = \frac{0.333}{.004\,(1.292)} = 65\ LB/FT^2 \text{ OR } 0.45\ PSI$$

2. A_p WITH 1000 FPS MISSILE VELOCITY:

$$A_p = \frac{0.333}{.004\,(0.752)} = 445\ LB/FT^2 \text{ OR } 3.1\ PSI$$

DS 00029635

PREPARED BY S. SAWKA
DATE 6/30/80
PROJECT NO. 605028, DIAMOND
SUBJECT BLAST BARRICADE

ENGINEERS INCORPORATED

MAXUS0998328

Estimate pressure due to explosion or rupture

1) Marks Handbook p 1195 & 1198 list BMEP's for internal combustion engines (with normal compression ratios) of about 90 psig

Marks p 1198 states that combustion pressures are 3.5 to 5 times the compression pressure. With no compression, or atmospheric pressure the resulting combustion pressure is —

15 x 5 = 75 psia
15
60 psig

2.) Internal explosion in autoclave

Assume flame temperature = 3500°F per Rubber Handbook p 1787

Assume mole increase is 10%

pressure rise = 1.1 $\left(\frac{3500+460}{460+60}\right)$ per gas law

= 8.4 atmospheres

8.4 x 15 = 126 psia = 111 psig

Therefore rupture autoclave and blowout is not significant compared to rupture (3) below.

3. Estimate gas pressure in concrete enclosure of reactor rupture (radioactive blanket)

Assume rupture pressure is 100 psig and assume approx space in autoclave = 25% of 1000 ft³ = 250 gal or $\frac{250}{7.48}$ = 33.4 cu ft

Volume of blanket solution is 13 x 12 x 14 = 2200 cu ft

Blown pressure due to explosion is 30 psi x $\frac{33.4}{2200}$

= 45 psia or 30 psig

DS 00029636

PREPARED BY H.T.

DATE 6 July 60

PROJECT NO. [illegible]

SUBJECT Blast data

ENGINEERS INCORPORATED

PAGE No. [illegible]

MAXUS0998329

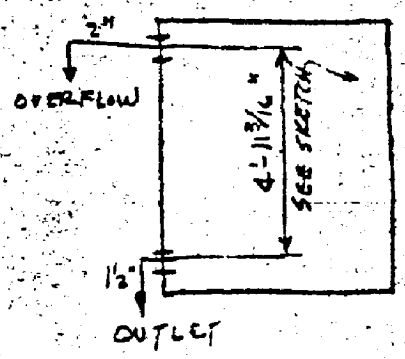
DILUTION WATER DROP TANK

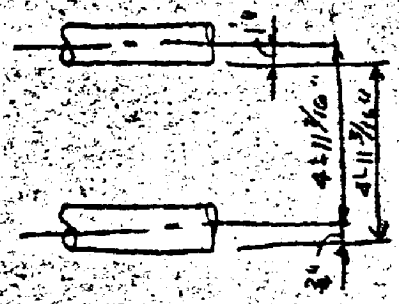
260 GALS PER BATCH.

3' DIA.

$$\frac{3^2 \times \pi}{4} \times h \times 7.48 = 260 \text{ gals}$$

$$h = 4.924' = 4'-11.2'' = 4'-11\tfrac{3}{16}''$$





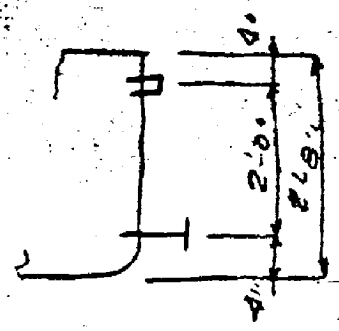
BRINE MAKE-UP TANK

200 GALS.

4' DIA.

$$\frac{4^2 \times \pi}{4} \times h \times 7.48 = 200$$

$$h = 2.125' \text{ - SAY } 2'-8'' \text{ min.}$$



DS 00029637

CLIENT DACO PROJECT NO. 605028

SUBJECT DILUTION WATER DROP TANK & BRINE MAKE-UP TANK PREPARED BY H TILP DATE

ENGINEERS INCORPORATED

MAXUS0998330

HCL ABSORBER

700 #/hr. HCL

700 = 0.32 (HCL SOLUTION)

HCL = 2190 #/hr PRODUCED AS CONCENTRATED (32%) SOLUTION.

SP. GR HCL SOLUTION = 1.159 @ 20°C

8.33 × 1.159 = 9.66 #/GAL.

62.4 × 1.159 = 72.4 lbs/FT³

$\frac{2190}{60 \times 9.66}$ = 3.78 GPM MURIATIC ACID.

WATER REQ'D. = $\frac{2190 - 700}{500}$ = 3 GPM

8500 #/BATCH × ½ × $\frac{36.47}{35.46}$ = 4370 #HCL/BATCH.

$\frac{4370}{0.32}$ = 13,640 # 32% ACID PER BATCH

COOLING WATER 15,000 CAL/GM MOLE HEAT OF ABSORP.

15,000 × 1.8 = 27,000 BTU/lb. MOLE

$\frac{27000 \text{ BTU/mole}}{37 \text{ \#/mole}}$ = 730 BTU/lb HCL

ASSUME ΔT COOLING WATER = 10°F

$\frac{730 \times 700}{1 \times 10 \times 500}$ = 100 GPM COOLING WATER

VELOCITY IN Cl_2 OFF GAS 0.55 CUFT./lb = 1.8 lb/FT³

$\frac{140}{3600 \times 1.8}$ = 0.022 CFS

FOR 2" → V = $\frac{0.022}{0.0205}$ = 1 FT/SEC

DS 00029638

CLIENT DACO PROJECT NO. 605028

SUBJECT MCA HCL ABSORBER PREPARED BY HTiLP DATE

ENGINEERS INCORPORATED SUBJECT NO. PAGE 4 OF 60

MAXUS0998331

REFRIG. UNIT (CONT.)

DISCHARGE $H_V = 722$ BTU/lb
$H_L = 138$
584 BTU/lb.

530 #/hr x 584 = 310,000 BTU/hr REJECTED TO CONDENSER.

FOR 10°F RISE IN CONDENSER WATER

$$\frac{310,000}{10 \times 60 \times 8.33} = 62 \text{ GPM}$$

WITH 2 MACHINES (FUTURE) 62 x 2 = 124 GPM → 3" LINE OK

BRINE CIRULATING PUMPS

5°ΔT BRINE, 21 TONS REFRIG.

C_p BRINE = 0.65 BTU/#
BRINE = 10.5 #/GAL

$$\frac{21 \times 12,000}{5 \times 0.65 \times 60 \times 10.5} = 123 \text{ GPM}$$

FOR 2 MACHINES PLUS GREATER CAPACITY PER MACHINE USE 300 GPM EXISTING CIRCULATING PUMP.

DS 00029639

CLIENT DACO
SUBJECT REFRIG. UNIT
PROJECT NO. 605023
PREPARED BY Hilp DATE
ENGINEERS INCORPORATED NEWARK, N. J. PAGE 7 OF

MAXUS0998332

ACETIC MIX.

	ACETIC ACID	ACETIC ANHYDRIDE	MIX
lb.	67,000	19,000	86,000
M.W	60.05	102.09	66 (AVE.)
Mols	1117	186.3	1303
WT %	78%	22%	
Mol %	85.75%	14.25%	

ONE REACTOR BATCH = 700 GAL. = 6160 #

$\frac{6160}{66} = 93.4$ MOLS

		CHLOROACETIC
ACETIC ACID = 93.4 x 0.8575 = 80.0 MOLS →		80.0
ACETIC ANHY = 93.4 x 0.1425 = 13.3 MOLS →		26.6
		106.6
CHLOROACETIC ACID →		106.6 MOLS
↳ 94.5 x 106.6		10,000 lbs.

$\frac{10,000}{0.8}$ = 12,500 OF 80% SOLUTION

12,500
10,000
2,500 lbs. H_2O = 300 GALS

13.3 MOLS H_2O = 240 # = 29 GALS

300 + 29 = 329 GALS.

DS 00029640

CLIENT DACO
SUBJECT ACETIC MIX
PROJECT NO. 605028
PREPARED BY H TILP DATE
ENGINEERS INCORPORATED NEWARK, N. J.
PAGE 5 OF 63

MAXUS0998333

LIQUID RATES IN Cl_2 ABS. & DRYING TOWER

ASSUME MAX. RATE AT 10,000 #/hr/sq.ft.

Cl_2 ABSORBER WITH NaOH LIQUOR (9#/gal) FIG. 31 PERRY P.691

$\frac{10,000}{60 \times 9} = 18.5$ GPM/□' 6"Φ = 0.2□'

18.5 x 0.2 = 4 GPM MAX. for pump & line sizing

DRYING TOWER H_2SO_4 LIQUOR (14#/GAL)

$\frac{10,000}{60 \times 14} = 12$ GPM/□' 12"Φ = 0.79□'

12 x 0.79 = 9 GPM. Max. for pump & line sizing

DS 00029641

CLIENT DACO PROJECT NO. 605028

SUBJECT Cl_2 ABSORBER & DRYING TOWER PREPARED BY HTilp DATE

PAGE 8 OF

MAXUS0998334

REFRIGERATION UNIT

BRINE HELD AT +5°F (−15°C)

ASSUME 7° ΔT BETWEEN BRINE AND EVAPORATING NH_3

∴ EVAPORATING TEMP. = −2°F (−19°C)

SUCTION PRESS. = 29.0 psia = 14.3 psig

ASSUME LOWEST CONDENSING TEMP. AT 85°F (29.4°C)

∴ DISCHARGE PRESS. = 152 psig.

WORTHINGTON CATALOG GIVES 21 TONS AT 14.3 to 152 psi

@ 14.3 psig $L = 570.3$ BTU/lb, 0.1049 #/ft³, $S = 1.3392$

$$\frac{21 \times 12{,}000}{570.3} = 442 \text{ \#/hr } NH_3 \text{ VAPORIZED IN EVAP.}$$

$442 \times 1.2 = 530$ #/hr. CIRCULATED.

$$\frac{530}{3600 \times 0.1049} = 1.49 \text{ CFS SUCTION}$$

EXPANSION $H_L = 138$ Hi Press.
$H_L = 40.8$ Lo Press.
$H_v = 611.1$ Lo Press.

$(1)(138) = (x)(611.1) + (1-x)40.8$

$x = 0.17$ # VAPORIZED IN EXPANDER

$$\frac{1.0}{1.0 - 0.17} = 1.2 \frac{\text{\# TOTAL } NH_3 \text{ CIRC.}}{\text{\# } NH_3 \text{ EVAP}}$$

FOR 3" SCHED. 40 → $\frac{1.49}{0.0513} = 29$ ft/sec. SUCTION LINE.

AT 152 psig DISCHARGE $S = 1.3392$ $V = 2.4$ ft³/lb.
↳ DISCHARGE TEMP. 219°F (104°C)

$$\frac{2.4 \times 530}{3600} = 0.353 \text{ CFS}$$

DS 00029642

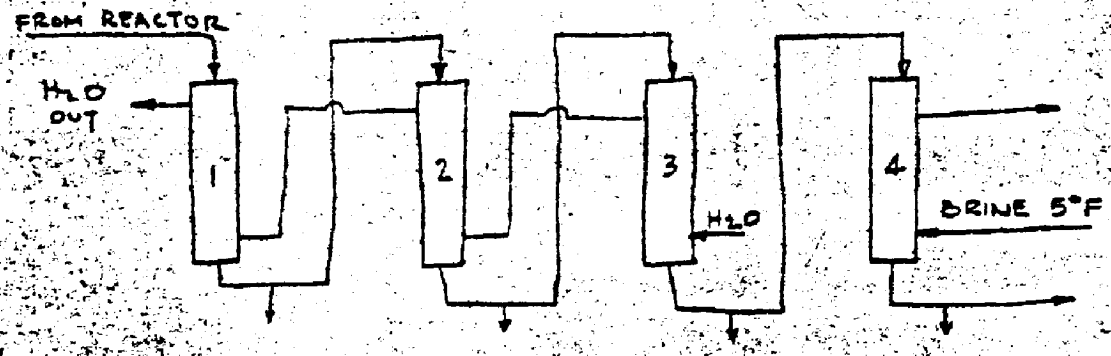
FOR 3" SCHED 40 → $\frac{0.353}{0.0513} = 6.8$ ft/sec DISCHARGE LINE

CLIENT DACO PROJECT NO. 605028

SUBJECT REFRIG. UNIT PREPARED BY H Tilp DATE

ENGINEERS INCORPORATED

MCA REFRIGERATION LOAD



360 # HCl per hr or 10 mols per hr

15 psig or 30 psia OPERATING PRESSURE

VAPOR PRESSURE ACETIC ACID @ 212°F = 8 psia
" " " ANHYDRIDE = 3 psia

MOL % OF ORGANIC VAPOR LEAVING WITH HCL CANNOT BE MORE THAN 50% OR SAY 10 MOLS/hr (SIMILAR TO STM DISTILLATION)

ASSUME LATENT HEAT VAPORS = 180 BTU/lb, M.W. = 60

60 x 10 x 180 = 108,000 BTU/hr $Q = UA\Delta T$

108,000 = U x 150 x 50
U = 13.3 BTU/hr/ft² APPROX.

FOR 50°F RISE IN WATER
$\frac{108,000}{50 \times 500}$ = 4.3 GPM COOLING WATER

∴ CONDENSERS ARE OVERSIZED AND BULK OF ORGANIC VAPORS WILL CONDENSE IN FIRST 3 CONDENSERS AND MUST IN ORDER TO PREVENT SOLIDIFICATION IN THE LAST, COLD CONDENSER. MATERIAL (ORGANIC) CONDENSING IN THE LAST CONDENSER WILL BE SMALL IN COMPARISON TO THE HCl - THEREFORE HEAT LOAD OF 4th CONDENSER WILL BE COOLING OF HCl GAS.

SPECIFIC HEAT HCl = 0.20 BTU/lb/°F, ΔT = 65-15 = 50°F

$\frac{3600}{12,000}$ = 0.3 TONS PER REACTOR OR 0.6 TONS FOR PROCESS

SAY 1½ TONS FOR PROCESS PLUS 1½ TONS FOR HEAT LOSSES = 3 TON UNIT

DS 00029643

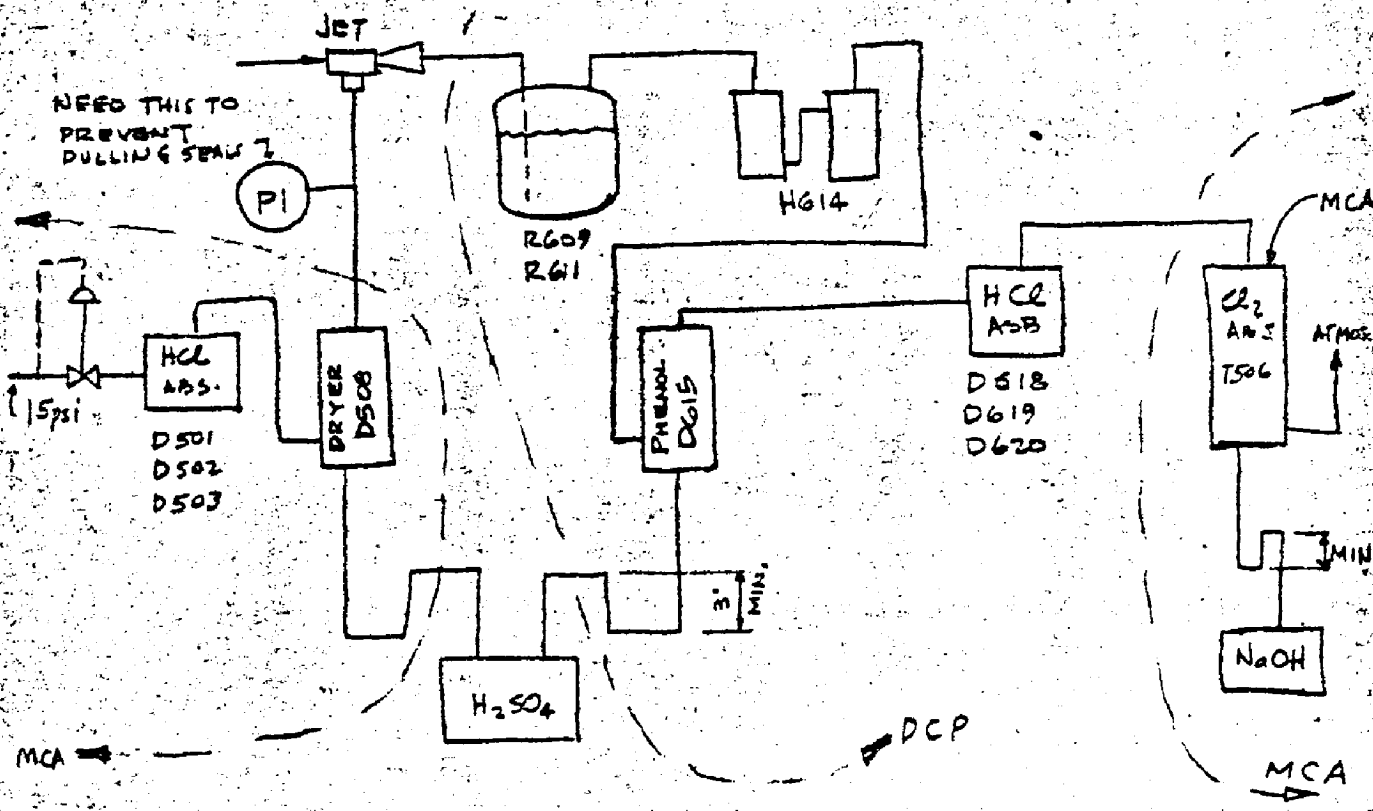
CLIENT DACO PROJECT NO. 605028

SUBJECT MCA REFRIGERATION LOAD PREPARED BY HTilp DATE 4/26/60

ENGINEERS INCORPORATED

MAXUS0998336

PRESSURE STUDY



1. ΔP THRU Cl_2 ABS. SMALL AND CANNOT EXCEED BACK PRESSURE ON THE SEAL LEG OF HCl ABSORBER (LOW ~~THRUPUT~~ ON Cl_2 ABSORBER)
2. SEAL LEG OF HCl ABSORBER APPROXIMATELY 2' OF 1.159 Sp.G. HCl
$= \frac{2 \times 62.4 \times 1.159}{144} = 1.0$ psi
3. ΔP THRU PHENOL ABSORBER = ½ psi.
4. PRESSURE ON LOOP SEAL OF PHENOL ABSORBER = ½ + 1 = 1½ psi
for H_2SO_4 IN SEAL $h = \frac{1.5 \times 144}{1.8 \times 62.4} = 1.92$ FT → SAY MIN. 3'
5. PRESSURE ON LOOP SEAL OF DRYER D508 WOULD NOT EXCEED MAX. BACK ON SEAL LEG OF HCl ABSORBERS D501, 502, 503 PLUS THE PRESSURE DROP THRU THE TAILS TOWER.
6. ΔP THRU TAILS TOWER WILL BE UNDER ½ psi ; SEAL LEG OF HCl ABS. = 1.0 psi.
7. PRESSURE ON LOOP SEAL OF DRYER D508 = ½ + 1 = 1½ psi = 1.92 FT H_2SO_4
SAY MIN. 3'

DS 00029644

CLIENT DACO 605028

SUBJECT PRESSURE STUDY (DCP) PREPARED BY HTILP DATE

ENGINEERS, INCORPORATED REPORT NO. PAGE 1 OF

MAXUS0998337

Estimate Phenol removed from Recycle

Phenol evaporates with HCl gas per stream distillation

$$\frac{W_{HCl}}{W_{phen}} = \frac{(P - p_{phen})\, M_{HCl}}{p_{phen}\, M_{phen}}$$

W_{HCl} = lb/hr HCl

W_{phen} = lb/hr phenol

P = Pressure in system

p_{phen} = Vapor Pressure Phenol at 80°C = 20 mm

M_{HCl} = Mol. wt. HCl = 36

M_{phen} = Mol. wt. Phenol = 94

$$\frac{700}{W_{phen}} = \frac{(800-20)(36)}{(20)(94)}$$

W_{phenol} = 47 #/hr

Estimate Uncondensed Phenol passing condenser

Assume dew point 50°C

Vapor pressure phenol @ 50°C = 2 mm

$y = 2/800 = 0.0025$ mol fraction

$\frac{700}{36} = 19.4$ mol HCl per stream

$x_{mol\ phenol} = 0.0025/(19.4 + x)$

$x = 0.05$ mol phenol/hr

M.W. 0.05 × 94 = 4.7 lb

1052 94

or say 5 lbs/hr of phenol passes condenser (+ unknown quantity as uncondensed vapor)

DS 00029645

CLIENT: Dow

PROJECT NO.: 605 [illegible]

SUBJECT: DCP (Sulfuric Scrubbing Column)

PREPARED BY: [illegible]

DATE: [illegible]

ENGINEERS INCORPORATED

PAGE 1 OF 6

MAXUS0998338

PHENOL STRIPPER

700 #/h - HCl

$\rho = \frac{36 \times 15.2}{10.73 \times (460+176)} = 0.079$ lb/ft³

$q = \sqrt{\frac{.079}{.075}} = 1.02$

	10" Pipe	12" Pipe	14" O.D.	16" O.D.
Area, sq ft	0.573	0.845	0.994	1.30
V, ft/sec	4.30	3.01	2.48	1.88
G, lb/hr/ft	1220	860	705	540
G/q	1190	840	690	530
L lb/hr/ft	1573	1100	900	685

1GPM = 500 lb/hr = 900 #/hr H₂SO₄

From 1" Saddle, Perry P. 6-83

ΔP in H₂O/ft (based on water)	0.65	0.34	0.21	0.12

Approaching loading zone of water. Since will use mixture, and a liquid rate higher than 1GPM may be used, the flooding zone may be approached. Therefore use 14" pipe

Tube column height used previously was 0.1 per FK.

DS 00029646

CLIENT DIAMOND PROJECT NO. 605024

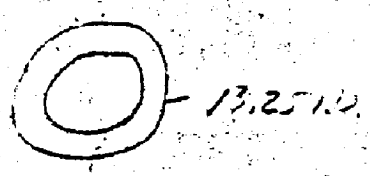
SUBJECT DCP PREPARED BY HK DATE 5 Oct 60

ENGINEERS Incorporated PAGE 1 OF 2

MAXUS0998339

PHENOL STRIPPER

Velocity in annular slot



13.25
10.75
2.50

$\frac{2.50}{2}$ = 1.75 mid slot

$12 \times \pi \times 1.75 = 66$ sq in

$V = \frac{700 \times 144}{3600 \times 66 \times 0.079}$

$V = 5.36$ ft/sec

Velocity large slot

assume 8 slots □ = 8 × 2 = 16 sq in

$V = \frac{700 \times 144}{3600 \times 16 \times 0.079}$

$V = 22.2$ ft/sec

DS 00029647

CLIENT Dupont

SUBJECT DCP

PROJECT NO. [illegible]

PREPARED BY [illegible] DATE [illegible]

ENGINEERS INCORPORATED NEWARK, N.J.

PAGE 3 OF 3 69

MAXUS0998340

Check Flooding Velocity per Perry FIG 16 P654

for 14" Column

$$\frac{L}{G}\sqrt{\frac{\rho_G}{\rho_L}} = \frac{900}{705}\sqrt{\frac{0.079}{62.4 \times 1.8}} = 1.28\sqrt{0.000705}$$

$$= 1.28 \cdot 0.0266$$

$$= 0.034$$

L = 900 #/hr-ft²

G = 705 #/hr-ft²

Fig 16

$$0.15 = \frac{V^2}{g}\,\frac{a}{F_p^3}\left(\frac{\rho_G}{\rho_L}\right)\mu^{0.2}$$

$$0.15 = \frac{V^2}{32.2}\cdot\frac{79}{(0.67)}\left(\frac{0.079}{112}\right)(4)^{0.2}$$

$$V^2 = \frac{0.15 \cdot 32.2 \cdot 0.67^3 \cdot 112}{79 \cdot (0.079) \cdot (1.32)} = 21.6$$

V = ft/sec

g = 32.2

a = 79 ft²/ft³ Table 8

F_p = 0.67 ft³/ft³ Table 8

ρ_G = 0.079 #/ft³

ρ_L = 62.4×1.8 #/ft³

μ = 4 cp for H₂O

4^0.2 = 1.32

V = 4.64 ft/sec flooding velocity (for rings) at 14 gpm

if 5 gpm used $L/G\sqrt{\rho_G/\rho_L}$ = 0.034 · 5 = 0.175

Fig 16

0.07

$$V^2 = \frac{0.07}{0.15} \cdot 4.64 = 2.17$$

21.6

10.3

Error 9/28

V = ~~1.47~~ ft/sec at flooding

3.2 ft/sec at flooding

Since actual velocity will be over 14 gpm and not

OK to use 3 gpm (V = 3.75 ft/sec at flooding)

DS 00029648

CLIENT

SUBJECT DCP

PROJECT NO. 605028

PREPARED BY HT DATE 5 Oct 86

ENGINEERS Incorporated

PAGE 5 OF 34

MAXUS0998341

DESCRIPTION	PAGE
H.P. STEAM A2-3-15 (4")	2-3
PHENOL FZ-4-05 (2")	4-5
TCB FZ-1-02 (3") & FZ-1-06 (1½")	6-9
ACETIC ACID FZ-4-14 (3"); FZ-4-13 (2")	10-13
80# STEAM FZ-3-16 (4") } COND. FZ-3-17 (2") }	14-16
LINES FZ-9-21 (2") } FZ-2-10 (2") } FZ-6-12 (2")	17
YARD PIPING	18-23

V. PIPING FLEXIBILITY & EXPANSION CALCULATIONS

DS 00029649

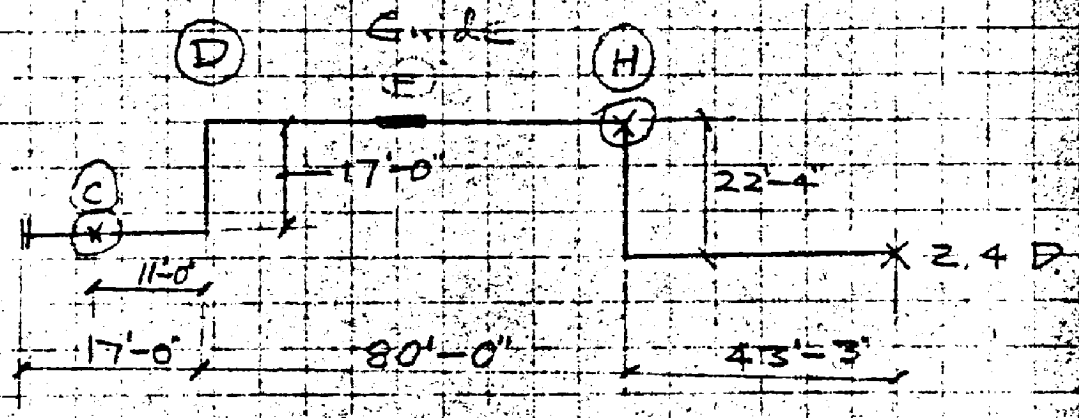
PREPARED BY H N Wi... PROJECT NO. 6050 28

DATE Oct 17, 1960 SUBJECT BUILDING PIPING

ENGINEERS, INCORPORATED PAGE 1 OF 23

MAXUS0998342

H.P. STEAM F2-3-15 (4") 225# — 397°F



Exp. = 3.351"/100 FT

3.351 x .43 = 1.44"
3.351 x .22 = 0.74"
3.351 x .80 = 2.68"
3.351 x .17 = 0.57"
3.351 x .11 = 0.37"

ANCHOR AT COL (C), (H) & WALL CF 2+D

$$M_{max} = S_E Z \frac{D}{D}$$

$$= 9,950 \times 3.214 \times \frac{4.5}{8.73}$$

$$= 16,400 \text{ IN-LB}$$

DS 00029650

PREPARED BY H. A. Wan
DATE Oct. 14, 60
PROJECT NO. 605022
SUBJECT F2-3-15 (4")

ENGINEERS INCORPORATED

Step 1: Enter Data — Select Sketch Shape — 2: Enter Given Data: Height of heavy bars, uniform or triangular, referring to designated Charts and Tables in Tube Turns Line Expansion and Flexibility Booklet (or compare S_E with S_A)

Nom. PIPE SIZE and WEIGHT		4" sch. 40	Nom. PIPE SIZE and WEIGHT		4" SCH. 40		Nom. PIPE SIZE and WEIGHT			
Table 1 — Elt. ELBOW DIAM.	D_r =	8.78	Table 1 — Elt. ELBOW DIAM.	D_r =	8.78	D_r =	Table 1 — Elt. ELBOW DIAM.	D_r =	D_r =	in.
Elt. ELBOW LENGTH	L_r =	4.70	Elt. ELBOW LENGTH	L_r =	4.70	L_r =	Elt. ELBOW LENGTH	L_r =	L_r =	ft
Symbol Notes: 1. For Table and Charts, refer to Tube Turns Booklet Line Expansion and Flexibility. 2. Elbow Radius = 1.5 Nominal Pipe Size		L BEND			Z BEND	U BEND		SYMM LOOP	GUIDED LOOP	
Length of SHORTER LEG	H	22.33'	Length of SHORT VERTICAL	h =	11'	h =	Extreme ANCHOR SPACING	U' = U	U' =	ft
Length of LONGER LEG	w	43	Length of LONG VERTICAL	H =	80'	H =	Need by RESTRAINT SPACING	U =	U =	ft
Table 3 — Enter at ABSCISSA	h H =	0	Horizontal OFFSET	w =	17'	w =	HEIGHT of LOOP	H =	H =	U
Chart 3 — Go to Curve for	H/w =	.51	Table 3 — Enter at ABSCISSA	h H =	.138	h H =	WIDTH of LOOP	w =	w =	ft
Table 3 — Read SHAPE FACTOR	f_s =	1.05	Chart 3 — Go to Curve for	H w =	4.7	H w =	Enter at ABSCISSA	w/U =	w/U =	no.
			Table 4 — Read SHAPE FACTOR	f_s =	1.8	f_s =	Chart 2 — Go to Curve for	H U =	H U =	no.
							Table 2 — Read SHAPE FACTOR	f_s =	f_s =	no.
							Read Elt. No. of ELBOWS	n =	n =	no.
Square Corner Length H + w =	L_s =	65	Sq. Corner Length h + H + w =	L_s =	108	L_s =	Sq. Corner Length U + 2H =	L_s =	L_s =	ft
Sum of Elt. ELBOW LENGTHS	L_r =	4.7	Sum of Elt. ELBOW LENGTHS	$2L_r$ =	4.4	$2L_r$ =	Sum of Elt. ELBOW LENGTHS	nL_r =	nL_r =	ft
TOTAL Elt. LENGTH $L_s + L_r$ =	L =	69.7	TOTAL Elt. LENGTH $L_s + 2L_r$ =	L =	117.4	L =	TOTAL Elt. LENGTH $L_s + nL_r$ =	L =	L =	ft
Elt. DIAMETER LENGTH $\frac{L}{D_r}$ =	f_l =	7.95	Elt. DIAMETER LENGTH $\frac{L}{D_r}$ =	f_l =	13.4	f_l =	Elt. DIAMETER LENGTH $\frac{L}{D_r}$ =	f_l =	f_l =	in.
PIPE MATERIAL (or Spec.)		GR. B. C.S.	PIPE MATERIAL (or Spec.)		GR. B. C.S.		PIPE MATERIAL (or Spec.)			
SERVICE (or Code Section)		225# STM.	SERVICE (or Code Section)		225# STM.		SERVICE (or Code Section)			
HOT (max) Metal TEMP.	T_h =	397	HOT (max) Metal TEMP.	T_h =	397	T_h =	HOT (max) Metal TEMP.	T_h =	T_h =	°F
COLD (min) Metal TEMP.	T_c =	0	COLD (min) Metal TEMP.	T_c =	0	T_c =	COLD (min) Metal TEMP.	T_c =	T_c =	°F
Table 5 — Read opposite T_h	S_A =	22,500	Table 5 — Read opposite T_h	S_A =	22500	S_A =	Table 5 — Read opposite T_h	S_A =	S_A =	psi
Table 5 — Read opposite T_h	f_{eh} =	63,000	Table 5 — Read opposite T_r	f_{eh} =	63,000	f_{eh} =	Table 5 — Read opposite T_r	f_{eh} =	f_{eh} =	psi
Table 5 — Read opposite T_c	f_{ec} =	11,000	Table 5 — Read opposite T_c	f_{ec} =	11,000	f_{ec} =	Table 5 — Read opposite T_c	f_{ec} =	f_{ec} =	psi
EXPANSION FACTOR $f_{eh} - f_{ec}$	f_e =	74,000	EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e =	74,000	f_e =	EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e =	f_e =	psi
COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_l}$	S_E =	9,800	COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_l}$ =	S_E =	9950	S_E =	COMPUTED EXP STRESS RANGE $\frac{U' f_e f_s}{U f_l}$ =	S_E =	S_E =	psi

CALC'D R.R.N. DATE 10-15-60

CHECKED DATE

TUBE TURNS, LOUISVILLE, KENTUCKY, PIPING FLEXIBILITY CALCULATION FORM

SIMPLIFIED CALCULATION OF L, Z AND U BEADS, AND EXPANSION LOOPS

JOB 605028

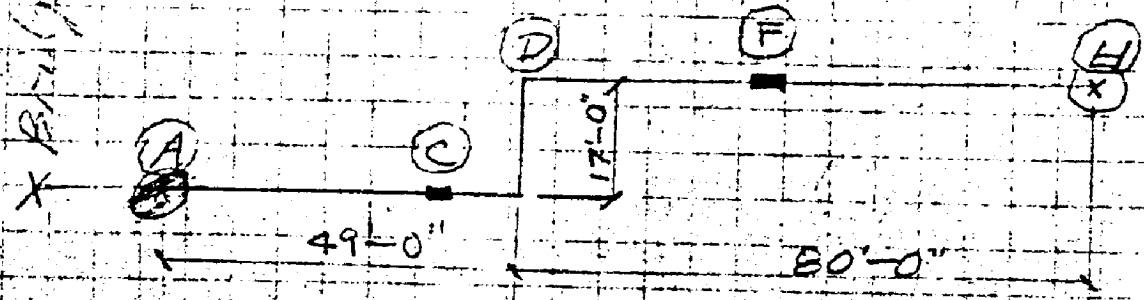
LINE F2-3-15(4")

SHEET 4 OF

DS 00029651

MAXUS0998344

PHENOL LINE F2-4-06 (2") FROM COL (A) TO COL. (H)



EXP = 1.546" / 100 FT.

1.546 x .49 = .76"
1.546 x .80 = 1.24"
1.546 x .17 = .263"

ANCHOR LINE AT COL. (A) & (H)
GUIDE PIPE AT COL. (C) & (F)

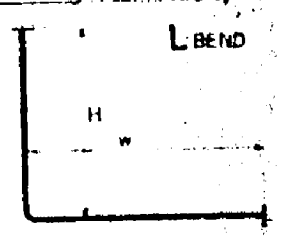
DS 00029652

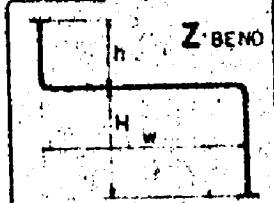
PREPARED BY N. M. U.
DATE OCT. 14 60'
PROJECT NO. 60E 28
SUBJECT F2-4-06 (2")
ENGINEERS

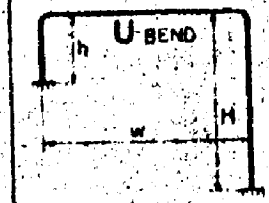
MAXUS0998345

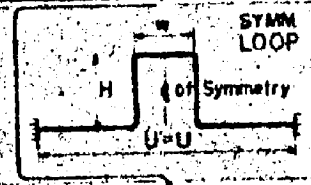
PROCEDURE: (a) Select Column applicable to Shape. (b) Enter Given Data in right of heavy bars (c) Complete form, referring to designated Charts and Tables in Tube Turns "Line Expansion and Flexibility" Booklet. (e) Compute S_1 with S_E

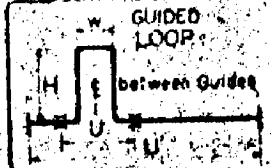
Nom PIPE SIZE and WEIGHT			Nom PIPE SIZE and WEIGHT		2" SCH. 80			Nom PIPE SIZE and WEIGHT									
Table 1	EFF ELBOW DIAM	D_r =	Table 1	EFF ELBOW DIAM	D_r = 3.14	D_r =		Table 1	EFF ELBOW DIAM	D_r =		D_r =					
	EFF ELBOW LENGTH	L_r =		EFF ELBOW LENGTH	L_r = 1.00	L_r =			EFF ELBOW LENGTH	L_r =		L_r =					











General Notes: For Tables and Charts, refer to Tube Turns booklet "Line Expansion and Flexibility"

Elbow Radius = 1½ Nominal Pipe Size

Length of SHORTER LEG		H =	Length of SHORT VERTICAL		h = 49'	h =		Extreme ANCHOR SPACING		U' = U		U' =					
Length of LONGER LEG		w =	Length of LONG VERTICAL		H = 80'	H =		Max by RESTRAINT SPACING		U =		U =					
			Horizontal OFFSET		w = 17'	w =		HEIGHT of LOOP		H =		H =					
Enter at ABSCISSA		h/H = 0	Chart 3 or 4	Enter at ABSCISSA	h/H = .613	h/H =		WIDTH of LOOP		w =		w =					
Go to Curve for		H/w =		Go to Curve for	H/w = 4.7	H/w =		Chart 2	Enter at ABSCISSA	w/U =		w/U =					
Read SHAPE FACTOR		f_s =		Read SHAPE FACTOR	f_s = 2.6	f_s =			Go to Curve for	H/U =		H/U =					
					(n = 2)	(n = 2)			Read SHAPE FACTOR	f_s =		f_s =					
									Read Eff No of ELBOWS	n =		n =					
Square-Corner Length	H + w =	L_s =	Sq-Corner Length	h + H + w =	L_s = 146	L_s =		Sq-Corner Length	U + 2H =	L_s =		L_s =					
Sum of Eff ELBOW LENGTHS		L_r =	Sum of Eff ELBOW LENGTHS		$2L_r$ = 2	$2L_r$ =		Sum of Eff. ELBOW LENGTHS		nL_r =		nL_r =					
TOTAL Eff LENGTH	$L_s + L_r$ =	L =	TOTAL Eff LENGTH	$L_s + 2L_r$ =	L = 148	L =		TOTAL Eff LENGTH	$L_s + nL_r$ =	L =		L =					
DIAMETER LENGTH	$\frac{L}{D_r}$ =	f_l =	Eff DIAMETER LENGTH	$\frac{L}{D_r}$ =	f_l = 46.5	f_l =		Eff DIAMETER LENGTH	$\frac{L}{D_r}$ =	f_l =		f_l =					
PIPE MATERIAL (or Spec)			PIPE MATERIAL (or Spec)		G.R.B.C.S.			PIPE MATERIAL (or Spec)									
SERVICE (or Code Section)			SERVICE (or Code Section)		PHENOL			SERVICE (or Code Section)									
HOT (max) Metal TEMP		T_h =	HOT (max) Metal TEMP		T_h = 200	T_h =		HOT (max) Metal TEMP		T_h =		T_h =					
COLD (min) Metal TEMP		T_c =	COLD (min) Metal TEMP		T_c = 0	T_c =		COLD (min) Metal TEMP		T_c =		T_c =					
Table 5	Read opposite T_h	S_A =	Table 5	Read opposite T_h	S_A = 29,800	S_A =		Table 5	Read opposite T_h	S_A =		S_A =					
	Read opposite T_h	f_{eh} =		Read opposite T_h	f_{eh} = 23,000	f_{eh} =			Read opposite T_h	f_{eh} =		f_{eh} =					
	Read opposite T_c	f_{ec} =		Read opposite T_c	f_{ec} = 11,000	f_{ec} =			Read opposite T_c	f_{ec} =		f_{ec} =					
EXPANSION FACTOR	$f_{eh} - f_{ec}$	f_e =	EXPANSION FACTOR	$f_{eh} - f_{ec}$ =	f_e = 44,000	f_e =		EXPANSION FACTOR	$f_{eh} - f_{ec}$ =	f_e =		f_e =					
COMPUTED EXP STRESS RANGE	$\frac{f_s f_l f_e}{f_1}$ =	S_E =	COMPUTED EXP STRESS RANGE	$\frac{f_s f_l f_e}{f_1}$ =	S_E = 2,460	S_E =		COMPUTED EXP STRESS RANGE	$\frac{U' f_s f_l f_e}{U f_1}$ =	S_E =		S_E =					

TUBE TURNS, LOUISVILLE, KENTUCKY, PIPING FLEXIBILITY CALCULATION FORM

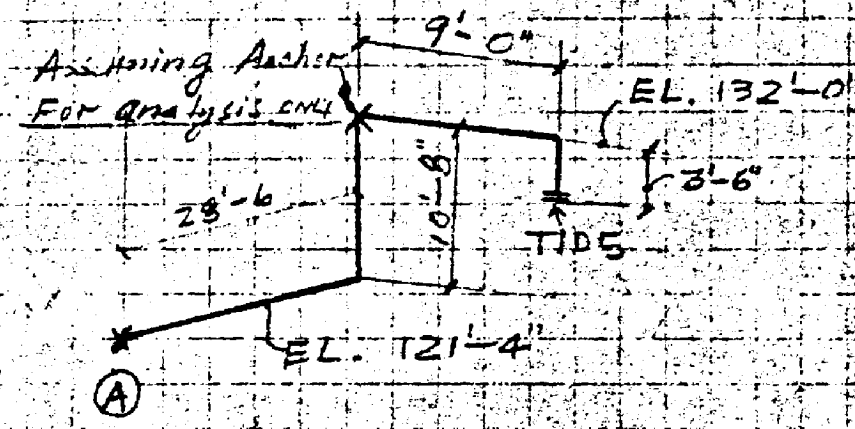
SIMPLIFIED CALCULATION OF L, Z AND U-BENDS, AND EXPANSION LOOPS

Job 605078

DS 00029653

MAXUS0998346

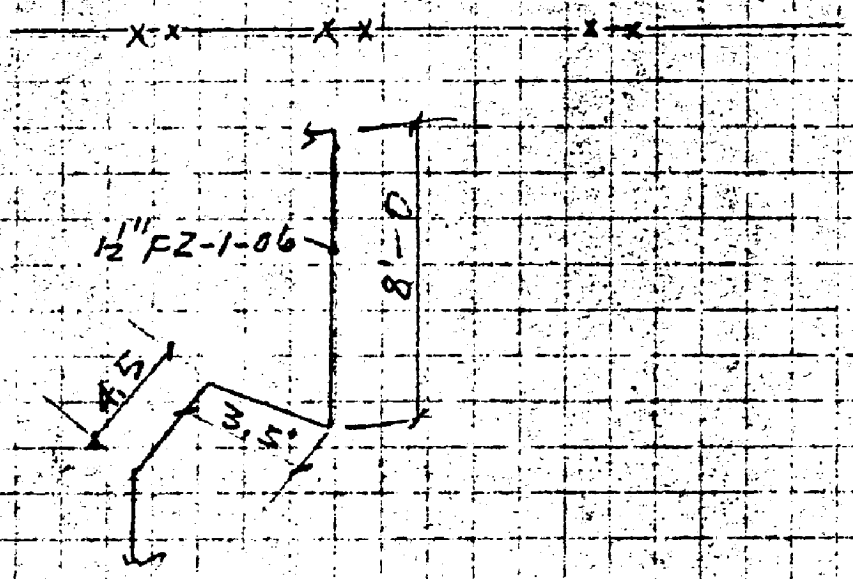
TCB



EXP = 2.8"/100 FT.

.285 x 2.8 = .8" ≐ 1"
.105 x 2.8 = .294"
.09 x 2.8 = .252"

→ ANCHOR LINE AT COLUMN A ONLY



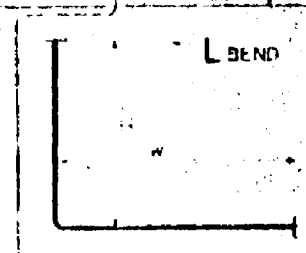
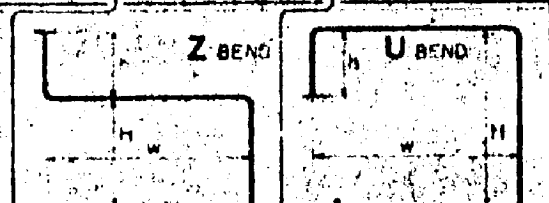
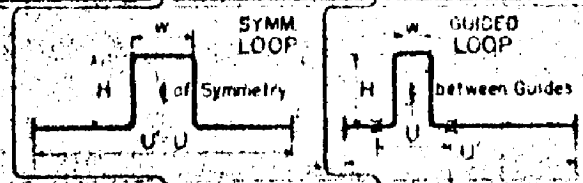
DS 00029654

PREPARED BY R. M. Wu
DATE Oct. 14, 60
PROJECT NO. 605028
SUBJECT FZ-1-02 3" (TCB)

ENGINEERS INCORPORATED 487 ORANGE STREET, NEWARK 7, N. J. HU 3-7040

MAXUS0998347

Step 1: Enter Pipe Size and Weight of Heavy Bars. Step 2: Complete form, referring to designated Charts and Tables in Tube Turns Line Expansion and Flexibility Bulletin. Compute S_E and f_E

	3" STD. WT.	Nom. PIPE SIZE and WEIGHT			Nom. PIPE SIZE and WEIGHT		
	D_o = 6.23	Table 1 EH ELBOW DIAM.	D_o =	D_o =	Table 1 EH ELBOW DIAM.	D_o =	D_o =
	L_r = 2.90	EH ELBOW LENGTH	L_r =	L_r =	EH ELBOW LENGTH	L_r =	L_r =
							
	H = 10.5'	Length of SHORT VERTICAL	h =	h =	Extreme ANCHOR SPACING	U' = U	U' =
	w = 28.5'	Length of LONG VERTICAL	H =	H =	Next by RESTRAINT SPACING	U =	U =
	h/H = 0	Horizontal OFFSET	w =	w =	HEIGHT of LOOP	H =	H =
	H/w = .37	Table 3 Enter at ABSCISSA	h/H =	h/H =	WIDTH of LOOP	w =	w =
3	f_s = 1.6	Read curve for	H/w =	H/w =	Enter at ABSCISSA	w/U =	w/U =
		Table 4 Read SHAPE FACTOR	f_s =	f_s =	Chart 2 Read curve for	H/U =	H/U =
			(h = 0)	(h = 0)	Read SHAPE FACTOR	f_s =	f_s =
					Read EH No. of ELBOWS	n =	n =
	L = 39	Sq. Corner Length L_s = H + w =	L_s =	L_s =	Sq. Corner Length L_s = U + 2H =	L_s =	L_s =
	L_r = 2.9	Sum of EH ELBOW LENGTHS	$2L_r$ =	$2L_r$ =	Sum of EH ELBOW LENGTHS	nL_r =	nL_r =
	L = 32	TOTAL EH LENGTH $L_s + 2L_r$ =	L =	L =	TOTAL EH LENGTH $L_s + nL_r$ =	L =	L =
	f_l = 11.05	EH DIAMETER LENGTH $\frac{L}{D_o}$ =	f_l =	f_l =	EH DIAMETER LENGTH $\frac{L}{D_o}$ =	f_l =	f_l =
	GR B. C. S.	PIPE MATERIAL (or Spec.)			PIPE MATERIAL (or Spec.)		
	TCB	SERVICE (or Code Section)			SERVICE (or Code Section)		
	T = 350	HOT (max) Metal TEMP	T_h =	T_h =	HOT (max) Metal TEMP	T_h =	T_h =
	T = 0	COLD (min) Metal TEMP	T_c =	T_c =	COLD (min) Metal TEMP	T_c =	T_c =
	S_A = 29,450	Table 5 Read opposite T_h	S_A =	S_A =	Table 5 Read opposite T_h	S_A =	S_A =
	f_{eh} = 53,000	Table 5 Read opposite T_h	f_{eh} =	f_{eh} =	Table 5 Read opposite T_h	f_{eh} =	f_{eh} =
	f_{ec} = -11,000	Table 5 Read opposite T_c	f_{ec} =	f_{ec} =	Table 5 Read opposite T_c	f_{ec} =	f_{ec} =
	f_e = 64,000	EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e =	f_e =	EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e =	f_e =
	S_E = 9,260	COMPUTED EXP. STRESS RANGE $\frac{f_e f_s}{f_l}$ =	S_E =	S_E =	COMPUTED EXP. STRESS RANGE $\frac{U' f_e f_s}{U' f_l}$ =	S_E =	S_E =

CALC'D H.H.W.	DATE 10-14-69	TUBE TURNS LOUISVILLE, KENTUCKY PIPING FLEXIBILITY CALCULATION FORM SIMPLIFIED CALCULATION OF L, Z, AND U-BENDS, AND EXPANSION LOOPS	JOB 605028
CHECKED	DATE		LINE A2-1-02 (3")

DS 00029655

MAXUS0998348

PROCEDURE: [illegible] Table 1 Shape [illegible] Enter values to right of heavy bars [illegible] form, referring to designated Charts and Tables in Tube Turns Line Expansion and Flexibility Booklet [illegible] compare S_E with S_A

New PIPE SIZE and WEIGHT		New PIPE SIZE and WEIGHT	12" S.CH.80		New PIPE SIZE and WEIGHT					
Table 1 EFF ELBOW DIAM	D_f =	Table 1 EFF ELBOW DIAM	D_f = 2.34	D_f =	Table 1 EFF ELBOW DIAM	D_f =		D_f =		
EFF ELBOW LENGTH	L_f =	EFF ELBOW LENGTH	L_f = 0.60	L_f =	EFF ELBOW LENGTH	L_f =		L_f =		
L BEND		Z BEND		U BEND	SYMM LOOP			GUIDED LOOP		
Length of SHORT VERTICAL	H	Length of SHORT VERTICAL	h = 4.5'	h	Extreme ANCHOR SPACING	U' =	U	U' =		
Length of LONG VERTICAL	w	Length of LONG VERTICAL	H = 8.0'	H	Max by RESTRAINT SPACING	U =		U =		
Horizontal OFFSET	h H = O	Horizontal OFFSET	w = 3.5'	w	HEIGHT of LOOP	H =		H =		
Chart 3 Enter at ABSCISSA	H/w	Chart 3 Enter at ABSCISSA	h/H = .565	h/H	WIDTH of LOOP	w =		w =		
Read SHAPE FACTOR	f_s	Read SHAPE FACTOR	H/w = 2.28	H/w	Enter at ABSCISSA	w/U =		w/U =		
			f_s = 1.25	f_s	Chart 2 Enter at ABSCISSA	H/U =		H/U =		
					Read SHAPE FACTOR	f_s =		f_s =		
					Total EFF No. of ELBOWS	n =		n =		
Square Corner Length H + w =	L_s	Sq Corner Length h + H + w =	L_s = 16	L_s	Sq-Corner Length U + 2H =	L_s =		L_s =		
Sum of EFF ELBOW LENGTHS	L_f	Sum of EFF ELBOW LENGTHS	$2L_f$ = 1.2	$2L_f$	Sum of EFF ELBOW LENGTHS	nL_f =		nL_f =		
TOTAL EFF LENGTH $L_s + L_f$	L	TOTAL EFF LENGTH $L_s + 2L_f$ =	L = 17.2	L	TOTAL EFF LENGTH $L_s + nL_f$ =	L =		L =		
EFF DIAMETER LENGTH $\frac{L}{D_o}$	f	EFF DIAMETER LENGTH $\frac{L}{D_o}$ =	f_1 = 7.35	f	EFF DIAMETER LENGTH $\frac{L}{D_o}$ =	f_1 =		f_1 =		
PIPE MATERIAL (Spec)		PIPE MATERIAL (Spec)	GR. A. C.S		PIPE MATERIAL (Spec)					
SERVICE (or Code Section)		SERVICE (or Code Section)	TCE.		SERVICE (or Code Section)					
HOT (max) Metal TEMP	T_h =	HOT (max) Metal TEMP	T_h = 350	T_h =	HOT (max) Metal TEMP	T_h =		T_h =		
COLD (min) Metal TEMP	T_c =	COLD (min) Metal TEMP	T_c = 0	T_c =	COLD (min) Metal TEMP	T_c =		T_c =		
Table 5 Read opposite T_h	S_A	Table 5 Read opposite T_h	S_A = 23,550	S_A =	Table 5 Read opposite T_h	S_A =		S_A =		
Table 5 Read opposite T_h	f_{eh}	Table 5 Read opposite T_h	f_{eh} = 53,000	f_{eh} =	Table 5 Read opposite T_h	f_{eh} =		f_{eh} =		
Table 5 Read opposite T_c	f_{ec}	Table 5 Read opposite T_c	f_{ec} = -11,000	f_{ec} =	Table 5 Read opposite T_c	f_{ec} =		f_{ec} =		
EXPANSION FACTOR $f_{eh} - f_{ec}$	f_e	EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e = 64,000	f_e =	EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e =		f_e =		
COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f}$	S_E	COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f}$ =	S_E = 11,900	S_E =	COMPUTED EXP STRESS RANGE $\frac{U' f_e f_s}{U f_1}$ =	S_E =		S_E =		

CALC'D H.N.W DATE 10-15-60

CHECKED DATE

TUBE TURNS, LOUISVILLE, KENTUCKY, PIPING FLEXIBILITY CALCULATION FORM

SIMPLIFIED CALCULATION OF L-, Z- AND U-BENDS, AND EXPANSION LOOPS

JOB 605028

LINE F2-1-06 (1/2)

SHEET 4.02

DS 00029656

MAXUS0998349

PROCEDURE: 1) Select Column applicable to Shape. 2) Enter Given Data to right of heavy bars. 3) Complete form, referring to designated Charts and Tables in Tube Turns' Line Expansion and Flexibility Booklet. 4) Compute S_E with

Nom PIPE SIZE and WEIGHT		3" STD. WT.	Nom PIPE SIZE and WEIGHT					Nom PIPE SIZE and WEIGHT							
Table 1	Eff ELBOW DIAM	D_r = 6.23	Table 1	Eff ELBOW DIAM	D_r =		D_r =	Table 1	Eff ELBOW DIAM	D_r =		D_r =			
	Eff ELBOW LENGTH	L_r = 2.90		Eff ELBOW LENGTH	L_r =		L_r =		Eff ELBOW LENGTH	L_r =		L_r =			
General Notes: For Tables and Charts, refer to Tube Turns' Booklet "Line Expansion and Flexibility"		L BEND		Z-BEND			U BEND		SYMM LOOP			GUIDED LOOP			
Elbow Radius = 1½ × Nominal Pipe Size															
Length of SHORTER LEG		H = 3.5	Length of SHORT VERTICAL		h =		h =	Extreme ANCHOR SPACING		U' =	U =	U' =			
Length of LONGER LEG		w = 9	Length of LONG VERTICAL		H =		H =	Near-by RESTRAINT SPACING		U =		U =			
Chart 3	Enter at ABSCISSA	h/H = 0	Horizontal OFFSET		w =		w =	HEIGHT of LOOP		H =		H =			
	Go to Curve for	H/w = 3.9	Chart 3 or 4	Enter at ABSCISSA	h/H =		h/H =	WIDTH of LOOP		w =		w =			
	Read SHAPE FACTOR	f_s = 1.5		Go to Curve for	H/w =		H/w =	Chart 2	Enter at ABSCISSA	w/U =		w/U =			
		(n = 1)		Read SHAPE FACTOR	f_s =		f_s =		Go to Curve for	H/U =		H/U =			
					(n = 2)		(n = 2)		Read SHAPE FACTOR	f_s =		f_s =			
									Read Eff No. of ELBOWS	n =		n =			
Square-Corner Length H + w =		L_s = 12.5	Sq-Corner Length h + H + w =		L_s =		L_s =	Sq-Corner Length = U' + 2H =		L_s =		L_s =			
Sum of Eff ELBOW LENGTHS		L_r = 2.9	Sum of Eff ELBOW LENGTHS		$2L_r$ =		$2L_r$ =	Sum of Eff ELBOW LENGTHS		nL_r =		nL_r =			
TOTAL Eff LENGTH $L_s + L_r$ =		L = 15.5	TOTAL Eff LENGTH $L_s + 2L_r$ =		L =		L =	TOTAL Eff LENGTH $L_s + nL_r$ =		L =		L =			
Eff DIAMETER LENGTH $\frac{L}{D_r}$ =		f_1 = 5.35	Eff. DIAMETER LENGTH $\frac{L}{D_r}$ =		f_1 =		f_1 =	Eff DIAMETER LENGTH $\frac{L}{D_r}$ =		f_1 =		f_1 =			
PIPE MATERIAL (or Spec)		GR. B. C.S.	PIPE MATERIAL (or Spec)					PIPE MATERIAL (or Spec)							
SERVICE (or Code Section)		TCB	SERVICE (or Code Section)					SERVICE (or Code Section)							
HOT (max) Metal TEMP		T_h = 350	HOT (max) Metal TEMP		T_h =		T_h =	HOT (max) Metal TEMP		T_h =		T_h =			
COLD (min) Metal TEMP		T_c = 0	COLD (min) Metal TEMP		T_c =		T_c =	COLD (min) Metal TEMP		T_c =		T_c =			
Table 5	Read opposite T_h	S_A = 29,450	Table 5	Read opposite T_h	S_A =		S_A =	Table 5	Read opposite T_h	S_A =		S_A =			
	Read opposite T_h	f_{eh} = 53,000		Read opposite T_h	f_{eh} =		f_{eh} =		Read opposite T_h	f_{eh} =		f_{eh} =			
	Read opposite T_c	f_{ec} = 11,000		Read opposite T_c	f_{ec} =		f_{ec} =		Read opposite T_c	f_{ec} =		f_{ec} =			
EXPANSION FACTOR $f_{eh} - f_{ec}$ =		f_e = 64,000	EXPANSION FACTOR $f_{eh} - f_{ec}$ =		f_e =		f_e =	EXPANSION FACTOR $f_{eh} - f_{ec}$ =		f_e =		f_e =			
COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_1}$ =		S_E = 17,950	COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_1}$ =		S_E =		S_E =	COMPUTED EXP STRESS RANGE $\frac{U' f_e f_s}{U f_1}$ =		S_E =		S_E =			

CALC'D H. M. W. DATE 10-14-60

CHECKED DATE

TUBE TURNS, LOUISVILLE, KENTUCKY, PIPING FLEXIBILITY CALCULATION FORM

SIMPLIFIED CALCULATION

OF L, Z AND U-BENDS, AND EXPANSION LOOPS

JOB 605028

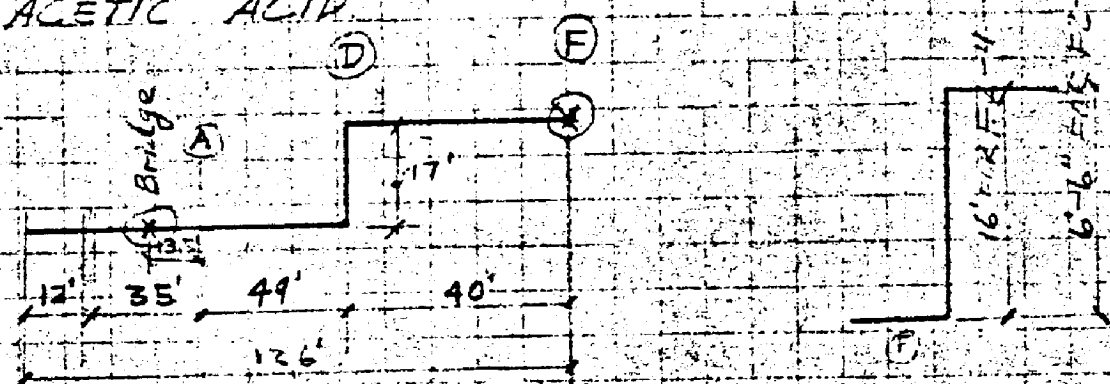
LINE F2-1-02 (3")

SHEET

DS 00029657

MAXUS0998350

ACETIC ACID



BASED ON 150°F
EXP. = 1.289" / 100 FT.

34

$1.289 \times .525 = .677" = \frac{3}{4}"$

$1.289 \times 40 = .516" = \frac{1}{2}"$

Anchor Lines F2-4-14 (3") & F2-4-18 (2") AT Bridge And Col. (F)

N. Gate

DS 00029658

PREPARED BY H N Wen

DATE Oct 17 1980

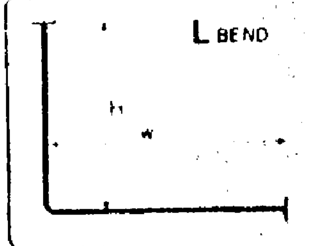
PROJECT NO. 605023

SUBJECT F2-4-14 & F2-4-18

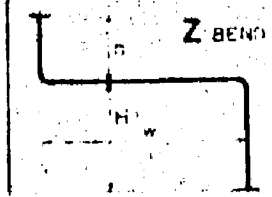
ENGINEERS

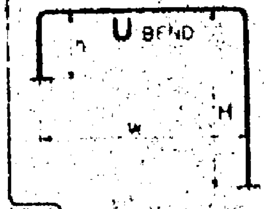
MAXUS0998351

[illegible] 2. Enter Size [illegible] weight of heavy bars 3. Complete form, referring to designated Charts and Tables in Tube Turns "Line Expansion and Flexibility" Booklet 4. Compare S_E with S_A

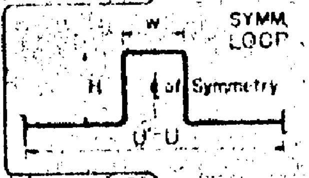


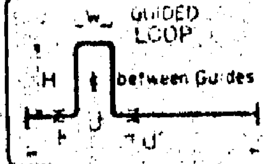
Nom PIPE SIZE and WEIGHT	
Table 1 EFF ELBOW DIAM	D_r –
EFF ELBOW LENGTH	L_r
General Notes: For Tables and Charts, refer to Tube Turns Booklet "Line Expansion and Flexibility" Elbow Radius [illegible] Nominal Pipe Size	
Length of SHORTER LEG	H
Length of LONGER LEG	w
Chart 3 Enter at ABSCISSA	h H 0
Go to Curve for	H w
Read SHAPE FACTOR	f_s
Square Corner Length H + w	L_s
Sum of EFF ELBOW LENGTHS	L_r
TOTAL EFF LENGTH $L_s + L_r$	L =
EFF DIAMETER LENGTH $\frac{L}{D_r}$	f_l =
PIPE MATERIAL (for Spec)	
SERVICE (for Code Section)	
HOT (max) Metal TEMP	T_h =
COLD (min) Metal TEMP	T_c =
Table 5 Read opposite T_h	S_A
Read opposite T_h	f_{eh}
Read opposite T_c	f_{ec}
EXPANSION FACTOR $f_{eh} - f_{ec}$	f_e
COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_l}$	S_E





	Z BEND	U BEND
Nom PIPE SIZE and WEIGHT	2" Sch [illegible]	
Table 1 EFF ELBOW DIAM	D_r = 5.32	D_r
EFF ELBOW LENGTH	L_r = 3.1	L_r =
Length of SHORT VERTICAL	h = 40	h
Length of LONG VERTICAL	H = 62.5	H
Horizontal OFFSET	w = 17	w
Chart 3 or 4 Enter at ABSCISSA	h H = .64	h H =
Go to Curve for	H w = 3.68	H w =
Read SHAPE FACTOR	f_s = 2	f_s =
Sq Corner Length h + H + w =	L_s = 119.5	L_s
Sum of EFF ELBOW LENGTHS	$2L_r$ = 6.2	$2L_r$ =
TOTAL EFF LENGTH $L_s + 2L_r$ =	L = 125.7	L
EFF DIAMETER LENGTH $\frac{L}{D_r}$ =	f_l = 23.6	f_l =
PIPE MATERIAL (for Spec)	STAINLESS STL	
SERVICE (for Code Section)	ACETIC ACID	
HOT (max) Metal TEMP	T_h = 150	T_h =
COLD (min) Metal TEMP	T_c = 0	T_c =
Table 5 Read opposite T_h	S_A = 27,850	S_A =
Read opposite T_h	f_{eh} = 21,000	f_{eh} =
Read opposite T_c	f_{ec} = -16,000	f_{ec} =
EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e = 37,000	f_e =
COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_l}$	S_E = 3140	S_E =





	SYMM. LOOP	GUIDED LOOP
Nom PIPE SIZE and WEIGHT		
Table 1 EFF ELBOW DIAM	D_r =	D_r
EFF ELBOW LENGTH	L_r =	L_r =
Extreme ANCHOR SPACING	U' = U	U'
Neighboring RESTRAINT SPACING	U =	U
HEIGHT of LOOP	H =	H =
WIDTH of LOOP	w =	w
Chart 2 Enter at ABSCISSA	w U =	w U =
Go to Curve for	H U =	H U =
Read SHAPE FACTOR	f_s =	f_s
Read EFF No of ELBOWS	n =	n
Sq Corner Length U + 2H =	L_s =	L_s =
Sum of EFF ELBOW LENGTHS	nL_r =	nL_r
TOTAL EFF LENGTH $L_s + nL_r$ =	L =	L
EFF DIAMETER LENGTH $\frac{L}{D_r}$ =	f_l =	f_l
PIPE MATERIAL (for Spec)		
SERVICE (for Code Section)		
HOT (max) Metal TEMP	T_h =	T_h
COLD (min) Metal TEMP	T_c =	T_c
Table 5 Read opposite T_h	S_A =	S_A =
Read opposite T_h	f_{eh}	f_{eh} =
Read opposite T_c	f_{ec} =	f_{ec} =
EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e =	f_e =
COMPUTED EXP STRESS RANGE $\frac{U'}{U} \frac{f_e f_s}{f_l}$ =	S_E =	S_E =

CALC'D DATE	TUBE TURNS, LOUISVILLE, KENTUCKY, PIPING FLEXIBILITY CALCULATION FORM	JOB 602028	SHEET 4.04
CHECKED DATE	SIMPLIFIED CALCULATION OF L-, Z- AND U-BENDS, AND EXPANSION LOOPS	LINE F2-4-13 (2")	

			Nom. PIPE SIZE and WEIGHT	3" SCH 10					
			1 EFF. ELBOW DIAM	D_r = 9.56	D_r				
			1 EFF. ELBOW LENGTH	L_r = 6.7	L_r				
	L BEND		Z BEND		U BEND		SYMM. LOOP / GUIDED LOOP		
			Length of SHORT VERTICAL	h = 40	h		Extreme ANCHOR SPACING	U' = U	U'
			Length of LONG VERTICAL	H = 62.5	H		Max. RESTRAINT SPACING	U =	U
			Horizontal WIDTH	w = 17	w		HEIGHT of LOOP	H =	H
			Enter at ABSCISSA	h/H = .64	h/H		WIDTH of LOOP	w =	w
			3	H/w = 3.68	H/w		Enter at ABSCISSA	w/U =	w/U
			4 Read SHAPE FACTOR	f_s = 2	f_s		2 Read SHAPE FACTOR	H/U =	H/U
								f_s =	f_s
							Read EFF. No. of ELBOWS	n =	n
	H								
	w								
	h/H	O							
	H/w								
	f_s								
Straight length H + w	L_s		Sq. Corner Length h + H + w =	L_s = 119.5	L_s		Sq. Corner Length U + 2H =	L_s =	L_s
Sum of EFF. ELBOW LENGTHS	L_r		Sum of EFF. ELBOW LENGTHS	$2L_r$ = 13.4	$2L_r$		Sum of EFF. ELBOW LENGTHS	nL_r =	nL_r
TOTAL EFF. LENGTH $L_s + L_r$	L		TOTAL EFF. LENGTH $L_s + 2L_r$ =	L = 132.9	L		TOTAL EFF. LENGTH $L_s + nL_r$ =	L =	L
EFF. DIAMETER LENGTH $\frac{L}{D_r}$	f		EFF. DIAMETER LENGTH $\frac{L}{D_r}$ =	f_1 = 13.9	f		EFF. DIAMETER LENGTH $\frac{L}{D_r}$ =	f_1 =	f_1
PIPE MATERIAL (or Spec.)			PIPE MATERIAL (or Spec.)	STAINLESS STL			PIPE MATERIAL (or Spec.)		
SERVICE (or Code Section)			SERVICE (or Code Section)	ACETIC ACID			SERVICE (or Code Section)		
HOT (max) Meter. TEMP	T_h		HOT (max) Meter. TEMP	T_h = 150	T_h		HOT (max) Meter. TEMP	T_h =	T_h
COLD (min) Meter. TEMP	T_c		COLD (min) Meter. TEMP	T_c = 0	T_c		COLD (min) Meter. TEMP	T_c =	T_c
Table 5 Read opposite T_h	S_A		Table 5 Read opposite T_h	S_A = 27,850	S_A		Table 5 Read opposite T_h	S_A =	S_A
Table 5 Read opposite T_h	f_{eh}		Table 5 Read opposite T_h	f_{eh} = 21,000	f_{eh}		Table 5 Read opposite T_h	f_{eh} =	f_{eh}
Table 5 Read opposite T_c	f_{ec}		Table 5 Read opposite T_c	f_{ec} = -16,000	f_{ec}		Table 5 Read opposite T_c	f_{ec} =	f_{ec}
EXPANSION FACTOR $f_{eh} - f_{ec}$	f_e		EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e = 37,000	f_e		EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e =	f_e
COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f}$	S_E		COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_1}$ =	S_E = 5330	S_E		COMPUTED EXP STRESS RANGE $\frac{U' f_s f_e}{U f_1}$ =	S_E =	S_E

CALC'D DATE

CHECKED DATE

TUBE TURNS, LOUISVILLE, KENTUCKY, PIPING FLEXIBILITY CALCULATION FORM

SIMPLIFIED CALCULATION

L, Z AND U BENDS, AND EXPANSION LOOP

JOB: 605028

SHEET 4.02

DS 00029660

MAXUS0998353

(1) Sketch pipe layout and note to scale (2) Enter Given Values to right of heavy bars (3) Complete form, referring to designated Charts and Tables in Tube Turns Line Expansion and Flexibility Booklet (4) Compare S_E with S_A

Nom. PIPE SIZE and WEIGHT			Nom. PIPE SIZE and WEIGHT	3" SCH. 40		Nom. PIPE SIZE and WEIGHT			
Table 1	EFF. ELBOW DIAM.	D_r =	Table 1	EFF. ELBOW DIAM.	D_r = 6.23	D_r =	Table 1	EFF. ELBOW DIAM.	D_r =	D_r =
	EFF. ELBOW LENGTH	L_r =		EFF. ELBOW LENGTH	L_r = 2.90	L_r =		EFF. ELBOW LENGTH	L_r =	L_r =
General Notes: 1. For Tables and Charts, refer to Tube Turns Booklet Line Expansion and Flexibility. 2. Elbow Radius = 1.5 Nom. Pipe Size	L BEND		Z BEND		U BEND	SYMM LOOP (H, w, ℄ of Symmetry, U'-U)		GUIDED LOOP (H, w, ℄ between Guides, U'-U)	
Length of SHORTER LEG	H		Length of SHORT VERTICAL	h = 40.0	h	Extreme ANCHOR SPACING	U' = U		U =
Length of LONGER LEG	w =		Length of LONG VERTICAL	H = 62.5	H =	Nom. to RESTRAINT SPACING	U =		U =
Chart 3	Enter at ABSCISSA	h/H = 0	Horizontal OFFSET	w = 17	w =	HEIGHT of LOOP	H =		H =
	Go to Curve	H/w	Chart 3	Enter at ABSCISSA	h/H = .64	WIDTH of LOOP	w =		w =
	Read CHART FACTOR	f_s =		Go to Curve	H/w = 3.68	Chart 2 Enter at ABSCISSA	w/U =		w/U =
			4	Read CHART FACTOR	f_s = 2	Go to Curve	H/U =		H/U =
						Read CHART FACTOR	f_s =		f_s =
						Nom. BEND No. of ELBOWS	n =		n =
Square Corner Length H+w		L_s =	Sq. Corner Length h+H+w =		L_s = 119.5	L_s =	Sq. Corner Length U+2H =		L_s =
Sum of EFF. ELBOW LENGTHS		L_r =	Sum of EFF. ELBOW LENGTHS		$2L_r$ = 5.8	$2L_r$ =	Sum of EFF. ELBOW LENGTHS		nL_r =
TOTAL EFF. LENGTH L_s+L_r		L =	TOTAL EFF. LENGTH L_s+2L_r =		L = 125.3	L =	TOTAL EFF. LENGTH L_s+nL_r		L =
EFF. DIAMETER LENGTH $\frac{L}{D_r}$		f_l =	EFF. DIAMETER LENGTH $\frac{L}{D_r}$ =		f_l = 20	f_l =	EFF. DIAMETER LENGTH $\frac{L}{D_r}$ =		f_l =
PIPE MATERIAL (or Spec.)			PIPE MATERIAL (or Spec.)		GR.E. GLASS LINE	PIPE MATERIAL (or Spec.)			
SERVICE (or Code Section)			SERVICE (or Code Section)		Acetic Acid	SERVICE (or Code Section)			
HOT (max) Metal TEMP		T_h =	HOT (max) Metal TEMP		T_h = 150°	T_h =	HOT (max) Metal TEMP	T_h =	T_h =
COLD (min) Metal TEMP		T_c =	COLD (min) Metal TEMP		T_c = 0°	T_c =	COLD (min) Metal TEMP	T_c =	T_c =
Table 5	Read opposite T_h	S_A =	Table 5	Read opposite T_h	S_A = 23,900	S_A =	Table 5	Read opposite T_h	S_A =
	Read opposite T_h	f_{eh} =		Read opposite T_h	f_{eh} = 14,000	f_{eh} =		Read opposite T_h	f_{eh} =
	Read opposite T_c	f_{ec} =		Read opposite T_c	f_{ec} = -11,000	f_{ec} =		Read opposite T_c	f_{ec} =
EXPANSION FACTOR $f_{eh}-f_{ec}$		f_e =	EXPANSION FACTOR $f_{eh}-f_{ec}$ =		f_e = 25,000	f_e =	EXPANSION FACTOR $f_{eh}-f_{ec}$ =		f_e =
COMPUTED EXP STRESS RANGE $\frac{f_e f_l}{f}$		S_E =	COMPUTED EXP STRESS RANGE $\frac{f_e f_l}{f}$ =		S_E = 2,500	S_E =	COMPUTED EXP STRESS RANGE $\frac{U' f_s f_{ss}}{U f_l}$		S_E =	S_E =

CALC'D DATE

CHECKED DATE

TUBE TURNS, LOUISVILLE, KENTUCKY, PIPING FLEXIBILITY CALCULATION FORM

SIMPLIFIED CALCULATION

OF L-, Z- AND U-BENDS, AND EXPANSION LOOPS

JOB 605028

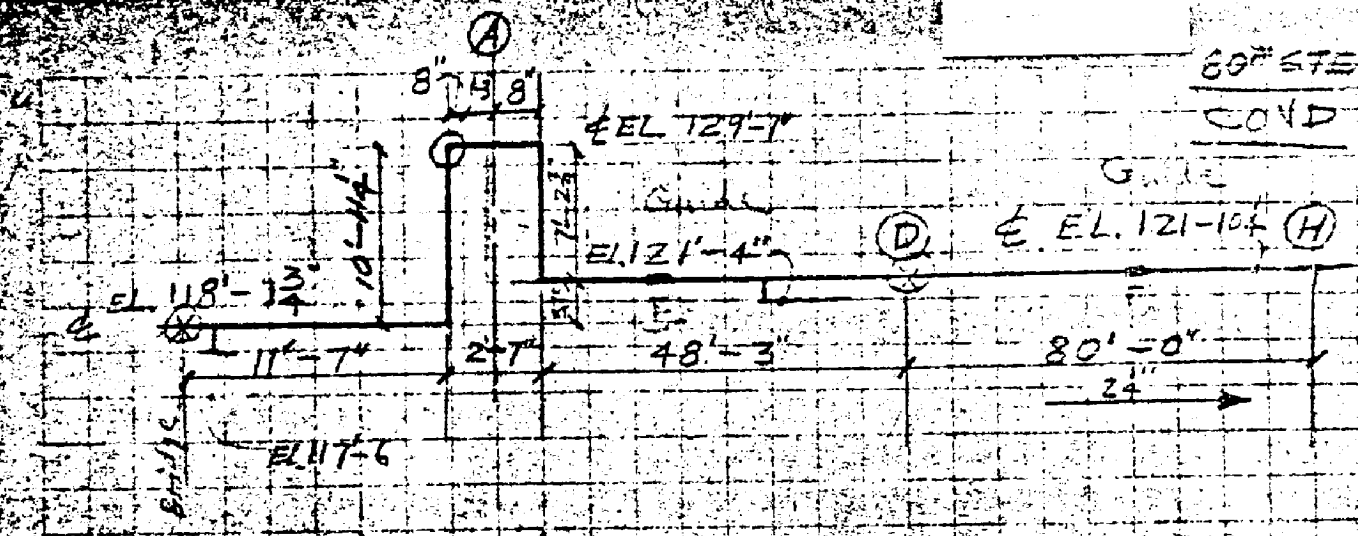
LINE F2-4-14 (3")

SHEET 4.02

DS 00029661

MAXUS0998354

69th STE.
COND



EXP. = 2.724" / 100 FT.

80 x 2.724 = 2.18" SAY 2 1/4"

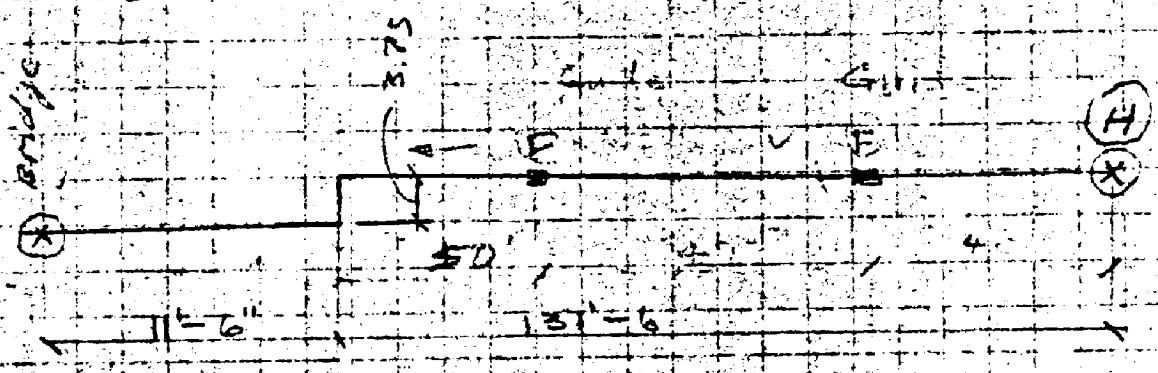
STM. LINE F2-3-16 (4")

ANCHOR AT BRIDGE & COL. D

$$M_{max} = S_E I \frac{D''}{D_f} = 21,700 \times 3.214 \times \frac{4.5}{8.78}$$

$$= 35,800 \text{ IN-LB}$$

COND. F2-3-17 (2")



EXP = 2.10" / 100 FT

2.1 x 131.5 = 2.76" ≈ 2 3/4"

Anchor at Bridge & col. H

DS 00029662

PREPARED BY H. N. Wen

PROJECT NO. 60-028

DATE OCT. 15, 1960

SUBJECT F2-3-16 (4")

ENGINEERS

MAXUS0998355

PROCEDURE: (1) Select Column applicable to shape. (2) Enter given data to right of heavy bars. (3) Complete form, referring to designated Charts and Tables in Tube Turns Line Expansion and Flexibility Booklet. (4) Compare S_E with S_A.

L BEND		Z BEND		U BEND		SYMM LOOP		GUIDED LOOP	
Nom. PIPE SIZE and WEIGHT	4" SCH 40	Nom. PIPE SIZE and WEIGHT	4" SCH. 40			Nom. PIPE SIZE and WEIGHT			
Table 1 EFF. ELBOW DIAM	D_t = 8.78	Table 1 EFF. ELBOW DIAM	D_t = 8.78	D_t		Table 1 EFF. ELBOW DIAM	D_t =	D_t	
Table 1 EFF. ELBOW LENGTH	L_t = 4.70	Table 1 EFF. ELBOW LENGTH	L_t = 4.70	L_t		Table 1 EFF. ELBOW LENGTH	L_t =	L_t	
Dimensions from Tube Turns Booklet Line Expansion and Flexibility									
Length of SHORT VERTICAL	H = 11.0	Length of SHORT VERTICAL	h = 2.5	h		Extreme ANCHOR SPACING	U' = U	U'	
Length of LONG VERTICAL	w = 11.75	Length of LONG VERTICAL	H = 48.25	H		Nearby RESTRAINT SPACING	U =	U	
Horizontal OFFSET	h/H = 0	Horizontal OFFSET	w = 7.25	w		HEIGHT of LOOP	H =	H	
Chart 3 Enter at ABSCISSA	H/w = 1.00	Chart 3 Enter at ABSCISSA	h/H = 0.052	h/H		WIDTH of LOOP	w =	w	
Chart 3 Go to Curve for	f_s = .5	Chart 3 Go to Curve for	H/w = 6.65	H/w		Chart 2 Enter at ABSCISSA	w/U =	w/U	
Chart 3 Read SHAPE FACTOR		Chart 4 Read SHAPE FACTOR	f_s = 2.6	f_s		Chart 2 Go to Curve for	H/U =	H/U	
						Chart 2 Read SHAPE FACTOR	f_s =	f_s	
						Read EFF. No. of ELBOWS	n =	n	
Square Corner Length H + w	L_s = 23.25	Sq. Corner Length h + H + w	L_s = 58	L_s		Total Corner Length U' + 2H	L_s =	L_s	
Sum of EFF. ELBOW LENGTHS	$2L_t$ = 4.7	Sum of EFF. ELBOW LENGTHS	$2L_t$ = 9.4	$2L_t$		Sum of EFF. ELBOW LENGTHS	nL_t =	nL_t	
TOTAL EFF. LENGTH $L_s + 2L_t$	L = 28	TOTAL EFF. LENGTH $L_s + 2L_t$	L = 67.4	L		TOTAL EFF. LENGTH $L_s + nL_t$	L =	L	
EFF. DIAMETER LENGTH $\frac{L}{D_t}$	f_t = 3.2	EFF. DIAMETER LENGTH $\frac{L}{D_t}$	f_t = 7.67	f_t		EFF. DIAMETER LENGTH $\frac{L}{D_t}$	f_t =	f_t	
PIPE MATERIAL (or Spec)	GR. B. C.S.	PIPE MATERIAL (or Spec)	GR. B. C.S.			PIPE MATERIAL (or Spec)			
SERVICE (or Code Section)	80# STM	SERVICE (or Code Section)	80# STM.			SERVICE (or Code Section)			
HOT (max) Metal TEMP	T_h = 325	HOT (max) Metal TEMP	T_h = 325	T_h		HOT (max) Metal TEMP	T_h =	T_h	
COLD (min) Metal TEMP	T_c = 0	COLD (min) Metal TEMP	T_c = 0	T_c		COLD (min) Metal TEMP	T_c =	T_c	
Table 5 Read opposite T_c	S_A = 22,500	Table 5 Read opposite T_c	S_A = 22,500	S_A		Table 5 Read opposite T_c	S_A =	S_A	
Table 5 Read opposite T_h	f_{eh} = 53,000	Table 5 Read opposite T_h	f_{eh} = 53,000	f_{eh}		Table 5 Read opposite T_h	f_{eh} =	f_{eh}	
Table 5 Read opposite T_c	f_{ec} = -11,000	Table 5 Read opposite T_c	f_{ec} = -11,000	f_{ec}		Table 5 Read opposite T_c	f_{ec} =	f_{ec}	
EXPANSION FACTOR f_{eh} f_{ec}	f_e = 64,000	EXPANSION FACTOR f_{eh} f_{ec}	f_e = 64,000	f_e		EXPANSION FACTOR f_{eh} f_{ec}	f_e =	f_e	
COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_t}$	S_E = 1,000	COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_t}$	S_E = 21,700	S_E		COMPUTED EXP STRESS RANGE $\frac{U' f_e f_s}{U f_t}$	S_E =	S_E	

CALC'D H. N. Wen DATE Oct 15 60

CHECKED DATE

TUBE TURNS, LOUISVILLE, KENTUCKY, PIPING FLEXIBILITY CALCULATION FORM

SIMPLIFIED CALCULATION

OF L, Z AND U BENDS, AND EXPANSION LOOPS

JOB 605028

LINE E2-3-16 (4")

SHEET 4 OF 2

DS 00029663

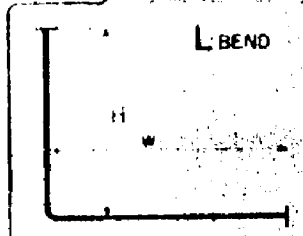
MAXUS0998356

PROCEDURE: (a) Select Loop applicable to Shape. (b) Enter Given Data to right of heavy bars. (c) Complete form, referring to designated Charts and Tables in Tube Turns Line Expansion and Flexibility Booklet. (d) Compare S_E with S_A.

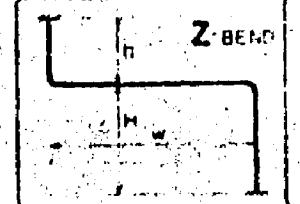
Nom. PIPE SIZE and WEIGHT		2" SCH. 80	
Table 1 — EFF. ELBOW DIAM.	D_r =	D_r = 3.14	D_r =
Table 1 — EFF. ELBOW LENGTH	L_r =	L_r = 1.00	L_r =
General Notes: (a) For Tables and Charts, refer to Tube Turns Booklet, Line Expansion and Flexibility. (b) Elbow Radius (Short Nomenclature) Pipe Size			
Length of SHORTER LEG	H		
Length of LONGER LEG	w		
Chart 3 — Enter at ABSCISSA	h H =	0	h H =
Chart 3 — Go to Curve for	H/w =		H/w =
Chart 3 — Read SHAPE FACTOR	f_s =		f_s =
Chart 4 — Enter at ABSCISSA	h H =	.084	h H =
Chart 4 — Go to Curve for	H/w =	34.9	H/w =
Chart 4 — Read SHAPE FACTOR	f_s =	18	f_s =
Square Corner Length H + w =	L_s =		L_s =
Sum of EFF. ELBOW LENGTHS	L_r =		L_r =
TOTAL EFF. LENGTH $L_s + L_r$ =	L =		L =
EFF. DIAMETER LENGTH $\frac{L}{D_r}$ =	f_l =		f_l =
Sq. Corner Length h + H + w =	L_s =	147	L_s =
Sum of EFF. ELBOW LENGTHS	$2L_r$ =	2	$2L_r$ =
TOTAL EFF. LENGTH $L_s + 2L_r$ =	L =	149	L =
EFF. DIAMETER LENGTH $\frac{L}{D_r}$ =	f_l =	47.5	f_l =
PIPE MATERIAL (or Spec.)		GR.B.C.S.	
SERVICE (or Code Section)		COND	
HOT (max) Metal TEMP.	T_h =	250	T_h =
COLD (min) Metal TEMP.	T_c =	0	T_c =
Table 5 — Read opposite T_h	S_A =	22,500	S_A =
Table 5 — Read opposite T_h	f_{eh} =	33,000	f_{eh} =
Table 5 — Read opposite T_c	f_{ec} =	11,000	f_{ec} =
EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e =	44,000	f_e =
COMPUTED EXP. STRESS RANGE $\frac{f_t f_e}{f_l}$ =	S_E =	16,650	S_E =

Nom. PIPE SIZE and WEIGHT			
Table 1 — EFF. ELBOW DIAM.	D_r =	D_r =	
Table 1 — EFF. ELBOW LENGTH	L_r =	L_r =	
Extreme ANCHOR SPACING	U' = U	U' =	
Next to RESTRAINT SPACING	U =	U =	
HEIGHT of LOOP	H =	H =	
WIDTH of LOOP	w =	w =	
Chart 2 — Enter at ABSCISSA	w/U =	w/U =	
Chart 2 — Go to Curve for	H/U =	H/U =	
Chart 2 — Read SHAPE FACTOR	f_s =	f_s =	
Read EFF. No. of ELBOWS	n =	n =	
Sq. Corner Length U + 2H =	L_s =	L_s =	
Sum of EFF. ELBOW LENGTHS	nL_r =	nL_r =	
TOTAL EFF. LENGTH $L_s + nL_r$ =	L =	L =	
EFF. DIAMETER LENGTH $\frac{L}{D_r}$ =	f_l =	f_l =	
PIPE MATERIAL (or Spec.)			
SERVICE (or Code Section)			
HOT (max) Metal TEMP.	T_h =	T_h =	
COLD (min) Metal TEMP.	T_c =	T_c =	
Table 5 — Read opposite T_h	S_A =	S_A =	
Table 5 — Read opposite T_h	f_{eh} =	f_{eh} =	
Table 5 — Read opposite T_c	f_{ec} =	f_{ec} =	
EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e =	f_e =	
COMPUTED EXP. STRESS RANGE $\frac{U' f_t f_e}{U f_l}$ =	S_E =	S_E =	

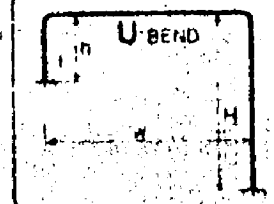
L BEND



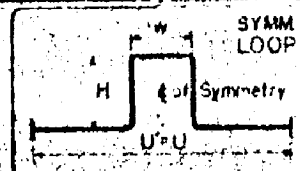
Z BEND



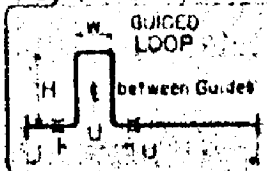
U BEND



SYMM. LOOP



GUIDED LOOP



CALC'D DATE

CHECKED DATE

TUBE TURNS, LOUISVILLE, KENTUCKY, PIPING FLEXIBILITY CALCULATION FORM

SIMPLIFIED CALCULATION

OF L, Z AND U-BENDS, AND EXPANSION LOOPS

JOB 605028

WE FZ-3-17(21)

SHEET 4.02

DS 00029664

MAXUS0998357

F2-9-21 (2")

EXP = 1.528"/100FT. MAX. TEMP = 176°F

.43 X 1.528 = .657" = ¾"
.20 X 1.528 = .306"

F2-2-10 (2") TEMP = 130°F

EXP = 1.209"/100FT.

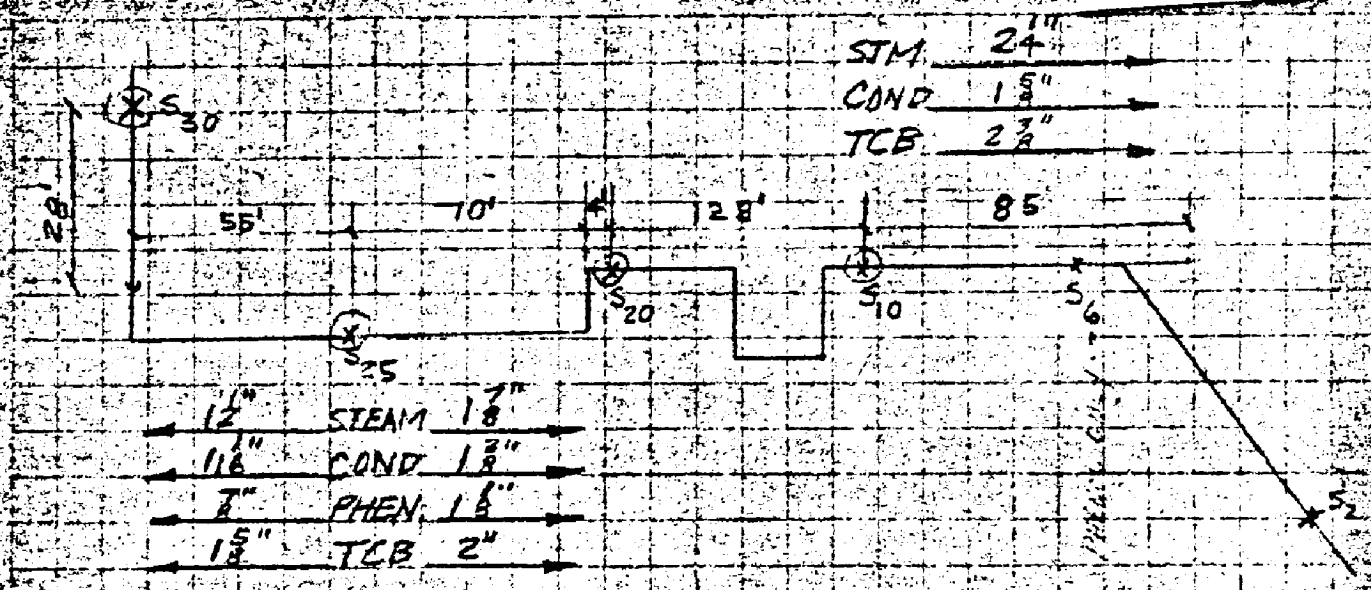
1.209 X .43 = .52"
1.209 X .30 = .363"

F2-6-12 (2") TEMP = 96°F
EXP = 0.898"/100FT.
.35 X .0898 = .314"

DS 00029665

PREPARED BY H. M. Wan PROJECT NO.
DATE Oct 18 1960 SUBJECT
ENGINEERS INCORPORATED

MAXUS0998358



STEAM: EXP. 2.61"/100 FT. 0°–300°F

2.61 x .55 = 1.44" 2.61 x .85 = 2.22"

2.61 x .70 = 1.83" 2.61 x .28 = .73"

2.61 x 1.28 = 3.35"

COND: EXP. = 1.91"/100 FT. 0°–250°F

1.91 x .55 = 1.05" 1.91 x .85 = 1.63"

1.91 x .70 = 1.34" 1.91 x .28 = .535"

1.91 x 1.28 = 2.45"

PHENOL: EXP. 1.546"/100 FT 0°–200°F

1.546 x .55 = .85 1.546 x .40 = .62" ($S_2 - S_4$)

1.546 x .70 = 1.08 1.546 x .28 = .43

1.546 x 1.10 = 1.70 1.546 x .80 = 1.24" ($S_{15} - S_{20}$)

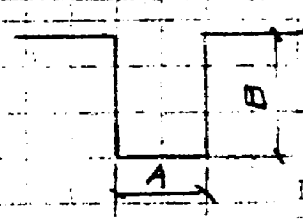
TCB: EXP. 2.8"/100 FT. 0°–350°F

2.8 x .55 = 1.54" 2.8 x .85 = 2.38

2.8 x .70 = 1.96" 2.8 x .28 = .785

2.8 x 1.28 = 3.58"

	A x B
PHENOL:	8' x 8'–9 1/2"
TCB	6' x 8'–6"
COND	4' x 8'–11 1/4"
STEAM	2' x 8'–6 1/2"



DS 00029666

PREPARED BY WEIJ ac PROJECT NO. 605-28

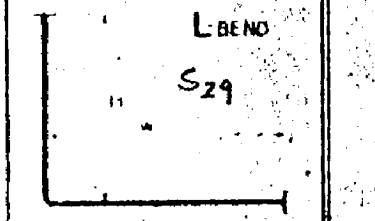
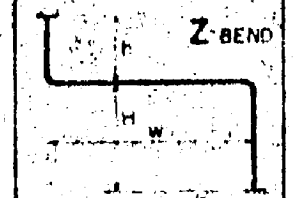
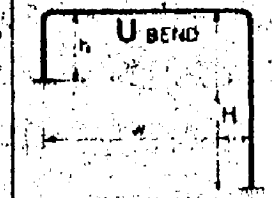
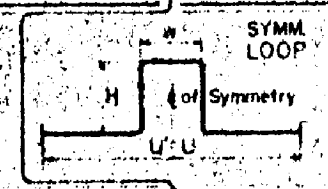
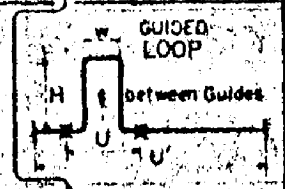
DATE 8-23-63 SUBJECT YARD PIPING

ENGINEERS

MAXUS0998359

JACKETED PIPE ANCHOR AT S_{25}

PROCEDURE: 1. Select L or U shape. 2. Enter given data. 3. Enter chart with height of heavy bars (3) Enter any table (referring to designated Charts and Tables in Tube Turns Line Expansion and Flexibility Booklet) (4) Compare S_E with S_A

Nom. PIPE SIZE and WEIGHT	3" STD. WT.	Nom. PIPE SIZE and WEIGHT	3" STD. WT.		Nom. PIPE SIZE and WEIGHT		3" STD. WT.
Table 1 EFF. ELBOW DIAM.	D_1 = 6.23	Table 1 EFF. ELBOW DIAM.	D_1 = 6.23	D_1 =	Table 1 EFF. ELBOW DIAM.	D_1 =	D_1 = 6.23
EFF. ELBOW LENGTH	L_1 = 2.90	EFF. ELBOW LENGTH	L_1 = 2.90	L_1 =	EFF. ELBOW LENGTH	L_1 =	L_1 = 2.90
							
					Extreme ANCHOR SPACING	U' = U	U' = 128
					Intermediate RESTRAINT SPACING	U =	U = 16
					HEIGHT of LOOP	H	H = 8.5
					WIDTH of LOOP	W =	W = 6
Length of SHORT SIDE	H 15	Length of SHORT VERTICAL	h = 4	h	Enter at ABSCISSA	W/U =	W/U = .375
Length of LONG SIDE	W 31	Length of LONG VERT. LEG	H = 68	H =	Enter chart to curve for	H/U =	H/U = .53
Enter at ABSCISSA	H/H = 0	Horizontal OFFSET	W = 9.5	W =	2 Read SHAPE FACTOR	f_s =	f_s = .28
Enter chart to curve for	H/W = .485	3 Enter at ABSCISSA	h/H = .058	h/H =	Read EFF. NO. of ELBOWS	n =	n = .33
3 Read SHAPE FACTOR	f_s = 1.05	Enter chart to curve for	H/W = 7.15	H/W =			
		4 Read SHAPE FACTOR	f_s = 4	f_s =			
Sum of Straight Lengths H+W	L_s = 46	Sum of Straight Lengths H+H+W =	L_s = 81.5	L_s =	Sum of Straight Lengths U+2H =	L_s =	L_s = 33
Sum of EFF. ELBOW LENGTHS	L_1 = 2.9	Sum of EFF. ELBOW LENGTHS	$2L_1$ = 5.8	$2L_1$ =	Sum of (n) ELBOW LENGTHS	nL_1 =	nL_1 = 9.6
TOTAL EFF. LENGTH L_s+L_1 =	L = 49	TOTAL EFF. LENGTH L_s+2L_1 =	L = 87.3	L =	TOTAL EFF. LENGTH L_s+nL_1 =	L =	L = 42.6
EFF. DIAMETER LENGTH $\frac{L}{D_1}$	f_1 = 7.88	EFF. DIAMETER LENGTH $\frac{L}{D_1}$ =	f_1 = 14.0	f_1 =	EFF. DIAMETER LENGTH $\frac{L}{D_1}$ =	f_1 =	f_1 = 6.85
PIPE MATERIAL (or Spec.)	GR. B. C.S.	PIPE MATERIAL (or Spec.)	GR. B. C.S.		PIPE MATERIAL (or Spec.)		GR. B. C.S.
SERVICE (or Code Section)	TCB	SERVICE (or Code Section)	TCB		SERVICE (or Code Section)		TCB
HOT (max) Metal TEMP.	T_h = 350	HOT (max) Metal TEMP.	T_h = ✓	T_h =	HOT (max) Metal TEMP.	T_h =	T_h = 350
COLD (min) Metal TEMP.	T_c = 0	COLD (min) Metal TEMP.	T_c = ✓	T_c =	COLD (min) Metal TEMP.	T_c =	T_c = 0
Table 5 Read opposite T_h	S_A = 29450	Table 5 Read opposite T_h	S_A = ✓	S_A =	Table 5 Read opposite T_h	S_A =	S_A = 29,450
Read opposite T_h	f_{eh} = 53,000	Read opposite T_h	f_{eh} = ✓	f_{eh} =	Read opposite T_h	f_{eh} =	f_{eh} = 53000
Read opposite T_c	f_{ec} = -11,000	Read opposite T_c	f_{ec} = ✓	f_{ec} =	Read opposite T_c	f_{ec} =	f_{ec} = -11,000
EXPANSION FACTOR $f_{eh}-f_{ec}$	f_e = 64,000	EXPANSION FACTOR $f_{eh}-f_{ec}$ =	f_e = ✓	f_e =	EXPANSION FACTOR $f_{eh}-f_{ec}$	f_e =	f_e = 64,000
COMPUTED EXP. STRESS RANGE $\frac{f_e f_s}{f_1}$	S_E = 8,500	COMPUTED EXP. STRESS RANGE $\frac{f_e f_s}{f_1}$ =	S_E = 18,250	S_E =	COMPUTED EXP. STRESS RANGE $\frac{U' f_e f_s}{U f_1}$	S_E =	S_E = 20,900

Made by H.M. Weber DATE 8/23/60 | TUBE TURNS, LOUISVILLE, KENTUCKY, PIPING FLEXIBILITY CALCULATION FORM | JOB 605028 | SHEET 4 of 4

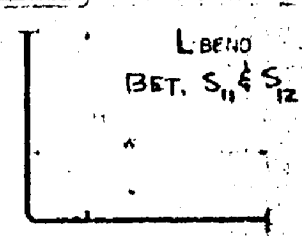
SIMPLIFIED CALCULATION OF L, Z AND U-BENDS, AND EXPANSION LOOPS

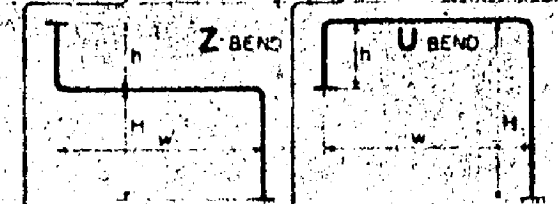
CHECKED DATE | DS 00029667 | LINE F2-1-02 (3")

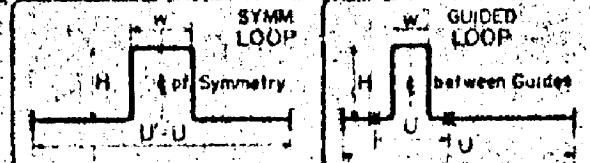
MAXUS0998360

ANCHOR AT S_{25}

New PIPE SIZE and WEIGHT			3" STD. WT.			New PIPE SIZE and WEIGHT			3" STD. WT.		
Table 1	Eff. ELBOW DIAM.	D_r =	D_r = 6.23	D_r =		Table 1	Eff. ELBOW DIAM.	D_r =	D_r = 6.23	D_r =	
	Eff. ELBOW LENGTH	L_r =	L_r = 2.90	L_r =			Eff. ELBOW LENGTH	L_r =	L_r = 2.90	L_r =	







Length of SHORTER LEG	H	15	Length of SHORT VERTICAL	h = 6	h	Extreme ANCHOR SPACING	U' = U	U' = 128			
Length of LONGER LEG	w	28	Length of LONG VERTICAL	H = 66	H	Next by RESTRAINT SPACING	U =	U = 16			
Enter at ABSCISSA	h/H =	0	HORIZONTAL OFFSET	w = 9.5	w =	HEIGHT of LOOP	H	H = 85			
Chart go to Curve for	H/w	.535	Chart 3 or 4: Enter at ABSCISSA	h/H	.091	WIDTH of LOOP	w =	w = 2			
3 Read SHAPE FACTOR	f_s =	.875	Go to Curve for	H/w	6.95	Enter at ABSCISSA	w/U =	w/U = .125			
			Read SHAPE FACTOR	f_s =	3	Chart 2 go to Curve for	H/U	H/U = .153			
						Read SHAPE FACTOR	f_s =	f_s = .41			
						Read Eff. No. of ELBOWS	n =	n = .56			
Square Corner Length H+w	L_s =	43	Sq. Corner Length h+H+w	L_s =	81.5	Sq. Corner Length U+2H	L_s =	L_s = 33			
Sum of Eff. ELBOW LENGTHS	L_r =	1.8	Sum of Eff. ELBOW LENGTHS	$2L_r$ =	5.8	Sum of Eff. ELBOW LENGTHS	nL_r =	nL_r = 1.62			
TOTAL Eff. LENGTH L_s+L_r	L =	44.8	TOTAL Eff. LENGTH L_s+2L_r	L =	87.3	TOTAL Eff. LENGTH L_s+nL_r	L =	L = 49			
Eff. DIAMETER LENGTH $\frac{L}{D_r}$	f_1 =	10.9	Eff. DIAMETER LENGTH $\frac{L}{D_r}$	f_1 =	14	Eff. DIAMETER LENGTH $\frac{L}{D_r}$	f_1 =	f_1 = 7.89			
PIPE MATERIAL (or Spec.)		GR. B C.S. STM.	PIPE MATERIAL (or Spec.)		GR. B, C.S. STM.	PIPE MATERIAL (or Spec.)		GR. B C.S. STEAM.			
SERVICE (or Code Section)			SERVICE (or Code Section)			SERVICE (or Code Section)					
HOT (max) Metal TEMP	T_h =	✓	HOT (max) Metal TEMP	T_h = 300	T_h =	HOT (max) Metal TEMP	T_h =	T_h = 300			
COLD (min) Metal TEMP	T_c =	✓	COLD (min) Metal TEMP	T_c = 0	T_c =	COLD (min) Metal TEMP	T_c =	T_c = 0			
Table 5: Read opposite T_h	S_A =	✓	Table 5: Read opposite T_h	S_A = 20,500	S_A =	Table 5: Read opposite T_h	S_A =	S_A = 22,500			
Read opposite T_h	f_{eh} =	✓	Read opposite T_h	f_{eh} = 42,500	f_{eh} =	Read opposite T_h	f_{eh} =	f_{eh} = 42,500			
Read opposite T_c	f_{ec} =	✓	Read opposite T_c	f_{ec} = -11,000	f_{ec} =	Read opposite T_c	f_{ec} =	f_{ec} = -11,000			
EXPANSION FACTOR $f_{eh}-f_{ec}$	f_e =	✓	EXPANSION FACTOR $f_{eh}-f_{ec}$	f_e = 53,500	f_e =	EXPANSION FACTOR $f_{eh}-f_{ec}$	f_e =	f_e = 53,500			
COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_1}$	S_E =	4,350	COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_1}$	S_E = 11,500	S_E =	COMPUTED EXP STRESS RANGE $\frac{U' f_e f_s}{U' f_1}$	S_E =	S_E = 22,400			

DATE 8/23/00 | TUBE TURNS, LOUISVILLE, KENTUCKY PIPING FLEXIBILITY CALCULATION FORM | Job 605028

SIMPLIFIED CALCULATION

OF L, Z AND U BENDS, AND EXPANSION LOOPS

DS 00029668

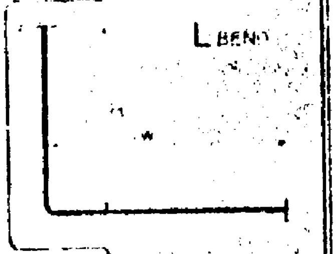
Line FZ-3-46(3")

MAXUS0998361

designated Charts and Tables in Tube Turns Line Expansion and Flexibility Manual

L BEND

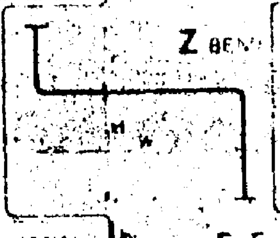
Nominal Size and Weight		
Eff. Elbow Diam.	D_r	
Eff. Elbow Length	L_r	

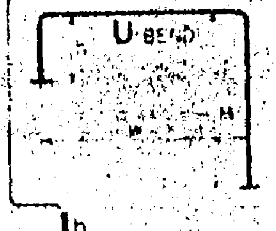


Length of SHORTER Leg	H	
Length of LONGER Leg	W	
Enter on Abscissa	h H	O
Go to Curve	H W	
3 Read SHAPE FACTOR	f_s	
Sq. Corner Length H + W	L_s	
Sum of Eff. Elbow Lengths	L_r	
Total Eff. Length $L_s + L_r$	L	
Eff. Diameter Length $\frac{L}{D}$	f_l	
Pipe Material		
Service		
Hot Metal Temp.	T_h	
Cold Metal Temp.	T_c	
Read opposite T_h	S_h	
5 Read opposite T_h	f_{eh}	
Read opposite T	f_{ec}	
Expansion Factor $f_{eh} - f_{ec}$	f_e	
Computed Exp. Stress Range $\frac{f_e f_s}{f_l}$	S_E	

Z BEND / U BEND

		Z BEND		U BEND
Nom. Pipe Size and Weight		$1\frac{1}{2}$" SCH. 80		
Tube Turns Eff. Elbow Diam.	D_r	2.34	D_r	
1 Eff. Elbow Length	L_r	.60	L_r	

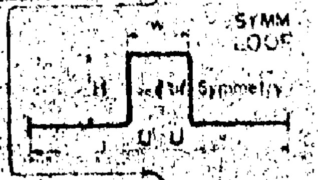


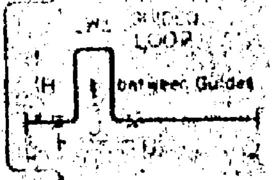


		Z BEND		U BEND
Length of Short Vertical	h	6.6	h	
Length of Long Vertical	H	51	H	
Horizontal Offset	W	9.5	W	
3 Enter on Abscissa	h H	.011	h H	
Go to Curve	H W	5.4	H W	
4 Read SHAPE FACTOR	f_s	2.3	f_s	
Sq. Corner Length h + H + W	L	66	L	
Sum of Eff. Elbow Lengths	$2L_r$	1.2	$2L_r$	
Total Eff. Length $L + 2L_r$	L	67.2	L	
Eff. Diameter Length $\frac{L}{D_r}$	f_l	28.7	f_l	
Pipe Material				
Service				
Hot Metal Temp.	T_h	✓	T_h	
Cold Metal Temp.	T_c	✓	T_c	
Read opposite T_h	S_h	✓	S_h	
5 Read opposite T_h	f_{eh}	✓	f_{eh}	
Read opposite T_c	f_{ec}	✓	f_{ec}	
Expansion Factor $f_{eh} - f_{ec}$	f_e	✓	f_e	
Computed Exp. Stress Range $\frac{f_e f_s}{f_l}$	S_E	3,530	S_E	

SYMM LOOP / GUIDED LOOP

		SYMM LOOP		GUIDED LOOP
Nom. Pipe Size and Weight				$1\frac{1}{2}$ SCH. 80
Tube Turns Eff. Elbow Diam.	D_r		D_r	2.34
1 Eff. Elbow Length	L_r		L_r	.60





		SYMM LOOP		GUIDED LOOP
Extreme Anchor Spacing	U	U	U	128
Length Between Guides	U		U	16
Height of Loop	H		H	8
Width of Loop	W		W	4
Enter on Abscissa	W U		W U	.25
Go to Curve	H U		H U	.50
2 Read SHAPE FACTOR	f_s		f_s	.34
Read No. of Elbows	n		n	39
Sq. Corner Length U + 2H	L		L	32
Sum of Eff. Elbow Lengths	nL_r		nL_r	2.34
Total Eff. Length $L + nL_r$	L		L	34.34
Eff. Diameter Length $\frac{L}{D_r}$	f_l		f_l	15.4
Pipe Material				GR. B. C.S
Service				COND.
Hot Metal Temp.	T_h		T_h	250
Cold Metal Temp.	T_c		T_c	0
Read opposite T_h	S_h		S_h	22,500
5 Read opposite T_h	f_{eh}		f_{eh}	33,000
Read opposite T_c	f_{ec}		f_{ec}	-11,000
Expansion Factor $f_{eh} - f_{ec}$	f_e		f_e	44,000
Computed Exp. Stress Range $\frac{U' f_e f_s}{U f_l}$	S_E		S_E	7,800

McWerner 8-22/60

DATE [redacted]

TUBE TURNS, LOUISVILLE, KENTUCKY PIPING FLEXIBILITY CALCULATION FORM

SIMPLIFIED CALCULATION OF L-, Z- AND U-BENDS, AND EXPANSION LOOPS

JOB 605028

F243-17

DS 00029669

BET. S_3 & S_4

	2" Sch. 80		2" Sch. 80	2" Sch. 80			2" Sch. 80
	D_r = 3.14		D_r = 3.14	D_r = 3.14		D_r	D_r = 3.14
	L_r = 1.00	1	L_r = 1.00	L_r = 1.00	1	L_r	L_r = 1.00
	L BEND		Z BEND	U BEND		SYMM LOOP / UNEQ LOOP	
	H		h = 6	h		U' = U	U = 107
	w		H = 50	H = 7		U	U = 16
	n H		w = 9.5	w = 38		H	H = 8
	H·w		n H = .12	n H = 0		w	w = 7
	f_s	3	H·w = 5.26	H·w = .184		w U	w U = .438
		4	f_s = 2.1	f_s = 5	2	H U	H U = .5
						f_s	f_s = .27
						n	n = 3
	L		L = 65.5	L = 45		L = U·2H	L = 32
	L_r		2L = 2	2L = 1		nL	nL = 3
	L		L = 67.5	L = 46		L	L = 35
	f_l		f_l = 21.5	f_l = 14.6		f_l	f_l = 11.1
							G.R.C.S. PHENOL
			✓	✓			T_r = 200
	T		T = ✓	T = ✓		T_r	T = 0
	T_c		T_c = ✓	T_c = ✓		T_c	S = 29,000
	S_h		S_h = ✓	S_h = ✓		S_h	f_{en} = 23,000
	f_{en}	5	f_{en} = ✓	f_{en} = ✓	5	f_{en}	f_{ec} = 14,000
	f_{ec}		f_{ec} = ✓	f_{ec} = ✓		f_{ec}	f_e = 44,000
	f_e		f_e = ✓	f_e = ✓		f_e	
	S_E		S_E = 4,300	S_E = 15,000		S_E	S_E = 7,160

TUBE TURNS PIPING FLEXIBILITY CALCULATION FORM

SIMPLIFIED CALCULATION

FOR L, Z AND U BENDS AND EXPANSION LOOPS

DATE 8/23/60

JOB 605028

DS 00029670

MAXUS0998363

INNER PIPE

INNER PIPE

PROCEDURE: (1) Select Column applicable to Shape (2) Enter Given Data to right of heavy bars (3) Complete form, referring to designated Charts and Tables in Tube Turns "Line Expansion and Flexibility" booklet (4) Compute S_E with S_E

Main PIPE SIZE and WEIGHT		3" STD WT.	Main PIPE SIZE and WEIGHT		2½ SCH. 80		Main PIPE SIZE and WEIGHT			2½ SCH. 80	
Table 1	ELL ELBOW DIAM	D_r = 6.23	Table 1	ELL ELBOW DIAM	D_r = 3.14	D_r =	Table 1	ELL ELBOW DIAM	D_r =	D_r = 3.14	
	ELL ELBOW LENGTH	L_r = 2.90		ELL ELBOW LENGTH	L_r = 1.60	L_r =		ELL ELBOW LENGTH	L_r =	L_r = 1.60	
General Notes: For Tables and Charts, refer to Tube Turns Booklet "Line Expansion and Flexibility". Elbow Radius = 1½ x Nominal Pipe Size		L BEND (H, w)		Z BEND (h, H, w)		U BEND (h, H, w)		SYMM LOOP (H, w, U-U, ℄ of Symmetry)		GUIDED LOOP (H, w_1, U, ℄ between Guides)	
	Length of SHORTER LEG	H = 9.5		Length of SHORT VERTICAL	h = 4	h =		EXTREME ANCHOR SPACING	U = U	U = 12.8	
	Length of LONGER LEG	w = 68		Length of LONG VERTICAL	H = 68	H =		Max by RESTRAINT SPACING	U =	U = 16	
Chart 3	Enter at ABSCISSA	h/H = 0		Horizontal OFFSET	w = 9.5	w =		HEIGHT of LOOP	H =	H = 8.5	
	Go to Curve for	H/w = .14	Chart 3	Enter at ABSCISSA	h/H = .058	h/H =		WIDTH of LOOP	w =	w = 6	
	Read SHAPE FACTOR	f_s = 8		Go to Curve for	H/w = 7.15	H/w =	Chart 2	Enter at ABSCISSA	w/U =	w/U = .375	
		(n = 1)		Read SHAPE FACTOR	f_s = 4	f_s =		Go to Curve for	H/U =	H/U = .53	
					(n = 2)	(n = 2)		Read SHAPE FACTOR	f_s =	f_s = .28	
								Read ELL No. of ELBOWS	n =	n = 3	
	Square-Corner Length H + w =	L_s = 77.5		Sq-Corner Length h + H + w =	L_s = 81.5	L_s =		Sq-Corner Length U + 2H =	L_s =	L_s = 33	
	Sum of ELL ELBOW LENGTHS	L_r = 2.9		Sum of ELL ELBOW LENGTHS	$2L_r$ = 2	$2L_r$ =		Sum of ELL ELBOW LENGTHS	nL_r =	nL_r = 3	
	TOTAL ELL LENGTH $L_s + L_r$ =	L = 80.4		TOTAL ELL LENGTH $L_s + 2L_r$ =	L = 83.5	L =		TOTAL ELL LENGTH $L_s + nL_r$ =	L =	L = 33	
	ELL DIAMETER LENGTH $\frac{L}{D_r}$ =	f_1 = 12.9		ELL DIAMETER LENGTH $\frac{L}{D_r}$ =	f_1 = 26.6	f_1 =		ELL DIAMETER LENGTH $\frac{L}{D_r}$ =	f_1 =	f_1 = 10.6	
	PIPE MATERIAL (or Spec.)	C.R.B.C.S		PIPE MATERIAL (or Spec.)	C.R.B.C.S			PIPE MATERIAL (or Spec.)			
	SERVICE (or Code Section)	TCB		SERVICE (or Code Section)	TCB			SERVICE (or Code Section)			
	HOT (max) METAL TEMP.	T_h = 350		HOT (max) METAL TEMP.	T_h = 350	T_h =		HOT (max) METAL TEMP.	T_h =	T_h =	
	COLD (min) METAL TEMP.	T_c = 0		COLD (min) METAL TEMP.	T_c = 0	T_c =		COLD (min) METAL TEMP.	T_c =	T_c =	
Table 5	Read opposite T_h	S_A = 29,450	Table 5	Read opposite T_h	S_A = 29,450	S_A =	Table 5	Read opposite T_h	S_A =	S_A =	
	Read opposite T_h	f_{eh} = 53,000		Read opposite T_h	f_{eh} = 53,000	f_{eh} =		Read opposite T_h	f_{eh} =	f_{eh} =	
	Read opposite T_c	f_{ec} = -11,000		Read opposite T_c	f_{ec} = -11,000	f_{ec} =		Read opposite T_c	f_{ec} =	f_{ec} =	
	EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e = 64,000		EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e = 64,000	f_e =		EXPANSION FACTOR $f_{eh} - f_{ec}$ =	f_e =	f_e =	
	COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_1}$ =	S_E = 39,600		COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_1}$ =	S_E = 9,600	S_E =		COMPUTED EXP STRESS RANGE $\frac{f_e f_s}{f_1}$ =	S_E =	S_E = 13,500	

Prepared by: Hal Warren Date: 8/23/60

TUBE TURNS, LOUISVILLE, KENTUCKY, PIPING FLEXIBILITY CALCULATION FORM

SIMPLIFIED CALCULATIONS OF L-, Z- AND U-BENDS, AND EXPANSION LOOPS

Date:

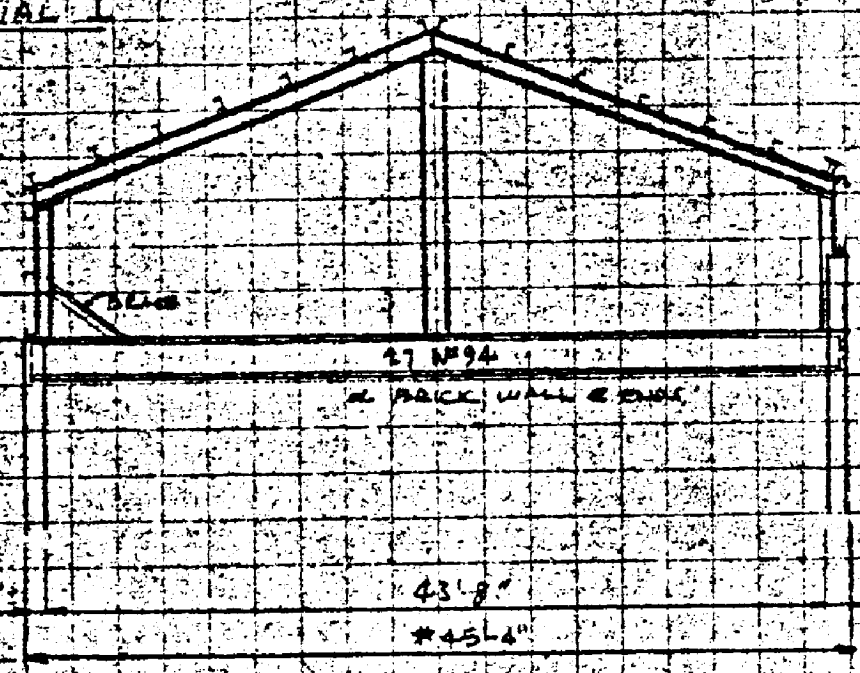
WO# 605028

Sheet 1 of 1

DS 00029671

MAXUS0998364

TRIAL I



LG. BLDG ~ 85'-6"
BEAMS @ 4 SPCS
SP. @ 21'

USE $f_s = 18{,}000$

DL Corr. Asb. ~ 3
Steel Assmb ~ 6
Process Piping ~ 15
Duct work ~ 5
29
LL 30
59 #/□'

GIRTS USE 7 C 9.8

PURLINS DLU = 3 + 5 + 30 = 38 #/□' @ 4' = 152 #/LF

$w_u = \frac{12}{12.8} \times 152 = 143$ #/LF

$S = \frac{143 \times 21^2 \times 12 \times 1}{8 \times 18} = 49.7$ in³ 7 C 9.8 @ 5'-6"

$R = 143 \times 21 = 3.0$ K

Roof Beam

UL to Roof Bm = $21 \times 0.059 \times \frac{12}{12.8} = 1.16$ #/LF No Beam

$L = \frac{12.8}{12} \times 22' = 23.5'$

$S_R = \frac{1.16 \times 23.5^2 \times 12}{8 \times 18} = 53.7$ in³ 16 WF 36 CTR
12 WF 27 EWS

$R_\phi = 21 \times 0.059 \times 22 = 27.8$ K, $R_E = 13.7$ K

DS 00029672

PREPARED BY HVB PROJECT NO. 605028

DATE 9/12/60 SUBJECT DACO - 240 BLDG

ENGINEERS

MAXUS0998365

CHECK 27WF94 $S_R = 242.8$

CONC. RE. LD. = 27.3K $M = \frac{27.3 \times 48.67}{4} = 298$ 'K

ADD 5K C.L. @ ℄ (FOR PLATF., EQUIP. ETC.) $M = \frac{5 \times 48.67}{4} = 55$

353 'K

$S_R = \frac{353 \times 12}{18} = 235 < 242.8$ ANALL. ∴ OK

BRG. R = ½ 27.3 + 13.7 + 2.5 = 29.8K

BRG. R/A = $\frac{29.8}{0.250} = 119.0$ #

10' LGT. BRG 27WF94 A = 10 × 10 = 100 ft² ∴ OK. FOR BRG. PL. FIG. 10.

EXISTING LD.: OLD PARTS PLANT = 13
REG. SQ. = 1.5
STEEL BAS = 6.0
PROCESS PIPING = 15.0
DUCTWORK = 5.0
40.5
LL 40
80.5 K

R = 0.080 × 5 × 21 × 2.2 + 2.5 = 39.8K > 29.8K NEW LD. ∴ WILL BE SATFD.

CENTER POST H = 15'±, P = 27.3K USE 8WF24

END POSTS H = 8'± P = 13.7K USE 8WF24

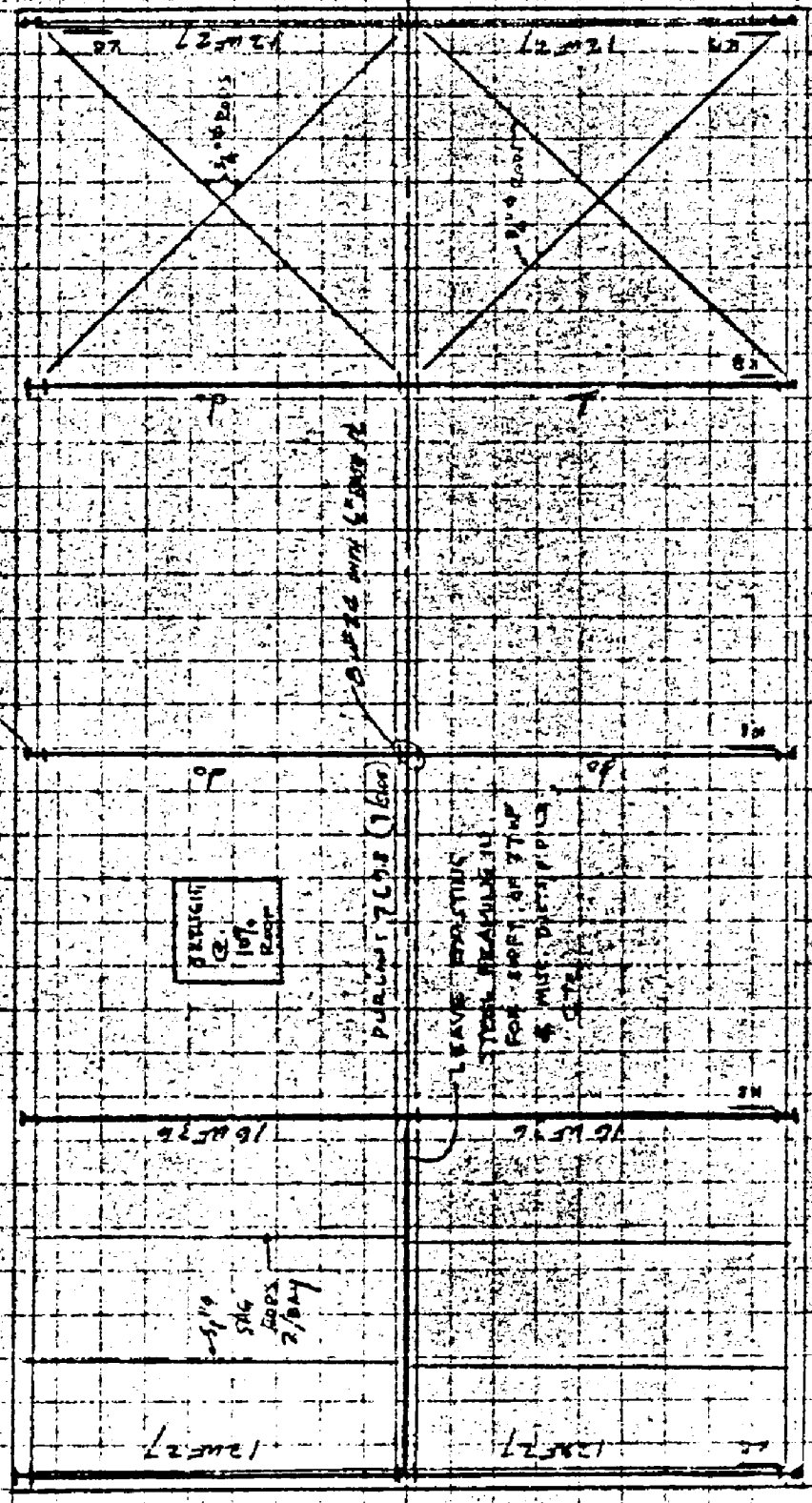
DS 00029673

PREPARED BY HVR PROJECT NO. 6CE025

DATE 9/12/60 SUBJECT DACO - 2-4D BLDG.

ENGINEERS

MAXUS0998366



DS 00029674

PREPARED BY HVB PROJECT NO. 6[illegible]

DATE 9/12/60 SUBJECT DAC 7-1D BLDG.

ENGINEERS INCORPORATED [illegible] FIFTH AVENUE [illegible]

ESTIMATES

TOTAL STEEL	16WF36	6 x 36 x 23.5 =	5010
	12WF27	4 x 27 x 23.5 =	2540
	8WF24 ENDS	10 x 24 x 8 =	1920
	" CENTER	5 x 24 x 15 =	1800
	7 C 9.8 SIDES & END	17 x 9.8 x 85 =	14100
	PLS 7x9x½ @ 9	15 x 9 =	135
	L4x4x3/8 @ 9.8	6 x 5.2 x 9.8 =	305
	ROOF 3/4" ϕ	4x3½' x 1.02 =	190
	5/8" ϕ	16 x 26' x 1.043 =	430
	7 C 9.8 ENDS	2x3 x 45' x 9.8 =	2610
	5/8" ϕ SIDE & END 3/4" ϕ	24 x 8' x 1.043 =	200
			30270#
		-5% =	41400#

STEEL COST ESTIMATE @ $.325/# — COST = $\frac{41400}{2} \times .325 = \$6,700$

ROOF	2 x 24' x 84"	=	4020#
WALLS SIDE	8 x 84	=	670
SIDE	4 x 84	=	370
ENDS	2 x 8 x 45	=	720
	2 x 2 x 7 x 45	=	315
			6095# TOTAL @ = 5.94

DS 00029675

PREPARED BY HVB PROJECT NO. 605028

DATE 9/12/60 SUBJECT DACO S & D BLDG

ENGINEERS

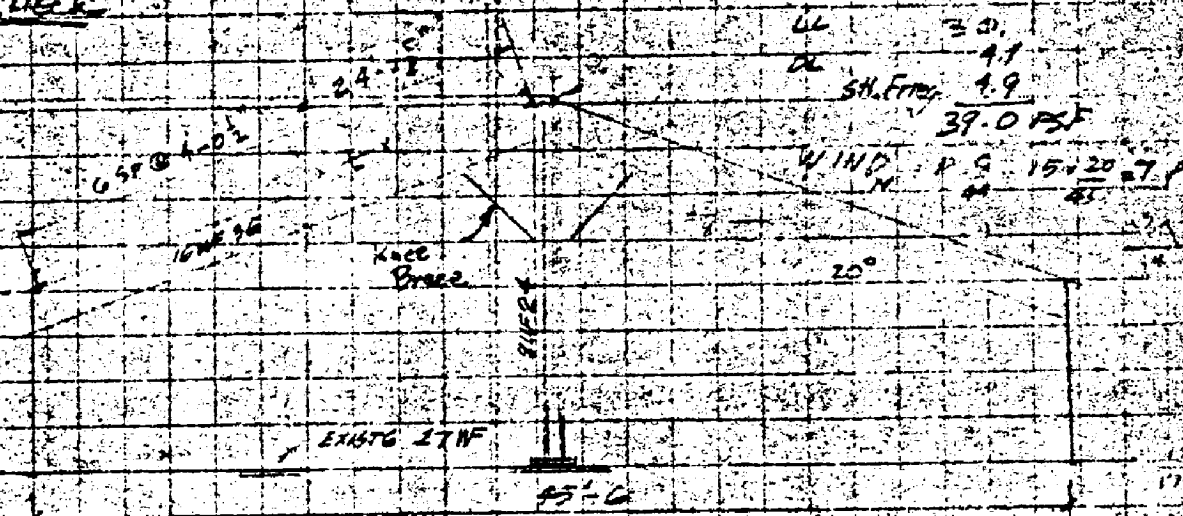
MAXUS0998368

Check

DESIGN DATA

LL 30.
DL 4.1
SH. Frame 4.9
39.0 PSF

WIND: 15 × 20/45 = 7 PSF



Min $d = 12 \times 21/30 = 9$ TRY 8WF35

Vert load = 39.0

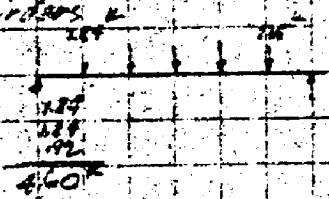
Purlin Normal Components: .039 sin 20° × 4 + .007 × 4 = .175

" " .068 sin 20° × 4 + .013 × 4 = .065

$M_{xx} = .175 \times 21^2/8 = 9.65$ $M_{yp} = .065 \times .525 = .0365$

$f = M/S = 9.65 \times 12/19.9 = 14.9$ $f = M/S = .0365 \times 12/2.71 = 0.6$ $f = \frac{M}{S} = \frac{.06}{14.9} < 0.6$ OK

Girders



$R = .175 \times 21/2 = 1.84^k$

$M = 4.6 \times 12.1 - 1.84 \times 14.04 \times 3 = 33.4$

$S = 33.4 \times 12/26.6 = 15$

USE 12WF27 $S = 34.1$

$M = 33.4 \times 2 = 66.8$

$S = 66.8 \times 12/26.6 = 30.$

USE 16WF36 $S = 56.3$

Column $W = 4.60 \times 4 = 18.4^k$ $L = 15'-0"$ TRY 8WF24

$P = 1.25 \times 21 \times .05 = 5.1^k$ $M = 12.0 \times 5.1/2 = 30.6^{'k}$

$f/2 = 12 \times 6/144 = 1.33$ $F_a = 8.49$

$f_a = 18.4/7.06 = 2.60$ $f_b = M/S = 30.6 \times 12/20.9 = 17.6$

$2.60/8.49 = .307$

$17.6/26.6 = .66$

$0.867 < 1.33$ OK USE 8WF24

Web Crippl. of 27WF44 $\frac{18.4}{19 \times 12} = 3.3$

Maximum of 27WF girder $S = 242.8$

$M = 13.2 \times 40/4 = 21.2^{'k}$ $f = \frac{M}{S} = \frac{21.2 \times 12}{242.8 \times 1.33} = 7.86$

Req'd Distance betw. lat. supports $= \frac{20 \times 13.5}{7.86} = 34.2'$ Provide lat. Support @ Midspan

PREPARED BY R. P. H. - CHECK

DATE Oct. 3, 1960

PROJECT NO. 695028 D

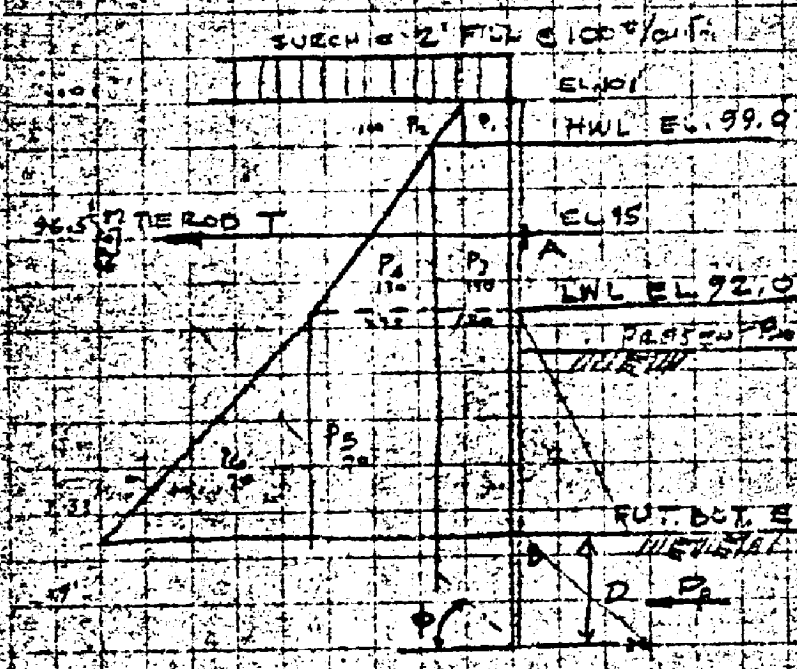
SUBJECT 2-4D PROCESS BLDG. STRUCTURAL REVISIONS

DS 00029676

ENGINEERS Incorporated

MAXUS0998369

BULKHEAD



SAT. EARTH @ 130#/cu.ft.
EL. 92 to 99
SUBM. EARTH @ 70
OTHER EARTH @ 100

USE $\phi \sim 33°$

$\frac{1-\sin\phi}{1+\sin\phi} \sim 0.3$

ASSUME THAT FUTURE SHEET PILING WILL BE ADEQUATELY EMBEDDED BELOW DREDGE LINE TO DEVELOP THE PASSIVE PRESSURE

S EQUIV. 2' SOIL

P_1	$2 \times 100 \times 0.3 = 60$	$60 \times 2 = 120$	
P_2	$2 \times 100 \times 0.3 = 60$	$\frac{1}{2} \times 60 \times 2 = 60$	
P_3	$= 120$	$120 \times 7 = 840$	
P_4	$7 \times 130 \times 0.3 = 273$	$\frac{1}{2} \times 273 \times 7 = 956$	
P_5	$= 393$	$393 \times 10 = 3930$	
P_6	$10 \times 70 \times 0.3 = 210$	$\frac{1}{2} \times 210 \times 10 = 1050$	
			6956

M_A	$120 \times 5 = 600$	$95 \times 6.67 = 637$
	$60 \times 4.67 = 280$	$3930 \times 8 = 31420$
	$840 \times 0.5 = 420$	$1050 \times 9.67 = 10140$
	1300	42197
		1300
		40897

Say D = 6'

$P_p = \frac{40897}{17} = 2,400$ with ϕ @ 33°

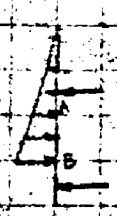
Min $P_p = \frac{1}{2} \times 6^2 \times 70 \times \frac{1}{0.3} = 4200$ FS = $\frac{4200}{2400} = 1.75$

PREPARED BY HVB
DATE 9-14-60
PROJECT NO. 605028
SUBJECT OAKO - BULKHEAD

DS 00029677

MAXUS0998370

TIE ROD STRESS



ΣM_B

120 × 18 =	2160
60 × 17.67 =	1060
840 × 13.5 =	11320
956 × 12.33 =	11800
3920 × 5.0 =	19650
1050 × 3.33 =	3500
	49470
2400 × 4.0 = +	9600
	59070

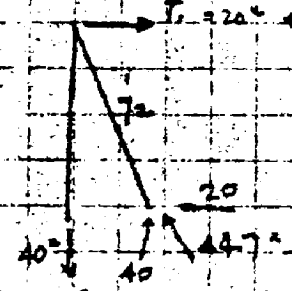
$$T = \frac{59700}{13} = 4560^{\#}/ft$$

4560 + 2400 = 6960 ≈ 6956 check

TIE PILES @10' $T_1 = 10 \times 4.56 = 45.6^k$ req'd $\frac{45.6}{18} = 2.54$ in² 1½"

Use 1⅝" ϕ w/ OVERSET

Use 2¼" ϕ w/ 1/10 OVERSET

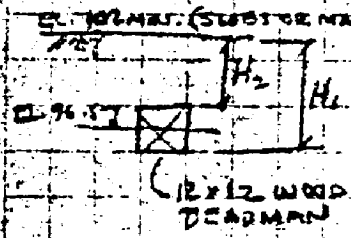


23.0^k / 2 = 11.6^k TO TIE BACK

DIST. TO DEADMAN

Tan 37° ≈ 0.66

DIST. FROM TOE ≈ $\frac{19}{0.66}$ = 28.8' USE 30'



$H_1 = 5$, $H_2 = 4$ $\delta = 33°$

Net Resisting Press @ Top = 100 (3.4 − 0.29) = 311 × 5 = 1555

@ B.H = 100 (3.4 − 0.29) × 7 = 2177

Total Resistance = $\frac{2177 + 1555}{2} \times 2 = 3732^{\#}/'$

SAFE RESISTANCE (F.S. = 1.5) = 2488

@10' TOTAL = 37320# > 22,600# OK

NOTE ADD 2' SURCHARGE TO ABOVE TO GIVE ADDT. TIE BACK

ALSO NOTE DEADMAN BEHIND BEAM PILES

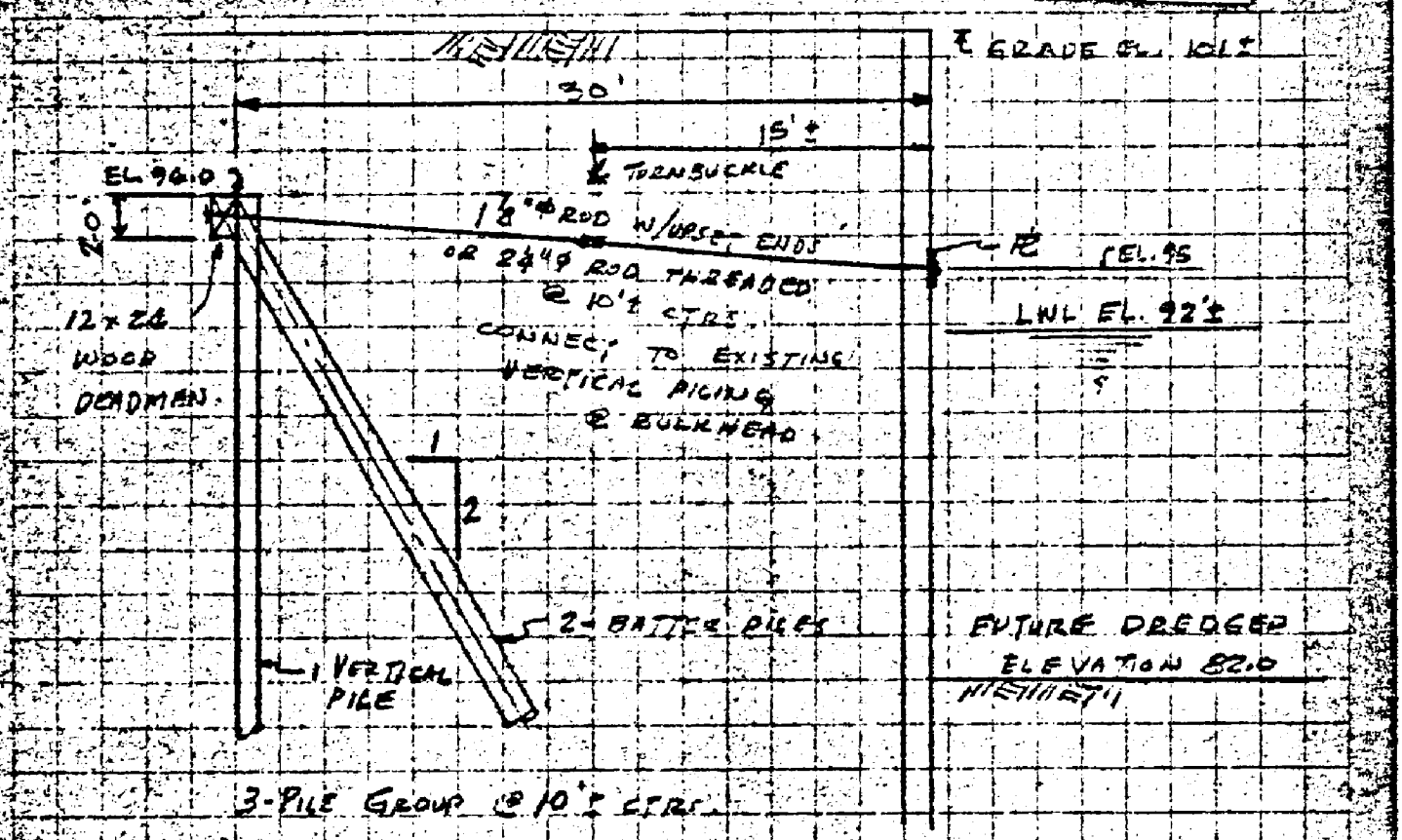
USE 1 - ADDITIONAL DEADMAN BELOW 12×12

PREPARED BY HVK PROJECT NO. 6050 28

DATE 9-14-60 DS 00029678 SUBJECT DACO BULKHEAD

ENGINEERS INCORPORATED 887 ORANGE STREET, NEWARK 2, N.J.

MAXUS0998371



ALL PILES & DEADMAN TO BE CREOSOTED.

DS 00029679

DIAMOND ALKALI CO.

PREPARED BY HVB

PROJECT NO. 605023

DATE 9-14-60

SUBJECT DAM - BULKHEAD

ENGINEERS INCORPORATED 687 ORANGE STREET, NEWARK 2, N. J. HUBBARD 3-

PAGE 3 OF 3

MAXUS0998372

DS 00029680

PREPARED BY HVB

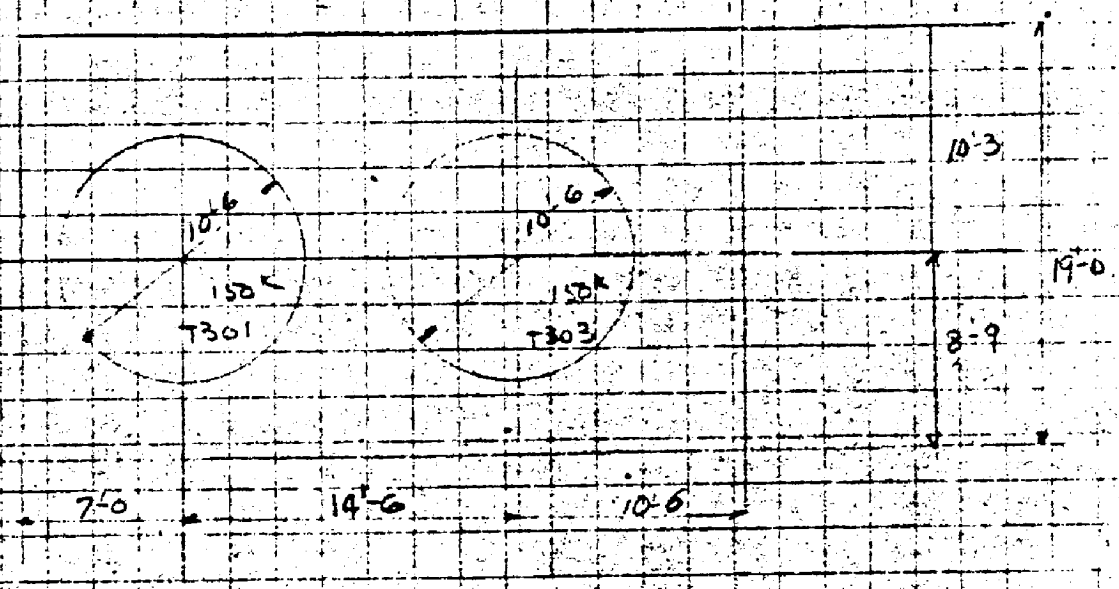
DATE 7-8-80

PROJECT NO. 605028

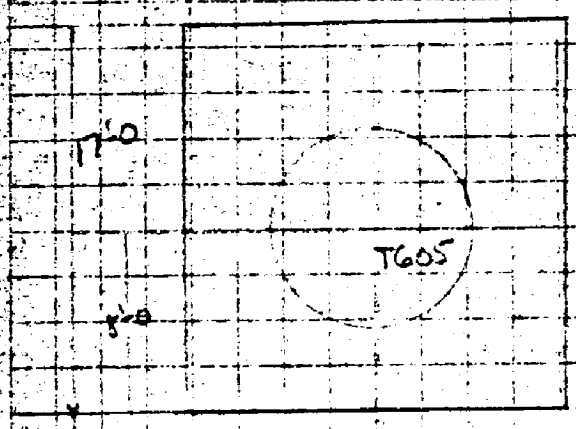
SUBJECT DACO E Tank Farm

ENGINEERS INCORPORATED

MAXUS0998373



$A = \frac{300}{5} = 600\,D'$ $\frac{600}{32} = 18.8$



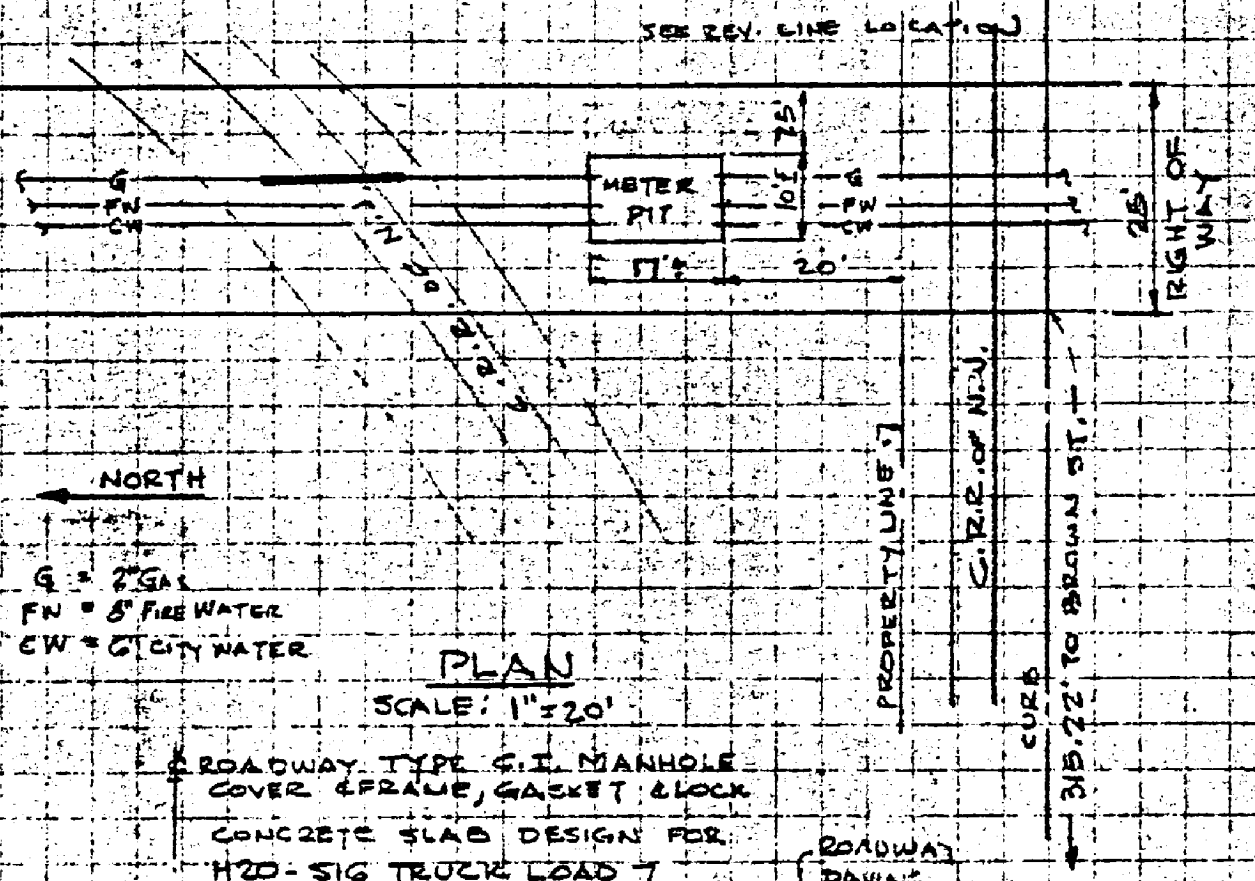
DS 00029681

PREPARED BY 14-18 PROJECT NO. 6050.28

DATE SUBJECT E Tank Form

ENGINEERS INCORPORATED 487 ORANGE STREET NEWARK N.J. PAGE 5 OF

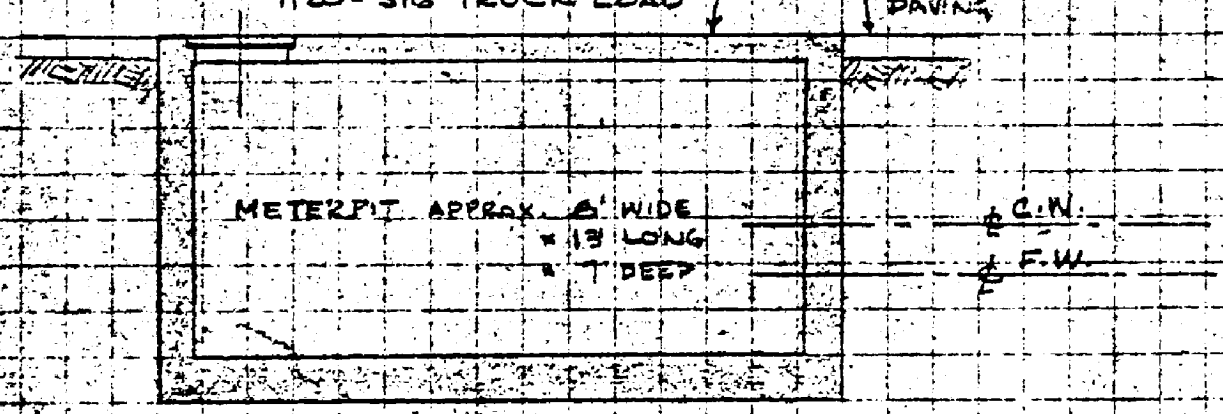
MAXUS0998374



G = 2" GAS
FW = 8" FIRE WATER
CW = 6" CITY WATER

PLAN

SCALE: 1" = 20'



SECTION THROUGH PIT

DS 00029682

PREPARED BY HVB

DATE 8-2-60

PROJECT NO. 605028

DIAMOND ALKALI CO.

SUBJECT METER PIT

ENGINEERS INCORPORATED 482 ORANGE STREET, NEWARK, N.J.

MAXUS0998375

Top Slab

Design for H20-S16 Loading. Slab span = 8'-0

Impact = $\frac{50}{L+125} = \frac{50}{133} = 0.374$

Distribution of wheel load, E = 0.4S + 3.75 = 3.20 + 3.75 = 6.95'

Slab LL Mom = $0.25 \frac{P_1}{E} S = 0.25 \times \frac{1.374 \times 16}{6.95} \times 8' = 4.75$ '-k/LF

Slab DL Mom = $\frac{1}{8} \times 2.10 \times 8^2 = 0.8$ '-k/LF

Total DL + LL Mom = 5.55 '-k/LF

Use 8" Slab for M.H. &

Reqd $d = \sqrt{\frac{5.55}{236}} = \sqrt{23.5} = 4.85'$ Free edge at centerline d = 6.62"

$A_s = \frac{5.55}{1.44 \times 6.62} = 0.58$ in²/LF (1) #6 @ 9" B.T. #4 @ 16" Top

For Long Direction (1) #4 @ 16" T & B

Rev. to Fixed Top Slab

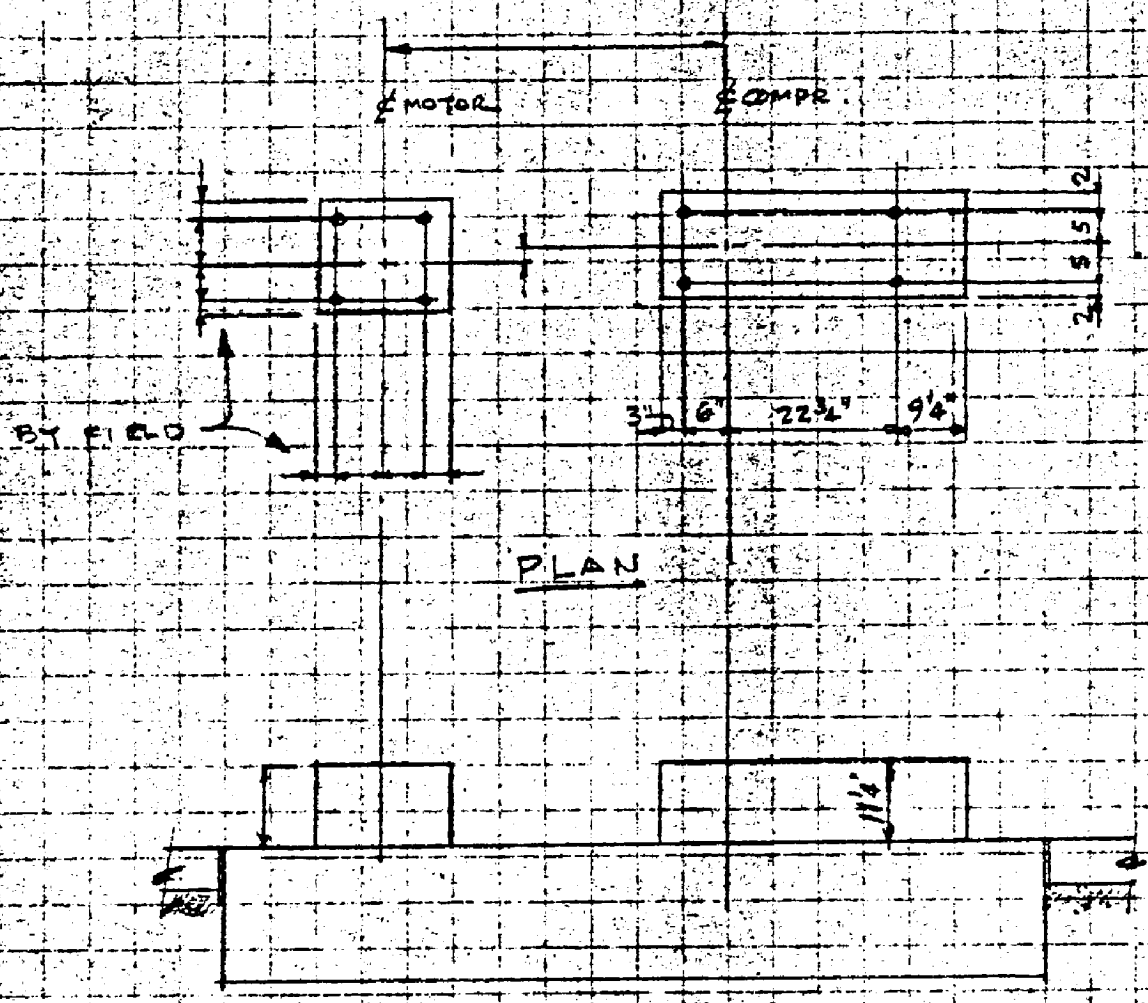
DS 00029683

PREPARED BY _____ PROJECT NO. 6050-9

DATE _____ SUBJECT Meter Pit & Valve Pit

AIR COMPRESSOR F2-P524

FOUNDATION



DS 00029684

PREPARED BY HYB

DATE 8-30-60

PROJECT NO. 605026

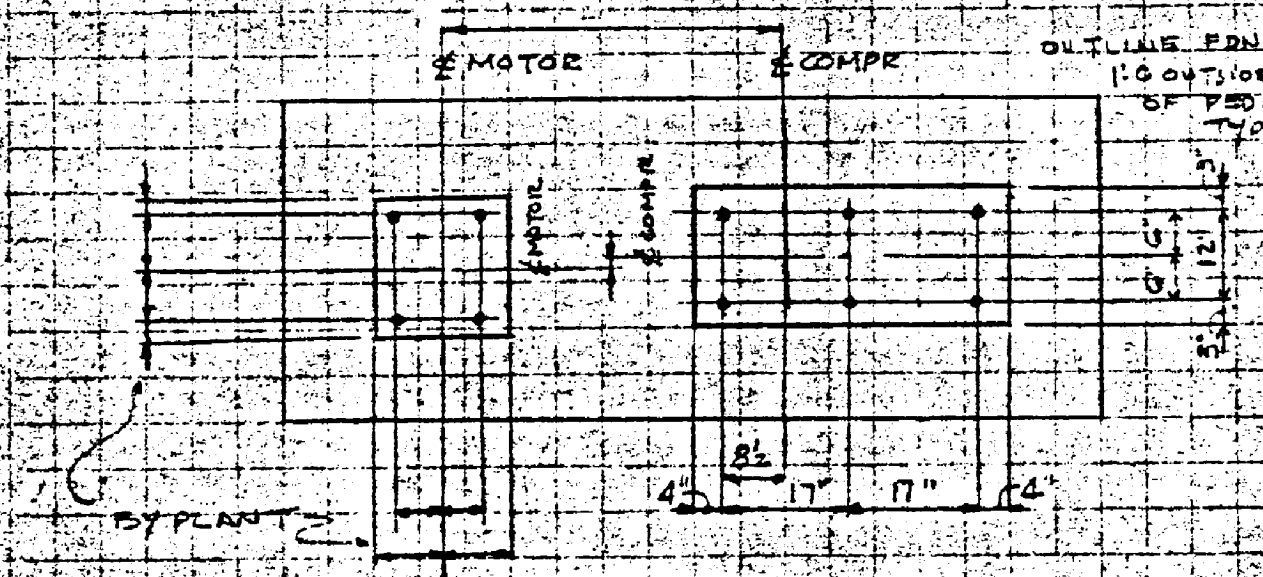
SUBJECT DACO

ENGINEERS INCORPORATED 487 ORANGE STREET, NEWARK, N.J.

MAXUS0998377

AIR COMPRESSOR F2-P521

FOUNDATION



PLAN

ELEV.

DS 00029685

PREPARED BY HVB

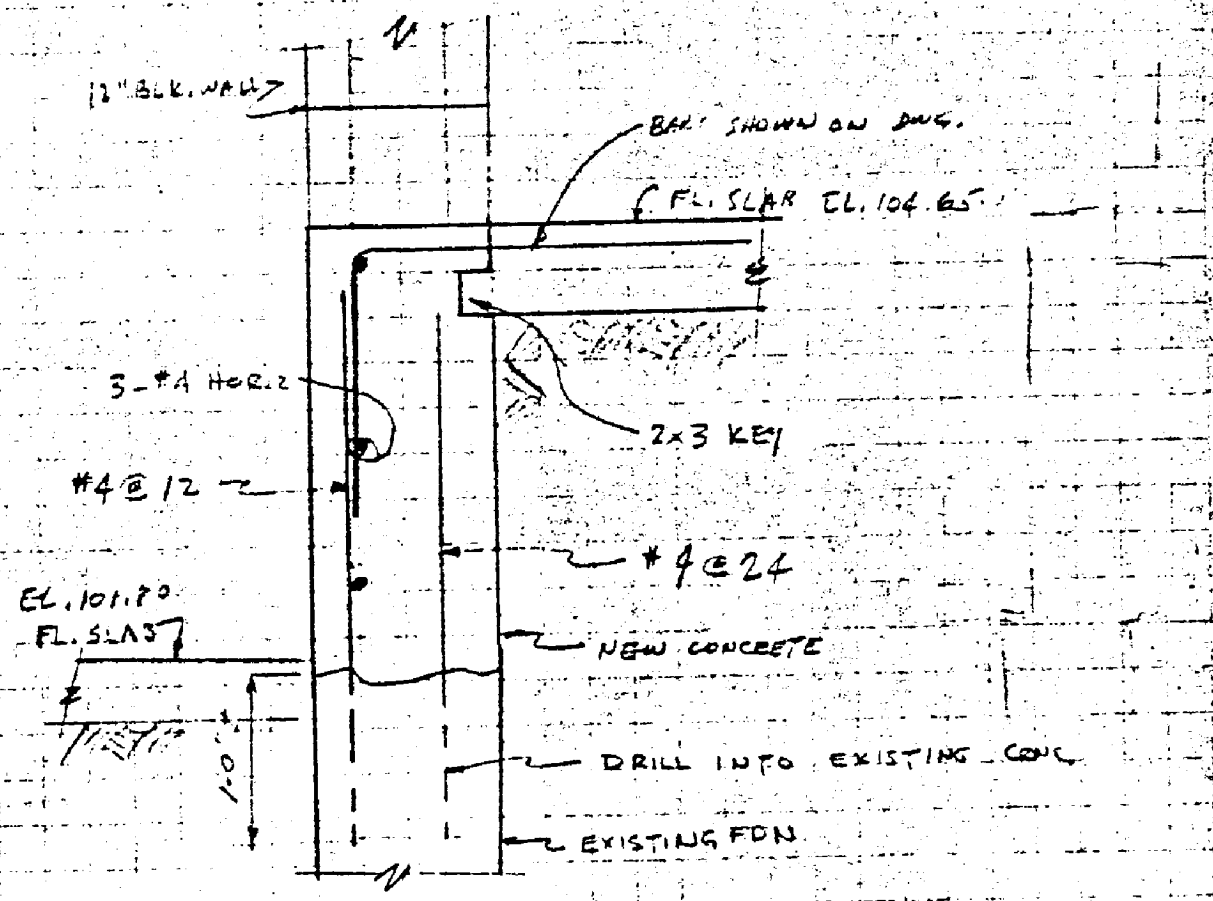
PROJECT NO. 605028

DATE 8-30-60

SUBJECT DACO

ENGINEERS INCORPORATED

MAXUS0998378



WAREHOUSE INTERIOR RAISED WALL

(REINFORCING FOR CONCRETE USED AT CONTRACTORS OPTION)

DS 00029686

PREPARED BY 113

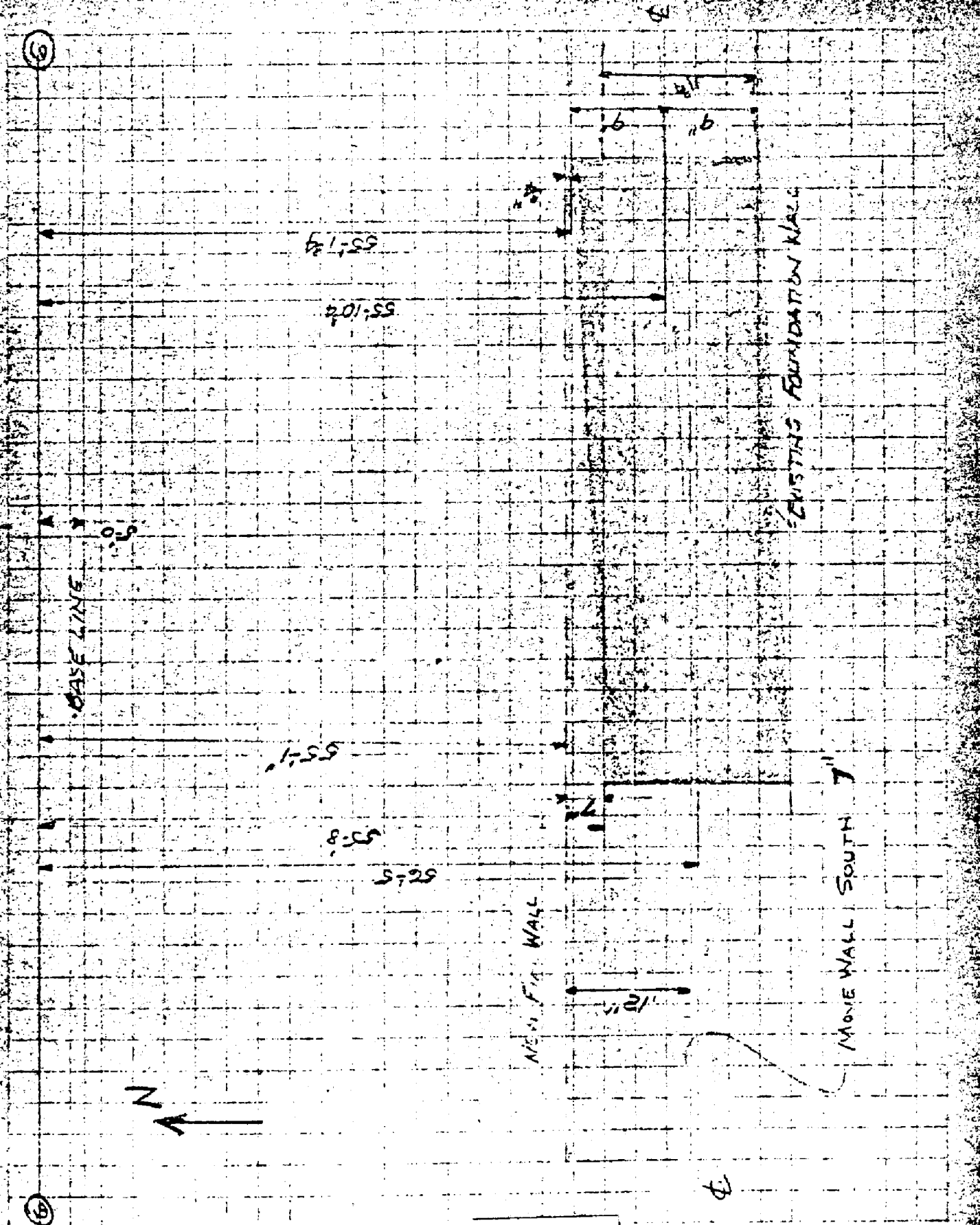
DATE 9-27-60

PROJECT NO. 605029

SUBJECT DACO - WHSE

ENGINEERS

MAXUS0998379

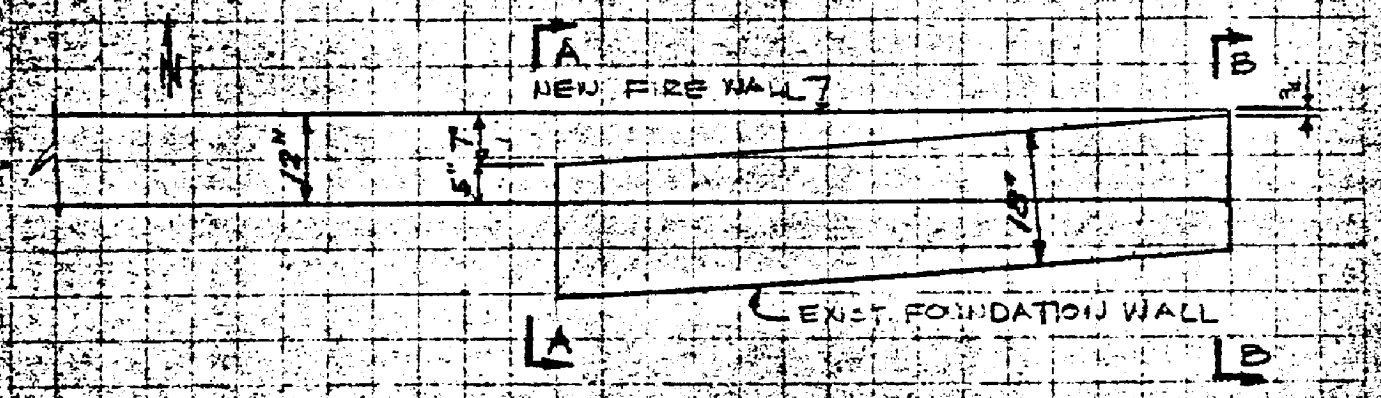


PREPARED BY [illegible] DS 00029687 PROJECT NO. 6052 2F

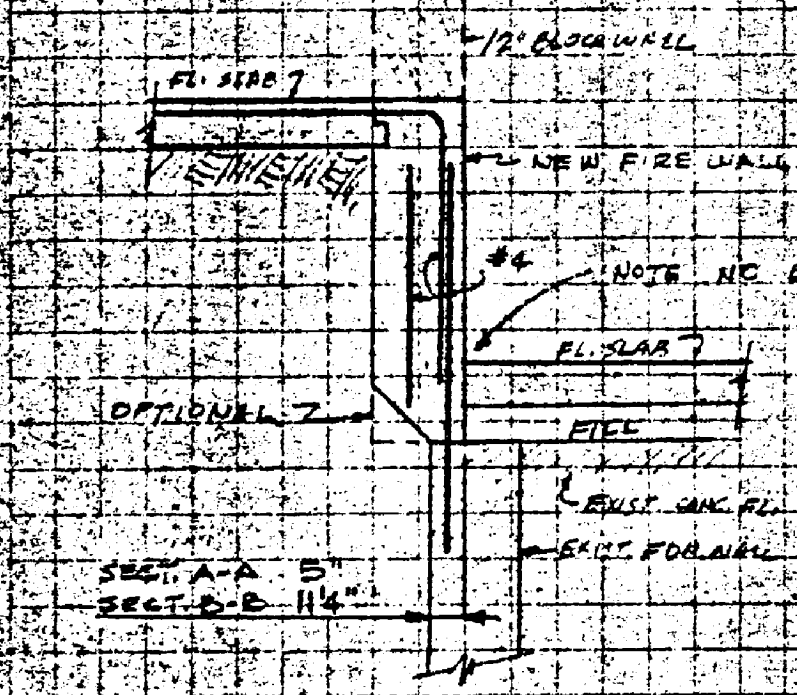
DATE 10-15-60 SUBJECT FOWHEL W-SE

ENGINEERS, Incorporated 487 ORANGE STREET, NEWARK, N.J. PAGE OF

MAXUS0998380



PLAN
NO SCALE



SECT. A-A
SECT. B-B
(AS NOTED)

FLOOR SLABS TO BE PLACED BEFORE BLOCK WALL IS ERECTED

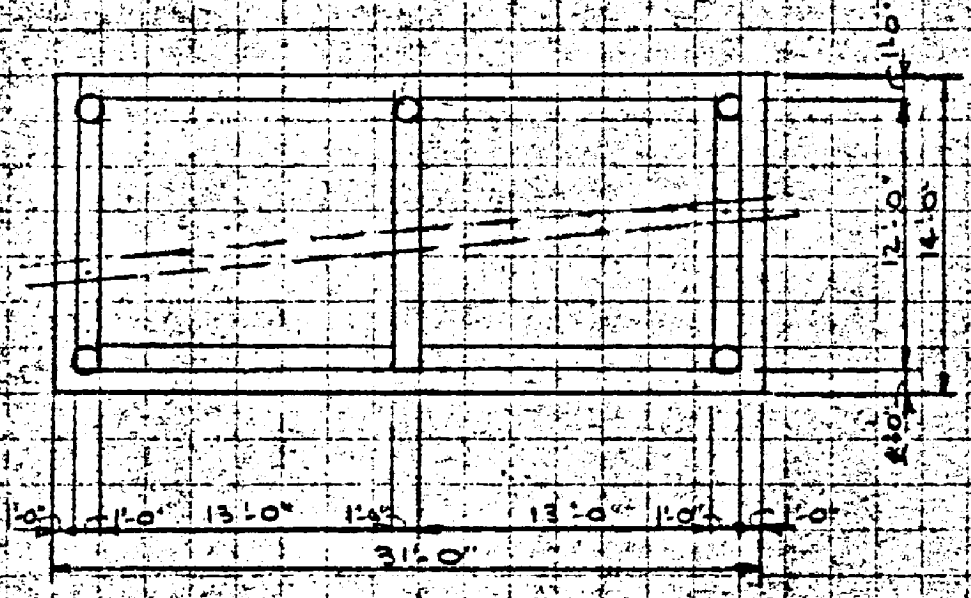
PREPARED BY HVB
DATE 10-17-60
PROJECT NO. 605023
SUBJECT WHSE. FDN. WALLS

DS 00029688

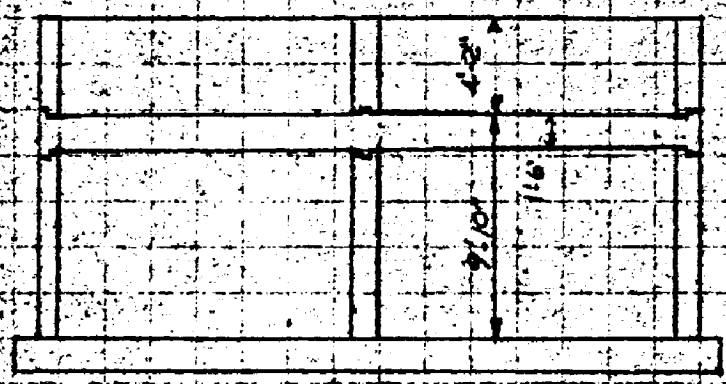
ENGINEERS'

MAXUS0998381

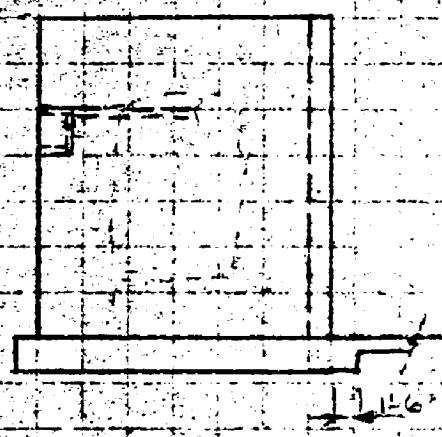
AUTOCLAVE ENCLOSURES



PLAN



ELEV.



SIDE

PREPARED BY HJP

DS 00029689

PROJECT NO. 60508

DATE

SUBJECT FCO - AUTOCLAVE ENCL.

ENGINEERS INCORPORATED

AUTOCLAVE ENCLOSURE (CONT)

STABILITY OF ENCLOSURE - USE A 43 PSF = 6.3 K/ft²

OVERTURNING ABOUT LONG AXIS

BACK WALL - P = 6.3 × 13 × 14 = 1150 K

M_o = P × (7 + 1.5) = 9770 'K

RESISTING

ON BASE P = 6.3 × 13 × 13 = 1065 K

ABT PIVOT M_o = 1065 × 6 = 6400 'K

WGT. STRUCTURE & TANK

NS WALLS 14 × 12 × 1 × .15 × 3 × 5.5 = 415

BASE " 15 × 31 × 14 × .15 × 5.5 = 537

TANK SPY 2 × 4 × 6.0 = 13

1000

6400

7400 < 9770 'K

EXTEND HEEL 1'-6", EXTEND TOE 1'-0", USE MAX. WGT

AN UNCLOTS EXPLOSION & SPACE = 432 #/ft²

BACK WALL M_o = 432 × 13 × 5 × 8.5 = 6680 'K

ON BASE M_o = 432 × 13 × 14 × 8 = 6300

WGT STRUCTURE M_R = 14 × 12 × 1 × .15 × 3 × 7 = 540

1.5 × 31 × 15.5 × 14 × .25 = 675

2 × 4 × 7.5 = 60

M_R = 7575 'K

F.S. = 7575 / 6680 = 1.14 OK

MAX. WGT FOR F.S. = 1.0 IS ~ 3700 #

PREPARED BY HR DS 00029690 PROJECT NO. 60592

DATE SUBJECT DACO - AUTOCLAVE ENCL

ENGINEERS INCORPORATED 487 ORANGE STREET, NEWARK, N.J. 07102 PAGE 7 OF 11

MAXUS0998383

AUTOCLAVE ENCLOSURES (CONT.)

MIN. REINF. #5 @ 6" E.W. & E.F.

IN ALL WALLS CRITICAL BENDING DIRECTION IS HORIZ.

USE 4000 #/□" DESIGN CONCRETE = f'_c

USE 55,000 #/□" " STEEL, INTERMEDIATE GRADE, ULT. STR.

USE ULTIMATE STRENGTH DESIGN TO DETERMINE UPPER LIMIT OF STRENGTH OF ENCLOSURES.

BLAST PRESSURE DISTRIBUTIONS ARE UNKNOWN DUE TO THE MANY UNCERTAIN FACTORS AND THEIR TIME & CONCENTRATION OCCURRENCES. FOR ANALYSIS ASSUME A UNIFORM PRESSURE DISTRIBUTION.

ALSO STRUCTURE IS INDETERMINATE TO A HIGH DEGREE ∴ USE APPROXIMATE ANALYSES FOR LIMITS.

JENSEN - PCA METHOD

CONSTANTS: $d = 12 - 1.5 - 0.31 = 10.19''$

$$p = \frac{A_s}{bd} = \frac{2 \times 0.31}{10 \times 12} = 0.0052 \qquad r = \frac{f_y}{f'_c} = \frac{55}{4} = 13.75$$

$$n = 5 + \frac{10}{4} = 7.5 \text{ FOR SHORT TIME LOADING}$$

$$K = \frac{2pr^2 + n}{2r + n} = \frac{2 \times 0.0052 \times 13.75^2 + 7.5}{2 \times 13.75 + 7.5} = \frac{9.47}{35} = 0.27$$

$$j = 1 - \frac{K}{3} - \frac{(2pr - K)^2}{6pr} = 1 - \frac{0.27}{3} - \frac{(2 \times 0.0052 \times 13.75 - 0.27)^2}{6 \times 0.0052 \times 13.75}$$

$$= 1 - 0.09 - \frac{(-.127)^2}{.428} = 0.872$$

$$M = pf_y jbd^2 = 0.0052 \times 55{,}000 \times 0.872 \times 12 \times 10.19^2 = 31.0^{\text{'k}}$$

PREPARED BY _____ PROJECT NO. 605024

DATE _____ SUBJECT DACO - AUTOCL. ENC.

DS 00029691

ENGINEERS INCORPORATED

MAXUS0998384

AUTOCLAVE ENCLOSURES

By WHITNEY METHOD - ULT. STR. OF REINF CONC.

$$m = \frac{f_y}{0.85 f'_c} = \frac{55}{0.85 \times 4} = 16.2$$

$$M = \rho f_y \left(1 - \frac{\rho m}{2}\right) b d^2 = 0.0052 \times 55{,}000 \left(1 - \frac{0.0052 \times 16.2}{2}\right) 12 \times 0.1^2$$

$$= 2.86 \left(1 - 0.042\right) 1245 = 341^{\text{in-k}} = 28.4^{\text{ft-k}}$$

CLOSE AGREEMENT.

WALL ANALYSIS

TIE BEAM ACROSS FRONT STIFFENS WALLS SO THAT EFFECTIVELY ABOVE THE BEAM THE WALL CANTILEVERS. THIS ASSUMES A VIRTUAL BEAM IN THE WALLS. NOTE THAT ANY EXPLOSIVE FORCE WILL BE VENTED IMMEDIATELY AT THE EDGES.

USE A 5' CANTILEVER AND A TRIANGULAR LOADING

$$M = w \times 5^2 \times \frac{1}{6} = 4.17\,w = 31.0^{\text{in-k}} \qquad w = 7.43^{\text{k/ft}} = 51.5^{\#/\text{in}^2}$$

WALLS BELOW VIRTUAL BEAM - ACT AS SLAB SUPPORTED THREE SIDES & DISCONT. ONE EDGE

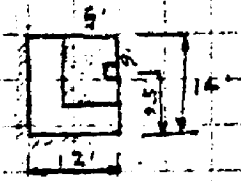
USE PCA METHOD TABLE 3, CASE 2, UNIF. LD.

$$m = \frac{9.5}{12.0} = 0.8$$

$$M_{max} = 0.055 \times w \times 9.5^2 = 4.94\,w \quad \text{AT JUNCTION WALL}$$

$$4.94\,w = 31.0, \qquad w = 6.28^{\text{k/ft}} = 43.5^{\#/\text{in}^2} \text{ SAY } 43^{\#/\text{in}^2}$$

APPROX. LD. TO TIE BM = $5.9' \times 6.3^{\text{k}} = 28.4^{\text{k}}$



$$A_{s\,req} = \frac{28.4}{55} = 5.16^{\text{in}^2}$$

USE 8 - #8
+ 3 TIES @ 12"

PREPARED BY HHC

DATE

PROJECT NO. 60524

SUBJECT UCC AUTOC. ENC.

DS 00029692

ENGINEERS INCORPORATED

MAXUS0998385

AUTOCLAVE ENCLOSURE (CONT)

PREPARED BY HHC

DATE

DS 00029693

PROJECT NO. 605028

SUBJECT DACO - AUTOCL. ENC.

ENGINEERS INCORPORATED

MAXUS0998386

PIPE BRIDGE #1 TO WAREHOUSE

L = 25' LL PIPES = 100 #/'

SNOW = 40

140 #/'

DL TRUSS SW = 40

180 #/'

SIMPLE SPAN $M = 0.18 \times 25^2 \times 1/8 = 14.2'^{k}$

TRUSS $d = 24'$ $T = \frac{14.2 \times 12}{24} = 7.1^{k}$ $A = \frac{7.1}{18} = 0.47^{\square''}$

ST4 WF 8.5

T4B (1/4" t)

$V = 0.18 \times 25 \times 1/2 = 2.25^{k}$

$L = (2^2 + 2.3^2)^{1/2} = 3.1' \times 12 = 37''$

$r = \frac{37}{120} = 0.31$ Use L 2 x 2 x 1/4

PREPARED BY HJG

DATE 9-29-90

DS 00029694

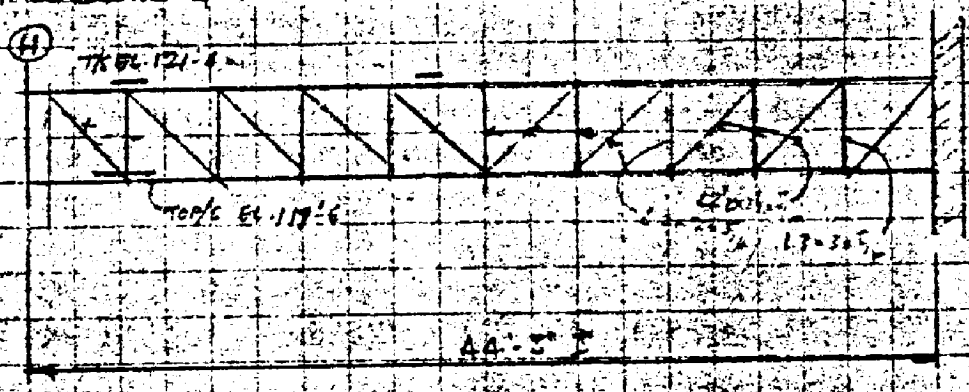
PROJECT NO. 60524

SUBJECT DALO - Pipe Bridge

ENGINEERS

MAXUS0998387

PIPE BRIDGE #4 TO 2-4D BLDG.



LOADING

EST. WGT. PIPES	=	1600 #/LF
STEEL	=	60
CABLE & CONDUIT	=	40
SNOW LOAD 2 × 30 × 4	=	240
		1940 #/LF

ASSUMED DEPTH TRUSS = 48"

$M = 1.940 \times 44.25^2 \div 8 = 474^{'k}$

$T\ (CHORD) = \frac{474^{'k} \times 12}{48''} = 11.8^k \quad A_{st} = \frac{11.8}{1.5} = 6.55^{\square''} = 2\ ST$

TOP CHD. USE ST5WF14.5

TOP CHORD L UNBRACED = 2 × 48" = 96"

TRY ST5WF22.5 r = 2.00

$\frac{L}{r} = \frac{96}{2.0} = 48 \quad f_{allow} = 15.88$

$A_{req} = \frac{11.8}{15.88 \times 2} = 3.72^{\square''} \quad A_{st} = 6.62$ USE ST5WF16.5

$A = 4.85^{\square''}\ r = 1.94$

BOT DIAG. $L = 1.414 \times 48 = 68''$

$P = 1.940 \times 44.25 \times \frac{1}{2} \times \frac{1}{2} \times 1.414 = 30.2^k$

$L_{eff} = \frac{30.2}{1.5} = 1.65^{\square''}$ USE 1.63 × 3 × 5/16

$r = \frac{68}{200} = 0.34$ $A_s = 1.71\ r = 0.97$

PREPARED BY HVB

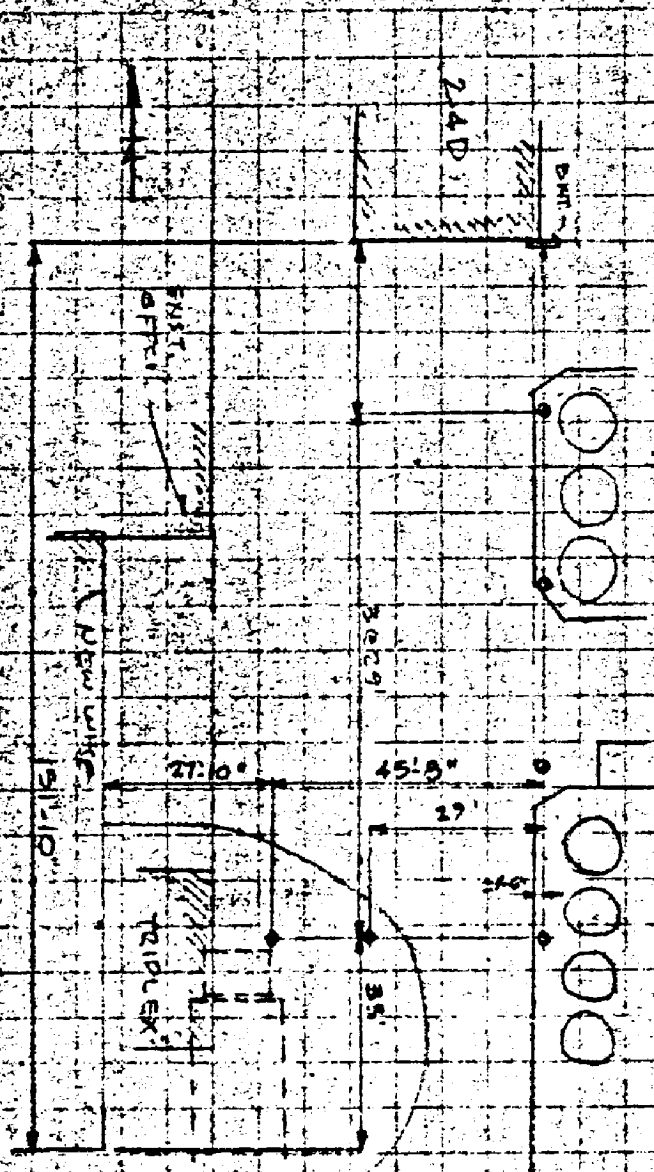
DATE 9-29-65

DS 00029695

PROJECT NO. [illegible]

SUBJECT [illegible]

ENGINEERS INCORPORATED



LAYOUT ELEC CABLE TRAY SUPPORTS

PREPARED BY HVB

DATE 9/8/60

DS 00029696

PROJECT NO. 6[illegible]

SUBJECT DACO

ENGINEERS

MAXUS0998389

PIPE BRIDGE CAMBERS

PB # 4 $\quad I \sim \left[(30" - 2 \times 1.96)\tfrac{1}{2}\right]^2 \times 1.36 \times 2 = 10{,}000$

$w \sim 1820$ # L.F.

$$\Delta = \frac{5 \times 1820 \times 44^4 \times 12^4}{12 \times 384 \times 29 \times 10^6 \times 10{,}000} = 0.58"$$ USE 1/2"

CABLE TRAY SUPPORTS $\quad I = 2 \times 128 = 256$

$w = 470$ #/LF

$$\Delta = \frac{5 \times 470 \times 25^4 \times 12^3}{384 \times 29 \times 10^6 \times 256} = 1.70$$

FOR DL ONLY $w = 210$, $\Delta = 0.54$ USE 3/4"

PREPARED BY HVB

DATE 9-30-60

DS 00029697

PROJECT NO. 605028

SUBJECT DACO - Pipe Bridges

ENGINEERS, INCORPORATED

MAXUS0998390

CABLE TRAY SUPPORTS

NET. TRAY & CABLES 2' WIDE 45 #/LF
SUPPORTING STEEL 25
PIPES 10 OF MISC. SIZES, FULL, MEDIUM
ASSUME 4 ADD'L FUTURE

2-9" F = 23 = 46 #
4-3 4 × 10.7 = 42.8
4-2" 4 × 5 = 20 20.2" 20.5 = 104# 437.6# ok
4-1" 4 × 5 = 20
12# 5 = 134 #/LF 134
210 #/LF

SNOW & ICE LL 2' TRAY 80
2-3" WIDE PIPE FILLED USE 1.5 × 3 × 40 = 180
470 #/LF

PIPE POSTS P = 29 × 470 = 13.6 K
ALL POSTS IN AREAS OF GOOD COMPACTION & UNDISTURBED
1. USE 3"/12' & PERFECT NOT CONSIDERED

FT4 A = 13.6 / 2 = 6.8 IN² USE BASE 2.8 × 2.8
ALL COLS. BRACED EXCEPT AT SUBSTATION USE 4 DEEP
AT SUBSTATION COL. USE 4 DEEP
H = ~19'
USE 6" ϕ SCH. 40 CONC. FILL BOTTOM 6'

BRIDGE - CABLE TRAY 1 UNIFORM LOAD
USE PIPE SUPPORT - GA 2 1/3 FT

M = 0.160 × 29² × 7 = 168
= 0.340 × 29/3 × 29/3 = 23.8
45.6 S = 2 × 30.4

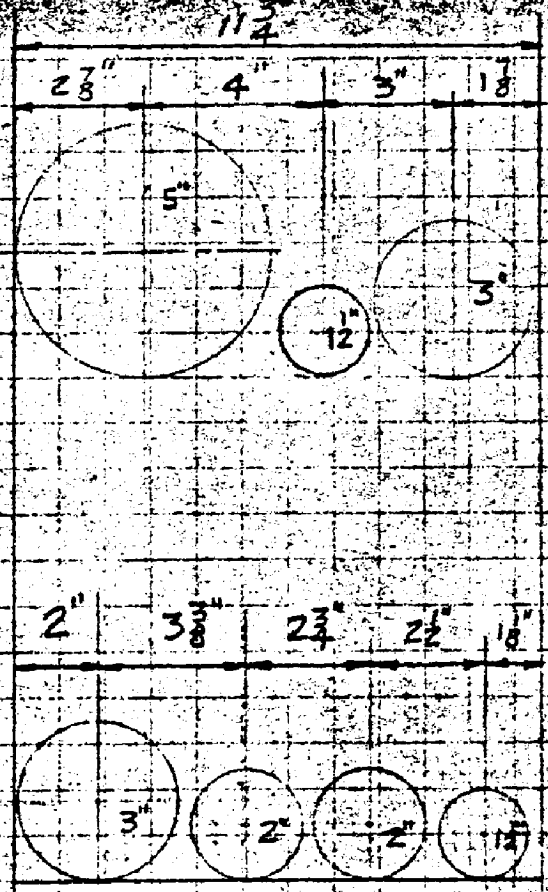
2 J = 1.2 = 30.7
S = 2 × 30.4 = 42.7

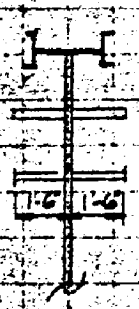
PREPARED BY HB
DATE 9-27-60
DS 00029698
PROJECT NO. 605027
SUBJECT DAQ - Cable Tray Sup
ENGINEERS

MAXUS0998391

CABLE TRAY COLUMN

PIPE RACK SUPPORTS





5-2"ϕ PIPE PER RACK. REQ'D: 4×2¼ + 2×½ = 14" < 15" AVAILABLE

PREPARED BY HAG

DATE 9-22-60

PROJECT NO. 6070-2

SUBJECT DAO - [illegible]

DS 00029699

ENGINEERS, INCORPORATED

MAXUS0998392

CABLE TRAY SUPPORTS (CONT.)

Pipe Cross Arm: P = 0.310 × 37/3 × 1/2 = 0.75 k

Spy Conn. (2) End

M = 0.75 × 1.5' = 1.13 ft-k Use 4" Fillet Weld

4" Arm

4" Clevis Fit

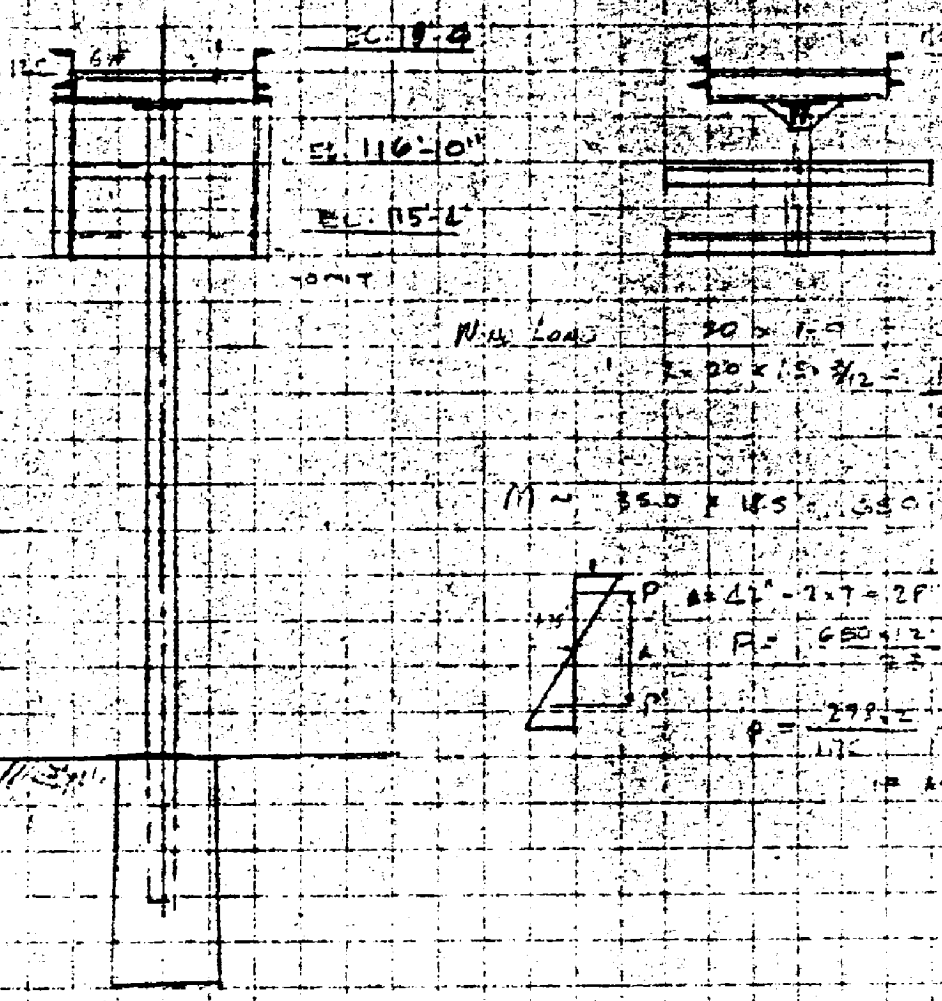
Top Cross Arm

2/3 × 29 × 0.310 = 6.0 k

29 × 0.160 = 4.6

10.6 k

At End: M = 5.3 × 1.0 = 5.3 k Sx = 3.0 Use 6" I.F.



Wind Load 20 × 1.9 = 38.0

2 × 20 × 1.5 × 3/12 = 15

35.0 k

M = 35.0 × 1.5' = 53.0 ft-k

P at 41" = 2 × 7 = 28

P = 650 × 12 / 23 = 339 k

P = 299 × 12 / 11.2 = 320 k Pass in capacity

P Accepted 1.5 × 1.2 = 1.8 SAFE

PREPARED BY HNB

DATE 9-27-60

DS 00029700

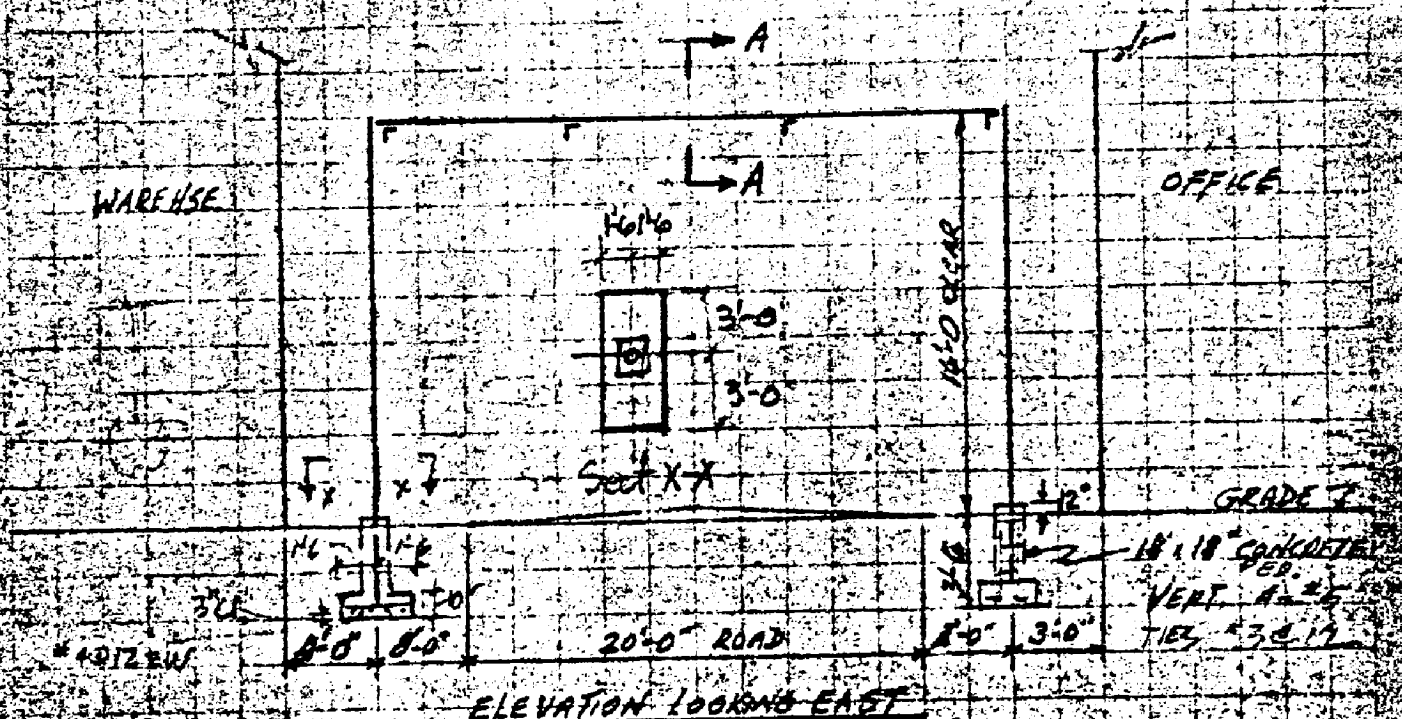
PROJECT NO. 6050 29

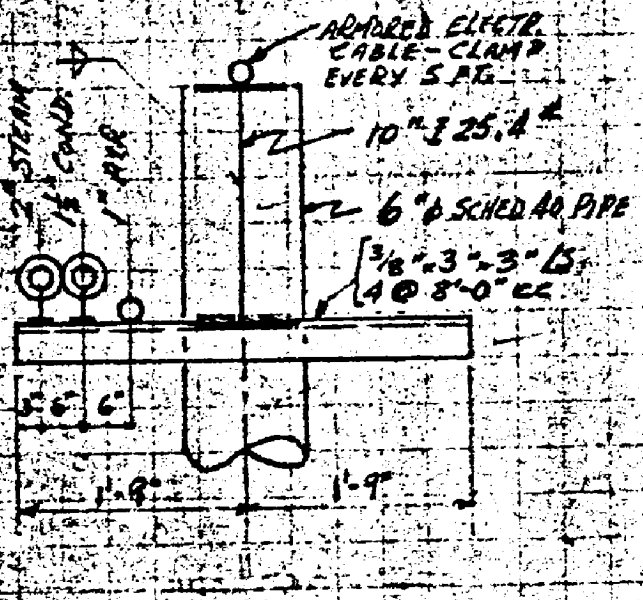
SUBJECT PACO - Cable Tray Supports

ENGINEERS INCORPORATED

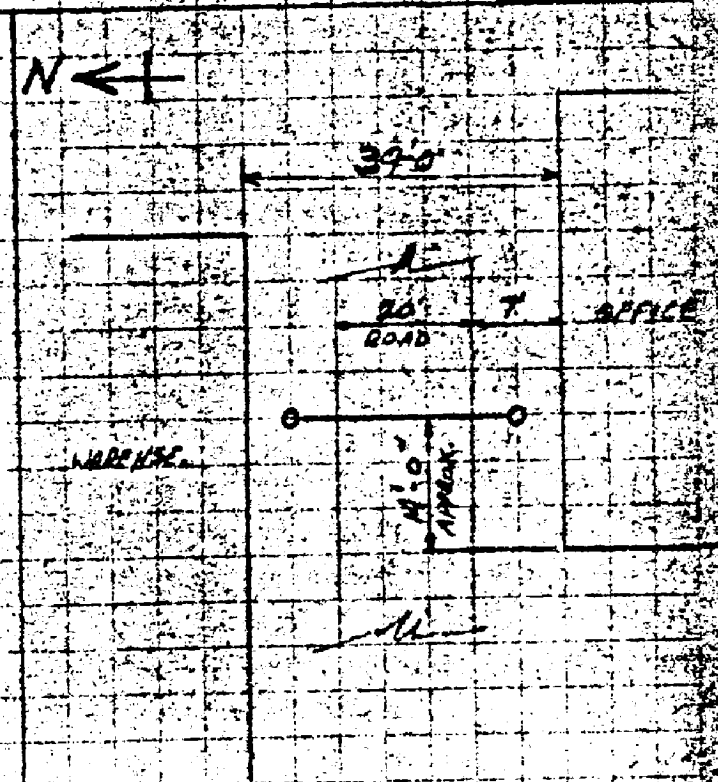
MAXUS0998393

PIPE BRIDGE (WHSE TO OFFICE)





SECTION A-A



PLAN
(SEE NS-SBI-1)

DWG. NO. SKETCH

PREPARED BY 10-13-60

DATE 10-7-60 REV. 10-13-60

PROJECT NO. 605028 DIVISION

SUBJECT PIPE BRIDGE - WAREHOUSE TO OFFICE BLDG.

ENGINEERS

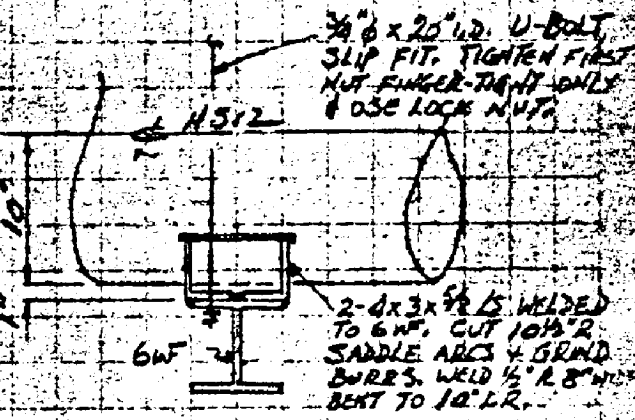
DS 00029701

MAXUS0998394

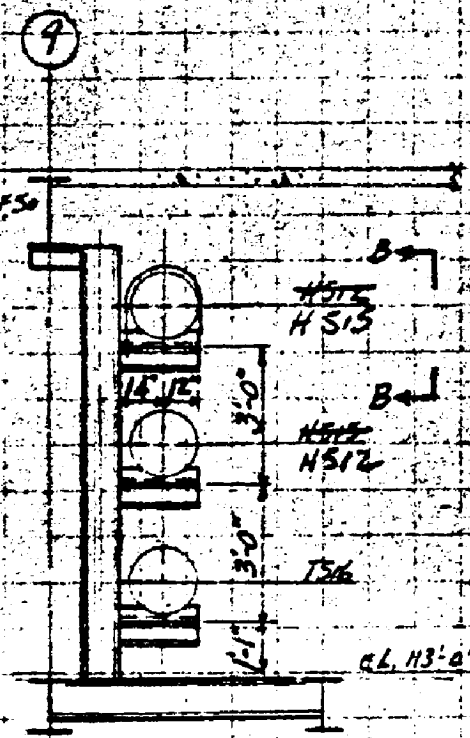
PLAN

NOTES

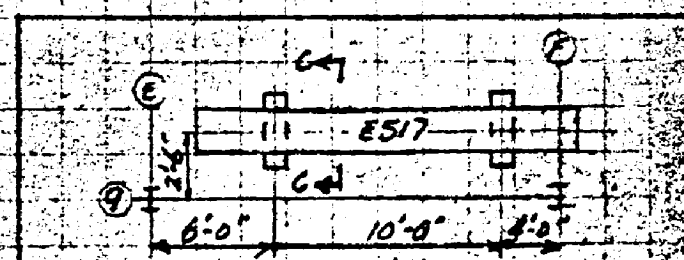
1. ALL CONN'S BOLTED.



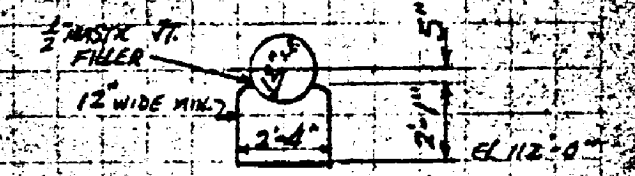
SECT. B-B, TYP. SADDLE



SECT. A-A, TYP. BENT



PLAN



SECT. C-C, TYP.

CONCRETE SADDLES FOR FZ-ES17, DS30 SITS ON ES17

PREPARED BY

DATE 11/3/60

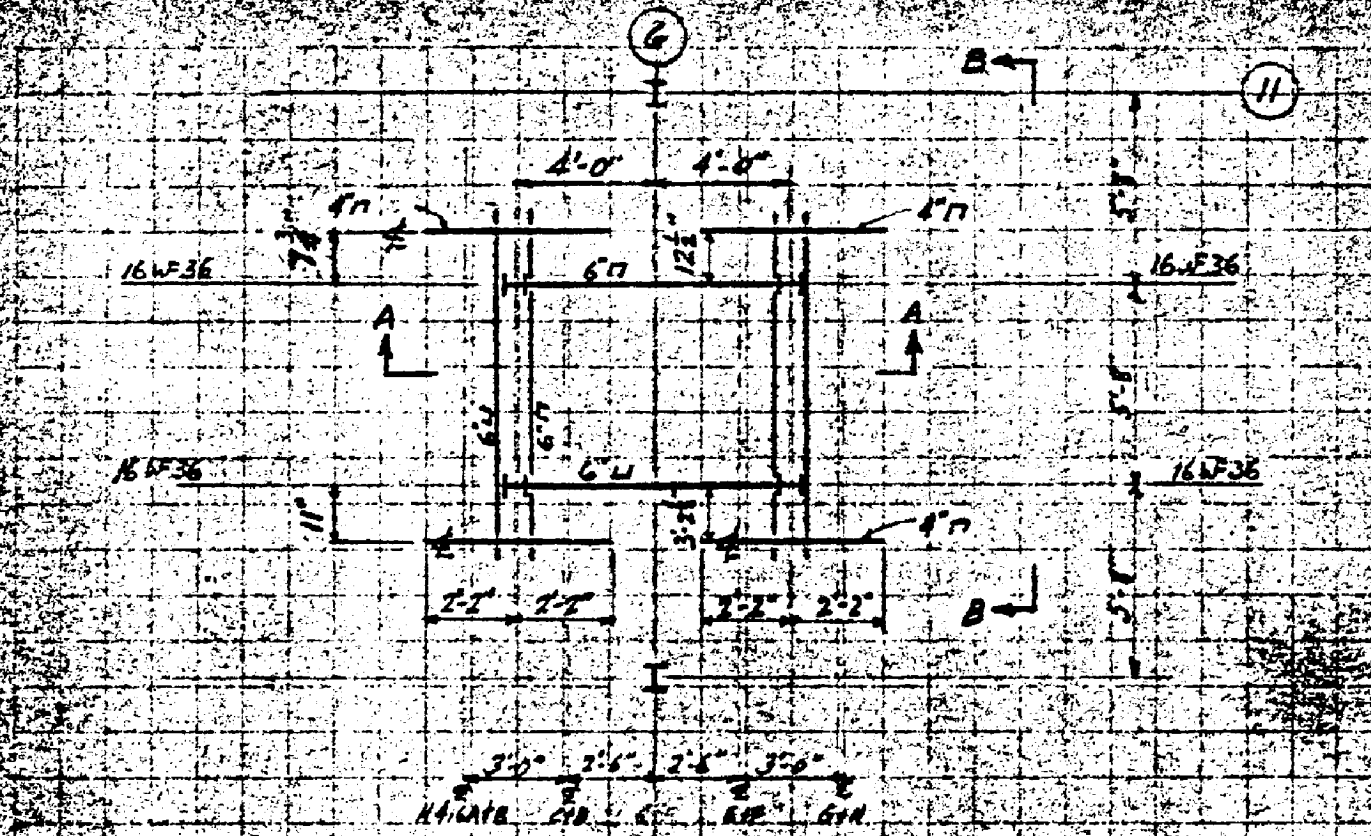
DS 00029702

PROJECT NO. 605028, SIAM

SUBJECT NH3 COMPX. SUPPORTS

ENGINEERS INCORPORATED

MAXUS0998395



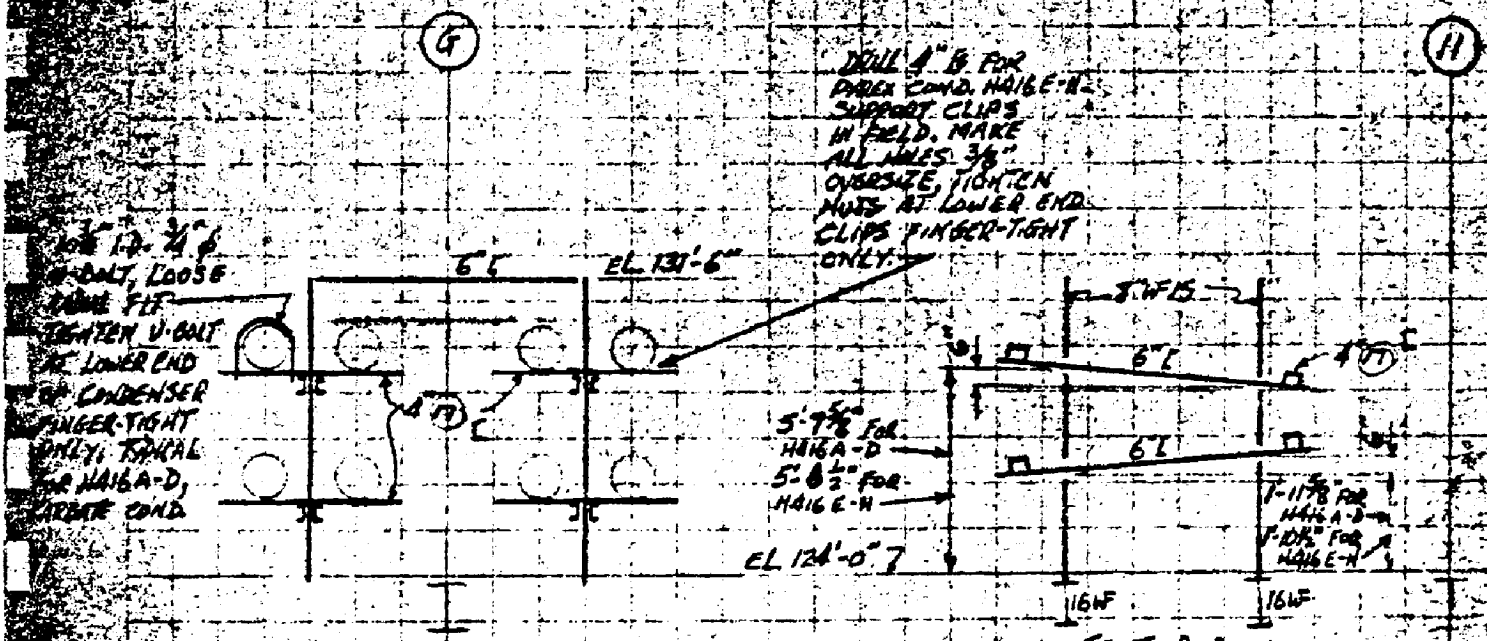
PLAN

NOTES -

1- ALL CONN'S BOLTED.

2- VERIFY ALL DIMENSIONS IN FIELD WITH PIPING DWGS. & EQUIPMENT.

3- MAX UNIT WEIGHT FLOODED IS 1100#



SECT A-A

SECT B-B

PREPARED BY

DATE 11/1/60

PROJECT NO. 605028, DIAM.

SUBJECT HA16 SUPPORTS

DS 00029703

ENGINEERS

MAXUS0998396

DIKED AREA

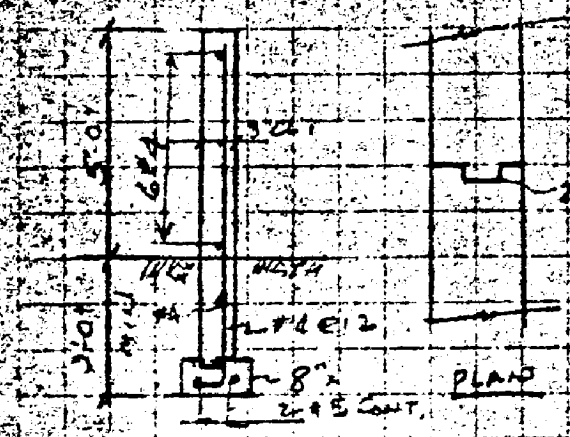
ASSUME 3' WATER

$P = 5 \times 62.4 \times 3 \times \frac{1}{2} = 281^{\#}$ $M = 281 \times 1.281^{'}$

8" WALL $d = 5^{"}$ $A_s = 0.08^{\#}$

$M_{u\,req}$ (VERT) = $0.002 \times 8 \times 12 = 0.192^{\#}$ #5 @ 12

(HORIZ) = $0.0015 \times 8 \times 12 = 0.24^{\#}$ #4 @ 10



2x8 KEY @ 2' PLACED IN EXIST. DIKE WALL & @ 1' PLACE IN SITU DIKE WALL FOR SHRINKAGE

USE SAME DIKE WALL FOR T 6CT ON EAST TANK FARM AREA

PREPARED BY HIB

DATE 9-14-90

PROJECT NO. 1.5302-P

SUBJECT DIKES

DS 00029704

ENGINEERS INCORPORATED

MAXUS0998397

DIKES - AREA - WEST TANK FARM - S. SECTION

TANK	CAPACITY
F2-T708	20,000 Gals
F2-T706	10,000
F2-T711	10,000
F2-T707	12,000
F2-T702	10,000
F2-T710	7,500
	69,500 Gals × .13368 = 9,320 C.F.

TOP MAT @ EL. 100.6'

INSIDE DIMENSIONS DIKE ~ 80' × 49'

VOL. PER FT. HGT. = 4390 C.F.

h_{POND} = 9320 ÷ 4390 = 2.22 FT.

N.J. STATE & NFPA CODES REQUIRE MIN. 3' EXCEPT ~5

USING A WALL TOP EL. 105.0' CAP IS OK.

CAST CONCRETE WALL, FTG. 3' BELOW GR. 100.6'

FTG. 0.67 × 1.33 × 1 × 1/27 = 0.03 × 36 = $1.19

8" WALL 0.67 × 6.83 × 1 × 1/27 = 0.17 × 47 = $8.00/L.F.

FILLED CONC. BLK.

12" BLOCK, DOWELS, GROUT 6.83 × 0.65 = 5.90

ADD 30% FOR FILLING & COMPING = 1.77

7.67 /L.F.

IN ADDED 285' WALL

Δ = (8.00 − 7.67) × 285' = $131

TOTAL INC. COST ~ $2620 INCL. ~ 5%

PREPARED BY HAS

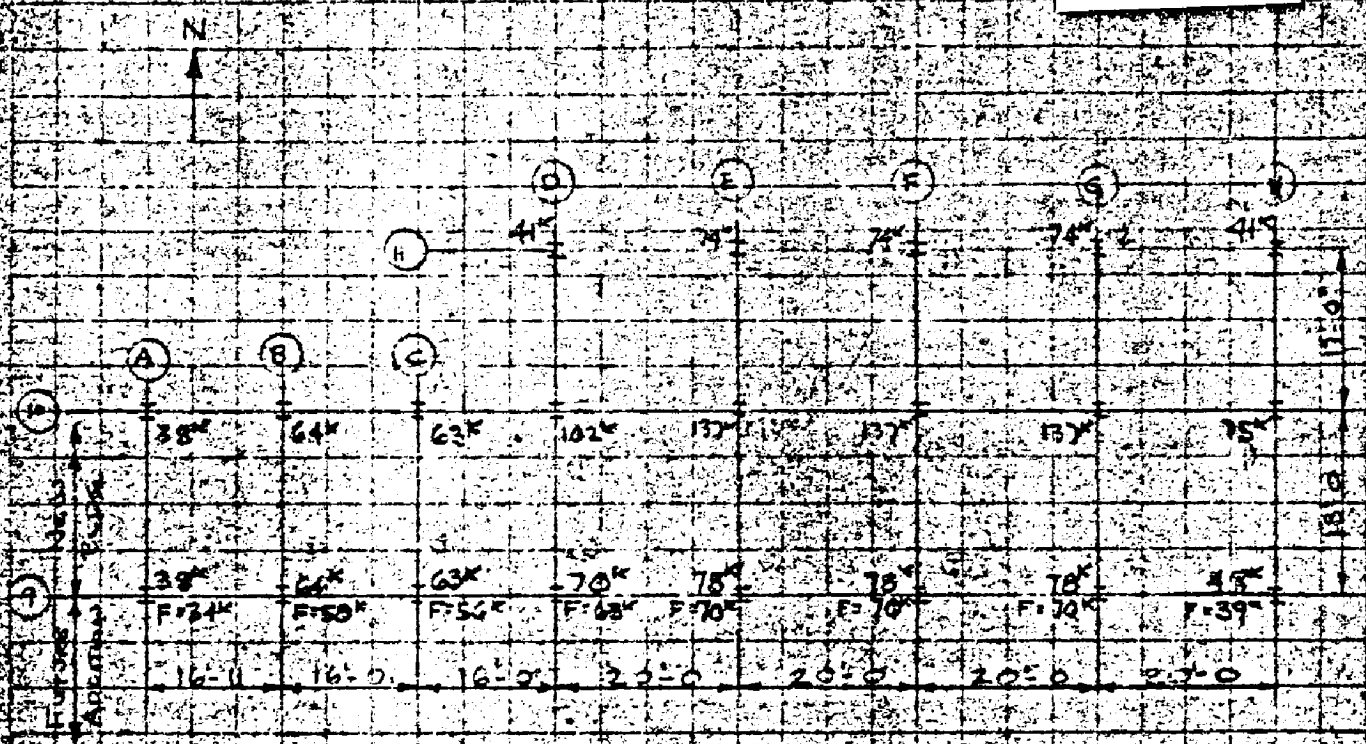
DATE 9-14-60

PROJECT NO. 6-7-24

SUBJECT DIKE - DIXIE

DS 00029705

MAXUS0998398



Roof 2ND FL. & 3RD FL. D.L. + L.L. Shown

Roof L.L. + D.L. = 60 PSF

2ND & 3RD FL. L.L. + D.L. = 165 PSF

Bldg Col. Wt. = 1K

Add Siding & Girts = 0.2K/LF (Use 4K per exterior Col.)

Loads on columns as shown are for uniform L.L. No consideration is taken for equipment weight. Equipment weight could add approximately 10K max. extra on a few columns.

Use 8WF 28, 31, & 40 Cols.

DS 00029706

PREPARED BY E. C. Johanson PROJECT NO. 605028

DATE May 7, 1960 SUBJECT Column Loads

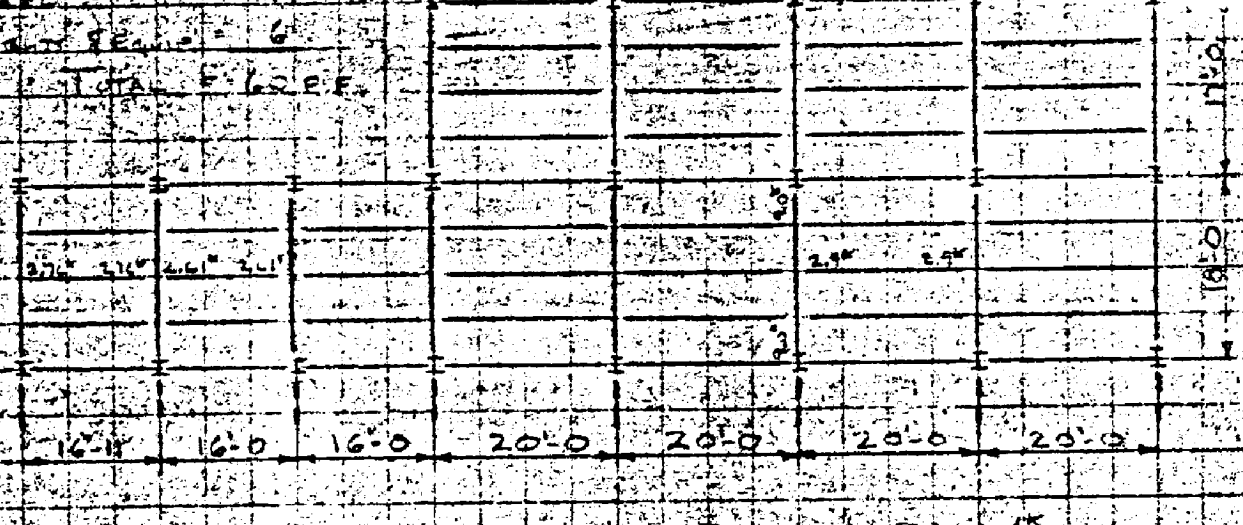
ENGINEERS

MAXUS0998399

Roof Framing

Roof	= 40 psf
Ceiling & Roofing	= 10
Steel	= 4
Live & Equip	= 6
Total	= 60 psf

No Snow Roof Reqd.



Design each beam for LL + DL or DL + 4k at center of span, whichever is critical. Allow $f_b = 18$ ksi

Purlin (20'-0 Lg)

LL + DL

$M = \frac{1}{8} \times 45 \times 0.06 \times 20^2 = 13.5^{1-k}$

$R = 45 \times 0.06 \times 10 = 27^k$

DL + 4k Load at Pt. Center

$M = \frac{1}{8} \times 45 \times 0.02 \times 20^2 + \frac{4 \times 20}{4}$

$= 45 + 20.0 = 24.5^{1-k}$ critical

$R = 45 \times 0.02 \times 10 + \frac{4}{2} = 0.9 + 2.0 = 2.9^k$ critical

$S_{reqd} = 24.5 \times \frac{12}{18} = 16.3$

Use 8 WF 29 $S = 24.3$ $L_u = 13.5$ when $F_b = 5/6$

If No Snow Roof $S_{reqd} = 16.3 \times \frac{20}{13.5} = 12.0 < 24.3$ ok

Purlin (16'-11 Lg)

$M = \frac{1}{8} \times 45 \times 0.06 \times 16.92^2 = 9.65^{1-k}$

$R = 45 \times 0.06 \times 8.46 = 2.28^k$

$M = \frac{1}{8} \times 45 \times 0.02 \times 16.92^2 + \frac{4 \times 16.92}{4}$

$= 3.23 + 16.92 = 20.15^{1-k}$ critical

$R = 45 \times 0.02 \times 8.46 + \frac{4}{2} = 0.76 + 2.00 = 2.76^k$ critical

$S_{reqd} = 20.15 \times \frac{12}{18} = 13.43$ critical

Use 8 WF 28

Girder (15'-0 Lg) For 20' Wide Bays

$M = 45 \times 2 \times 5.8 + \frac{1}{8} \times 0.30 \times 18^2$

$= 52.2 + 1.2 = 53.4^{1-k}$ critical

$R = 8.7 + 0.3 = 9.0^k$ critical

$S_{reqd} = 53.4 \times \frac{12}{18} = 35.6$

$M = \frac{4 \times 18}{4} + 45 \times 2 \times 0.9 + \frac{1}{8} \times 0.030 \times 18^2$

$+ 18.0 + 8.1 + 1.2 = 27.3^{1-k}$

$R = 2.0 + 1.4 + 0.3 = 3.7^k$

Use 14 WF 30 $S = 41.8$ $F_b = 5/6$

DS 00029707

Demand Attach.

PREPARED BY E. C. Johnston Chk'd 5-10-60 DB PROJECT NO. 605028

DATE May 4, 1960 SUBJECT Roof Steel

FLOOR FRAMING

LL = 150 psf
GRATING = 10
STEEL = 4
TOTAL = 164 psf

ORDINARY FL. BM. 6'-0" o.c., 20'-0" LG., UNIFORM EQUIV. LOAD

$M = \frac{1}{8} \times 0.164 \times 6.0 \times 20^2 = 49.2$ ft-k

$R = 0.164 \times 6.0 \times 10 = 9.84$ k

REQ'D $S = 49.2 \times \frac{3}{2} = 34.8$

USE 14WF30 $S = 41.5$ DEFL. 5/16"

OTHER BEAMS TAKING ADDITIONAL EQUIPMENT LOADS WILL BE LARGER AS REQUIRED.

15'-0" GIRDER WITH 2 - ADJACENT 20' BAYS

$M = 2 \times 9.84 \times 6 + \frac{1}{3} \times 0.05 \times 15^2 = 118.0 + 7.0 = 125$ ft-k

$R = 2 \times 9.84 + 0.05 \times 9 = 19.68 + 0.45 = 20.13$ k

REQ'D $S = 125 \times \frac{2}{3} = 80$

USE 18WF50 $S = 88.9$

END GIRDER - 15' SPAN

$M = \frac{11}{20} \times 125 = 66$ ft-k

REQ'D $S = 66 \times \frac{2}{3} = 44$

USE 14WF34 $S = 48.5$

20' BEAM ON COL. LINE 19 UNDER WALL

$M = \frac{1}{8} \times 20^2 (5.83 \times 0.164 + 1.5 \times 0.051)$

$= 50 (0.952 + 0.587) = 77.2$

REQ'D $S = 77.2 \times \frac{2}{3} = 51.4$

USE 16WF36 $S = 56.3$

DS 00029708

PREPARED BY E. C. JOHANSSON PROJECT NO. 605029

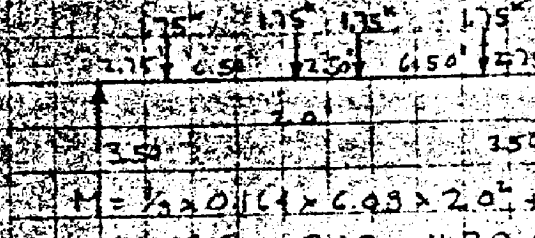
DATE MAY 4, 1960 SUBJECT FLOOR STEEL

ENGINEERS

MAXUS0998401

2ND F. BEAMS TY ELEVATORS (BETWEEN COLUMNS 10 & 11 – F & H)

EQUIPMENT LOADS 125# (REDUCE TO 7# BECAUSE OF AREA TAKEN UP)

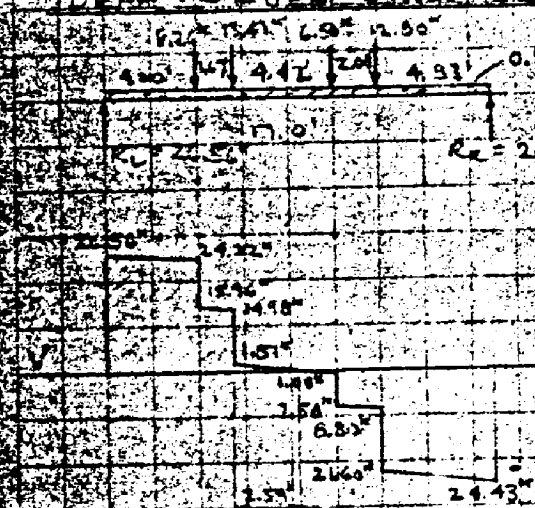


$M = \frac{1}{2} \times 0.116 \times 6.93 \times 2.0^2 + 3.5 \times 2.75 + 6.50 \times 1.25$

$= 1.49.90 + 9.63 + 11.38 = 20.91$ $S = 2/3 \times 20.91$

Use 16WF36 $S = 56.3$

BEAM UNDER WALL ON COL. LINE F



WALL LOAD = 11.5 × 0.051 = 0.537#/LF

$R_L = \frac{17}{2} \times 0.537 + 8.26 \times \frac{13.0}{17.0} + 13.47 \times \frac{11.33}{17.0}$

$+ 6.50 \times \frac{2.91}{17.0} + 12.80 \times \frac{4.93}{17.0}$

$= 4.98 + 6.32 + 8.98 + 2.64 + 3.64 = 26.5$#

$R_R = \frac{17}{2} \times 0.537 + 8.26 \times \frac{4.3}{17.0} + 13.47 \times \frac{5.67}{17.0}$

$+ 6.50 \times \frac{10.09}{17.0} + 12.80 \times \frac{12.17}{17.0}$

$= 4.98 + 1.94 + 4.49 + 3.56 + 9.16 = 24.4$#

$M_{max} = \frac{1}{2} \times 4.0 (26.56 + 24.32) + \frac{1}{2} \times 1.0 (15.96 + 14.98)$

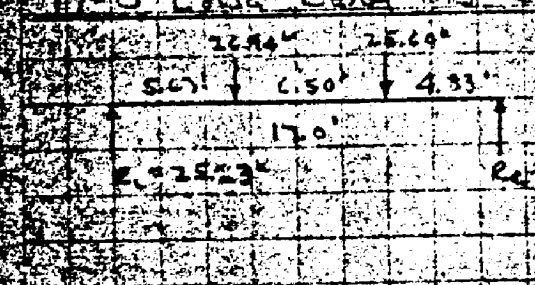
$+ \frac{1}{2} \times 2.55 \times 1.51$

$= 101.5 + 25.30 + 1.95 = 129.31$'-#

Req'd $S = 129.31 \times \frac{2}{3} = 86.2$

Use 21WF62 FOR DEFLECTION $S = 126.4$
(UNCERTAINTY OF LOADS)

17'-0" LONG BEAM ON COL. LINE G



$R_L = 22.94 \times \frac{11.33}{17.0} + 25.60 \times \frac{4.67}{17.0}$

$= 17.96 + 7.27 = 25.23$

$R_R = 22.94 \times \frac{5.67}{17.0} + 25.60 \times \frac{12.17}{17.0}$

$= 7.65 + 18.33 = 23.98$

Max. Min. $= 5.67 \times 25.23 = 143$'-#

Req'd $S = 143 \times \frac{2}{3} = 95.5$

Use 21WF62 FOR DEFLECTION $S = 126.4$
(UNCERTAINTY OF LOADS)

PREPARED BY E. C. Johnson

DATE May 4 1968

PROJECT NO. 6-9-07-8

SUBJECT 2ND F. STEEL

ENGINEER

DS 00029709

MAXUS0998402

20'-0 LG. BEAM UNDER WALL AT EXT. 20'-0 BAY

WALL LOAD = 0.051 × 8.67 = 0.443 K/LF

SLAB LOAD = 0.075 × 4.0 = 0.300

CONC. SHELF LOAD = 0.075 × 1.33 × 24/12 = 0.110

L.L. ON SHELF = 1.20 × 1.83 × 4/3 = 1.100

L.L. ON SLAB = 0.05 × 5.17 × 2.92/8 = 0.094

LOAD FROM GIRT WT = 0.164 × 2 = 0.328

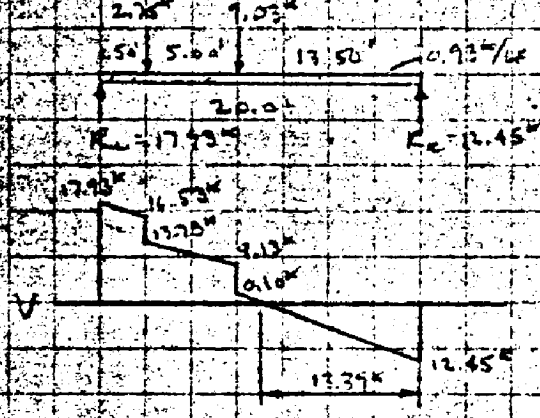
TOTAL = 2.645 K/LF

MAX. MOM = 1/8 × 2.645 × 20² = 132.25

REQ'D S = 132.25 × 2/3 = 88.2 USE 18WF50 S = 89.0

20'-0 LG. BEAM BETWEEN COL. LINES 10 & 11 - E & F

EQUIPMENT LOAD = 14K (REDUCED TO 11K BECAUSE OF AREA TAKEN UP)



UNIFORM LOAD = 5.67 × 0.164 = 0.93 K/LF

$R_L = 0.93 \times 10 + 2.75 \times \frac{15.50}{20.0} + 9.03 \times \frac{13.50}{20.0}$

$= 9.30 + 2.54 + 6.09 = 17.93^K$

$R_R = 0.93 \times 10 + 2.75 \times \frac{4.50}{20.0} + 9.03 \times \frac{6.50}{20.0}$

$= 9.30 + 0.21 + 2.94 = 12.45^K$

MAX. MOM = 1/2 × 17.39 × 12.45 = 834 '-K

REQ'D S = 834 × 2/3 = 556

USE 16WF36 S = 56.3

PREPARED BY E. C. JOHANSEN PROJECT NO. 605028

DATE MAY 4 1960 SUBJECT 3RD. FL. STEEL

DS 00029710

ENGINEERS

MAXUS0998403

Wt of Siding = 4.1 #/ft²

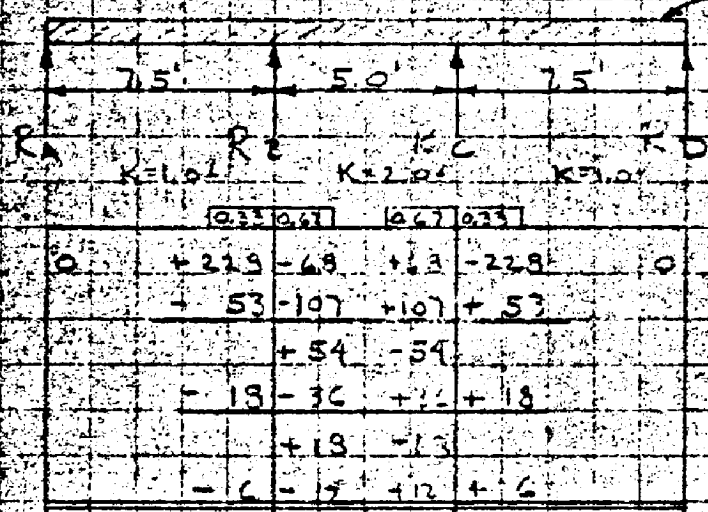
Wind = 20 #/ft²

For 20'-0 Lg. Girt (5'-6 Spacing)

Horizontal Mom = M_{x-x} = 1/8 × 0.02 × 5.5 × 20² = 5.5'-k

Sag Rods & Window Jambs will be approximately 2.5' from the center of the bay.

Load per ft. for girt = 4.1 × 5.5 + 9.8 = 32.4 #/lf. for 7L18
(siding) (girt)



For 7.5' Span

FEM = 1/8 × 32.4 × 7.5² = 229'-#

For 5.5' Span

FEM = 1/12 × 32.4 × 5.0² = 68'-#

Reactions

$\Sigma M_B = 0$

$7.5 R_A + 151 - 32.4 \times \frac{7.5^2}{2} = 0$

$7.5 R_A = 911 - 151 = 760$

$R_A = 101\# = R_D$

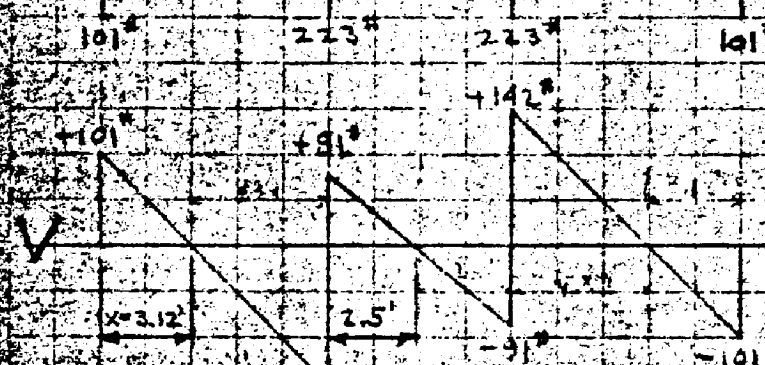
$\Sigma M_C = 0$

$5 R_B + 12.5 \times 101 + 151 - 32.4 \times \frac{12.5^2}{2} = 0$

$5 R_B = 2530 - 151 - 1116.2 = 1117$

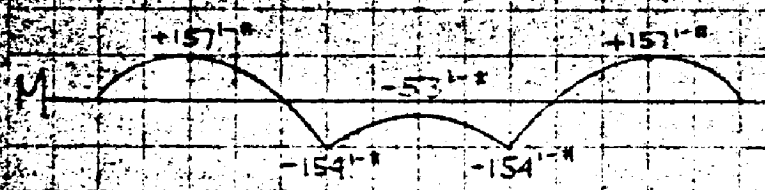
$R_B = 223\# = R_C$

$\frac{x}{101} = \frac{7.5}{101 + 142}$ $x = 3.12'$



Max Pos. Mom = 1/2 × 101 × 3.12 = 157'-#

Max Neg. Mom = 1/2 × 142 × 4.33 = 157
= 311 - 157 = 154'-#



Max. Pos. Mom. for 5' Span

M = 154 - 1/2 × 2.5 × 101

= 154 - 101 = 53'-#

DS 00029711

PREPARED BY E. C. JOHANSON CHK'D 5-10-60 PROJECT NO. 605061

DATE May 9, 1960 SUBJECT Girts

ENGINEERS

MAXUS0998404

VERTICAL MOM (MAX) = 0.157 '-k

$f_{x-x} = \frac{5.5 \times 12}{6.0} = 11.00$ KSI

$f_{y-y} = \frac{0.157 \times 12}{1/2 \times 0.63} = 5.98$ KSI ASSUME ONLY HALF OF THE GIRT ACTS VERTICALLY (HENCE $\frac{S}{2}$).

MAX f = 11.00 + 5.98 = 16.98 KSI

ALLOWABLE $f = 1.33 \times 19 \times \frac{5.5}{2.5} = 17.56$ KSI > 16.98 OK $L_b = 5.5'$

FINAL MEMBER

TRY ST-4 WF 8.5

$M_{x-x} = 157 \times \frac{40}{32.4} = 194$ '-#

VERTICAL LOAD = 41 × 5/2 + 40 = 46 #/LF ROOF LOAD = $\frac{60}{3} + 13 = 40$

$M_{y-y} = 157 \times \frac{46}{32.4} = 223$ '-#

$f_{x-x} = \frac{0.194 \times 12}{1.01} = 2.31$ KSI $f_{y-y} = \frac{0.223 \times 12}{1.28} = 2.09$ KSI

MAX f = 2.31 + 2.09 = 4.40 KSI OK

DS 00029712

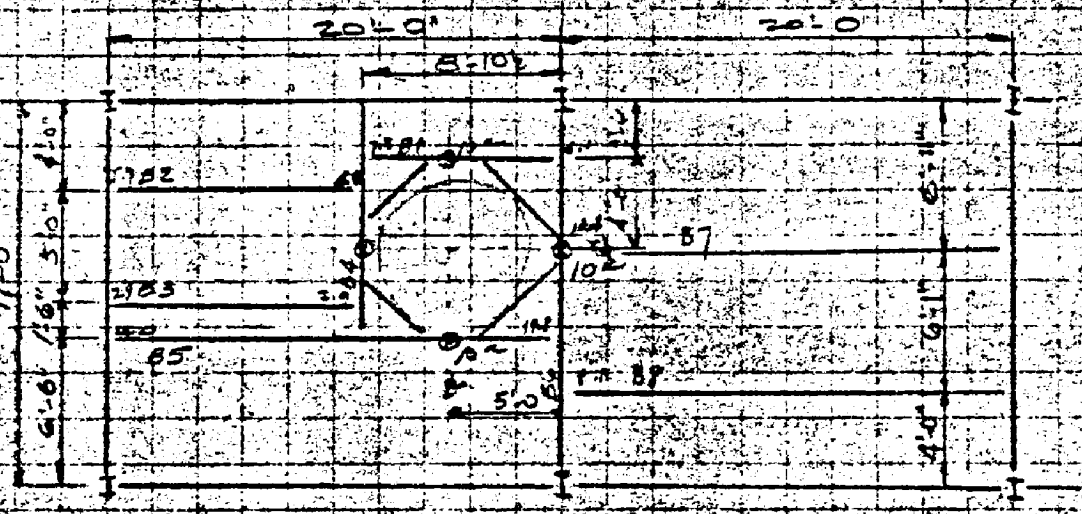
PREPARED BY E. C. JOHANSON Ch'k'd 5-10-60 L.P.B. PROJECT NO. 605027

DATE MAY 9 1960 SUBJECT GIRTS

ENGINEERS

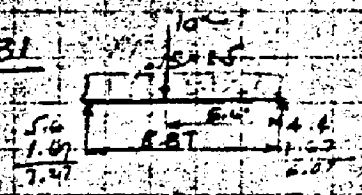
MAXUS0998405

PROCESS BLDG - REV. 2ND FL. STEEL @ CAUSTIC MIX TANK



WGT. TANK, INSUL, AGITATOR, REDUCER MOTOR, OPERATING WGT. = 32.5#
ADD 25% FOR IMPACT TOTAL = 40.6# say 41#

B1



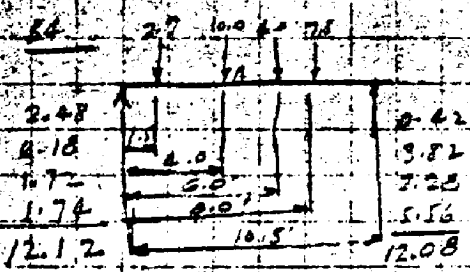
R = 7.27 × 3.87 = 28.2
− .375 × 3.87² × ½ = 2.8
25.4 S_x = 3/4 × 25.4 = 17.0
BUT ≥ 9 ∴ OK
S = 24.2

B2 9 □ 13.4 : S_x = 10.5, M = 15.8, w = 8 × 15.8 ÷ 11.13² = 1.02#/in
R = 11.13 × ½ × 1.02 = 5.7# 1.02/4.5 = 0.227#/in 9 □ 13.4 OK

OR M = 0.16 × 2.5 × 11.13² × 1/8 = 11.2#, S_x = 7.5 R = 4.0#
9 □ 13.4 OK

B3 P = 0.16 × 3.25 × 11.13² × 1/8 = 2.9#

B4



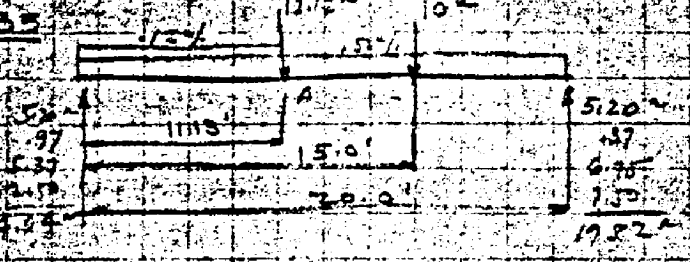
M_A = 12.12 × 4.0 = 48.48
− 2.9 × 2.5 = 7.25
41.2# S_R = 27.5
EXIST. 9 □ 13.4 NG
REQUIRE 15 □ 33.9

DS 00029713

PREPARED BY HWB PROJECT NO. 60502 DAC
DATE 10/27/60 SUBJECT SUSPENDED CAUST. MIX TANK
ENGINEERS

MAXUS0998406

B3



$M_p = 19.82 \times 8.87 = 175.5$

$- 10 \times 3.87 = -38.7$

$- .52 \times 8.5^2 \times \frac{1}{2} = -20.3$

116.5^{k} $S_L = 2/3 \times 116.5 = 77.7$

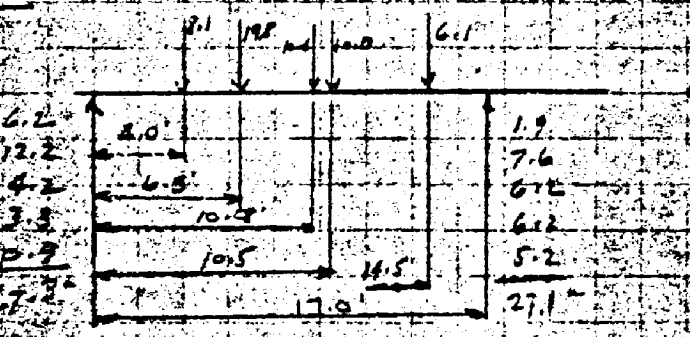
Require 16 WF 50

Exist. 14 WF 30, S = 81.1 NG

B7 $R = 0.16 \times 6.5 \times 10 = 10.4^{k}$

B8 $R = 0.16 \times 5.0 \times 10 = 8.1^{k}$

B6



$M = 27.3 \times 6.5 = 177.5^{k}$

$- 8.1 \times 2.5 = -20.2$

157.3^{k}

$S_L = 2/3 \times 157.3 = 105$

Req'd. 18 WF 60 S = 107.2

Exist. 18 WF 50 S = 90.0

(14" mm) NG

Columns OK

Column Check: Roof Load $20 \times 17.5 \times (.040 + .015 + .02 \times 20 + .015) = 33^{k}$

(E10) 3rd Floor $20 \times 17.5 \times (0.160 + 0.025) = 65$

98^{k}

2nd Floor (See B6) 27.3

$20 \times 17.5 \times 2 \times 0.125 = 32^{k}$

157.8^{k}

Col. E10 is 8 WF 40

For H = 11' $P_{allow} = 176^{k}$ OK

PREPARED BY HJS PROJECT NO. 60504 Phase

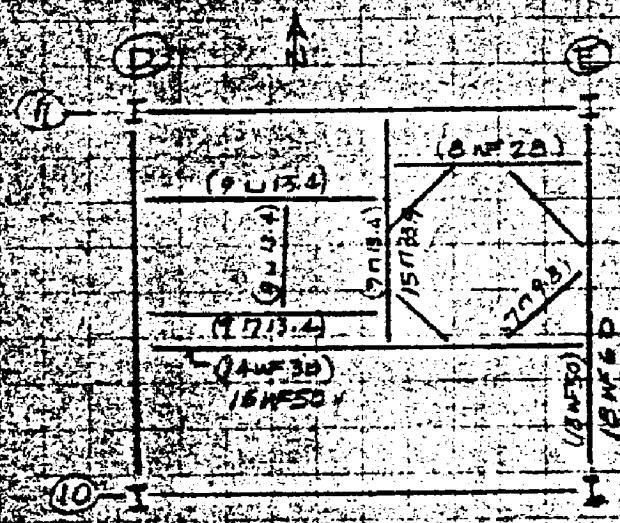
DATE 10/31/62 SUBJECT Structural Calculations

ENGINEERS

DS 00029714

MAXUS0998407

Roof Flr - Rev. 2nd Fl. Steel @ Caustic Mix Tank



( ) EXISTING

3 NEW MEMBERS REQUIRED
1 - 16WF50
1 - 15WF33.9
1 - 18WF60

PREPARED BY: HB

DATE: 10/31/60

PROJECT NO. 60,028-DA00

SUBJECT: 2nd Fl. Steel Rev.

DS 00029715

MAXUS0998408

REVISED LAYOUT 2ND FL.

PREPARED BY NWB & HJ

DATE

ENGINEERS

DS 00029716

PROJECT NO. 605028

SUBJECT 2ND FLOOR LAYOUT

ITEM NO. F2U-	DESCRIPTION	SPEC. NO. NF-259-1	REF. DWGS. DET.	REF. DWGS. NO.	REF. DWGS. QUT.	REQUISITION NO.	REQUISITION DATE	PUR. ORDER NO.	PUR. ORDER DATE	VENDOR	LOCATION	REMARKS
101-PI	PRESSURE GAUGES	PAGE 24		1-2	1	EG-3324	7/15	G66095	8/16/60	Jay Instrument (M.M.&M)	F2-1-03	
02		42		5-6	1	"					F2-1-24	
03		43		10	1	"					F2-1-02	
04		43		10	1	"					F2-1-04	
05		24		3-4	1	"					F2-3-03	
06		—		3-4	1	EG3385	12/23	—	—	Plant Stock	F2-11-22	0-60
07		29		3-4	1	EG3320	7/15	666095	8/16/60	Jay Instrument	F2-3-01	
08		25		5-6	1	"					PANEL	
09		24		3-4	1	"					F2-3-02	
110		—		3-4	1	EG3385	12/23	—	—	Plant Stock	F2-11-22	0-60
111 PI		25		5-6	1	EG3320	7/15	666095	8/16/60	Jay Instrument	PANEL	
12		24	NF-259-11 DETAIL N2	3-4	1	"					F2-D116	
13		43		7-2	1	"					F2-1-15	
14		24		3-4	1	"					F2-3-05	
15		24		3-4	2	"					F2-3-06	
16		29		3-4	2	"					F2-3-07	
17		24		3-4	2	"					F2-3-08	
18		43		5-6	2	"					F2-2-04	
19		24	NF200-1 DET 2 AS SHOWN	3-4	2	"					F2-3-09	
120-PI		43		5-6	2	"					F2-1-33	
21		43		5-6	2	"					F2-2-05	
22		24		3-4	2	"					F2-3-10	
23		43		5-6	2	"					F2-2-08	
24		24		3-4	2	"					F2-3-11	
25		43		5-6	2	"					F2-2-10	
26		43		5-6	2	"					F2-1-29	
27		24		3-4	2	"					F2-D212	
28		24		3-4	1	"					F2-3-15	
29		24		1-2	1	"					F2-3-32	
130-PI		24		1-2	1	"					F2-2-17	
31		24		1-2	1	"					F2-3-33	
32		24		1-2	1	"					F2-2-30	
33		24		3-4	1	"					F2-3-16	
34		24		1-2	1	"					F2-2-18	
135		24		1-2	2	"					F2-F220 PIPING	

DWG.	DATE	APPRD. NO.
A	7-26-60	
B	7-26-60	
C	11/17	
D	5/22	

APPROVED FOR CONST. [signature] DATE 8-26-60

DRAWN [signature] DATE 6/24/60

ASSOCIATE ENGINEERS
ENGINEERS INC.
NEWARK, N.J.

APPROVED [signature]

CONTRACT

PLANT NEWARK N.J. DIV. CHLORINATED PRODUCTS

SODIUM TCP UNIT

DIAMOND ALKALI COMPANY
CENTRAL ENGINEERING DEPARTMENT

NF-259-1 D

DS 00029720

MAXUS0998410

ITEM NO. F2U	DESCRIPTION	SPEC. NO. NF5-259-1	REF. DWGS. DETL Dwg. No.	SHT	REQUISITION NO.	REQUISITION DATE	PUR. ORDER NO.	PUR. ORDER DATE	VENDOR	LOCATION	REMARKS	VENDOR'S DWGS
201-TRCV	TEMP. RECORDER CONTROL VALVE	PAGE-8	NF259-13 DET. 8	1	EG-3314	7/15/60	G 65980	8/15/60	GENERAL CONTROLS	F2-S-05	HAMMEL DAHL	
02-TRC	TEMP. RECORDER CONTROLLER	5	" "	1	EG-3300	7/15/60	G 66605	8/22/60	Bristol Co.	PANEL (D11C)		
03-TIC	TEMP. INDICATOR CONTROLLER	6	NF259-10 DET. 9	2	EG-3312	7/15/60	"	"	"	F2-3-26 (NAISOLE CONT.)		
04-PI	PRESSURE GAUGE	—	—	1	EG 3385	12/23	—	—	PLANT STOCK	F2-3-23 To R201	0-60 PSIG	
05-TS	TEMPERATURE SWITCH	—	—	1	EG3381	12/14	N1551	12/22/60	MERCOID CORP.	T111 OVERFLOW		
06-TI	TEMPERATURE GAUGE	PAGE-36	DET. 1	1	EG-3318	7/15/60	G66092	8/15/60	JAY INSTRUMENTS (HMRM)	F2-1-13	COMPLETE WITH WELL	
07-TW	THERMOMETER WELL	—	"	1	EG 3316	"	G66091			F2-3-25		NAL 70
08-TI	TEMPERATURE GAUGE	36	"	1	EG 3318	"	G66092			F2-1-11	COMPLETE WITH WELL	
09-TW	THERMOMETER WELL	—	"	1	EG-3316	"	G66091			F2-3-21	"	NAL 70
210-TW		—	"	1	"	"				F2-3-21		do.
11-TW		—	"	1	"	"				F2-3-22		do.
12-TI	TEMPERATURE GAUGE	36	"	2	EG 3318	"	G66092			F2-1-31	COMPLETE WITH WELL	
13-TI		36	"	1	"	"				F2-1-17	" "	
14-TI		36	DET. 2	2	"	"				F2-T215	" "	
15-TI		36	"	2	"	"				F2-T301	" "	
16-TI		36	"	2	"	"				F2-T302	" "	
17-TI		36	"	2	"	"				F2-T208	" "	
18-TS	TEMPERATURE SWITCH	—	—	1	EG3385	12/23	N1555	?	MERCOID	R101		
19-TI	TEMPERATURE GAUGE	36	DET. 2	1	EG3318	7/15	G66092	8/15/60	JAY INSTRUMENTS	F2-3-32	" "	
220-TI		36	"	1	"	"				F2-T105	" "	
21-TI		36	"	2	"	"				F2-D212	" "	
222-TI		53	NF259-13 DET. 8	1	EG 3318	7/15/60	G66608	8/22/60	Jay Instrument	PANEL (R101)	SEE NF259-13 DET. 8 FOR TW	
223-TI		53	"	1	"	"				PANEL (R102)	"	
24-TS	TEMPERATURE SWITCH	—	—	1	EG3385	12/23	N1555	?	MERCOID	R102		
25-TR	TEMPERATURE RECORDER	PAGE-4	NF259-10 DET. 8	1	EG3322	7/15/60	G66605	8/22/60	Bristol Co.	PANEL (R101)	SEE NF259-13 DET. 8 FOR TW	
26-TR		4	" "	1	EG-3322	7/15/60				PANEL (R102)	"	
27-TR		5	NF259-13 DET. 8	1	EG-3322	7/15/60	G76284	11/7	BRISTOL Co.	PANEL (R201)	G66604 CANCELLED	
28-TR		58	NF259-10 DET. 9	2	EG-3322	7/15/60	G-66604 G76284	8/24 11/7	Frank J. Lincoln, Inc. do. BRISTOL Co.	F2-D212	do.	
~~29-TCV~~	~~TEMP. CONTROL VALVE (TCV)~~	~~PAGE-9~~	—	—	~~EG-3314~~	~~7/15/60~~	—	—	—	—	CANCELLED 8/12/60	
230-SS	SPEED (PLUGGING) SWITCH	—	—	1	EG3347	9/7/60	G67370	9/14/60	WINTERBURN MFG.	A103	MARKED RS103 ON WIRING DIAG.	
31-TCV	TEMPERATURE CONTROL VALVE	"	—	—	EG-3314	7/15/60	—	—	—	—	CANCELLED 8/12/60	
32-TCV		"	—	—	EG-3314	7/15/60	—	—	—	—	"	
33-TCV		9	—	—	EG-3314	7/15/60	—	—	—	—	"	
34-TCV		10	NF259-10 DET. 9	2	EG-3314	7/15/60	G65980	8/15/60	GENERAL CONTROLS	F2-3-26 (NAISOLE CONT.)	HAMMEL DAHL	
35-SS	SPEED (PLUGGING) SWITCH	—	—	1	EG3347	9/7/60	G67370	9/14/60	WINTERBURN MFG.	A104	MARKED RS104 ON WIRING DIAGRAM	

DWG.	DATE	APPRO. NO.
A	7-26-60	
B	9/14/60	
C	11/7	
D	12/22	
E	7/27/61	

APPROVED FOR CONST. [signature] DATE 8-26-6

DRAWN [signature] DATE 6/20/60

CHECKED [signature] DATE 7-26-60

ASSOCIATE ENGINEERS
ENGINEERS INC.
NEWARK N.J.

APPROVED [signature] DATE 7-26-60

CONTRACT 605028

PLANT NEWARK N.J. DIV. CHLORINATED PRODUCTS.

SODIUM TCP UNIT

INSTRUMENT LIST

DIAMOND ALKALI COMPANY
CENTRAL ENGINEERING DEPARTMENT

NF-259-2

DS 00029721

MAXUS0998411

ITEM NO. PEV-	DESCRIPTION	SPEC. NO. NFE 259-1	REF. DWGS. DCN. NO.	REF. DWGS. FLO-SHEET	REQUISITION NO.	REQUISITION DATE	PUR. ORDER NO.	PUR. ORDER DATE	VENDOR	LOCATION	REMARKS	VI PLATE
301-FG	FLOW GLASS	PAGE-13	—	1	EG-3321	7/15	665480	8/5	FISCHER & PORTER	F2-1-05		
02-FG		13	—	1	"	"				F2-2-14		
03-FG		13	—	1	"	"				F2-1-11		
04-FG		13	—	2	"	"				F2-2-05		
05-FG		13	—	2	"	"				F2-1-31		
06-FG		13	—	2	"	"				F2-2-15		
307-FG		13	—	2	EG 3321	7/15				F2-2-02		
08-FCV	FLOW CONTROL VALVE	13	NF259-13 DETL. 1	1	EG-3314	7/15	665980	8/15/60	GENERAL CONTROLS	F2-3-01	PANEL-DANL	
09-FCV		13		1	EG-3314	"				F2-3-02		
310-FCV		12		1	EG-3314	"				F2-3-13		
11-FCV		12		1	EG-3314	"				F2-3-14		
12-FCV		14		1	EG-3314	"				F2-3-19		
13-FCV		14		1	EG-3314	"				F2-3-20		
14-FCV		14		1	EG-3314	"				F2-3-15		
15-FCV		14		1	EG-3314	"				F2-3-20		
16-PCV	PRESSURE CONTROL VALVE	—	—	1	EG3381	12/14	N1522	12/22/60	FISHER GOVERNOR GEAR	F2-3-33	1"-BACKPRESS. 50PSIG	—
17-PSV	RELIEF VALVE	—	—	1			N1554	12/22/60		F2-1-16	1½x2-50PSIG	—
18-FIQ	FLOW INDICATOR TOTALIZER	39	NF231-9	1	EG-3317	7/15	665490	8/8/60	ROCKWELL MFG.	F2-1-09		BM 8013, HT8712 M7392-1
19-TS	TEMPERATURE SWITCH	—	—	1	EG3385	12/23	N1498	11/30/60	MERCOID CORP.	F2-T101 OVERFLOW	DAN-3B, RANGE B, 6'CAP, S.S.	
320-FIQ	FLOW INDICATOR TOTALIZER	40	NF231-2	1			665711	8/8/60	ILLES POWER CONTROL CO.	F2-3-30	BUFFALO METER	R100 & 107
21-FIQ		40	NF231-2	1						F2-3-31		do.
22-FIQ		41	NF231-7	2						F2-3-28		do.
23-PCV	PRESSURE CONTROL VALVE	—	—	1	EG3385	12/22	N1550	12/22/60	LESLIE CO.	F2-11-22	¼" - 30PSIG	—
24-PCV	" " "	—	—	1	EG3385	12/22	N1550	12/22/60	LESLIE CO.	F2-3-33 TO R201	1¼" - 30PSIG	—
25-FI	FLOW INDICATOR - ROTAMETER	16	NF231-8	1	EG-3311	7/15	665480	8/5	FISCHER & PORTER	F2-1-15		
26-FI		17	"	1	"	"				F2-1-18		
27-FI		18	"	1	"	"				F2-1-19		
328-PCV	PRESSURE REGULATING VALVE	—	—	1	EG3385	12/23	N1415	—	JAY HELLER & SONS	AIR TO R101	½" "NORRON" 20A6-46	—
329-PCV	" " "	—	—	1	EG3385	12/23	N1415	—	" " "	AIR TO R102	INVOICE BV1420	—
330-PCV	PRESSURE REGULATING VALVE	7	NF259-13 DETL. 10	1	EG-3314	7/15	665980	8/15/60	GENERAL CONTROLS	F2-3-15	#2 U30-DC HYDRAULIC VALVE	
331-PCV	" " "	—	—	2	EG3385	12/23	N1415	—	JAY HELLER & SONS	AIR TO F220	SEE 32849	—
32-PIR	PRESSURE RECORDER	2	NF259-11 DET. 7	1	EG-3320	7/15	G-66605	4/23/60	Bristol Co.	PANEL (R101)		
33-PIR	" "	2	"	1	EG-3321	7/15	↓	↓	↓	PANEL (R102)		
34-PS	PRESSURE SWITCH	—	—	1	EG3385	12/23	WP01115	12/5/60	BARKSDALE VALVE CO.	F2-3-19	920-20LSS	—
35-PS	" "	—	—	1	EG3385	12/14	N1553	12/22/60	" " "	INST. AIR HEADER	50PSIG 920-20LSS	—

DWG.	DATE	APPRO. NO.
A	1-26-60	[illegible]
B	5/20/60	[illegible]
C	8/1/60	CAR
D	12/61	CAR

APPROVED FOR CONST. [illegible] DATE 8-26-60
DRAWN [illegible] DATE 4/2/60
CHECKED [illegible] DATE 7-26-60

ASSOCIATE ENGINEERS
ENGINEERS INC.
NEWARK N.J.

APPROVED [illegible]
DATE 7-26-60

CONTRACT 605028

PLANT NEWARK N.J. DIV. CHLORINATED PRODUCTS

SODIUM TCP UNIT

INSTRUMENT LIST

DIAMOND ALKALI COMPANY
CENTRAL ENGINEERING DEPARTMENT

NF-259-3 D

ITEM NO. F2U	DESCRIPTION	SPEC. NO. NPL 239-1	REF. DWGS. DETL. DWG.	REF. DWGS. FLO-SHEET	REQUISITION NO.	REQUISITION DATE	PUR. ORDER NO.	PUR. ORDER DATE	VENDOR	LOCATION	REMARKS
401-PSV	RELIEF VALVE	PAGE 33	—	1	EG 3327	7/28	666093	8/16/60	JAY INSTRUMENT	F2-R 201	CANCELLED (MISSM)
02-PSV	"	32	—	1	"	"				F2-R 102	
03-PSV	"	32	—	1	"	"				F2-R 102	
04-PSV	"	33	—	1	"	"				F2-3-24	
05-PSV	"	31	—	1	"	"				F2-R101	
06-PSV	"	31	—	1	"	"				F2-R101	
07-PSV	"	33	—	1	"	"				F2-8-21	
08-PSV	"	33	—	1	"	"				F2-3-21	
09-PSV	"	33	—	1	"	"				F2-3-22	
410-PSV	"	33	—	1	"	"				F2-3-25	
11-PSV	"	33	—	2	"	"				F2-3-26	
12-PSV	"	—	—	2	EG 3364	11/15	669248	10/31	JAY INSTRUMENT	F2-F220 PIPING	do.
13-PI	PRESSURE GAUGE	—	—	2	EG 3386	12/23	—	—	PLANT STOCK	F2-2-37 AT P218	SAME AS NEW 0-160
14-TA	TEMPERATURE ALARM UNIT	—	—	2	EG 3385	12/23	N1556	?	SQ. ELEC.	—	—
15-FA	FLAME ARRESTERS	—	—	1						F2-T205	CANCELLED - EXISTING
16-FA		35	—	1	EG 3320	7/28	666603	8/25/60	Shand + Jurs Co.	F2-3-27 (R201)	
17-FA		35	—	1	"	"				F2-2-23 (T120)	
18-FA		35	—	1	"	"				F2-1-12 (T113)	
19-FA		35	—	1	"	"				F2-T114	
420-FA		35	—	1	"	"				F2-2-31 (T111)	
21-FA		—	—	—						—	CANCELLED NOT REQ'D
22-FA		34	—	NF200-5	EG 3320	7/28	666603	8/25/60	Shand + Jurs Co.	F2-T406	
23-FA		55	—	NF200-5	"	"	666603	8/25/60	" + Jurs Co.	F2-T403	
24-FA		—	—	—						INSTR. No. SHOULD READ F2U343 FA	
25-FA		—	—	—						" " " " F2U345 FA	
26-FA		34	—	NF200-5	EG 3320	7/28	666603	8/25/60	Shand + Jurs Co.	F2-T402	
27-FA		—	—	—						CANCELLED - EXISTING	INSTR. No. SHOULD READ F2U342 FA
28-FA		—	—	—						" " "	F2U350 FA
29-FA		—	—	—						" " "	F2U348 FA
430-FA		—	—	—						" " "	F2U341 FA
31-TCV	TEMPERATURE CONTROL VALVE	—	—	2						—	—
32-TCV	TEMPERATURE REGULATOR	30	NF2530 DETL. 7	NF200-2	EG 3328	7/20	666609	8/24/60	Leslie Co.	F2-3-06	
33-TCV	" "	30	"	"	EG 3328	7/20				F2-3-09	
34-TCV	" "	30	"	"	EG 3328	7/20				F2-3-10	
435-TCV	" "	30	"	"	EG 3328	7/20				F2-3-11	

DWG.	DATE	APPRO. NO.
A	1-26-60	
B	7/20/60	
C	11/2	CAR

APPROVED FOR CONST. [signature] DATE 8-26-61

DRAWN [signature] DATE 6/20/60

ASSOCIATE ENGINEERS
ENGINEERS INC.
NEWARK N.J.

APPROVED [signature] CONTRACT

PLANT NEWARK N.J. DIV. CHLORINATED PRODUCTS

SODIUM TCP UNIT

DIAMOND ALKALI COMPANY
CENTRAL ENGINEERING DEPARTMENT

NF-259-4 E

DS 00029743

MAXUS0998413

ITEM NO. F2U	DESCRIPTION	SPEC. NO. NPS 259-1	REF. DWGS. DET. DWG.	REF. DWGS. REV. SHEET	REQUISITION NO.	REQUISITION DATE	PUR. ORDER NO.	PUR. ORDER DATE	VENDOR	LOCATION	REMARKS	VENDOR'S DWGS.
501-PSD	RUPTURE DISCS-	PAGE-37	NF259-1 Det. 4	1	EG3328	7/4	G70493	11/8	BLACK SIVALLS & BRYSON	F2-R101		
02-PSD		37	"	1	"	"				F2-R102		
03-PSD		38	"	1	"	"	G66602	8/24/60	JAY INSTRUMENT	F2-R101		
04-PSD		38	"	1	"	"				F2-R102		
05-PSD		—	—	—	—	—	—	—	—	F2-D212	EXISTING	
06-PT	PRESSURE TRANSMITTERS	1	NF259-11 Det. 7	1	EG3324	7/15	G66605	8/23/60	BRISTOL CO.	F2-R101		
07-PT	" "	1	NF259-11 Det. 7	1	EG3324	7/15				F2-R102		
08-TCV	TEMPERATURE CONTROL VALVE	—	—	2						—	—	
09-PS	PRESSURE SWITCH (A&B)	42	NF259-11 Det. 7	1	EG3319	7/15	G64868	7/22	BARKSDALE	F2-R101		
510-PS	" " "	42	NF259-11 Det. 7	1	"	"	"	"	"	F2-R102		
11-PS	" "	60	NF259-11 Det. 8	1	EG3332	7/20	G-66094	8/17/60	BARKSDALE VALVES	F2-3-13		
12-SV	SOLENOID VALVE	28	NF259-13 Det. 1	1	EG3315	7/15	G64867	7/22	ASCO	OPERATES REV 303, 10, 12 & 14		HVA 43-778
13-SV		28	NF259-13 Det. 12	SEE NOTE	"	"	"	"	"	F2U-SHEET NF 200-6	REPLACES F2U957-SV	do.
14-SV		28	NF259-13 Det. 1	1	"	"	"	"	"	OPERATES REV 303, 11, 12, 15		do.
15-SV		28	NF259-13 Det. 13	SEE NOTE	"	"	"	"	"	F2U-SHEET NF 200-6	REPLACES F2U964-SV	do.
16	—	—	—	—	—	—	—	—	—	—	—	
17	—	—	—	—	—	—	—	—	—	—	—	
18-LG	LEVEL GAGE GLASS (A&B)	21	NF 290-10 Det. 4	1	EG3322	7/28	G66601	8/23/60	Jerguson Gage & Valve	F2-R201		
19-LG	(A,B&C)	23	Det. 7	1	"	"				F2-T120		
520-LG	(A&B)	22	Det. 2	1	"	"				F2-T109		
21-LG	(A&B)	21	Det. 6	1	"	"				F2-T111		
22-LG		22	Det. 1	1	"	"				F2-T113		
23-LG	(A&B&C)	22	Det. 10	1	"	"				F2-T114		
24-LG		22	Det. 1	1	"	"				F2-D116		
25-LG	(A&B&C)	46	Det. 7	2	"	"				F2-T215		
26-LG	(A&B) (C)	46	Det. 8 Det. 3	2	"	"				F2-D212	USE LG-5366 ON F2-T608	
27-	AIR SWITCH	—	NF259-12 Det. 1	1	EG3366	10/26	G70491	11/8/60	FOXBORO	NEAR PANEL		
28-	AIR SWITCH	—	"	1	EG3366	10/26	G70491	11/8/60	FOXBORO	" "		
29-LI	LEVEL INDICATOR	—	NF259-12 Det. 12	1	EG3343	8/26/60	G67688	9/28	PETROMETER CORP	F2-T805		
530-LT	LEVEL TRANSMITTER	~~28~~	NF259-12 Det. 9	2	—	—	—	—	—	F2-T105	EXISTING	—
31-LT	LEVEL TRANSMITTER	29	NF259-12 Det. 9	2	EG3313	7/15	G65714	8/5	CONOFLOW CORP			A21-1
32-LI	LEVEL INDICATOR	26	NF259-12 Det. 15	2	EG3343	8/26/60	G67688	9/28	PETROMETER CORP.	F2-T301 & 302		
~~33-LI~~	~~LEVEL INDICATOR~~	—	—	~~1~~	~~EG3343~~	~~"~~	—	—	—	—	CANCELLED	—
34	—	—	—	—	—	—	—	—	—	—	—	—
35	—	—	—	—	—	—	—	—	—	—	—	—

DWG.	DATE	APPRO. NO.
A	1-26-60	
B	9/28/60	
C	11/17	
D	3/23	

APPROVED FOR CONST. [signature] DATE 8-26-60

DRAWN: [signature] DATE 4/20/60

ASSOCIATE ENGINEERS
ENGINEERS INC
NEWARK N.J.

APPROVED [signature] CONTRACT

PLANT NEWARK N.J. DIV. CHLORINATED PRODUCTS

SODIUM TCP UNIT

DIAMOND ALKALI COMPANY
CENTRAL ENGINEERING DEPARTMENT

1F-259-5

DS 00029724

MAXUS0998414

ITEM NO.	DESCRIPTION	SPEC. NO.	REF. DWGS.	PURCHASE ORDER NO.	PURCHASE ORDER DATE	VENDOR	LOCATION	REMARKS
F206 01	Purge Meters	MCC-20			5/5/60	Fischer & Porter		
602								
603								
4	Not Used							
5								
6								
7	(LI) IND'G. Pneumatic Receiver						PZ-F206	Existing
8	LI - IND'G. Pneumatic Receiver				8/16/60	Jay Instrument (Hydrin)	PZ-F208	
9	Not Used							
610	Instrument Air Dryer							Cancelled
11	Not Used							
12								
613	PT Pressure Transmitter				8/4/60	Foxboro	PZ-25 (B-108) PZ-125 (P-106)	
614	PT " "						Water Line to R-101	Transit Bypass Line 8-30 Pipe
615	PI - Press. Indicator						PZ-D212	Existing
616	PSO - Pressure Switch						Air Line at Pump Room	Relocated at Plant Service
617	PI - Press. Indicator						Air Line at Water Line to R-102	8-150 Pipe
618	PI - Press. Indicator							Provided at Plant Service
619	PI - Press. Indicator							8-52 Pipe
F20 620	FG - Flow Glass				8/5	Fischer & Porter	PZ-E32	
21	Not Used							
22								
F20 623								
624	TCV - Temp. Control Valve				8/19/60	Leslie Co.	Plenum	
F20 625	PI - Press. Indicator				8/4/60	Jay Instrument	Air Line	
626	PI " "				8/4/60	Jay Instrument	PZ-D213	
627	PA - Temp. Alarm				8/4/60	P. G. Davis Co.	C-D211	
628	RCV - Flow Control Valve				8/4/60		Air Line	
629	FI - Press. Indicator				8/18/60	Panel Vibr. Engrs.	Panel	Added for Central Plant Panel
630	FI " "				8/18/60	Panel Vibr. Engrs.	Panel	
631	FCV - Flow Control Va.				8/4/60	Panel Quincy	Panel	
632	FG - Flow Glass						C-F101	
633	FG - Flow Glass				8/18	Brooms Wise	PZ-D214	
634					8/18		PZ-D215	
35	Not Used							
36	TR - Temp. Recorder		12	10/5/60	11/7/60	Bristol	PZ-D216	Enclosure

REV.	DATE	NO.	REVISED	DATE	APPROVED
A	11-10-60				
B	11-16-60				
C	11-17-60				
D	11-18-60				

ASSOCIATE ENGINEERS, INC.
NEWARK, N.J.

PLANT ENGINEERING DIV.

SODIUM TCP UNIT

DIAMOND ALKALI COMPANY

6-20-60
6-27-60
7-26-60
6050-45

NF-259-A

D1

DS 00029725

MAXUS0998415

ITEM NO.	DESCRIPTION	APPROX WEIGHT	SPEC. NO.	REF. DWGS.	REQUISITION NO.	REQUISITION DATE	PUR. ORDER NO.	PUR. ORDER DATE	VENDOR	EXISTING	REMARKS
F2 R 101	TCP Autoclave	35,000#	NFS-255-1		EG-3290	5-3-60	G61309	5-9-60	McGREGOR-MICH CORP D-694	1000 GAL	5' Dia. x 6'-6" T.T. +Jacket 750 psi Design
F2 R 102	TCP Autoclave	35,000#	NFS-255-1				"	"	"	"	5' Dia. x 6'-6" T.T. +Jacket 750 psi Design
F2 A 103	TCP Autoclave Agitator		NFS-255-1	G-61475			G61475	5-17-60	MIXING EQUIP. CO.	—	125 RPM (4) FAN BLADES
F2 RA 103	Reducer		NFS-255-1							—	
F2 MA 103	Motor		NFS-255-1							—	7½ HP
F2 A 104	TCP Autoclave Agitator		NFS-255-1							—	125 RPM (4) FAN BLADES
F2 RA 104	Reducer		NFS-255-1							—	
F2 MA 104	Motor		NFS-255-1							—	7½ HP
F2 T 105	Tetrachlorobenzene Melt Tank	18,000#							NICKEL CLAD 300 FT(2) SCHED-40 6"DIA-6" PITCH	E	9' DIA. x 25'-6" Fig. only Hds. (5/16" STL.) 12,000 GAL
F2 P 106	TCB Pump (CHARGE)		NFS-258-2		(EXIST.	PER F.	KENNEDY)		LAWRENCE (RB-H)	E	1½ x 2 - 90 GPM - 68 FT. HD.
F2 MP 106	Pump Motor		NFS-258-2		("	"	")			E	3HP GE (FRAME 28) 1750 RPM (X.P)
F2 T 107	TCB Charge Tank	900#	"							E	300 GAL. 36" DIA. x 72" O.A. (½" STL)
F2 P 108	METHANOL CAUSTIC FEED PUMP		NFS-258-11		(EXIST	PER F.	KENNEDY)		HILLS McCANNA M3M-2E	E	2½ KB PROPORTIONING (MAX 13.7 GPM - MIN 13.7 GPM)
F2 MP108	Pump Motors		NFS-258-11		(EXIST	PER F.	KENNEDY)			E	5 HP 1725 RPM GE KP
F2 T 109	Anisole Drop Tank	1100#	NFS-221-1		EG-3295	5-20-60	G62083	5-26-60	500 GAL	—	3' Dia. x 6' long Fig. Heads only, 5/16" wall
F2 H 110	TANK HEATER FOR T-111		FIELD FABRICATE	NF-231-10						—	
F2 T 111	Methanol-Caustic Feed Tank	1900#	NFS-221-3		EG-3302	6-9-60	64171	6-30-60	BUFFALO TANK	—	700 Gals, 48" x 84" FLG HDS. (3/8" WALL)
F2 H 112 A&B	Methanol Condensers	A B	NFS-251-7							(E)	[illegible]
F2 T 113	Crude Methanol Receiver	1700#	NFS-221-2		EG-3296	5-23-60	G64171	6-30-60	600 GAL.	—	4'-0" Dia. x 5', 3/8 wall, cone bottom
F2 T 114	Crude Methanol Storage	4000#							EXIST. #1160	E	1700 GAL, 5' DIA x 11'-10" FLAT HD.
F2 P 115	Methanol Still Feed Pump		NFS-258-10		EG-3309	7-11-60	G65676	8-5-60	CHEMPUMP	—	CF ¾
F2 MP 115	Pump Motor		NFS-258-10		EG-3309	7-11-60	G65676	8-5-60		—	½ HP
F2 D 116	Methanol Redistillation Still	7000#	NFS-255-1&2		EG-3298	5-23-60	G64591	7-11-60	McGREGOR-MICH.	—	14" x 16' packed column, 48" x 34" dia. x 5' STL. BOTTOMS [illegible]
F2 H 117	Methanol Still Condenser		NFS-251-1		EG-3299	5-23-60	G64962	7-19-60		—	
F2 T 118	Methanol Still SPLITTER	150#	FIELD FABRICATE	NF-231-13	—		—		14 GAL.	—	Reflux Splitter 12" Dia. x 84"
F2 H 119	Methanol Cooler		NFS-251-6							E	Double pipe
F2 T 120	Methanol Receiver	4000#							EXIST 1151	E	1000 GAL, 4' DIA 11'0" DISH. HD.
F2 P 121	CRUDE Methanol Pump		NFS-258-9		(EXIST.	PER. F.	KENNEDY)			E	CHEMPUMP 1CP
F2 MP 121	Pump Motor		NFS-258-9		("	"	")			E	¾ HP
F2 M 122	CAUSTIC LOADING HOIST		NFS-257-1	-	EG-3310	7-12-60	G65651	8-4-60	ESSEX CONVEYORS	—	DRUM SKIP HOIST
F2 MP 122	CAUSTIC LOADING HOIST MOTOR										
F2 H 123	Methanol Still Reboiler		NFS-251-2		EG-3297	5-23-60	G64961	7-19-60		—	800,000 BTU/HR, 5' tubes MONEL
F2 G 124	FLAKE CAUSTIC VANE FEEDER				(EXIST.	PER F.	KENNEDY)		METAL & DISINTEGRATING CO. INC.	E	12 VANE FEEDER ROTOR 45 R(P)1 @ 0.10 CU.FT/R
F2 MC 124	FLAKE CAUSTIC FEEDER MOTOR				("	" "	")		" "	E	1.1 RPM (MIN) — 2.8 RPM (MAX.)
F2 T 125	FLAKE CAUSTIC HOPPER & ADAPTER		ORD. BY PLANT	NF-231-10	EG-3334	7-19-60	G666074 WO 3849	10-17-60 8-5-60			10 CU.FT.

DWG.	DATE	APPRO. NO.
A	6/8/60	
B	11/11/60	3

APPROVED FOR CONST. [signature] DATE 6/24/60

DRAWN HT DATE 5-13-60

CHECKED ARC [signature] DATE 5-13-60

ASSOCIATE ENGINEERS
ENGINEERS INC.
NEWARK PP-31 REV.3

APPROVED 7/27/60 [signature]
DATE 6/24/60

CONTRACT 605028

PLANT NEWARK DIV. CHLORINATED PRODUCTS

T.C.P.

EQUIPMENT LIST

DIAMOND ALKALI COMPANY
CENTRAL ENGINEERING DEPARTMENT

NF-201-1 DS 00029726 B

SHEET 1 OF 5

MAXUS0998416

ITEM NO.	DESCRIPTION	APPROX WEIGHT	SPEC. NO.	REF. DWGS.	REQUISITION NO.	REQUISITION DATE	PUR. ORDER NO.	PUR. ORDER DATE	VENDOR	EXISTING	REMARKS
F2 B 201	Methanol & Caustic Mix Tank	10,000#	NFS-255-2		EG-3291	5-3-60	662083	5-27-60	2250 GAL	—	6'-6 Dia. x 7'-9 T.T. +Jacket, atmos.
F2 A 202	Methanol & Caustic Mix Tank Agitator		NFS-255-2		EG-3291	5-3-60	663121	6-14-60		—	
F2 RA 202	Agitator Reducer		NFS-255-2		do		do			—	
F2 MA 202	Agitator Motor		NFS-255-2		do		do			—	3 HP
F2 H 203	Mix Tank Vent Condenser		NFS-251-3		EG-3308	7-11-60	664963	7-19-60		—	Double Pipe (EQUAL TO ROSS BCF 7M602DI)
F2 P 204	Methylate Transfer Pump		NFS-258-4		(EXISTING PER		F. KENNEDY)		WORTHINGTON	E	1½ CF
F2 MP 204	Pump Motor		NFS-258-4		("	"	")			E	2 HP
F2 T 205	Methanol Storage Tank	10,000#							EXIST. 1137	E	6'-9" DIA x 35' HORIZ. (EX. R.R. CAR) 9900 GAL
F2 P 206	Methanol Transfer Pump		NFS-258-3		(EXISTING PER		F. KENNEDY)		WORTHINGTON	E	1½ CF
F2 MP 206	Pump Motor		NFS-258-3		("	"	")			E	2 HP
F2 P 207	TCB Unloading Pump		NFS-258-1		(EXISTING PER		F. KENNEDY)		LAWRENCE	E	2" x 1½
F2 MP 207	Pump Motor		NFS-258-1		("	"	")			E	5 HP
F2 T 208	Crude NaTCP Holding Tank	11,000#		EXIST. NO. 1133					4000 GAL.	E	120" DIA. x 7'-8" T.T. DISHED HEADS
F2 A 209	Crude NaTCP Holding Tank Agitator								EXIST. M-6	E	120" ø x 7'-6"
F2 RA 209	Reducer									E	
F2 MA 209	Motor									E	5 HP
F2 P 210	Crude NaTCP Pump		NFS-258-5		(EXISTING PER		F. KENNEDY)		WORTHINGTON	E	1½ CF
F2 MP 210	Pump Motor		NFS-258-5		("	"	")			E	3 HP
F2 H 211A/B	Anisole ~~xxxx~~ ~~xxx~~ STILL HEATERS									E	(A) U TUBE (B) PIPE
F2 D 212	Anisole Still ~~Pot Heaters~~	11,000#		EXISTING M-17						E	8'ø x 32'-8½ OA
F2 P 213	36% TCP Pump		NFS-258-6		(EXIST. PER		F. KENNEDY)		AURORA	E	1¼ x 1½ - 7BJP
F2 MP 213	Pump Motor		NFS-258-6		("	"	")			E	5 HP
F2 H 214	Anisole Condenser									E	19¼" ID SHELL, 13'-9" OA.
F2 T 215	Anisole Receiver	4000#								E	1000 GAL, 4' DIA + 10' DISH HD.
F2 P 216	Anisole Pump		NFS-258-8		(EXIST. PER		F. KENNEDY)		CHEMPUMP	E	¾ CF
F2 MP 216	Pump Motor		NFS-258-8		("	"	")			E	2 HP
F2 H 217	ANISOLE RECEIVER HEATER		FIELD FABRICATE	NF-231-10						—	U-20
F2 H 218	HEATER FOR TANK F2 T 501									E	
F2 H 219	HEATER FOR TANK F2 T 503									E	
F2 F 220	36% TCP FILTER	2000#	NFS-254-1		EG-3303	6-27-60	665584	8-3-60			
F2 T 221	BLOW LINE DISCHARGE PIT		FIELD FABRICATE	NF-213-1							
F2 T 222	PROCESS SUMP		FIELD FABRICATE	NF-214-1							

DWG.	DATE	APPRO. NO.
A	6/8/60	
B	11/8/60	

APPROVED FOR CONST. [illegible] DATE 6/24/60

DRAWN HT DATE 5-13-60

APP. [illegible] 5-61 5-13-60

ASSOCIATE ENGINEERS
ENGINEERS, INC.
NEWARK PP-3B REV.3

APPROVED [illegible] DATE 6/24/60

CONTRACT 605028

PLANT NEWARK

DIV. CHLORINATED PRODUCTS

TCP

EQUIPMENT LIST

DIAMOND ALKALI COMPANY
CENTRAL ENGINEERING DEPARTMENT

NF-201-2 DS 00029727 B
SHEET 2 OF 3

MAXUS0998417

ITEM NO.	DESCRIPTION	APPROX. WEIGHT	SPEC. NO.	REF. DWGS.	REQUISITION NO.	REQUISITION DATE	PUR. ORDER NO.	PUR. ORDER DATE	VENDOR	EXISTING	REMARKS
F2 T 301	25% TCP Tank	13,000#					NEW TOP REQUIRED		EXIST. 1146	E	15,000 GAL, 10'-6" DIA X 26'-8"
F2 P 302	25% TCP Pump		NFS-258-7		(EXISTING	PER F.	KENNEDY)		WORTHINGTON	E	1½ CF
F2 MP 302	Pump Motor		NFS-258-7		("	"	")			E	2 HP
F2 T 303	25% TCP Tank	13,000#					NEW TOP REQUIRED		EXIST. 1161	E	15,000 GAL, 10'-6" DIA - 26'-8"
F2 P 304	25% TCP Pump		NFS-258-7		(EXISTING	PER F.	KENNEDY)		WORTHINGTON	E	1½ CF
F2 MP 304	Pump Motor		NFS-258-7		("	"	")			E	2 HP
F2 H 305	CRUDE NaTCP HOLDING TANK HEATER				(EXISTING PER F. KENNEDY)					E	Bayonet
F2 P 306	METHANOL CAUSTIC FEED PUMP		NFS-258-21		EG-3326	7-19-60	G65386	8-2-60	HILLS McCANNA	—	K3M-2F 2½x3" TWO FEED
F2 MP 306	FEED PUMP MOTOR		NFS-258-21		EG-3326	7-19-60	G65386	8-2-60	" "	—	
F2-U 307	AUTOCLAVE CONTROL PANEL		NFS-259-2		EG-3332	7-25-60	G66606	8-24-60	PANEL-OVEN	—	

DWG.	DATE	APPRO. NO.
A	4/8/60	
B	8/11/60	2

APPROVED FOR CONST. [signature] DATE 6/24/60

DRAWN HT DATE 5-13-60

CHECKED ARC [signature] DATE 5-13-60

ASSOCIATE ENGINEERS
ENGINEERS INC.
NEWARK PP-39 REV.3

APPROVED [signature] DATE 6/27/60

DATE 6/24/60

CONTRACT 605028

PLANT NEWARK

DIV. CHLORINATED PRODUCTS

TCP

EQUIPMENT LIST

DIAMOND ALKALI COMPANY
CENTRAL ENGINEERING DEPARTMENT

NF-201-3 DS 00029728 B

SHEET 3 OF 3

MAXUS0998418

Specification NFS-255-1

Specification

For

T. C. P. Autoclave

Item - F2 - R101
F2 - R102

Diamond Alkali Company

Central Engineering Department

Cleveland, Ohio

Appropriation Number

April 4, 1960

Prepared: H. V. Jackson Date 4/5/60
H. V. Jackson

Checked: J. R. Siemoneit Date 4-5-60
J. R. Siemoneit
Project Engineer

Approved: R. C. Sutter Date 4/6/60
R. C. Sutter
Director of Engineering

DS 00029729

VESSEL SPECIFICATIONS

SPEC. NO. NFS-255-1	APPROP. NO.		
REQ. NO.	J.N. NO.		
ENGINEER H.V. JACKSON	DATE 3/25/60		

NAME OF ITEM: TCP AUTOCLAVE

R.B.'S: F2-R101 & R102	NUMBER REQUIRED: 2	LOCATION: NEWARK	
NOMINAL SIZE: 5'-0" I.D. X 6'-6" TAN. TO TAN.		CODE: ASME VIII MSM STAMPED	
OPER. PRESS: 375 PSIG	DESIGN PRESS: 750 PSIG @ 450°F	OPER. TEMP.: 340°F	DESIGN TEMP.: 450°F
SELF SUPPORTING: YES	STRESS RELIEVE: YES	RADIOGRAPH: YES	

COMPONENT	SPECIFICATIONS	CORR. ALLOW.	TOTAL THICK.
SHELL	ASTM A-212 B FIREBOX	1/8"	
HEADS ASME ELLIPTICAL	ASTM A-212 B FIREBOX	1/8"	
SUPPORTS	A-7 OR A-283 C	0	

INSULATION 2 INCH BY OTHERS

QUAN.	NOZZLE	MK.	SIZE	DESCRIPTION
1	MANHOLES	A	16"	ALL FLANGES TO BE
1	SAFETY VALVE	B	4"	ASTM-A105 GRADE 1
1	RUPTURE DISC	C	6"	600# ASA FLANGE
1	AIR & WATER	D	2"	FEMALE, BOLTING
1	THERMOWELL	E	2"	TO BE ASTM-A193
1	AGITATOR MOUNTING FLANGE	F	12"	GRADE B7.
1	BLOW LEG	G	3 & 2"	
1	VAPOR LINE	H	3"	
1	TCB CHARGE	J	1"	
1	METHYLATE CHARGE	K	2"	

JACKET CONNECTIONS NOTE (6)

1	STEAM	L	2"	300# ASA R.F. SLIP ON FLANGE & PIPE
1	CONDENSATE	M	2"	FLANGES - ASTM A-181 GR I PIPE ASTM A 106 B
1	WATER IN	N	2"	(FOR ALL JACKET FLANGES)
1	WATER OUT	P	2"	
1	PRESSURE GAGE	Q	3/4"	3000# FORGED STEEL SCREWED COUPLING

NOTES

1) VESSEL TO BE SELF SUPPORTING. VENDOR TO SPECIFY SUPPORT DESIGN. SEE DETAIL I

2) FOUR BAFFLES, 5'-0" x 4" x 1/4" TO BE ATTACHED AS SHOWN

3) NOZZLE "F" TO BE REINFORCED TO SUPPORT AGITATOR, MOTOR AND REDUCTION GEAR. SEE SHEET 2, THIS SPECIFICATION FOR AGITATOR DETAILS.

4) FURNISH 16" 600# ASA R.F. BLIND FLANGE FOR MANWAY COVER.

5) NOZZLES "B" THRU E AND "G" THRU "K" TO BE ARRANGED WITH THEIR ℄S IN A CIRCLE AROUND THE VERTICAL ℄ OF THE VESSEL. ORIENTATION TO BE DETERMINED LATER.

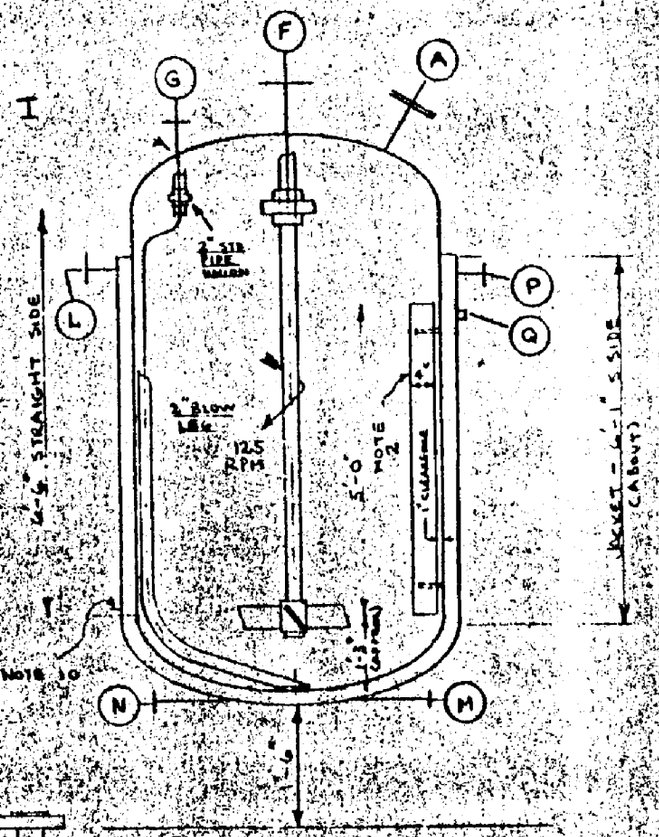
6) JACKET CONDITIONS
OPERATING TEMP. 406°F
OPERATING PRESS 250 PSIG
TEST PRESS 350 PSIG

7) VESSEL TEST PRESSURE - 1125 PSIG

8) GASKETS - 1/8 INCH THICK SPIRAL WOUND TYPE GASKETS.

9) 1/8" CORROSION ALLOWANCE WILL BE IN ADDITION TO THICKNESS REQUIRED FOR 750 PSIG DESIGN PRESSURE.

10) 1½" INSULATION SUPPORT RING, CONTINUOUS WELD.



DETAIL - I

DS 00029730

MAXUS0998420

This specification covers agitation units to be used in the two jacketed autoclaves shown in the attached sketch. The units shall include the following:

Motor Drive

7½ H.P. Class I, Group D explosion proof 220/440 volt, 3 phase, 60 cycle.

Speed Reducer

Adequately rated to handle the load conditions herein specified with an output rpm of 125.

Stuffing Box

A completely external water-cooled stuffing box which can be removed and replaced with a spare unit without removing the agitator from the vessels. The assembly should be designed so that the stuffing box can be replaced with an external balanced double mechanical seal later if this is desired.

The stuffing box will be installed on a vessel with a design pressure of 750 psig. The design of the stuffing box body and flanges should be for this pressure.

Mounting

The vessel agitator opening will be a 600# ASA flange with large female facing. The agitator assembly shall be mounted on a 600# ASA raised face flange. The attached vessel sketch calls for a 12" agitator mounting flange. Vendor should advise if a different size nozzle is desirable.

The materials to be agitated will have a maximum specific gravity of 1.35. No solids are present. The function of the agitation is to intimately mix incoming reactants with the mass of the liquid in the autoclave to prevent localized overheating of the reactants. Equally important is the necessity of circulating the contents of the vessel past the heat exchange surface (the vessel walls and bottom head) at a rate sufficient to insure a good heat transfer rate.

Vendor is to specify the type and size of the impeller. Shaft should be unsupported.

An identical autoclave in the same service is equipped with a six-bladed pitched turbine impeller 21½" in diameter, the blades being 5" x 8", pitched at 45°. The shaft rotates at 125 rpm. This agitator has given satisfactory service.

Please make an alternate quotation for a unit with a double external balanced mechanical seal, complete with a lube oil system at a pressure of 600 psig.

HVJ:sld
4/4/60

NS-918-2

FIRST FLOOR PLAN

DOOR SCHEDULE

WINDOW SCHEDULE

ROOF PLAN

Notes

DS 00029732

REFERENCE DRAWINGS

ASSOCIATE ENGINEERS

ENGINEERS

NEWARK, NEW JERSEY

NS-918-2

DIAMOND ALKALI CO.

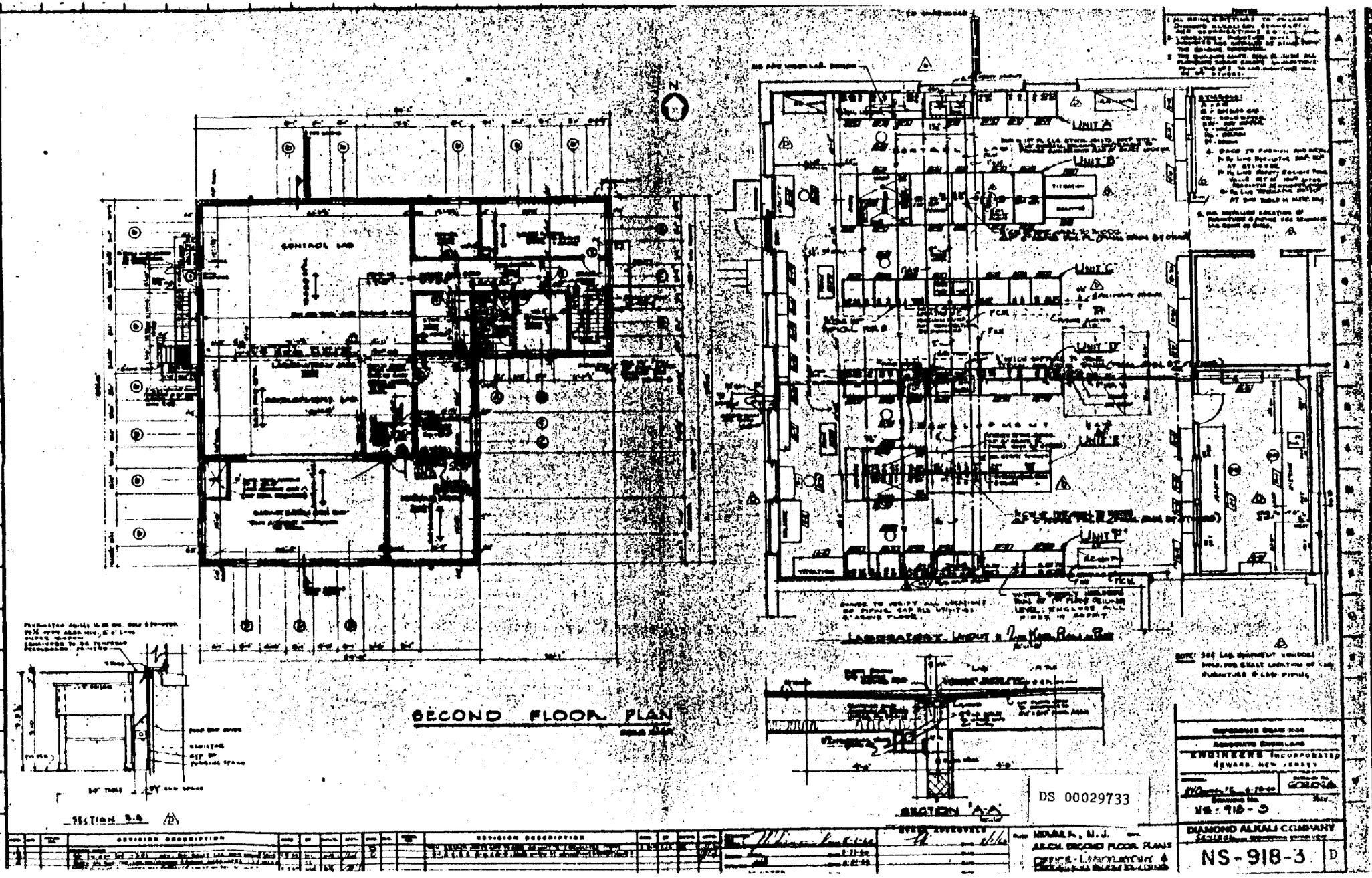
NEWARK, N.J.

ARCH. FIRST FLOOR PLAN

OFFICE LABORATORY & DRESSING ROOM BUILDING

NS-918-2

MAXUS0998422



MAXUS0998423