CEA 2080

SOLID AROCLOR

EXPANSION

Anniston, Alabama

CONFIDENTIAL

PROJECT MANUAL

Central Engineering Department

Monsanto

0613151

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CEA 2080

SOLID AROCLOR EXPANSION

Anniston, Alabama

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PROJECT MANUAL

Monsanto

Central Engineering Department

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Copy A

PROJECT ORGANIZATION AND PROCEDURE

CEA 2080

EIC 6079

SOLID AROCLOR EXPANSION - 20M LBS/YEAR

ORGANIC DIVISION

Anniston, Alabama

Project Manager - R. S. Yates

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R. E. Howard/R. M. Kountz
O. A. Klingler
J. L. Mathews/R. R. Cook
C. L. Parish
J. B. Phifer
L. H. Todd
H. E. Waldrep - Anniston
R. B. West/K. J. Johnston
R. S. Yates
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Organic Division

W. E. Voss - Anniston (2)

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TABLE OF CONTENTS

		Page No.
1.	INTRODUCTION	1
2.	DESCRIPTION OF FACILITIES	1
	2.1 General Description	1
	2.2 Specific Description	1
3.	PROJECT ORGANIZATION	1
4.	SECURITY	2
5.	CED-PLANT RELATIONSHIPS	3
6.	REVIEW AND APPROVAL	3
7.	DISTRIBUTION	4
8.	PROCUREMENT	4
9.	CONSTRUCTION	5
10.	ACCOUNTING	5
11.	PROJECT COMPLETION	6

APPENDICES

PROJECT ORGANIZATION CHART	Appendix 1
REVIEW AND APPROVAL RESPONSIBILITIES	" 2
DISTRIBUTION OF DESIGN INFORMATION FOR COMMENTS	" 3
DISTRIBUTION OF PROJECT INFORMATION	" 4
DISTRIBUTION OF VENDOR PRINTS AND DRAWINGS FOR APPROVAL	" 5
DISTRIBUTION OF VENDOR FINAL PRINTS, DRAWINGS, DATA	" 6
PROJECT DISTRIBUTION LIST	" 7

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1. INTRODUCTION

This document describes the organization and procedure for the design, procurement, construction and start-up of manufacturing facilities at Monsanto's Anniston, Alabama, Plant. Communication channels for approval and distribution of documents are established.

Any suggested corrections to this procedure shall be sent to the Project Manager and all revisions will be issued by him.

2. DESCRIPTION OF FACILITIES

2.1 General Description

This project provides for the expansion of the Solid Aroclor facilities of the Organic Chemicals Division at its Anniston, Alabama, Plant from the present 9.6M lbs/year to 29.6M lbs/year. The estimated costs are:

Capital	$1,100,000
Expense	90,000
Total	$1,190,000

Target completion date is January, 1970. Low capital cost is important to this project; however, a December, 1969, or earlier start-up even at some increased capital cost is desirable.

2.2 Specific Description

Aroclors are reaction products formed by the chlorination of biphenyl or terphenyl using an iron catalyst. The by-product HCl gas is absorbed in water. Crude Aroclors are produced in chlorination reaction vessels, air blown and distilled. Solid Aroclors are produced in chlorinator reaction vessels, air blown and distilled. They are drummed, flaked, or flaked and milled and packaged for shipment. Distillation residues are discarded as waste or sold as Montars. This project, to simplify control, will be considered as Area 1 in its entirety.

3. PROJECT ORGANIZATION

3.1 Process design and engineering design of all facilities are being done by CED.

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3.2 Procurement will be by CED. See Section 8 - Procurement.

3.3 All construction at the plant site will be done by construction contracts--either on a lump sum or cost basis. See Section 9 - Construction.

3.4 Cost accounting will follow CED procedures. See Section 10 - Accounting.

3.5 All project participants within CED should communicate freely with each other and should keep the Project Manager informed by copies of communications of significance.

Communications involving decisions, approvals or other action shall be through the key individuals named below:

Between CED and Organic Division

See Section 5 - CED Plant Relationships

Between Monsanto and Construction Contractor
H. E. Waldrep

4. SECURITY

4.1 Monsanto employees shall maintain the security of proprietary information in compliance with CED Procedure No. 27, "Security of Information." Members of CED, when visiting the plant site, shall comply with security requirements of the plant.

4.2 Arrangements for admission of contractor's employees connected with execution of this project will be made by Anniston, Alabama, management and the Field Construction Superintendent.

4.3 Permission to visit the plant site can be obtained from the following:

H. E. Waldrep, Field Superintendent - All Visitors
W. E. Voss, Manufacturing Liaison - All Visitors

4.4 Drawings, specifications, etc., will be issued to the contractors for construction by the Field Superintendent only. Reclaiming all such data from the contractors at the end of construction will be the responsibility of the Field Superintendent.

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5. CED-PLANT RELATIONSHIPS

5.1 Communications involving decisions, approvals or other action between CED and the Organic Division shall be through the key individuals named below:

R. S. Yates and W. E. Voss

5.2 Trips to the Anniston Plant should be kept to a minimum to conserve travel costs.

Trip itinerary copies shall be sent to the Project Manager and ACM Design Coordinator so that maximum information can be obtained on each trip.

Use the Plant Representative, W. E. Voss, or H. E. Waldrep, the Field Superintendent, to obtain field information as much as possible to minimize the number of trips to the field.

Trips to the plant should be cleared through the Project Manager, who will clear with the Plant Representative. After return to the office, a brief trip report should be issued summarizing accomplishments. Copies should be sent to the Project Manager, Design Coordinator, and Plant Representative and any others who need to know.

6. REVIEW AND APPROVAL

6.1 To prevent delays of project execution, comments arising from review of drawings or other documents must be transmitted to the Project Manager within five working days from receipt of material for plant personnel and three working days for CED personnel. Comments may be made by telephone, followed by written confirmation.

6.2 On documents requiring review or approval from the Organic Division, initials of W. E. Voss will indicate that concurrence of appropriate operating and maintenance personnel has been obtained.

6.3 Review and approval responsibilities for this project are shown in Appendix 2.

6.4 The originating design engineer will transmit copies of design information for design review in accordance with Appendix 3.

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7. DISTRIBUTION

7.1 The originator of specification data sheets, process data sheets or drawings will be responsible for the final distribution.

7.2 The Project Manager will issue approved documents to Project Manual holders only.

7.3 Distribution, including the number of copies of information generated for this project, is shown in Appendix 4.

7.4 Vendor prints for initial approval are distributed according to Appendix 5.

7.5 Vendor prints and data for final distribution are issued according to Appendix 6 and 7.

8. PROCUREMENT

8.1 The appropriate design engineer will initiate bid solicitations and purchase requisitions. Bids are generally solicited before design review is complete. However, design review shall proceed simultaneously with the bid solicitation.

8.2 All purchase orders for numbered equipment items will require the signature of the Project Manager. All other purchases will require his signature unless he specifically delegates this responsibility.

8.3 Instrument and electrical items will be purchased by the instrument and electrical engineers after approval of the respective design bases by the Project Manager. Exceptions will be for major items which will require the signature of the Project Manager.

8.4 The Material Control System for piping, instrument, and electrical material will be used on this project. The Materials Control Engineer for piping and for instruments and electrical will coordinate the activities involving the Materials Control System. Procurement of the following will be handled by CED at St. Louis:

8.41 All numbered equipment items

8.42 All instruments, including panel boards

8.43 All major electrical items, including feeder cables (if required), lighting fixtures, thermocouple wire, motor control center, transformers

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8.44 All structural steel, grating, floor plate, handrail and stair treads

8.45 All pipe, valves and fittings

8.46 Permanite waste disposal piping materials

8.5 Bill of materials for piping and electrical items will be furnished by the AC&M and EI&U design sections to the purchasing section.

8.6 Procurement of the following will be handled by the selected contractors subject to approval of the Construction Superintendent, H. E. Waldrep, and the CED Purchasing Manager:

8.61 Concrete and reinforcing steel

8.62 All building items

8.63 Backfill

8.64 Thermal insulation materials

8.65 Waste disposal piping materials other than Permanite

8.66 Sheet metal ductwork

8.67 All carbon steel pipe and fittings less than 1½"

9. CONSTRUCTION

9.1 Supervision of contract construction personnel will be exercised exclusively by H. E. Waldrep, Field Construction Superintendent. Contact with the Construction Contractor or their employees must be through H. E. Waldrep or his representative.

9.2 Shutdowns for tie-ins to existing equipment, steam mains, relocating instrument control panel shall be scheduled by agreement with Mr. Waldrep and Mr. Voss. Any delays in this area should be brought to the attention of the Project Manager.

10. ACCOUNTING

10.1 All field invoices, approved by the Construction Superintendent, shall be forwarded to the Project Accountant for payment by Monsanto.

10.2 Accounting procedures shall be those specified by C. R. Becker, Project Accounting Supervisor at St. Louis.

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11. PROJECT COMPLETION

11.1 Mechanical Completion

CED Procedure No. 125 outlines the general procedures and responsibilities for determining when facilities are mechanically complete to release to the Division for start-up.

Punch list procedures and records of mechanical testing to assure the facilities are mechanically complete will be developed jointly by the Project Manager and Construction Superintendent.

11.2 Process Simulation and Project Demonstration

The Organic Division has the primary responsibility for planning and performing the process simulation ("water batching") and for proving accomplishment of project objectives.

R. S. Yates will review these plans, participate in the process simulation and arrange for participation of other CED personnel as required.

11.3 Initial Operation

The Organic Division is responsible for the initial operation of the facility. This is the early chemical operation of the facility in which each unit of the plant is operated, debugged if necessary, and put on-stream. R. S. Yates will represent CED during this phase and will work out an agreement with W. E. Voss on correction of deficiencies made evident by initial operation.

11.4 Project Demonstration

The Organic Division will carry out the project demonstration which is a planned operational run of predetermined duration. The objective is to produce material at the quality, yield and rate as specified in the Process Manual and Project Manual and in complete accordance with safety standards.

R. S. Yates and W. E. Voss will work out an agreement on termination of CED participation. This will occur when progress toward meeting the project objectives has reached the point where further joint effort is not warranted. W. E. Voss will make the formal report.

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11.5 Project Closing

R. S. Yates will notify C. R. Becker, CED Accounting, when project demonstration has been completed and work out details of fiscal closing with Mr. Becker. Partial closures will be made when facilities are completed and placed in service.

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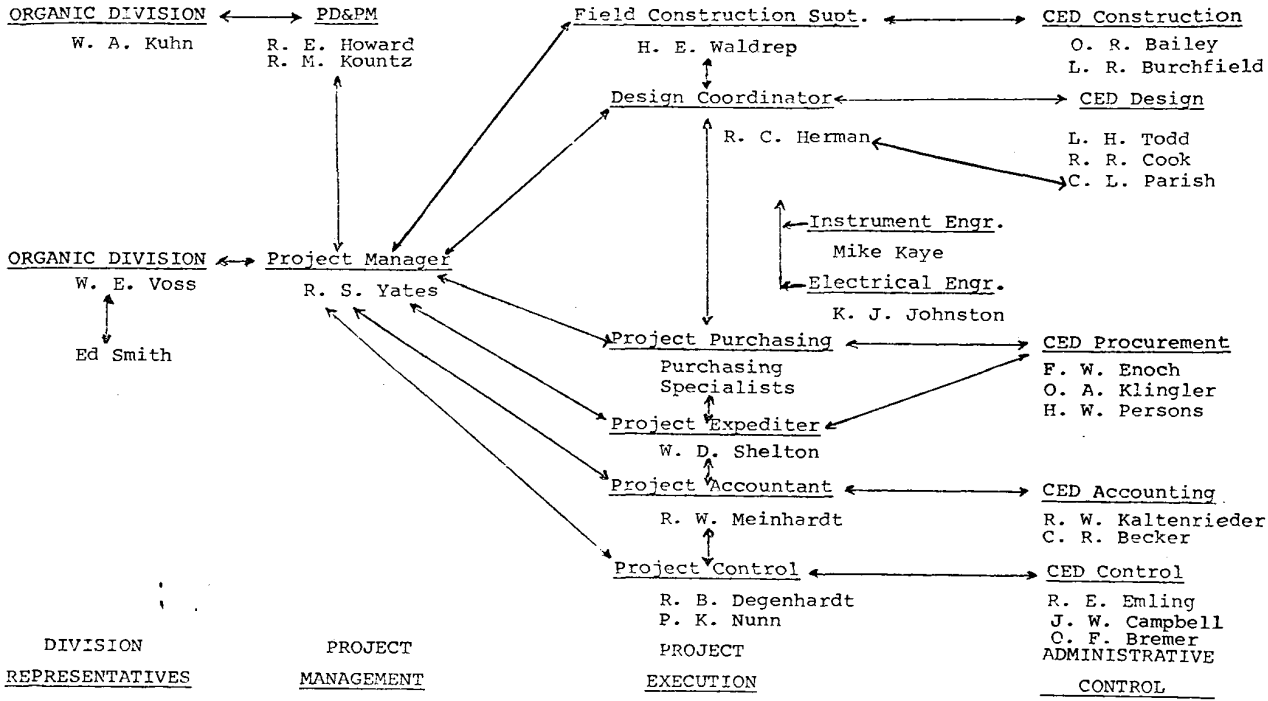
APPENDIX 1

PROJECT ORGANIZATION CHART



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APPENDIX 2

REVIEW AND APPROVAL RESPOSIBILITIES

A - Approve R - Review O - Originate	Project Manager R.S.Yates	ACM Design Coordinator R. C. Herman	ACM Design Engineer	EIU Design Coordinator R. C. Herman	Instrument Engineer Mike Kaye	Electrical Engineer K. J. Johnston	Division Representative W. E. Voss
GENERAL							
Design Basis	A,O						R
Arrangement Drawings	A,O	A		R		R	R
Scope Changes	A,O						R
PROCESS							
Engr. Flow Diagram	A,O				R		R
Perf. Data Sheets	A,O	R					R
Instr. Per Data Sheets	A				R,O		R
MECHANICAL & STRUCTURAL							
Equip. Specs.	A	R	A,O		R		R
Equip. Drawings	A	R	A,O		R		R
Foundation Drawings	A	R	A,O				R
Structural Drawings	A	R	A,O				R
Undergr. Util. Drawings	A	R	A,O				R
Piping Drawings	A	R	A,O		R		R
ELECTRICAL							
Electrical Drawings	A	R				A,O	R
Electrical Specs	A	R				A,O	R
INSTRUMENTATION							
Instrument Drawings	A	R			A,O		R
Instrument Specs	A	R			A,O		R
PROJECT EXECUTION							
Instrument Purchases	R				A,O		
Electrical Purchases	R					A,O	
ACM Purchases	A		O				
Cost Status Reports	R	R		R			
Project Schedule	A,O	R		R			R
Procur. Status Reports	R	R		R			
Construction Specs	A	R		R			
Construction Contracts	A	R		R			

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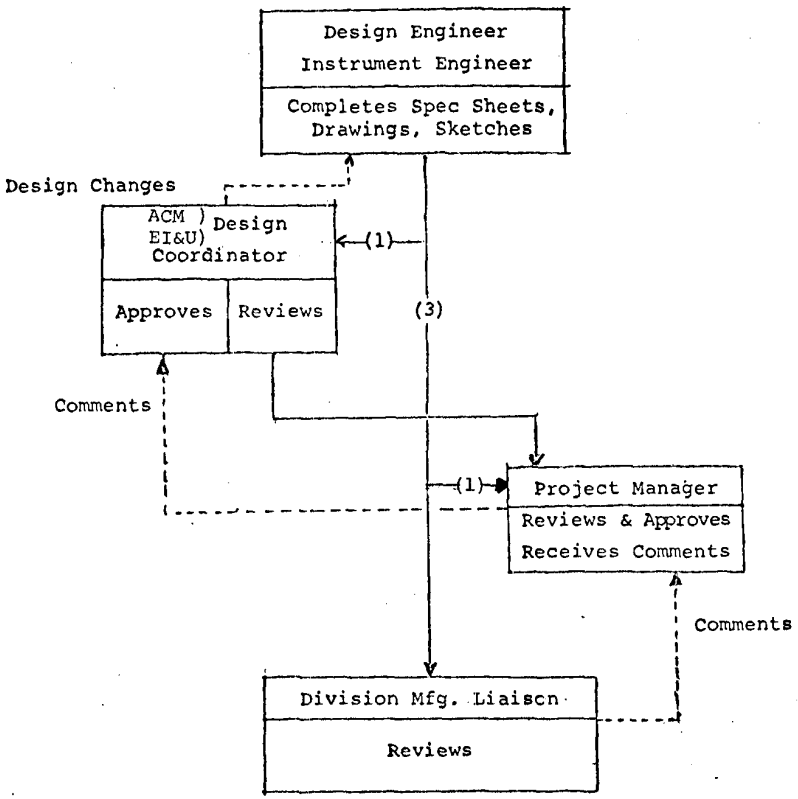
APPENDIX 3

DISTRIBUTION OF DESIGN INFORMATION FOR COMMENTS



Number in parenthesis is the number of copies distributed

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Central Engineering Department

Project Scope Report

Solid Aroclor Expansion

CEA 2080

New 20 M lbs./year Plant

Anniston, Alabama Plant

By: R. S. Yates
Central Engineering Department
January 14, 1969

0613165

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TOWOLDMON0048734

CEA 2080
Date: 1/16/69
By: R. S. Yates

TABLE OF CONTENTS

		Page No.
1.1	Project Scope Summary	1
	1.11 Title	1
	1.12 Synopsis and Project "Tone"	1
1.2	Process Technology	3
	1.21 Process Description	3
	1.211 Details of Process	3
	1.212 Yields and Raw Material Usage	3
	1.213 Process Documents	4
	1.22 Raw Materials	4
	1.221 Specifications	4
	1.222 Sources	5
	1.23 Products and By-Products	5
	1.231 Quality Considerations	5
	1.232 Specifications	5
	1.233 By-Products	6
	1.234 Packaging and Shipping	6
	1.24 Waste Streams	7
	1.25 Personnel, Property and Public Hazards	7
1.3	Manufacturing Facilities	9
	1.31 Description	9
	1.311 General	9
	1.312 Manufacturing Facilities	9
	1.32 Design Capacity	10
	1.33 Flexibility Requirements	10
	1.34 Future Expansion	11
	1.35 Physical Appearance	11
	1.36 Storage and Shipping Requirements	11
1.4	Utilities	12
	1.41 Utilities Summary	12
	1.42 Utilities Facilities	12

TOWOLDMON0048735

Appendices

A. Equipment Information Summary

B. Process Flow Diagram

C. Equipment Arrangement Study

D. Building and Site Requirements

E. Description of Work by Code of Accounts

F. Preliminary Schedule

G. Project Loss Prevention Report

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1.1 Project Scope Summary

1.11 Title

Aroclors - Increase Solid Aroclor Capacity - Organic Division at Anniston, Alabama Plant
CEA 2080

1.12 Synopsis and Project "Tone"

The objectives of this project are to

a. Provide new facilities to increase solid Aroclor plant capacity from 9.6 M lbs./year to 29.6 M lbs./year.

b. Provide an overall production capacity for solid Aroclors of up to 30% more than indicated in the latest sales forecast.

c. Provide for an orderly expansion of the solid Aroclor facilities.

d. Complete these facilities by December, 1969.

New facilities to be added are:

1. Two batch chlorinator systems consisting of a single terphenyl feed tank, two chlorination tanks with heat removal systems and one intermediate storage and blow tank.

2. An off-gas recovery system consisting of heat exchanger and surge tank to recover entrainment lossss from both chlorinator systems.

3. One batch distillation system consisting of still pot, external circulating system through a gas-fired heater, condensing and receiving equipment, and a high vacuum ejector.

4. Sufficient piping tie-ins to insure good operating flexibility with the existing batch system.

5. Expand the existing control room to provide sufficient space for instrumentation for the new facility.

6. Expand the existing Therminol heating system to provide proper distribution of hot fluid to the new facility.

7. Add drowning facilities at the HCl plant to drown the extra HCl gas produced from the chlorinators.

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8. A new elevator in Building 27.

9. A flaker for Aroclor 1268.

Sales forecasts indicate that we will be out of solid Aroclor capacity in 1969. The plant is carrying out a debottlenecking program which will allow us to meet most of our 1969 requirements. The new facilities should be operational by December 1969 or earlier if possible. A preliminary schedule shows that if we can start definitive engineering in January, these new facilities will be available for start-up in December 1969.

Full design capacity will not be necessary until after 1973. It is divisional policy in certain product groups to provide excess capacity over and above sales forecasts and we are providing a 31% excess capacity in these new facilities for 1973 based on the sales forecast of December 6, 1968.

Low capital cost is important to this project, however, schedules must be met for a December 1969 or earlier start-up even at some increased capital cost. There are no items that could be deferred from this project to a later date.

It is estimated that the cost of these new facilities will be:

Capital	$ 950,000
Expense	50,000
Total	$1,000,000

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1.2 Process Technology

1.21 Process Description

1.211 Details of Process

Aroclors are the reaction products formed by the chlorination of biphenyl and/or terphenyls using an iron catalyst. The by-product HCl gas produced is absorbed in water to produce muriatic acid. Solid Aroclors are produced in chlorinator reaction vessels, air blown and distilled. They are drummed, flaked, or flaked and milled and packaged for shipment.

Distillation residues are discarded as waste or sold as Montars.

Aroclors, when used as plasticizers and that crystallize at ambient temperatures are considered solid Aroclors. Below is a list of the Aroclor grades that are considered solid Aroclors:

Aroclor Designation	Starting Raw Material	Chlorination Level	Distilled
1268	Biphenyl	68%	Yes
2565	25% Santowax C 75% Biphenyl	65%	No
4065	40% Santowax R 60% Biphenyl	65%	No
4465	40% Santowax R 60% Biphenyl	65%	Yes
5060	100% Santowax R	60%	No
5460	100% Santowax R	60%	Yes
5042	100% Santowax R	42%	No
5442	100% Santowax R	42%	Yes

We intend to make only Santowax R based Aroclors in this new equipment.

1.212 Yields and Raw Material Usage

Yields are calculated for both chlorine and Santowax and/or Biphenyl. Based on cost standards of January 1, 1969 these are (% theory to standard):

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Aroclor Designation	On Chlorine	On Biphenyl	On Santowax C	On Santowax R
1268	73	73		
2565	96	96.2	96.2	
4465	73	73		73
5060	96			96
5460	82			85
5442	80.2			73

The yield on 5460 has not been demonstrated. Last year the standard yield on chlorine and Santowax R was 73.5%

Lime and Ferric chloride are added to all products as follows:

	Lbs./100 Lbs. Aroclor
Lime	1.000
Ferric Chloride	0.020

1.213 Process Documents

"Standard Manufacturing Process for Aroclors Anniston Plant" September, 1966, M. J. Williams

"Standard Operating Instructions for Aroclors Anniston Plant" November, 1968, M. J. Williams

1.22 Raw Materails

1.221 Specifications

Raw material specifications, as listed below, are appended.

Material Code	Date	Material
33500	2/26/57	Ferric Chloride Anhydride
83601	11/18/65	Biphenyl
82910	3/9/66	Santowax "C"
82602	3/2/66	Santowax "R"
82638	8/31/66	Chlorine Gas
38800	7/20/66	Lime Hydrate

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1.222 Sources

Biphenyl

Biphenyl is stored in horizontal tanks in the Biphenyl Area and pumped on demand into the Terphenyl Mix Tank.

Ferric Chloride

Received from the warehouse in 100 lb. kegs.

Chlorine

Received from tank cars and the chlorine plant. In 1969 the chlorine plant will be shut down and the entire supply will be from 44, 55 or 90 ton tank cars shipped into the plant. Liquid chlorine will be vaporized and transferred as a gas to the department area.

Lime Hydrate

Received from the warehouse in 50 lb. bags loaded on palettes.

Santowax "C"

Received from the continuous biphenyl stills on demand through a transfer line.

Santowax "R"

Received from a 50,000 gallon storage tank, heated west of the HB40 department, on demand, through a transfer line. Santowax "R" is obtained from the continuous Santowax still in the Biphenyl refining area.

1.23 Products and By-Products

1.231 Quality Considerations

Aroclor 5460 has a color and softening point specification which because of the nature of the process gets out of control on occasion. Color is more of a problem than softening point.

1.232 Specifications

Finished goods specifications, as listed below, are appended.

TOWOLDMON0048741

Product Code	Date	Product
82616	3/11/66	Aroclor 1268
82618	3/11/66	Aroclor 2565
82619	3/11/66	Aroclor 4465
82620	3/11/66	Aroclor 5060
82622	3/11/66	Aroclor 5460
82621	3/15/66	Aroclor 5442

1.233 By-Products

HCl gas is a by-product of the chlorination reaction and can be absorbed in water to produce muriatic acid or sewered and neutralized with limestone.

Residues from the distillation are drawn off to drums and sold as Montars or discarded. Listed below are data on the Montars.

Montar No.	Aroclor	Softening Point Range	Calcium Oxide
5	5460	155-195°C	1.6%
6	4465	135-190°C	2.0%
7	1268	200°C	
8	5442		

The plant is considering the flakering of Montars in order to change the product form.

Latest sales forecast, November 27, 1968, indicates sales requirements for the solid Montars as follows for the year 1969:

Montar 5	180,000 lbs.
Montar 5 crushed, dom.	400,000 lbs.
Montar 5 crushed, inter.	80,000 lbs.
Montar 6	50,000 lbs.

1.234 Packaging and Shipping

Container Weights

Material	Weight - lbs.	Container	Form
1268	200	41 gal. fibre drum	Flakes
2505	50 and 500	5 and 40-gal. drums	Solid
4465	50 and 500	5, 40 and 55 gal. drums	Solid
5060	50 and 100	paper bags	Flakes
5460	50 and 100	paper bags	Flakes
5442	50 and 450	5 and 40 gal. drums	Solid

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1.24 Waste Streams

Approximately 2200 gallons of Montar 5 will be produced daily with an approximate composition as follows:

Chlorine	57-59%
Iron	0.12%
Calcium Oxide	1.6%

Some of this material is sold, the remainder is put in drums and taken to the toxic dump. The plant has a project to pump these waste materials to Cleghorn's lake, a sump used for residue disposal.

An additional 70,000 lbs. of HCl gas will be produced daily from this new plant and will have to be absorbed and sewered at the acid plant. If additional absorption capacity is required, a separate project will be submitted.

1.25 Personnel, Property and Public Hazards

Chlorine Gas

Causes eye, skin and mucous membrane irritation. Maximum allowable concentration is 2 ppm. Concentrations in the order of 15 ppm will cause throat irritation. Cannister gas masks, Scott Air Paks or other similar equipment is required in strong concentrations.

Biphenyl

A toxic organic chemical. Breathing fumes or vapors should be avoided. During processing the material is usually hot (100°C or above) and can cause serious thermal burns in contact with the skin. Protective garments should be worn to aboid contact. Flash point of biphenyl is 235°F.

Ferric Chloride

Not toxic but presents an eye hazard. Normal precautions of wearing safety glasses should be followed.

HCl Gas

Fumes are toxic and hazardous to teeth, skin, eyes and mucuous membranes. In strong concentrations, rubber protective equipment should be worn. Maximum allowable concentration of HCl gas in air is 10 ppm.

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Santowax R

Relatively non-toxic, however, the vapors are irritating to the bronchial tract. Prolonged breathing of vapors should be avoided. Material is generally hot (150°C or above) and can cause serious thermal burns in contact with the skin.

Crude Aroclors

Crude Aroclors are hot since all are handled in Therminol heated jacketed lines. They can cause serious thermal burns in contact with the skin.

Still Bottoms or Residue

Fumes from still bottoms are toxic. They are extremely irritating to the mucous membranes, eyes and respiratory tract and should be avoided. They are hot (above 150°C) and can cause serious thermal burns.

Hydrated Lime

Dust is irritating to the eyes and skin and any material on the skin should be washed off with water.

TOWOLDMON0048744

1.3 Manufacturing Facilities

1.31 Description

1.311 General

The following information is included in the Appendix of this report:

Equipment Information Summary

Process Flow Diagram

Equipment Arrangement Study

Building and Site Requirement

Description of Work by Code of Accounts

Preliminary Schedule

Project Loss Prevention Report

1.312 Manufacturing Facilities

A 2000 gallon mix tank for terphenyls with charge lines and supported on a 40,000 lb. hopper scale.

Two 3100 gallon chlorination tanks with circulation pumps and heat removal systems consisting of two shell and tube heat exchangers and a Therminol surge tank and pump.

An off-gas system consisting of heat exchanger and 2000 gallon storage tank to recover entrainment losses from the chlorinator off gases with tailings pump.

A 6500 gallon batch intermediate storage and blow tank with scrubber and transfer pump.

A 7300 gallon still pot, 3500 gallon receiver with entrainment separator, still condenser and external gas fired heater with submerged centrifugal pump.

A condenser control system consisting of two shell and tube heat exchangers and a Therminol surge tank and pump.
A three-stage ejector with intercondenser, and aftercondenser and catch tank and sump tank.

Additions to the present control room to provide space for additional instrumentation.

A two-stage HCl gas drowning system.

A new freight elevator for Building 27.

Additions to the present Therminol system.

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1.32 Design Capacity

Chlorination:

Basis	Producing Aroclor 5060
OST	6350 hrs./year
Rate	27.6 M lbs./year

Distillation:

Basis	Producing Aroclor 5460
OST	6350 hrs./year
Rate	20.0 M lbs./year

After these additions are complete, plant capacity will be as follows:

Present Capacity	9.6 M lbs./year
New Capacity	20.0 M lbs./year
Total Capacity	29.6 M lbs./year

Basis: OST 6350 hrs./year
OAY 73%

Based on the December 6, 1968 Sales Forecast, (HD to RY), excess capacity will be as follows:

	1970	1973
New Capacity	29.6 M lbs./yr.	29.6 M lbs./yr.
Required	17.1 M lbs./yr.	22.6 M lbs./yr.
Excess Capacity	12.5 M lbs./yr.	7.0 M lbs./yr.
Excess Capacity	73 %	31 %

1.33 Flexibility Requirements

Two complete and separate solid Aroclor systems will allow flexibility in our production runs. We will produce the larger volume requirement, Aroclor 5460 (82%) in the new units with the remaining solid Aroclors being produced in the smaller unit. Consideration will be given to incorporating the chlorinators into a continuous chlorination system at some future date. Both units will have the flexibility of being able to produce any of the solid Aroclor products. If fractionation is required to meet FDA standards, a separate distillation unit can be added to the existing system.

TOWOLDMON0048746

1.32 Design Capacity

As a supplement to the Design Capacity statements on Page 10, the following is added to show excess capacity of Aroclor 5460 only in the new facilities (based on the December 6, 1968, Sales Forecast, HD to RY):

	1970	1973
New Capacity	20.0$\overline{M}$ lbs./yr.	20.0$\overline{M}$ lbs./yr.
Required	14.1$\overline{M}$ lbs./yr.	18.5$\overline{M}$ lbs./yr.
Excess Capacity	5.9$\overline{M}$ lbs./yr.	1.5$\overline{M}$ lbs./yr.
Excess Capacity	42%	8%

TOWOLDMON0048747

1.34 Future Expansion

The present expansion will occupy an 18 foot wide area directly to the north of Building 27. There is sufficient area to the north of this expansion to provide for two additional chlorination-distillation systems. In the meantime, work should proceed toward developing a continuous chlorination system which long range should provide greater flexibility in labor and equipment.

1.35 Physical Appearance

We propose to make the top roof deck concrete, a continuation of the surface we installed to the west of Building 27 on project OEA 4-488. Additional weather protection will be provided in the form of a panel enclosure on the north wall of the structure.

1.36 Storage and Shipping Requirements

No additional storage facilities are contemplated. Recently completed project CEA 1430 provided a 5500 gallon day tank for finished solid Aroclors. In addition, a new 6900 lb./hr. flaker with a 5500 gallon flaker feed tank has also been installed in a separate flaking and packaging building.

Raw material storage for Santowax R and Biphenyl are adequate.

TOWOLDMON0048748

1.4 Utilities and Services

1.41 Utilities Summary

The approximate utility requirements are as follows:

For ejector, lbs./hr.	450
For tracer and tank heating, lbs./hr.	250
Power, Installed HP	245
Cooling Tower Water, GPM	600
Potable Water, GPM	50
Natural Gas, Cu.Ft./hr.	2000

1.42 Utilities Facilities

No additional utility facilities are required for this project.

TOWOLDMON0048749

Monsanto

FROM (NAME & LOCATION) General Offices - St. Louis

DATE January 24, 1969

SUBJECT Project Loss Prevention Report 69-7

REFERENCE CEA 2080

cc R. E. Howard
G. O. Hunt
P. K. Ward - Anniston
S&PP Project File
S&PP Location File

TO : Mr. R. S. Yates

COPIES TO THOSE PRESENT

R. J. Green
W. B. Howard
R. M. Kountz
W. E. Voss - Anniston
R. S. Yates

DATE AND PLACE OF MEETING January 23, 1969, Creve Coeur, Missouri.

CEA 2080 Expand Solid Arochlors, Anniston Plant, Anniston, Alabama.

This project is increasing the plant capacity for manufacture of solid arochlors from 9.6 to 29.6M ppy. The project capital is approximately $1.03M. Completion target is December 15, 1969.

PERSONNEL

1. Chlorinated Biphenyl Content of Product An overall project objective is to minimize chlorinated biphenyl content in the solid arochlor 5460. This is needed for FDA approval of the material, since it is used in hot-melt adhesives in food packaging. It is also used in plasticizers.

2. Elevator It is planned to install an elevator to handle both freight and passengers. The elevator will have the capacity for 5000 pounds and will likely be hydraulically operated. It was agreed that the project manager will review the elevator design and safety controls with Mr. George Gorbell.

3. Lime Addition Lime is added to the still pot from 50 pound bags. This size bag is considered safe for personnel handling.

Appendix C

0613182

TOWOLDMON0048750

MECHANICAL An external gas-fired heater is used for the still pot. Combustion safeguards are planned by the project; these will include a Honeywell protecto-glow unit. There will also be a pilot interlock. The combustion safeguards should be reviewed with Mr. George Ostroot when the heater design is further along.

In addition, some process safety provisions will be incorporated in the heater. A high temperature sensing unit on the process material coming out of the furnace will shut down the burner on high temperature. If the circulation through the heater stops, an alarm will sound. Standard instrumentation will be employed for these functions.

PROCESS

1. Alarms and Interlocks The operation of the chlorinators will be sequence controlled. Chlorination starts at a temperature of about 150°C. As the batch progresses the sequence controller steps the temperature upward so that, at the conclusion of chlorination of a batch, the temperature is in the range of 250-255°C. The temperature will be recorded in the chlorinator; an alarm will be actuated at high temperature. It was agreed that the project will consider use of a differential temperature alarm, based on the desired temperature at any stage of the batch, rather than a high temperature alarm which must function at a temperature higher than the maximum batch temperature. It was believed that this type of alarming would be a better investment of money than the addition of a second high temperature alarm on the reactor, and located in the vapor discharge from the reactor.

   There will also be temperature detection in the arochlor circulating line on the chlorinator. A high temperature in this line will give an alarm and will also close the chlorine supply valve. The complete closure of the chlorine supply valve will not be possible because chlorine will come from tank cars rather than from the chlorine unit.

   If flow should cease in the arochlor circulating line there will be an alarm and the chlorine valve will be closed.

   There will also be an alarm if the therminol circulation should stop.

APPENDIX "G"

TOWOLDMON0048751

Other alarms include the following: a scale alarm to prevent overcharge of the weigh tank; a low temperature alarm on the chlorinator at 120°C; water coolant to the therminol cooler to prevent too low a water temperature; a signal when the batch is 80% chlorinated in order to signal the time to initiate sampling; high (80°C) and low (60°C) temperature on the circulating therminol. The project is also considering installation of a nuclear instrument on the process circulating line at the chlorinator to determine density; it is hoped that this density figure can be correlated with softening point. If the correlation works out on a present plant test, the equipment will be installed.

2. Operating Time The operating time of the present unit is only about 74%. Downtime on a chlorine plant has been a part of the problem; the new purchased chlorine arrangement should help this. Another part of the problem has been maintenance. It is also hoped that this can be improved in order to improve the on-stream factor.

3. HCl Scrubber In order to minimize the HCl venting to the atmosphere the project will add equipment for improved HCl absorption and scrubbing.

4. Gas Fired Heater Operation The firing rate on the heater is manually indexed on a flow controller on the gas to the burner. This type of control has proved adequate with the present plant installation and is believed to be adequate for the new heater. The project will also try to design the heater coils in such a manner as to simplify coil removal for the furnace. The furnace coils can be expected to burn out approximately annually. This is considered a normal maintenance item and presents no major problems.

5. Residue Removal If the residue is removed from the system in the manner used at present, the fume hood venting provisions will be improved over those at present. The project also plans to try to develop a system for flaking the residue.

BUILDING AND FIRE PROTECTION An 18' x 90' x 2 level bay will be erected adjacent to the north wall of Building No. 27. The construction will be open steel frame with reinforced fiber glass polyester wind-breaks, concrete slab roof and steel grate flooring at the first level above ground level.

Hydrant #13 with hose house and hydrant #19 with attached monitor nozzle are adequate fire protection. No sprinklers or fireproofing are needed.

0613184

TOWOLDMON0048752

A 20' x 30' extension to the existing control room will be erected at the 16 ft. level. The construction will be concrete block walls and non-combustible roof. No fire protection is needed.

LOSS EXPOSURE The maximum probable loss was considered to come from loss of the heater for the still pot as a result of explosion in the fire box. It was considered that approximately six days will be required to re-brick and repair the heater. A spare coil will be kept in stock.

It was estimated that the repairs would cost about $10M. Six days were estimated to be sufficient for the repairs. The business interruption loss during this period of time would be approximately $45M.

LOSS PREVENTION REVIEW CHECK LIST Attached to R. S. Yates' copy of this report is a copy of Form G-1425, Loss Prevention Review Check List, which can be used as a safety check list for this project.

LOSS PREVENTION REVIEW BY PLANT The S&PP Branch of CED cannot review design prints and construction steps in detail as this project progresses. S&PP requests plant personnel, including plant safety personnel, to hold additional safety reviews at the plant, to follow the development of design prints, and to check the progress of construction in order to make maximum contributions from their experience with these operations to the CED personnel involved in execution of this project.

SAFETY MANAGER G. O. Hunt will be Safety Manager for this project. Please contact him for additional safety reviews needed during design.

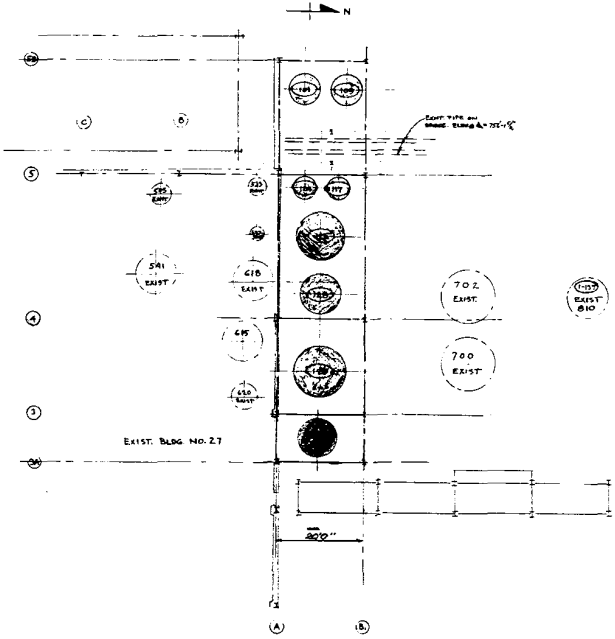
R. J. Green

W. B. Howard

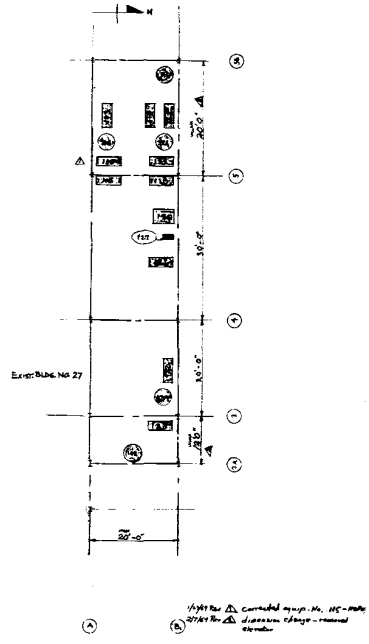
bjr
Attachment

0613185

TOWOLDMON0048753



SECOND LEVEL
SCALE 1" = 10'-0"



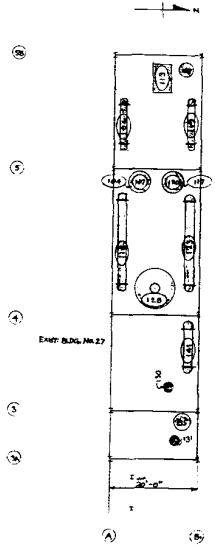
1/2/69 Rev △ corrected equip. No. HS-[illegible]
2/7/69 Rev △ dimension change - removed elevator

GROUND LEVEL (Elev. = 749.19')
SCALE 1" = 10'-0"

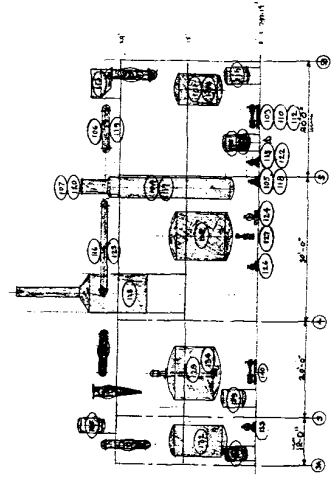
EQUIPMENT ARRANGEMENT STUDY
SOLID AROMATIC EXPANSION
CEA-2080 SCALE 1" = 10'-0"
By H.D. Gabelman
1/14/69
sheet 1 of 2

0613186

TOWOLDMON0048754



THIRD LEVEL
SCALE 1" = 10'-0"



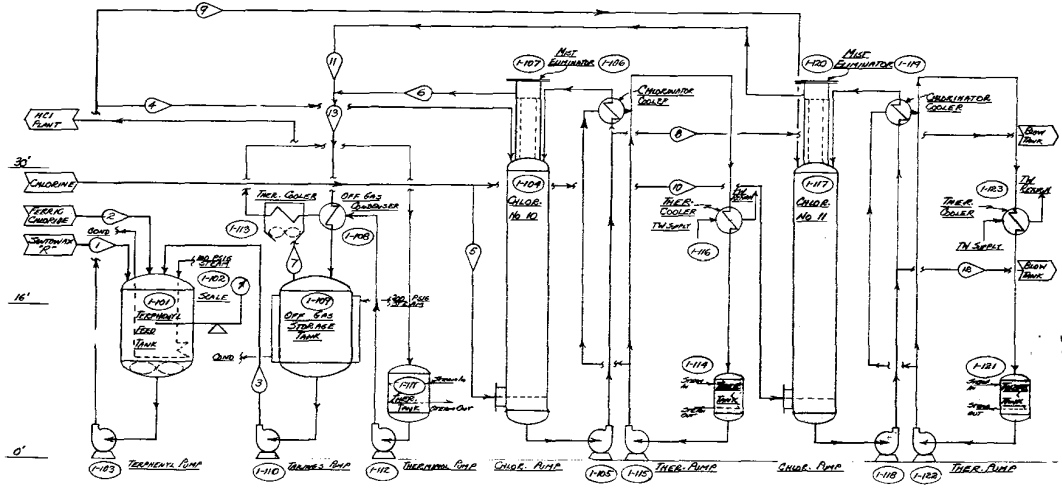
ELEVATION
SCALE 1" = 10'-0"

1/13/61 Rev. D Corrected equip No. 115
Added item 115 to elevation - HGB
2/17/69 Rev. A dimensions change - manual elevator

EQUIPMENT ARRANGEMENT STUDY
SOLID AROCLUR EXPANSION
CRA-2080 SCALE 1" = 10'-0"
by H.D. Gabelman
1/9/69
Sheet 2 of 2

0613187

TOWOLDMON0048755



STREAM NUMBER	FORMULA	MOL WT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SOLUTION "A"	$Co\ H_{24}$	250.3	11300			11200					11200															
FERRIC CHLOR.	$Fe\ Cl_3$	162.2		15		15				15	15			15				30					30			
CHLORINE	Cl_2	70.9					32400	25	50			32400	25		50											
AIR		29.0					3500	3500	7000			3500	3500		7000	500	500									
HYDROGEN	H_2	2.0					100	100	200			100	100		200											
CHLOR 5860										25700				25700				5800								
HYDROGEN CHLOR.	HCl	36.5						17425	34850	250			17425	250	34850		500									
LIME	$Ca(OH)_2$	74.1																	400				400			
5460	$Co\ Mg\ Cl_{16}$	574.8																		37950	50	37700		100	37800	37800
MIXTURE 5																							43900			
TAILINGS					945	945		945			945		945		1890											
TOTAL LBS/DAY			11300	15	945	2160	36000	21795	42100	26465	28160	36800	21795	26465	43990	300	800	5830	400	37950	50	37900	43330	100	37800	37800
GAL / DAY			1350		95	1450				2160	1450			2160				4180			42	3020	1100		3020	3020
CU FT / DAY							100800	33680	94250			100800	33680		162800	2790	11750			106000				14650			
GPM - AIR					100	125				250	125			250											125	
GPM - HCl					100	125				250	125			250											125	
DENSITY - LBS/GAL			8.4		10	8.4	75 PSIG 100°F	100# 100°F	100# 100°F	12.1	8.4	75 PSIG 100°F	100# 100°F	12.1	100# 100°F	100# 100°F	100# 100°F	12.4		10.7 @ 70°F	12.0	12.5	13	100# 100°F	12.5	12.5
VISCOSITY - CP			1.0		100	2.6				12	2.6			12								120	40		120	120
TEMP °C			140		100	160	15	250		250	160	15	250	250	250	15	100	200		30	30	160	370	150	160	160
PRESSURE - ATM			1		1	1	1.35	1.35	1.35	1	1	1.35	1.35	1	1.35	1.35	1	1		.033	.033	.0197	1	.0197	1	1

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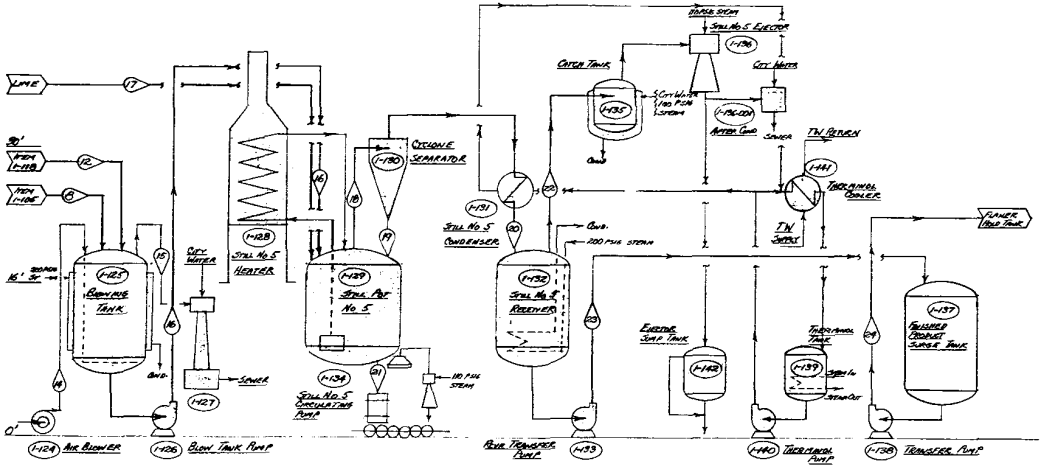


ANNUAL CAPACITY = LBS/BATCH × BATCH/HR × OPERATING HRS.

20,000,000 = 37,800 LBS/BATCH × ONE BATCH/12 HOURS × 6350 HRS

BATCH CALORIMATOR CYCLE		TIME-HRS
CHARGE SANTOWAX	4/7	0.50
CHARGE AT: 1500 LB/HR	5/10	1.00
2000 "		1.00
3000 "		9.00
EMPTY	12	0.50
TOTAL		12.00 HRS

BATCH STILL CYCLE		TIME-HRS
CHARGE STILL	16	0.50
HEAT UP		2.00
DISTILL	19	8.50
EMPTY	23	1.00
TOTAL		12.00 HRS

REV	DATE		BY
B	1-10-69	FINAL	RSY

MONSANTO COMPANY
CENTRAL ENGINEERING DEPARTMENT
ST LOUIS, MISSOURI

ORGANIC DIVISION | ANNISTON PLANT

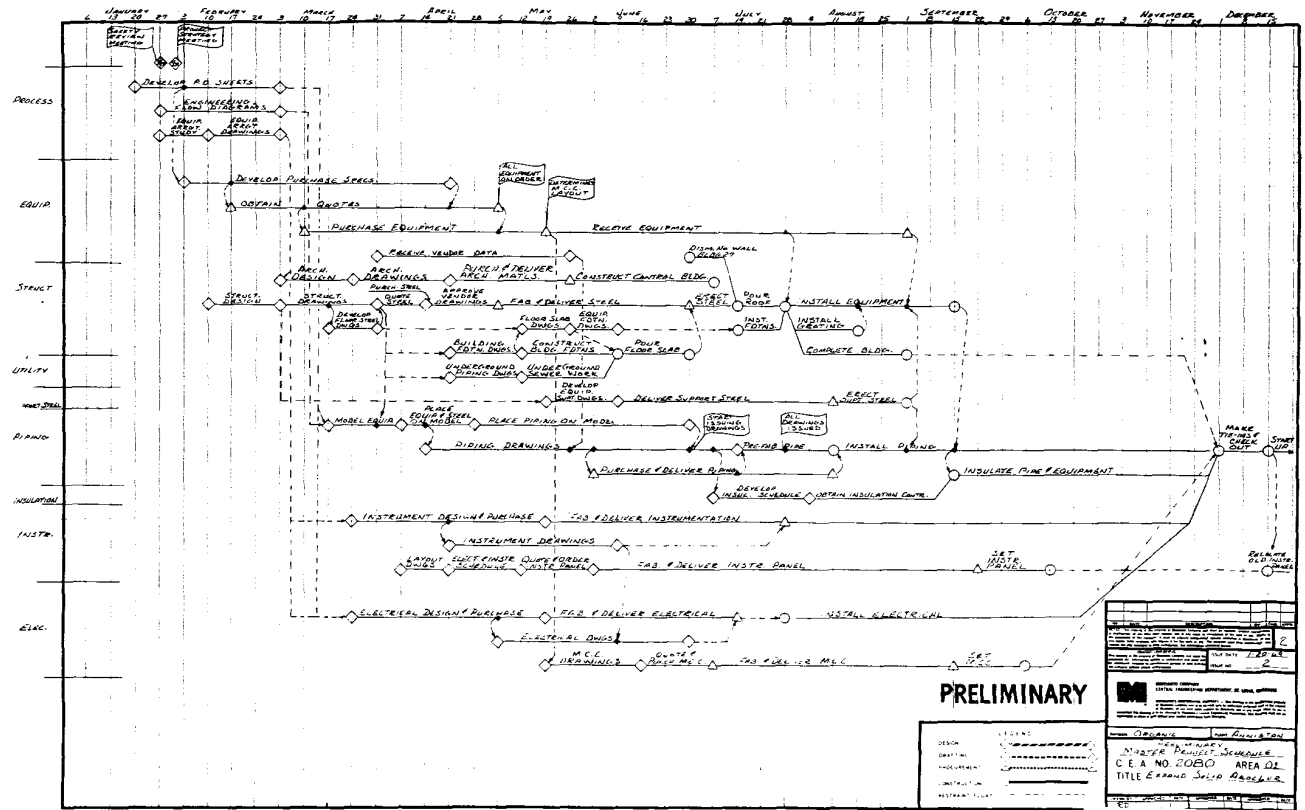
PROCESS FLOW DIAGRAM & MATERIAL BALANCE
SOLID ARCELOR EXPANSION DISTILLATION

	BY	DATE
DRAWN	RS YATES	1-10-69

CLR NO	PLANT	SIZE	DEPT	TYPE	VARIATION	REV
2080		C		D	2	B

0613189

TOWOLDMON0048757



TOWOLDMON0048758

PROCESS DESCRIPTION

SOLID AROCLOR MANUFACTURING FACILITIES

PROJECT CEA 2080

TABLE OF CONTENTS

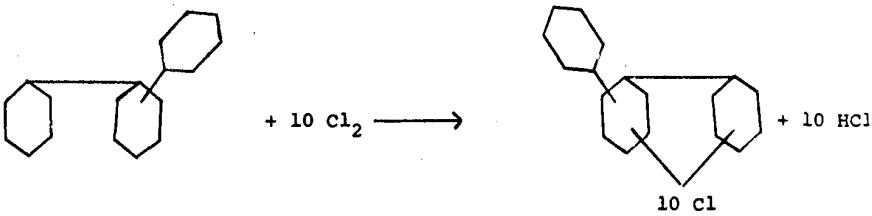
		Page No.
Section I	- Synopsis of Aroclor Processes	1
Section II	- Terphenyl Feed Tank	3
Section III	- Chlorinators No. 10 and No. 11	5
Section IV	- Intermediate Storage and Blow Tank	11
Section V	- Off-Gas Purification	13
Section VI	- Distillation	16
Section VII	- Still Heater	23
Section VIII	- Therminol System	25

TOWOLDMON0048759

Section I - Synopsis of Aroclor Process

Aroclor is a tradename used to designate the chlorination products of biphenyl, biphenyl high boilers or a mixture of the two. Solid Aroclors are produced by chlorinating the biphenyl or Santowax R to a high level of chlorine content. The process here described is for the Solid Aroclor system using Santowax R or a mixture of biphenyl high boilers as the starting material. They are identified by a four digit number. The last two digits represent the chlorine content (percentage by weight) and the first two numbers represent the chlorine condition. If the first digit is "5," it signifies that the Aroclor has been made from Santowax R. If the second digit is "0," the product has not been distilled. If it is "4," the product is a distilled grade. As an example, Aroclor 5460 is a distilled chlorinated terphenyl containing 60% chlorine.

The first process step in the manufacture of Solid Aroclors is a chlorination step. Santowax R and chlorine gas in the presence of ferric chloride catalyst react to form a chlorinated aromatic compound. Hydrogen chloride gas is liberated during the reaction and either recovered or drowned in a scrubber and sewered. The main reaction is a simple replacement of hydrogen by chlorine, but the product of the chlorination contains trace amounts of halogen containing by-products which are less stable than the direct ring-substituted products. Many isomers are formed. A schematic representation of Santowax R chlorination is as follows:



Terphenyl Chlorine Aroclor 5460 Hydrogen Chloride

Molecular Weights:		
	Terphenyl	= 230.3
	Chlorine	= 70.9
	Aroclor 5460	= 574.8
	Hydrogen Chloride	= 36.5

TOWOLDMON0048760

The second process step is aeration. The material is held at a high temperature, 200°C, and then blown with dry air in an aeration tank to remove trace amounts of HCl gas and other gaseous impurities.

The third process step is a flash distillation. This is carried out under vacuum conditions at an absolute pressure of 5-10 mm at the still pot and a temperature of 260°-360°C. Heat for the distillation is supplied by an external source. The distillation must be carried out in the presence of lime. The residue product, which contains lime, ferric chloride, and tars, is generally drawn off to drums for discard or for sale as Montar.

The fourth process step is flaking. The distilled Aroclor is flaked on a drum flaker and the flakes bagged or placed in fiber drums for shipment to our customers.

TOWOLDMON0048761

Section II - Terphenyl Feed Tank

A. Routine Operation

1. Design Consideration

a. $FeCl_3$ is mixed with Santowax R in an agitated tank. Minimum catalyst concentration is 0.13% by weight or 15 lbs/charge.

b. To provide the correct charge to the chlorinator, the tank is set on a hopper scale.

2. Terphenyl Feed Tank Operation

a. Check that steam is on the coil in the tank and the temperature controller is operational. Set at 150°C in automatic.

b. Close valve under feed tank.

c. Set scale pointer to 11,200 lbs and start Santowax R charge pump. At this weight, the charge valve will shut off and an alarm will sound. The charge valve will not open if the transfer pump is operating.

d. Start agitator.

e. Add 15 pounds of ferric chloride.

f. Charge to chlorinator is made on demand. When tank is empty, pump will stop and an alarm will sound.

B. Safety Features

1. A temperature controller controls the temperature in the tank by throttling a steam control valve. This will prevent the tank from overheating.

2. The charge valve to the tank cannot be opened when the transfer pump is running. The pump cannot be started if the charge valve is open.

3. If the weight in the tank reaches the first set point, the Santowax R charge valve will close and an alarm will sound. If the weight exceeds the normal charge, a switch on the scale set at 12,000 lbs will shut the Santowax R charge valve and sound an alarm.

4. A steam jacketed vent with flame arrestor is installed on the tank.

TOWOLDMON0048762

C. Emergency Shutdown

1. Shut off steam to steam coil.

2. Shut down agitator.

D. Control Loops, Interlocks and Alarms

1. There are two major control loops in this system.

a. Terphenyl Feed Tank Temperature Control - TIC-101

The function of this loop is to provide temperature control for the Santowax R in the mix tank. This is accomplished by measuring the Santowax R temperature and controlling the steam supply to the coil through a control valve. Set point is 150°C.

b. Terphenyl Feed Tank Weight Control - WV-101

The function of this loop is to permit a fixed charge of Santowax R to pass through a charge valve into the feed tank. As soon as the correct weight is attained, the valve will close and an alarm will sound.

2. Interlocks

a. If the feed tank overfills, a second cutoff on the scale will sound an alarm and attempt to close the charge valve.

b. When the feed tank is empty, the charge pump to the chlorinator will stop and an alarm will sound.

c. When the chlorinator charge pump is operating, the charge valve cannot be opened. Likewise, when the charge valve is open, the chlorinator charge pump cannot be started.

3. Alarms

The following alarms exist through the system:

a. Correct charge in the mix tank.

b. An overcharge in the mix tank.

c. When the mix tank is empty and the chlorinator charge pump stops.

TOWOLDMON0048763

Section III - Chlorinators No. 10 and No. 11

A. Routine Operations

1. Design Considerations

a. Based on the demonstrated Solid Aroclor chlorinator system at Anniston. The chlorinator was designed 1) at the same apparent vapor velocity of the No. 9 chlorinator unit at a demonstrated rate of 10M lbs/yr and 2) the material level at least equal to the level in No. 9 chlorinator.

b. Allowance was made for a volume expansion of 50% with a minimum of 36 inches for vapor disengaging at the end of the chlorination.

c. The heat removal system is based on a heat evolution of 510 BTU/hour/pound of chlorine added. Normal evolution at the input rate of 3M pounds/hour of chlorine is 1,530M BTU/hour. With a radiation and convection loss of 735M BTU/hour, the net heat evolution is 795M BTU/hour. Design rating of the external Therminol heat exchangers is 1,400M BTU/hour. This external heat removal system is similar to the system on No. 9 chlorinator which has worked successfully for the past 5 years.

d. The flow of chlorine to the chlorinator is controlled by a flow controller which allows manual adjustment of chlorine feed rate with automatic control by means of a batch sequence controller. This allows the batch to be controlled as follows:

   1) Three feed levels of chlorine input.

   2) Eight time periods for the regulation of batch temperatures since the batch temperature has to be increased during the chlorination period to prevent high pumping viscosities. The batch temperature will vary between a beginning temperature of 160°C to an ending temperature of 250°C.

e. The system is designed so that hot Aroclor can be put on the following items:

   1) Circulating lines at the chlorinator.

   2) Chlorinator coolers.

   Normally, hot Aroclor will be kept on the circulating lines at the chlorinators to prevent blockages.

TOWOLDMON0048764

f. Entrainment separators are installed at the top of each chlorinator to prevent Aroclor from being lost from the chlorinator. The Brinks-Monsanto unit will eliminate 99% of all particles 3 microns and smaller from the vapor stream and return the entrained liquid to the chlorinator.

g. Chlorine sparger design is based on a chlorine velocity of 50 feet per second, a chlorine rate of 3,000 pounds per hour with 3/16 inch hole size.

2. Chlorinator Operation

a. Check that the 2 inch chlorine valves on the header at the chlorine distributor are closed.

b. Align vent valves to the muriatic acid area.

c. Check that hot Aroclor is on the transfer line from the terphenyl charge tank and that steam is on the tracer around the transfer pump.

d. Check that the external Aroclor system is operating in the normal manner. Water should be going into the Aroclor coolers (Item 116, or Item 123). Pumps (Item 115 or 122) should be circulating Therminol through the chlorinator coolers (Item 106 or 119).

e. The control system should be set for the desired chlorinator program. For Aroclor 5060, settings should be:

1) For chlorine input, flow recorder controller:

First Hour	1,500 lbs/hour
Second Hour	2,000 lbs/hour
Third Hour	3,000 lbs/hour
Subsequent Hours	3,000 lbs/hour

Note: This is based on 100% available chlorine.

2) For temperature control, temperature recorder controller:

First Hour	190°C
Second Hour	200°C
Third Hour	210°C
Fourth Hour	220°C
Fifth Hour	230°C
Sixth and Seventh Hours	240°C
Eighth and Nineth Hours	250°C
Tenth and Eleventh Hours	255°C

TOWOLDMON0048765

f. Set the chlorine integrator for 80% of the calculated input, which is 24,400 pounds. By setting the integrator to 80% of the calculated flow, an alarm will sound giving the operator a signal when the batch is 80% chlorinated. The chlorine integrator will continue to totalize the flow of chlorine into the chlorinator until the batch is complete.

g. Align valves from terphenyl feed tank to chlorinator and transfer Santowax to chlorinator.

h. Set selector switch of the temperature controller (TRCA 106-1 or TRCA 119-1) to automatic position with set point at 190°C.

i. Align chlorinator valves and circulate mass through external cooler.

j. Align chlorinator valves in chlorine line to chlorinator and set flow controller (FRC 104-1 or FRC 117-1) to the manual position. Set flow controller to 1,500 pounds/hour. Open chlorine valves at the inlet to the sparge pipe.

k. When the chlorine feed stabilizes at 1,500 pounds per hour, put flow controllers in automatic with set point at 1,500 pounds/hour.

Note: Chlorine control valve should be open before the manual valves are opened.

l. Take softening point measurements at regular intervals during the chlorination. As soon as the batch reaches the finished softening point, then:

1) Shut off the chlorine hand valves.

2) Set temperature recorder to manual. Leave set point at 255°C until batch is transferred, then reset to 190°C.

3) Align valves for transfer to the blow tank.

m. A density recorder is provided in the chlorinator circulating line to record the density of the crude product. Density correlates with the softening point of the crude Aroclors.

B. Safety Features

1. A high temperature alarm is set at 275°C on the individual chlorinators to prevent excessive carryover of material into the HCl off-gas header. Temperatures above this will cause excessive carryover of Santowax R or crude solid Aroclor.

TOWOLDMON0048766

2. A low temperature alarm is set at 120°C on the individual chlorinators to prevent a too low starting temperature for the process.

3. If the chlorinator temperature gets too high, a high temperature switch will cut off the flow of chlorine to the chlorinator. Likewise, if the circulating pump into the chlorinator coolers shuts down, the chlorine flow into the chlorinators will be cut off.

4. The circulating loop through the chlorinator coolers contain the control system for removing heat of reaction. These units (TRCA 106-1 or TRCA 119-1) will sound an alarm if the temperature in the circulating loop is 120°C or 275°C.

5. The circulating Therminol loop through the water Therminol exchangers contains flow controllers (FICA 115-1 or FICA 122-1) which control the flow of Therminol to the water Therminol exchangers. In the event the flow stops, an alarm will sound. Normal flow of Therminol is 250 gallons per minute. A temperature control system on the water Therminol exchangers will control the output temperature of the Therminol coming back to the chlorinator coolers. High temperature for the Therminol leaving the water Therminol exchanger is 90°C. Low temperature for Therminol leaving the water heat exchanger is 50°C.

6. Rupture discs are installed on each chlorinator to protect against over-pressurization, but not failures which may result from explosions. Set pressures for the rupture discs are 50 psig.

C. Emergency Shutdown

1. Close block valves to the chlorine distributor to the chlorinators. Reset chlorine feed control valves to zero with instrument in manual.

2. In the event of a prolonged shutdown, greater than 2 hours, the batch should be circulated through the chlorinator cooler and Therminol put on the Therminol cooler in order to maintain a minimum batch temperature of 150°C.

D. Control Loops, Interlocks and Alarms

1. There are five major control loops in this system.

TOWOLDMON0048767

a. Density Recorder, DR-104-4, 117-4

The function of this loop is to provide an estimate of what the softening point of the distilled product will be. A correlation exists between density and softening point which may eliminate the time-consuming softening point determination.

b. Chlorinator Flow Control and Totalizer, FRC-104-1, FQS-104-2, FRC-117-1, FQS-117-2

The function of this loop is to control the chlorine flow to the chlorinators and regulate the rate of chlorination. This is done by measuring the chlorine flow with an orifice and controlling this flow with a control valve in the chlorine feed line. This system can be operated manually or automatically. The flow of chlorine is altered in three steps, 1,500 lbs/hour for the first hour, 2,000 lbs/hour for the second hour, and 3,000 lbs/hour for each of nine subsequent hours. The integrator readout is total pounds of chlorine. This instrument has two dials, one is set at 80% of total batch poundage of chlorine and figures are not affected by increasing figures on the second dial which indicates the total flow. When the integrated flow equals the pre-set flow (80% of total), an alarm rings in the control room. Totalizing continues until chlorine flow stops. A reset button on the integrator returns the integrated flow dial to zero. The chlorinator circulating pump must be running and normal temperature must exist in the chlorinator before the flow control valves can be opened. A high chlorinator temperature, 275°C, or circulating pump shutdown automatically stops the flow of chlorine.

c. Chlorinator Temperature Control - TRCA-106-1, TRCA-119-1

The function of this loop is to provide temperature control for the batch in the chlorinator. This is done by measuring the temperature of the crude Aroclor in the circulation line at the discharge of the Therminol heat exchanger and controlling the flow of cool Therminol to the heat exchanger. The temperature system has a low temperature alarm at 120°C, a high temperature alarm at 275°C. Chlorination temperature is controlled through a series of discreet time dependent steps. This is accomplished through a controller mounted on the panel board and pre-set with the control conditions.

TOWOLDMON0048768

d. Therminol Flow to Chlorinator Cooler, FICA-115-1, FICA-122-1

The function of this loop is to control Therminol flow to the Therminol coolers. This is done by measuring flow with an orifice plate and splitting the flow into two streams. One stream is modulated by a temperature control valve. The other stream contains the flow control valve, which is modulated by a control signal from the temperature controller and carries the difference in flow between set point and fresh stream. In this way, the total flow always continues through the Therminol water heat exchanger. If the flow is too small, an alarm will sound. Set point is 250 gpm. Normal flow is 300 gpm.

e. Therminol Temperature Control, TICA-116-1, TICA-123-1

The function of this loop is to control the temperature of Therminol leaving the water-Therminol heat exchangers. This is done by measuring the temperature out of the cooler and controlling the flow of tower water with a control valve in the tower water line to the heat exchanger. An alarm will sound if the temperature in this line is 90°C or 50°C.

2. Interlocks

a. If the temperature in the chlorinator at the sparge ring reaches 260°C, the chlorine control valve will close and an alarm will sound.

b. If the chlorinator circulating pump motor shuts off, the chlorine control valve will close and an alarm will sound.

3. 3. Alarms

The following alarms exist through the system:

a. High temperature at the chlorine sparge ring, 275°C.

b. High temperature in the chlorination circulation mass, 275°C.

c. Low temperature in the chlorination circulation mass, 120°C.

d. Low flow of Therminol through the chlorinator-cooler and water-Therminol heat exchanger, 250 gallons per minute.

e. High outlet Therminol temperature from water-Therminol heat exchanger, 90°C.

f. Low temperature of Therminol out of water-Therminol heat exchanger, 50°C.

TOWOLDMON0048769

Section IV - Intermediate Storage and Blow Tank

A. Routine Operations

1. Design Considerations

a. The blow tank is designed to accommodate two batches from the chlorinator. This amounts to 4,320 gallons. A free board of 2,166 gallons has been allowed.

b. The tank is equipped with an air sparger system so that trace amounts of hydrogen chloride can be removed before a charge is made to the still system. The amount of air that will be blown through the batch is 300 pounds.

c. A sparger pipe is in the tank to distribute the air through the batch. It is designed for a rate of 50 ft per second through the sparge holes.

2. Blowing Tank Operation

a. Check that hot Therminol is on the plate coils of the blow tank. Normally, once this is energized, it will remain energized. Temperature is set at 240°C.

b. Check that hot Therminol is on the transfer line from the chlorinator transfer pump to the blowing tank.

c. Align valves in transfer line from Chlorinator No. 10 or No. 11 circulating pump to blowing tank.

d. Energize scrubber system for blowing tank by opening water valve at the S&K eductor.

e. Check that valve at bottom of blow tank is closed. Transfer batch from chlorinator to blowing tank.

f. As soon as the batch is transferred, realign valves at the chlorinator and shut down the transfer pump.

g. Start air blower and open valve into the blowing tank sparger. Sparge for 60 minutes.

B. Safety Features

1. A rupture disc is installed on the blowing tank to protect against over-pressurization. Set pressure for the rupture disc is 50 psig.

TOWOLDMON0048770

2. The blowing tank has a level indicator to show the level of material in the tank. An alarm will sound when the level reaches 90%.

C. Emergency Shutdown

1. Shut down the blow tank air pump and the hot Therminol input to the heating coils.

D. Control Loops, Interlocks and Alarms

1. There are two major control loops in this system.

a. Blowing Tank Level Indicator - LIA-125-2

The function of this loop is to indicate the blow tank level in the control room and in the field. It also alarms on high level. This is done by dip tubes which extend into the tank. These tubes are purged with air and the differential pressure, sensed by a d/p cell, is transmitted to a locally mounted and panel mounted receiver gauge graduated 0 to 100%. A high level will sound on the annunciator cabinet when the level is 90%.

b. Blowing Tank Temperature Control - TIC-125-1

The function of this loop is to control the temperature of crude Aroclor 5060 in the blowing tank during the tank filling, pump-out and hold periods. This is done by measuring the temperature of the batch in the tank and controlling the flow of Therminol into the plate coils on the tank through a control valve. Set point is 240°C.

2. Interlocks

a. An interlock exists between the blowing tank transfer pump and the still pot. If the level in the still pot reaches a higher than normal level, a swtich in a level device at the still pot will prevent the transfer pump from starting.

3. Alarms

The following alarm exists in the system:

a. High level in the blowing tank, 90% full.

TOWOLDMON0048771

Section V - Off-Gas Purification

A. Routine Operation

1. Design Considerations

a. HCl gas from Chlorinators No. 10 and No. 11 will be cooled from 225°C to a temperature of 130°C in a gas cooler. Entrained Santowax and Aroclor, condensed by the gas cooler, will be stored in an off-gas storage tank. The cooled gas will pass into the transfer line to the HCl purification plant.

b. HCl gas can be vented through the blow tank into the local scrubbing system.

c. It is expected that the tank will be pumped empty at approximate five-day intervals.

2. Off-Gas Storage Tank Operation

a. Check that steam is one the plate coil of the storage tank and the temperature controller is operational. Set at 130°C in automatic.

b. Close valve under tank.

c. Align valves to circulate Therminol through air cooler, off-gas condenser, and return to surge tank.

d. Set the Therminol controller in automatic with set point at 130°C.

e. Start the Therminol circulation pump.

f. Align valves to direct HCl gas from the chlorinators into the off-gas condenser.

g. Align valves to direct HCl gas to the HCl department.

h. Check level in the off-gas storage tank. The material can be pumped to the existing terphenyl charge tank by aligning valves and starting pump. The tank will hold 2,000 gallons of material.

B. Safety Features

1. A temperature controller is located at the tank to control the temperature in the tank and prevent the tank from overheating.

TOWOLDMON0048772

2. A level instrument is located at the tank to indicate level of material in the tank.

3. A rupture disc, with a bursting pressure of 50 psig, is located on the off-gas storage tank.

C. Emergency Shutdown

1. Close the chlorine valves to the chlorinators. This will prevent HCl gas from entering the off-gas condenser.

2. Shut down temperature control system.

D. Control Loops, Interlocks and Alarms

1. There are three major control loops in this system.

a. Off-Gas Storage Level Indication, LI-109-2

The function of this loop is to provide an indication of level of material in the off-gas storage tank. This is done by dip tubes which extend into the tank. One tube senses tank internal pressure, the other extends to the bottom of the tank. The dip tubes are purged with air, and the differential pressure is sensed by a d/p cell. The signal is transmitted to a locally mounted receiver gauge graduated 0 to 100% which indicates tank level in the field.

b. Off-Gas Storage Tank Temperature Control - TIC-109-1

The function of this loop is to provide temperature control for the material in the off-gas storage tank. This is done by measuring the temperature and controlling the heat input by throttling a control valve in the steam line to the plate coils on the storage tank. Set point for controller is 130°C.

c. Off-Gas Condenser Temperature Control - TIC-111-1

The function of this loop is to control the temperature of the circulating Therminol to the off-gas condenser. This is done by measuring the Therminol temperature in the surge tank and transmitting a signal to a controller in the control room. The controller compares this signal with the set point and transmits a control signal to each of two positioners. One positioner is mounted on an air cooled heat exchanger and operates louvers, the second positioner operates a steam control valve in a steam line to heating coils of the surge tank. Set point for the controller is 130°C.

TOWOLDMON0048773

2. Interlocks

There are no interlocks in this system.

3. Alarms

There is a low flow alarm which is activated if the Therminol circulation pump motor stops.

TOWOLDMON0048774

Section VI - Distillation

A. Routine Operations

1. Design Considerations

a. Time cycle:

Charge	0.5 hours
Heat-up	3.0 hours
Distill	7.5 hours
Empty	1.0 hours
Total	12.0 hours
Distilling Rate	5,050 lbs/hour
Capacity for Aroclor 5460	5,050 lbs/hour x 7.5 hours/ba x 8,750 hours x 72.5% divided by 12.0 hours = 20M lbs/year

b. The charge to the still pot is 4,180 gallons. The still pot has a capacity of 6,550 gallons, which leaves a free board of 2,370 gallons or 38 inches.

c. Heat for distilling is provided by an external gas-fired heater. Calculated loading for the external still heater is:

Heat-up	1.4M/BTU/hour
Vaporize	1.1M/BTU/hour

The design absorption rating of the heater is 2.0M/BTU/hour. The batch will circulate through the heater coil at 250 gpm.

d. The distillation rate is controlled by a flow controller mounted on a panel board and controlling the gas flow to the heater.

e. The calculated vapor load for the still vapor condenser is 5,050 lbs/hour. The design loading is 5,560 lbs/hour. The heat balance for the condenser is:

Condense	556,000 BTU/hour
Cool	695,000 BTU/hour
Total	1,251,000 BTU/hour

The condenser was designed for a gas flow velocity of 159 feet per second, which is less than 50% of the critical velocity of 348 feet per second.

TOWOLDMON0048775

f. Heat removal from the condenser is accomplished by circulating Therminol through the shell side of the condenser and cooling the Therminol in a water-Therminol exchanger.

g. Two batches will be distilled through the still system before Montar or residue is withdrawn from the still pot. Lime will be added to the still pot before each distillation.

h. The still receiver is designed to hold 4,100 gallons of finished material at a gravity of 1.5 at 200°C. This represents a yield of 98% on the still charge.

i. During distillation, the material in the still pot decomposes and HCl gas is formed. The ejector system is designed to handle an HCl gas load.

2. Still Operation

a. Align valves to charge from blowing tank.

b. Start blowing tank pump and charge 4,180 gallons into the still pot. This will leave 38 inches of free board for disengaging height. A high level cutoff is on the still and will shut off the transfer pump.

c. Add 400 lbs of lime directly to the still pot. Close still and still receiver.

d. Energize the steam ejector.

1) Close main valve in vacuum line to still above receiver.

2) Start steam to fourth stage. Start water into second barometric condenser.

3) Start steam to third stage and readjust water flow to second barometric condenser.

4) Start water into first barometric condenser. Start steam to second stage and readjust water into first barometric condenser.

5) Start steam to first stage.

6) Open water valve to the after-condenser and adjust to a point where no steam is escaping from the after-condenser vent.

7) Vacuum should pull down steadily to about 1 mm mercury absolute and hold steady.

TOWOLDMON0048776

e. Align valves at still receiver from ejector to condenser.

f. Energize the Therminol circulating system to the condenser.

1) Align valves to circulate Therminol through the still condenser and water-Therminol exchanger and return.

2) Set TRC-131-1 at a temperature of 150°C.

3) Start the Therminol circulating pump.

g. Align valves in still pump line to circulate through external gas-fired heater and back into the still. Start pump.

h. Increase the flow of gas to the external gas-fired heater by adjusting the flow controller, FRCA-128-1. This is the control over the rate of distillation and also the heat-up rate of the batch.

i. When the still is under proper operating conditions, the following data can be expected:

1) Proper operating temperatures for Aroclor 5460:

Begin Distilling	End Distilling
260°C	355°C

Temperature Profile Through Heater

At Beginning	
Into Coil	200°C
Out of Coil	212°C
At End	
Into Coil	388°C
Out of Coil	400°C

2) Vacuum 5 mm mercury absolute at the still pot.

3) Distilling rate 5,560 lbs/hour.

4) Still condenser. Forward flow temperature at 155°C.

5) Still pump. Output pressure at 65 psig and flow at 250 gpm.

TOWOLDMON0048777

j. As the distillation continues, the temperature in the still pot will rise and flow through the heater coil will remain steady. When the flow drops to 125 gallons per minute, an alarm will sound. This should be the time to cut the gas flow to the heater. As an additional aid, a cutoff switch will stop the flow of material through the coil when the level in the still pot reaches the bottom dish.

k. At the end of the distillation, the batch is checked for color and softening point and is transferred to the flaker hold tank. Check that space is available in the flaker hold tank before transfer is made.

l. Clear heater coil by opening vent valve in line at still pot and allowing vacuum to suck coil dry. The jet should be isolated from the still receiver when this is done.

B. Safety Features

1. A low flow through the external heater coil will activate an alarm.

2. A low gas flow to the external heater will sound an alarm.

3. If the level in the still pot is too high, the transfer pump from the blowing tank will not operate.

4. A rupture disc, with a bursting pressure of 50 psig, is installed on the still pot and on the receiver.

5. If the temperature in the still pot gets too high or too low, an alarm will sound.

6. A site glass has been placed in the return leg from the cyclone. Some flow is necessary for satisfactory operation.

C. Emergency Shutdown

1. Shut off feed to the still pot.

2. Shut off gas flow to the external heater.

3. Shut off still pot circulating pump and drain coil through heater.

4. Release vacuum by closing the block valve to the jet and venting the receiver or still pot.

D. Control Loops, Interlocks and Alarms

There are nine major control loops in the still pot system.

TOWOLDMON0048778

a. Fuel Gas Flow to Still No. 5 Heater - FRCA-128-1

The function of this loop is to control the flow of fuel gas to the heater. This is done by measuring the gas flow with an orifice and controlling this flow with a control valve in the gas feed line.

b. Low Flow Still No. 5 Heater, Alarm and Shutdown - FIA-128-2

The function of this loop is to measure the circulating flow through the still heater coil and to shutdown the heater if the flow becomes too low. This is done with a target meter in the transfer line to the still heater. If the flow decreases below a previous set point, an alarm will sound and the main burner will shut down. The low flow alarm switch is set at 125 gpm.

c. Still No. 5 Heater Control BCA-128-9

The function of this loop is to provide a safe start-up and shutdown facility for Still No. 5 heater and to provide a safe, automatic heater shutdown in case of emergency. The complete details of this system are contained in the instrument function outline, Loop No. 1-BCA-128-9.

d. Still Pot No. 5 Level System - LS-129-3

The function of this loop is to prevent overcharging of the still pot and to alert the operator that the batch distillation has continued to a point that endangers the flow requirements of the still circulating pump. This is done by gamma radiation operating through the batch from a single source mounted at high level to activate the high-level switch. The low-level switch is mounted on the circular part of the bottom dish. The high-level switch will shut down the blow tank pump and extinguish the run light. The low-level switch will activate an alarm.

e. Still No. 5 Condenser Temperature Control - TRC-131-1

The function of this loop is to maintain the temperature of the Aroclor 5460 from the condenser at a suitable level. This is done by measuring the temperature in the outlet line from the condenser and controlling the cool Therminol flow to the condenser with a control valve. Set point for the controller is 150°C.

TOWOLDMON0048779

f. Still No. 5 Receiver Temperature Control - TIC-132-1

The function of this loop is to control the temperature of Aroclor 5460 in the receiver during filling and pump-out to storage. This is done by measuring the temperature in the tank and controlling this temperature by throttling a control valve in the steam line to the tank coil. Set point for the controller is 130°C.

g. Still No. 5 Receiver Level Indication - LI-132-2.1/2.2

The function of this loop is to indicate the level of Still No. 5 receiver, both in the field and in the control room. This is done by a displacement-type level transmitter. A 0 to 100% dial indicates level in the field and a similar dial indicates tank level at the control panel.

h. Therminol Flow to Still No. 5 Cooler - FICA-140-1

The function of this loop is to control the Therminol flow to the water-Therminol cooler. This is done by measuring the Therminol flow with an orifice. One stream is modulated by a temperature control valve in the line to the still condenser. The other stream contains the flow control valve and carries the difference in flow between set point and the first stream. Normal flow is 200 gpm. An alarm is activated if the flow drops below a set point of 160 gpm.

i. Therminol Temperature Controller - TICA-141-1

The function of this loop is to control the temperature leaving the water-Therminol exchanger. This is done by measuring the temperature of the Therminol leaving the water-Therminol exchanger and controlling this temperature by throttling a control valve in the water line to the exchanger. An alarm will sound if the outlet Therminol temperature is too high or if the outlet Therminol temperature is too low.

High Temperature Alarm	-	90°C
Low Temperature Alarm	-	50°C

2. Interlocks

a. Low flow of circulating Aroclor through the external fired heater will shut the heater down.

b. Low fuel gas pressure, PS-128-10, 2.5 psig.

c. High fuel gas pressure, PS-128-11, 25 psig.

d. High furnace coil outlet temperature, ITSUI-128-6, above 800°F.

TOWOLDMON0048780

e. Failure of pilot flame, DCA-128-9.

f. An electric power failure will shut the furnace down.

g. A high level in the still will shut the blow tank pump down to prevent overfilling.

h. A low flow to Still No. 5 condenser will cause an alarm to sound in the control room, 160 gpm.

i. A low or high-temperature Therminol stream leaving the water-Therminol exchanger will activate an alarm in the control room.

3. Alarms

The following alarms exist through the system:

a. A low flow of Aroclor through the external heater will stop the flow of fuel gas to the heater and sound an alarm.

b. A complete shutdown of the external heater.

c. High or low-temperature in Still Pot No. 5.

d. High temperature in the circulating loop through the external fired heater, above 800°F.

e. High or low temperature of Therminol from the water-Therminol exchanger.

f. Low flow of Therminol through the water-Therminol exchanger.

g. Low level in the still pot.

TOWOLDMON0048781

Section VII - Still Heater

A. Start-up Operations

1. Design Considerations

a. The still heater is designed to provide enough heating for distilling and with a skin temperature low enough to prevent carbonization. Tests in the Anniston Lab on Aroclor 5060 show the following:

	Condition			
Temperature	11 Mins.	12 Mins.	15 Mins.	60 Mins.
437°C (819°F)	No Decomp.	No Decomp.	No Decomp.	No Decomp.
455°C (851°F)	Sl. Decomp.	Sl. Decomp.	Rap. Decomp.	Rap. Decomp.
471°C (880°F)	Sl. Decomp.	Rap. Decomp.	Rap. Decomp.	Rap. Decomp.

The above information shows the importance of keeping the skin temperature below 440°C (824°F).

b. The furnace is equipped with a Juhn Zink-VBM-16 burner. Heat release:

Maximum: 3.240M BTU/Hr
Normal: 2.700M BTU/Hr

Heat release of the pilot:

Normal: 0.05M BTU/Hr

c. The pilot flame must be proven by the "purple peeper" before the main gas burner can be started.

2. Start-up Operations Prior to The Initial Batch

a. A three (3) day dryout cycle should be considered the minimum time required for drying the furnace refractory.

b. Block off valves in line from circulating pump and into still. Open vent in line from heater. Inject 100 psig steam into the coil. Pressure should be about 30 psig. This can be done by removing TJRI-128A, a 1½" connection. Put this thermocouple temporarily into a side furnace opening. A dial thermometer can be used instead of the thermocouple (opening T1 on Dwg. 91287-4-A1).

c. Open damper in furnace stack.

TOWOLDMON0048782

d. Open manual valves in main gas line to the furnace and pilot line.

e. Gas test the atmosphere inside the heater. Use a 3 foot length of copper tubing on the end of a rubber hose. If test shows dangerous, stop and correct the condition before lighting the burner. When the heater is cold, there is no natural draft to carry away gas or fumes. After the unit is hot, a natural draft is always present.

f. It is now necessary to "jumper out" those connections in the circulating system which require a positive liquid flow through the coil.

g. Activate the main burner system and hold wall temperature to 204°C (400°F). Hold for 48 hours.

h. Increase firing rate and temperature to 371°C (700°F). Hold for 24 hours.

i. Firing rate can be increased to 482°C (900°F) during the fourth and subsequent days. Temperature recommendations are subject to a tolerance of plus, or minus, 38°C (100°F).

j. After the furnace is dry, leave the pilot light operating and remove "jumper" connections. Return furnace to original condition.

B. Other Features - Safety, Alarms, Interlocks

For these features, see Section VI - Distillation.

TOWOLDMON0048783

Section VIII - Therminol System

A. Start-up Operations

1. Design Considerations (Refer to Dwg. 2080, D2)

   a. The existing heater has a design capacity of 6M BTU/hr of which only 2.8M BTU/hr is being utilized at present.

   b. A new surge tank, of 3,500 gallons working volume, is provided for the storage of hot Therminol.

   c. Flow rates from the surge tank will be:

		Design	Normal
Item 1-150	To Existing System	1,000 GPM	1,000 GPM
Item 1-158	To New System	350 GPM	300 GPM
Item 1-159	To Existing Furnace	450 GPM	400 GPM

   d. Estimated heat requirements:

New System	2M BTU/Hr
Existing System	3M BTU/Hr

   e. A heat balance across the system will show the following temperatures based on the heat requirements as listed above:

	Flow Rate lb/hr	Flow Rate GPM	Temperature	Loading
Into Furnace	232,000	400	275°C (527°F)	5.0M BTU/Hr
Out of Furnace	232,000	400	310°C (590°F)	
Into Existing System	583,000	1,000	275°C (527°F)	3.0M BTU/Hr
Out of Existing System	583,000	1,000	267°C (512°F)	
Into New System	175,000	300	275°C (527°F)	2.0M BTU/Hr
Out of New System	175,000	300	256°C (493°F)	

TOWOLDMON0048784

2. Start-up Operations

   a. Fill Therminol surge tank, Item 1-149, with 2,500 gallons of Therminol FR-2. Heat the material to 100-110°C with the steam coil. It may take 24-36 hours to do this since the coil was not designed for a large heat-up requirement.

   b. Start Therminol into the suction of Pump 1-158. Be careful in opening valve, not to thermal shock the system.

   c. Check that cooling water is on the stuffing box gland and pump bearings.

   d. Align valves through new system and start pump. Check for leakages and flow.

   e. Start Therminol into the suction of Pumps 1-150 and 1-159. Be sure discharge valves are closed.

   f. Make proper tie-ins to the existing system and at the existing heater.

   g. Put existing Therminol heater on low heat. Align valves and start Pump 1-159.

   h. Align valves and start Pump 1-150.

   i. Activate "Seal-Guard" system.

B. Routine Operation

   1. The system in normal operation will require the periodic check of the pump systems to make certain they are operating correctly and not leaking.

   2. The temperature controller in the existing heater will be adjusted to 310°C or to the desired operating temperature.

C. Safety Factors

   1. A level gauge is located on the side of the surge tank, and the surge tank is vented to the atmosphere.

D. Control Loops, Interlocks, and Alarms

   1. Control Loops

      Control loops exist at the existing Therminol heater, and these are covered in the Department Operating Instructions.

TOWOLDMON0048785

2. Interlocks

Interlocks exist at the existing heater and are covered in the Department Operating Instructions.

3. Alarms

When the Therminol pumps are shut down, an alarm will sound.

TOWOLDMON0048786

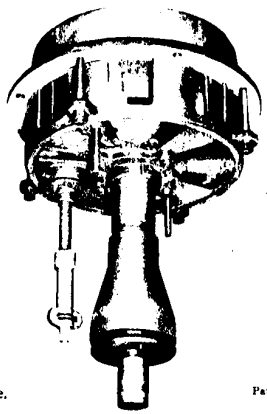
JOHN ZINK
A GOOD BRAND

SERIES VBMR

VERTICAL GAS BURNER

HIGH CAPACITY BURNER

The John Zink Company pioneered floor-firing to give furnace designers and operators a completely satisfactory floor-fired burner. Especially designed to burn *any* gaseous fuel, the vertical-firing VBMR simplifies furnace operation.



Patented

PRINCIPAL FEATURES:

Highest heat release per cubic foot of furnace volume.

Maximum duty with minimum draft.

Even distribution of heat in furnace.

Burns high sulphur content gases without port stoppage.

The VBMR burner is fired vertically upward when located in the floor of the furnace. This arrangement makes FULL USE of all available combustion volume. Since the maximum draft is at the lowest point in the furnace, this burner can provide the greatest heat release through a given size opening.

Removable orifice bushings are provided in all burners. By operating as a premix burner, the gas stream draws in a large percentage of the total air for combustion.

Controls for both primary and secondary air are provided. A shutter-type air register provides even distribution of air to the combustion zone at all times. Secondary air may be closely controlled from a point remote from the burner. It is not necessary to go beneath the furnace. A patented radiating-armed spider, made as only John Zink can make it, discharges the mixture of gas and primary air evenly over the secondary air stream to distribute heat according to the requirements of the furnace being fired.

Burners may be furnished with standard pilots or with pilots suitable for use with any electronic flame safe-guard system.

0613219

WE MAKE HEAT AROUND THE WORLD

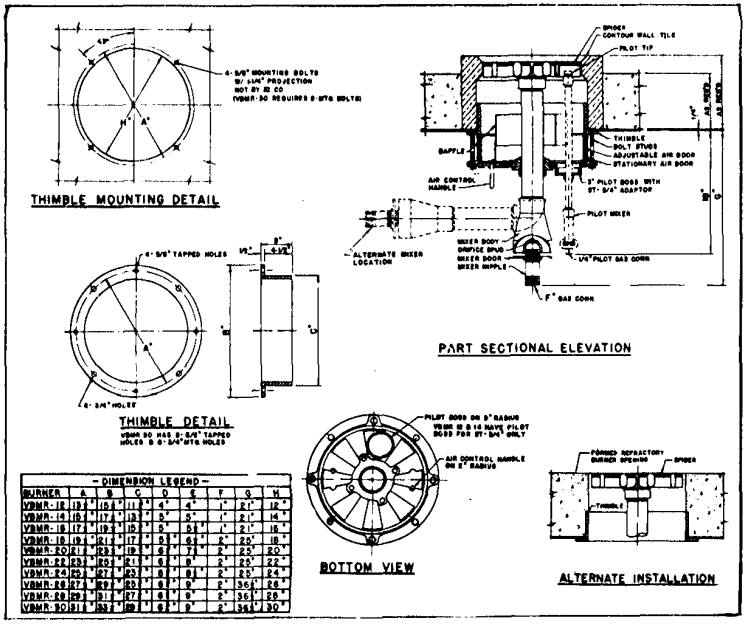
JOHN ZINK COMPANY

4401 South Peoria **Riverside 7-1371**

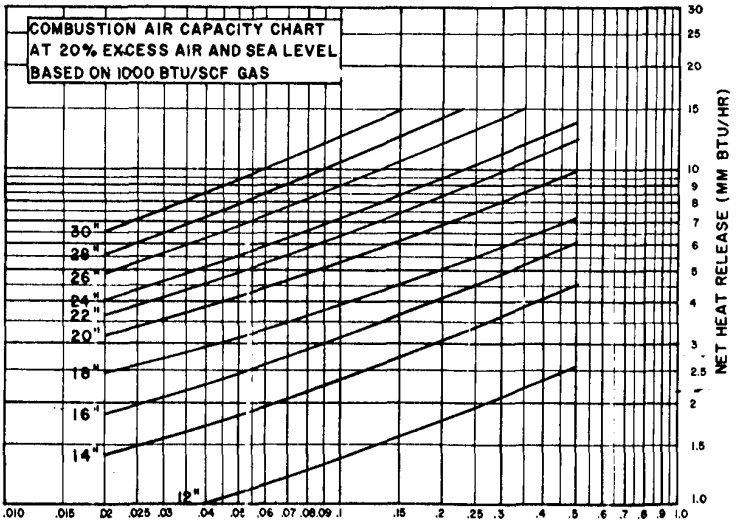
Tulsa 5, Oklahoma

Offices in: New York — Chicago — Houston — Philadelphia — Los Angeles — London — Mexico City — Paris — Frankfort — Rome

TOWOLDMON0048787



BURNER	A	B	C	D	E	F	G	H
VBMR-12	13"	15 1/4"	11"	4"	4"	1"	2 1/2"	12"
VBMR-14	15"	17"	13"	5"	5"	1"	2 1/2"	14"
VBMR-16	17"	19"	15"	5"	5 1/2"	1"	2 1/2"	15"
VBMR-18	19"	21"	17"	5"	6 1/2"	2"	2 1/2"	18"
VBMR-20	21"	23"	19"	6"	7"	2"	2 1/2"	20"
VBMR-22	23"	25"	21"	6"	8"	2"	2 1/2"	22"
VBMR-24	25"	27"	23"	6"	8 1/2"	2"	2 1/2"	24"
VBMR-26	27"	29"	25"	6"	9"	2"	3 1/2"	26"
VBMR-28	29"	31"	27"	6"	9"	2"	3 1/2"	28"
VBMR-30	31"	33"	29"	6"	9"	2"	3 1/2"	30"



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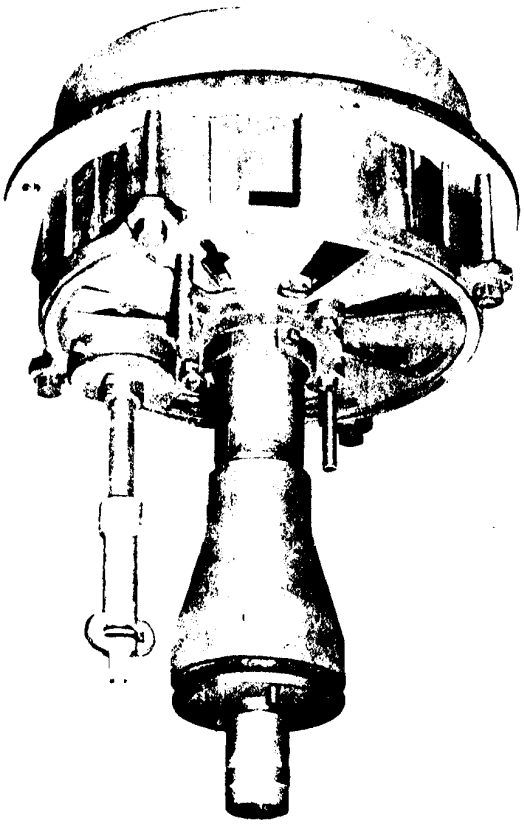
JOHN ZINK
A GOOD BRAND

SERIES VBMR

VERTICAL GAS BURNER

INSTALLATION & OPERATING INSTRUCTIONS



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JOHN ZINK COMPANY

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Tulsa 5, Oklahoma

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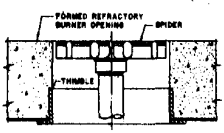
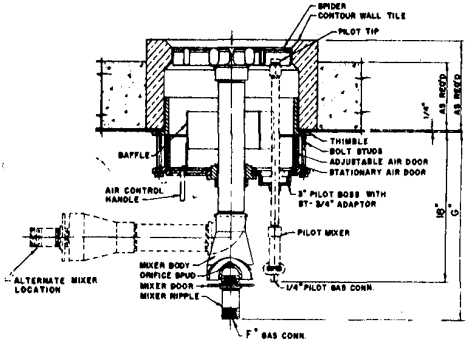
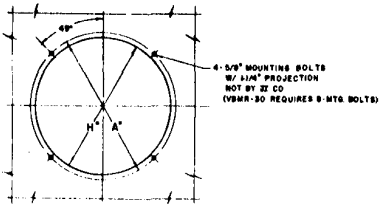


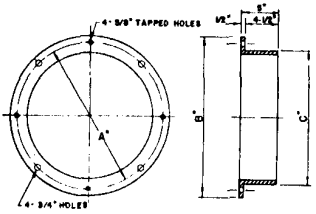
ALTERNATE INSTALLATION



PART SECTIONAL ELEVATION



THIMBLE MOUNTING DETAIL

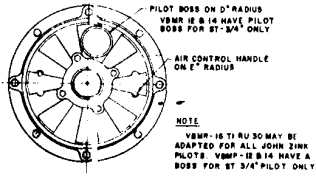


THIMBLE DETAIL

VBMR 30 HAS 8-5/8" TAPPED HOLES & 8-3/4" MTG. HOLES

BURNER	A	B	C	D	E	F	G	H
VBMR-12	13"	15½"	11"	4"	4"	1"	21"	12"
VBMR-14	15"	17½"	13"	5"	5"	1"	21"	14"
VBMR-16	17"	19½"	15"	5"	5½"	1"	21"	16"
VBMR-18	19"	21½"	17"	5½"	6½"	2"	25"	18"
VBMR-20	21"	23½"	19"	6"	7½"	2"	25"	20"
VBMR-22	23"	25½"	21"	6"	8"	2"	25"	22"
VBMR-24	25"	27"	23"	6"	8½"	2"	25"	24"
VBMR-26	27"	29"	25"	6½"	9"	2"	36½"	26"
VBMR-28	29"	31"	27"	6½"	9"	2"	36½"	28"
VBMR-30	31"	33"	29"	6½"	9"	2"	36½"	30"

— DIMENSION LEGEND —



NOTE

VBMR-16 TI RU 30 MAY BE ADAPTED FOR ALL JOHN ZINK PILOTS. VBMP-18 & 14 HAVE A BOSS FOR 8T 3/4" PILOT ONLY

BOTTOM VIEW

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OPERATING INSTRUCTIONS FOR JOHN ZINK VBMR GAS BURNERS

GENERAL

The VBMR burner consists of the following parts: (1) mixer; (2) mixer air door (primary air door); (3) gas air tube; (4) spider; (5) secondary air register; (6) floor mounting thimble.

The mixer enables the fuel gas to inspirate a portion of the air required for combustion as "primary air". This air quantity is controlled by means of the mixer primary air door (2). The spider (4) distributes the air-gas mixture to the burning zone. The secondary air register (5) controls the flow of secondary air to the burning zone.

The burners are designed for the particular duty and gas condition which they are to serve. Gas limiting orifices are sized for a specified heat release and fuel gas pressure up to 30 psig maximu. The efficiency of a furnace is dependant upon the amount of excess air in the combustion chamber. A nomograph is available from the John Zink Company for determining the excess air volume from Orsat Analysis. If the tester is provided with correct analysis of the flue gases and stack temperature he can, through the use of the nomograph, determine the net or gross loss in the stack gases and arrive at the thermal efficiency of the furnace. Full directions for the use of the nomograph are provided. The proper excess air condition will be dictated by the design of the furnace and the process served by the furnace. Manufacturer's recommendations should be followed without exception.

DIRECTIONS FOR LIGHTING BURNERS

1. Check all gas valves to see that they are CLOSED.
2. Open all air registers wide and allow the furnace to purge for not less than 5 minutes.
3. Open the main gas supply valve to make gas available up to the individual burner valves which are still CLOSED.
4. Prepare a torch which will make a flame at least 18" long and light it in an area away from the gas lines.
5. Insert the torch through the openings of the register in such a manner as to cause the torch flame to play freely over the spider.
6. See that the primary air door is at least partially open.
7. Turn on the gas which will light off instantly then adjust the primary air door to provide the required flame condition.
8. Wait until the heater is in operation then adjust the secondary air doors to provide the proper excess air condition.

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FLUE GAS CHART

DIRECTIONS:

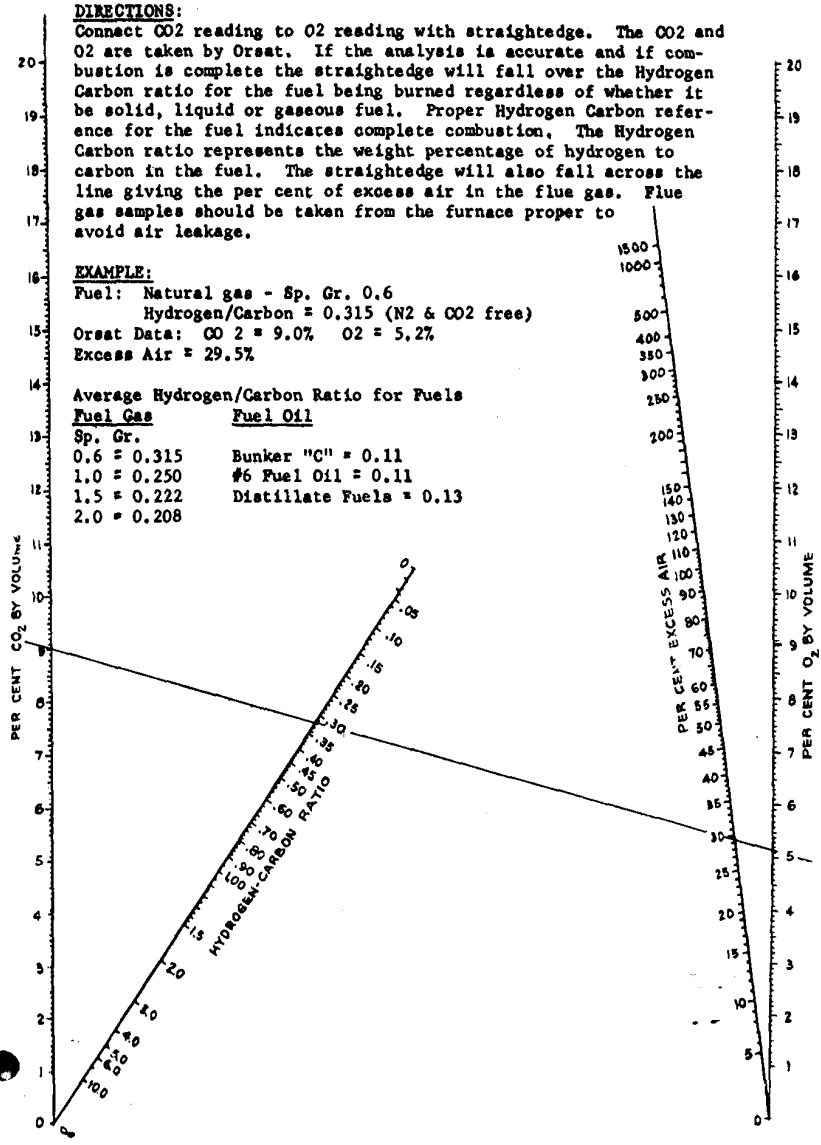
Connect CO2 reading to O2 reading with straightedge. The CO2 and O2 are taken by Orsat. If the analysis is accurate and if combustion is complete the straightedge will fall over the Hydrogen Carbon ratio for the fuel being burned regardless of whether it be solid, liquid or gaseous fuel. Proper Hydrogen Carbon reference for the fuel indicates complete combustion. The Hydrogen Carbon ratio represents the weight percentage of hydrogen to carbon in the fuel. The straightedge will also fall across the line giving the per cent of excess air in the flue gas. Flue gas samples should be taken from the furnace proper to avoid air leakage.

EXAMPLE:

Fuel: Natural gas - Sp. Gr. 0.6
Hydrogen/Carbon = 0.315 (N2 & CO2 free)
Orsat Data: CO 2 = 9.0% O2 = 5.2%
Excess Air = 29.5%

Average Hydrogen/Carbon Ratio for Fuels

Fuel Gas	Fuel Oil
Sp. Gr.	
0.6 = 0.315	Bunker "C" = 0.11
1.0 = 0.250	#6 Fuel Oil = 0.11
1.5 = 0.222	Distillate Fuels = 0.13
2.0 = 0.208	



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INSTRUMENT DESIGN BASIS
CEA-2080
SOLID AROCLOR EXPANSION

ORGANIC DIVISION
ANNISTON, ALABAMA

INSTRUMENT DESIGN SECTION
CENTRAL ENGINEERING DEPT.

WRITTEN BY: _____

APPROVED BY: _____

REV.	DATE	BY	DESCRIPTION

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TOWOLDMON0048793

INSTRUMENT DESIGN BASIS

CEA-2080

INDEX

1. Introduction
2. Design
3. Units of Measurement
4. Control Room Instruments
   - 4.1 General
   - 4.2 Controllers
   - 4.3 Recorders
   - 4.4 Annunciators
   - 4.5 Indicators
   - 4.6 Density Instruments
5. Field Mounted Instruments
6. Valves
7. Instrument Process Piping
8. Pneumatic Signal Piping
9. InstrumentAir Supply
10. Electrical Signal Wiring
11. Instrument Installation
12. Control Room & Panels
13. Instrument Numbering
14. Documents
15. Preferred Vendor (Tentative)

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INSTRUMENT DESIGN BASIS

1. INTRODUCTION

1.1 The project objective is the construction of additional solid aroclor capacity to increase yearly output to 29.6$\overline{M}$ pounds from existing capacity of 9.6$\overline{M}$ pounds. All equipment will be located at the existing plant facilities at Anniston, Alabama.

1.2 The project will have one process area (01).

2. DESIGN SUMMARY

2.1 On all instruments, close contact will be maintained with plant personnel. There are two technical reasons for this

(a) To learn what difficulties they have experienced with instrument application & materials on the existing plant and to avoid such difficulties (as far as possible) on the expansion plant,

(b) The plant has experimented with additional instruments to minimize downtime. Such successes as they may have had will be duplicated from the outset on this project.

2.2 No existing or rebuilt instruments will be used, only new instruments & devices will be purchased.

2.3 All panel mounted instruments & devices will be mounted on a new panel board. Panel mounted instruments will be of the pneumatic type.

2.4 Field pneumatic controllers will be used on variables whose set points require little changing.

2.5 The existing chlorinator panel will be relocated. Scheduling of this work will have to be worked out with construction and plant operators in order to minimize production downtime.

3. UNIT OF MEASUREMENT

3.1 GENERAL

VARIABLE	UNITS
Flow-Liquid	G.P.M.C. 60°F
Flow-Gas	#/HR or S.C.F.H.
Pressure-Gauge	PSI
Pressure-Vacuum	mmHg
Temperature	°C

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3. UNITS OF MEASUREMENT (CON'T.)

3.2 Scales and charts for all flow, temperature, pressure, level will be similar to that used on existing panel instruments for convenience of operating personnel.

3.3 FLOW INSTRUMENTS

All flow instruments shall have 0-10 sq. root charts unless a manufacturer's standard chart is available which is graduated in exactly the flow range measured. Scales will correspond to flow range being measured (either square root or linear). Linear flow measurement devices will have 0-100 uniform chart.

3.4 TEMPERATURE INSTRUMENTS

All temperature instruments shall have charts & scales that match the measuring transmitters in calibration and span.

3.5 PRESSURE INSTRUMENTS

All pressure instruments shall have charts and scales that match the measuring transmitters in calibration and span.

3.6 LEVEL INSTRUMENTS

All level instrument charts and scales shall be 0-100 uniform.

4. CONTROL ROOM INSTRUMENTS

4.1 GENERAL

All control panel mounted controllers, indicators and recorders (except multipoint) will be pneumatic type instruments.

4.2 CONTROLLERS

4.2.1 Controllers for temperature will not have rate action as standard. Level controllers will not have reset action. All controllers will have automatic/manual switching with provision for balancing.

4.3 RECORDERS

Continuous recorders will be used on density measurements. A multipoint recorder will be used for temperature.

4.4 ANNUNCIATORS

4.4.1 Alarm circuits are to be normally open. Relay type annunciators are to be used.

4.4.2 Where both high and low alarms are required for a single variable, a single common annunciator

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4. CONTROL ROOM INSTRUMENTS (CON'T.)

4.4.2 point may be used.

4.5 INDICATORS

Pneumatic indicators will be an integral part of controllers when controllers are specified. Separate indicators will be 4½" circular receiver gauges.

5. FIELD MOUNTED INSTRUMENTS

5.1 FLOW

5.1.1 GENERAL

5.1.1.1 Primary elements for flow measurement will be of two types; orifice flange meter tube, and target meter.

5.1.1.2 Flanges shall have a minimum rating of 300#, shall be tapped & will be purchased with upstream & downstream straight runs attached.

5.1.2 ORIFICE PLATES

5.1.2.1 Orifice plates will generally be the square edge, concentric type.

5.1.2.2 Orifice to pipe diameter rations (d/D) shall lie in the range 0.3 to 0.7. Plate material shall be 1/8" thick type 316 stainless steel unless process conditions dictate otherwise. Weep holes will not be provided.

5.1.2.3 The following identifying information shall be stamped on the tab of each orifice plate on the inlet (upstream side):

INLET
Orifice Diameter
Instrument Item Number
Orifice Plate Diameter

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5. FIELD MOUNTED INSTRUMENTS (CON'T.)

5.1.3 METER RANGES

Meter ranges shall, in general, be 100 inches of water. Low pressure gas will have a differential in inches of water which approximates the pressure (in psia) of the gas. The d/D ratio requirements will be a factor in selecting the differential.

5.1.4 METER RANGEABILITY

Metering rangeability for d/p instruments shall not exceed 3 to 1 full scale.

5.1.5 d/p TRANSMITTERS

All d/p transmitters shall be of the dry force balance type, with 1500 psi cadmium plated steel body, type 316 stainless steel diaphragm, 1/2" NPT process connections, universal 2" pipe mounting bracket and will have a continuously adjustable range.

5.2 PRESSURE INSTRUMENTS

5.2.1 INDICATING PRESSURE GAUGES

Indicating pressure gauges shall be of the Bourdon tube type, bottom connected, with 4½" nominal diameter dial. Dial shall be white with black numerals and pointer. Accuracy shall be 1%.

5.2.2 Diaphragm seal gauges will have a valve installed between the seal and the main process line.

5.2.3 PRESSURE TRANSMITTERS

All pressure transmitters shall be of the force balance type. Process connections are to be ½" NPT or manufacturer's standard. Blind transmitters will have a pressure gauge connected to the transmitter process connection. Materials used for pressure elements shall be selected for compatibility with the process stream.

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5. FIELD MOUNTED INSTRUMENTS (CON'T.)

5.2.4 Pressure switches are to have adjustable set points and will be suitable for weatherproof classification (Nema 3).

5.3 LEVEL INSTRUMENTS

Bubbler type level transmitters will be used for level transmission. Rod out facilities will be provided. Where level alarm only is required nuclear type alarm switches will be used. There is no application on this project for bouyancy type transmitters or float type switches.

5.4 TEMPERATURE

5.4.1 PRIMARY ELEMENTS

5.4.1.1 All thermocouples which are tied to multi-point recorder will be iron constantan.

5.4.1.2 Certain temperature alarms will have chromel-alumel thermocouples in keeping with previous project.

5.4.2 THERMOWELLS

Thermowells shall be type 304 stainless steel not withstanding that most thermowells on existing plant are carbon steel. Thermowells will have 1" NPT screwed or minimum 1½" flanged process connections.

5.4.3 DIAL THERMOMETERS

Dial thermometers will be of filled type and generally will be back connected. Dial size will be manufacturer's standard but not less than 4" diameter. Separate thermowells will be provided.

6. VALVES

6.1 CONTROL VALVES

6.1.1 Diaphragm operated control valves will be flanged with 1" minimum body size. Piping specifications will be followed on body materials and flange rating.

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6. VALVES (CON'T.)

6.1 CONTROL VALVES (CON'T.)

6.1.2 Standard trim will be type 316 stainless steel unless process conditions require otherwise.

6.1.3 POSITIONERS

Valve positioners will generally be side mounted, direct acting type with three gauges and a by-pass, except that the bypass will be omitted on valves in split range service.

6.2 SAFETY RELIEF VALVES

6.2.1 CONSTRUCTION

Flanged relief valves, in general, shall be enclosed spring, bolted bonnet, screwed cap, full nozzle type with stainless steel nozzle, disc, guide & spindle, and cast steel bodies. Body pressure ratings for all flanged valves shall be the same rating as valve inlet flange. Screwed valves (thermal relief) may have screwed bonnets and may be used where small orifice areas are required and if allowed by piping specifications.

6.3 RUPTURE DISCS

6.3.1 SAFETY HEAD FITTINGS

Generally, the safety head shall be the type with a diameter that fits inside the bolt circle.

6.3.2 RUPTURE DISCS

All rupture discs will be interchangeable with all safety head fittings for a particular size. Maximum bursting pressure of disc shall not exceed the maximum allowable working pressure of the protected system.

6.4 SOLENOID VALVES

Solenoid operated valves shall be of the continuous duty type with encapsulated coils and shall meet Nema 3.

7. INSTRUMENT PROCESS PIPING

Process instrument piping shall match process piping specification in material of construction. Other materials may be used when required due to process conditions.

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8. PNEUMATIC SIGNAL PIPING

8.1 OUTISDE OF PANEL BOARD

8.1.1 Single tubes outside of the panelboard will be high density polyethylene in thin wall conduit.

8.1.2 Multitube bundles will be 4 tube number coded high density polyethylene inside pvc sheath. Assembly is then wrapped with asbestos and whole covered with heavy poly-vinyl sheath.

8.1.3 All tubing fittings will be Swagelock or equal.

9. INSTRUMENT AIR SUPPLY

9.1 Air supplies to individual instruments shall be 1/2" pipe size with block valve at header and 1/4" Flolok valve at supply side of filter regulator. Connections. from the instrument filter regulator to the instrument will be tubing. Connections into air header to be from top of pipe.

9.2 An air supply pressure gauge will be supplied at the filter regulator.

10. ELECTRICAL SIGNAL WIRING

10.1 GENERAL

Thermocouples and other low energy signals will be seperated from 115 vac wiring. All wires and cables will be tagged with their assigned number.

10.2 THERMOCOUPLE EXTENSION WIRE

Single twisted pair #16 awg solid conductor with pvc or fiberglass wire insulation and overall insulation depending on maximum expected ambient temperature.

11. INSTRUMENT INSTALLATION

11.1 All field instruments shall be mounted at grade or on platforms. Force balance transmitters will be mounted on 2" pipe stands, and shall be accessible from grade or platform.

11.2 All field mounted indicating or recording instruments shall be mounted so that chart or scale centerline is 5' above grade or platform and shall be located as near primary connection as possible, consistent with instrument accessbility.

11.3 Dial thermometers, pressure gauges, test wells, etc. that are line mounted, shall be located so as to be plainly

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11. INSTRUMENT INSTALLATION (CON'T.)

11.3 seen and accessible from grade or platform.

11.4 All instrument leads to vessel, line or equipment will be properly supported to relieve strain on connections at equipment and instrument.

12. CONTROL ROOM AND PANELS

12.1 GENERAL

12.1.1 The existing control room will be enlarged to the south to accomodate the new control panel.

12.1.2 The existing chlorinator panel will be relocated to a new position in existing control room. This relocation will be scheduled after new plant start-up.

12.2 ELECTRIC POWER

Electric power for the control panel will be supplied from breaker panels for this purpose only.

12.3 CONTROL PANEL

12.3.1 A new control panel with straight vertical front will be installed in expanded control room. Mounted on the front of this panel will be the following:

Pneumatic Recording Controllers
Multipoint Recorders
Annunciators
Indicators
Pushbuttons and "Run" Lights for Electric Motors

Mounted behind panelboard will be the following:

Sequencing Instruments
Pressure Switches
Power Supplies for Chart Drives

12.3.2 Panel will be light green (enamel) outside and white inside.

12.3.3 All panel layout drawings will be by Monsanto except detailed steel drawings by the panel fabricator.

13. INSTRUMENT NUMBERING

Instruments will be numbered and shown on flow sheets and engineering flow diagrams as per new Monsanto Procedure Standard No. R1.1 Std. 2 titled "IDENTIFICATION OF LOOPS AND COMPONENTS".

14. DOCUMENTS

The following schedules and drawings will be prepared:

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14. DOCUMENTS (CON'T.)

DRAWING TYPE	DESCRIPTION
I	Instrument Design Basis
I	Instrument List
I	Instrument Schematics
E	Annunciator Schematics
I	Instrument Installation Details
I	Instrument Specifications
I	Layout-Instrument Tubing
E	Wiring-Instrument Panel
I	Tubing-Instrument Panel
I	Nameplate List
I	Instrument Function Outlines

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15. PREFERRED VENDOR:

INSTRUMENT	VENDOR
Annunciator	Scam Model #51;Sequence AF.
~~Non-Indicating On-Off T/C Switch (Furnace Outlet)~~	~~Transmation~~
Temperature Recorder-Multipoint	~~Leeds & Northrup~~ HONEYWELL ELECTRONIK 15
Dial Thermometers	Palmer MODEL 50A
Thermocouples & Extension Leadwire	ThermoElectric
Thermowells	Alloy Engineering
Pneumatic Temp. Transmitter with T/C Input	Taylor 721T Series - Solid State
BLIND ~~Indicating~~ Temperature Transmitters	Foxboro Model ~~45~~ 12A
Pressure and Temperature Switches	Mercoid MODEL DAW
Orifice Plates, Flanges and Meter Runs	Daniel
Sight Feed Bubblers	Meriam 93155
Pressure Gauges (1% Accuracy)	Ashcroft Model 1020, ½"NPT
Diaphragm Seals	Mansfield & Green TYPE SA
Manometers	Meriam 11AA1D
Instrument Air Filter/Regulator	Fisher Governor 67FR
Insyrument Air Precision Regulator	Moore Model 41
Absolute Pressure Transmitters	Foxboro Model 11AL
Indicating Pressure Transmitter	Foxboro Model 45
Tank Level Transmitter	~~Fischer-Porter~~ FOXBORO TYPE 13FE
Blind Differential Pressure Transmitters	Foxboro Model 13
Gauge Glasses	Jerguson SERIES 12
Relief Valves	Lonergan T ¼ LTC-11
Diaphragm Control Valves	Fisher Governor
Piston Operated Control Valve	Jamesbury D150F

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15. PREFERRED VENDOR (CON'T.)

INSTRUMENT	VENDOR
Solenoid Valves	Skinner; ASCO
Receiver Gauges	Ashcroft 1223 UC
Set Point Receivers	Fischer Porter MODEL 1303
1 Pen Recording Controllers	Taylor Series 91JF
Indicating Controllers	Taylor Series 91K
Integrator	Foxboro Model ~~224~~ 14A-EB
Horns and Bells	Federal;Benjamin
3 Valve Manifolds	Anderson-Greenwood MIVC-4
Rupture Discs	Falls Industries; B.S. & B. QUICK-SERT*7R
Stepping Switches	Taylor Model ~~350-27~~ 42-RC
Pneumatic Tubing	Dekoron High Density FB
Junction Boxes	Brockmeier
Combined Chlorinator & Still Panel Board	Competitive Bids

SPECIAL INSTRUMENTS

DESCRIPTION & LOCATION	PROBABLE VENDOR
Flow measurement on inlet to still furnace. Previous experience indicates problems with Taylor volumetric D/P cell. ~~Target~~ STRAIN GAUGE type transmitter will work.	~~Foxboro~~ ROSEMOUNT
Density measurement of 5460 may be correlated with softening point and it is desired to eliminate quesswork in deciding when a batch has been distilled. A nuclear device for low still level alarm & for receiver density recording will be purchased.	Ohmart/INDUSTRIAL NUCLEONICS
Density of chlorinated product is considered to be correlated with 5060 formation. Nuclear gauges for density recording will be purchased.	Ohmart/INDUSTRIAL NUCLEONICS

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