STANDARD OPERATING INSTRUCTIONS
FOR
SOLID AROCLOR 5460

PROCESS FUNCTION OUTLINE

III. C. I. MAIN THERMINOL HEATER SYSTEM

1.1 Scope

This covers the charging, start-up, shutdown, normal operation, and emergency situations involving the Therminol heater in the Aroclor Department.

1.2 Description of Process

Therminol FR-2 (Aroclor 1248) or FR-1 (Aroclor 1242) is circulated through a pipe system in the Aroclor Department. This heating system is used to heat up tanks, transfer lines, and material involved in producing solid Aroclors.

There are three separate circulating systems drawing off the same surge tank (Item 149). They should not be confused with the Therminol cooling systems other places in the process. The first system circulates 400 GPM through the furnace to heat the Aroclor to 250°C. The second system can circulate 1,000 GPM through the old system (existing users). The third system can circulate 300 GPM through the new Solid Aroclor Expansion area (CEA 2080 users). The pumps are equipped with a seal guard system.

II. PROCESS DIAGRAM

Attached.

III. OPERATION OF PROCESS

3.1 a. Charge System with Therminol FR-2 (Aroclor 1248)

1. Use temporarily relocated Pyranol pump to charge Therminol surge tank.

2. Position 55 gallon drum next to pump. Remove drum bung and vent cap.

3. Connect flexible hose to pump suction and the stainless steel pipe to be inserted into the drum.

4. Position discharge line from the pump into the tank.

5. Open valve on pump suction. Insert pipe into drum and start pump.

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6. Adjust the suction valve on the pump until flow is steady.

7. Continue to fill the tank until 72 drums or approximately 3,950 gallons total are in the surge tank (Item 149).

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C. III. 3.1 b. Therminol 1242 can be charged directly to the surge tank (Item 149) by the following procedure:

1. Align valves from storage tank No. 5 to surge tank (Item 149). Care must be taken to ensure that all valves to the other surge tanks are closed. They are also filled from this storage tank line.

2. Check level gauge at surge tank.

3. Start storage tank pump.

4. Observe the level gauge at surge tank and shut off pump when you have 3,950 Gals.

5. Close valves in line from storage tank to surge tank.

3.2 Start-Up

A. Initial Start-Up

1. Turn on circuit No. 5 at the still panel and the switch at the field control box.

2. Place TRCA-629.12 in "Manual" with the output pressure at 15 psig. Blower air control valve is air to open.

3. Check to be sure Therminol is in the surge tank (Item 149). Temperature should be 100°C. minimum.

4. There is no flow control through the heater. The old FIC instrument will be used as a flow indicator, FIA-159-1. An alarm will sound if the pump stops and furnace shutdown will occur below 200 GPM.

5. Open natural gas valves in line to furnace.

6. Open blower air valves in pilot and main air lines.

7. Actuate red inset safety lever inside the Honeywell Protectoglo unit (lower right cover of case). You must wait 10 seconds between settings of this lever in case it has to be redone.

8. Set the temperature shutdown control point on Honeywell coil outlet temperature indicator at 325°C. (617°F.).

9. Start Therminol circulating pump (Item 159).



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C. III. 3.2 A. 10. Start air blower. Use pushbutton at side of field panel. Red light on Protectoglo unit should light up. Air pressure at the blower discharge should be above 1 psig.

11. Check pressure gauge at main air inlet to burner. It must be above 15 o.s.i.

12. Wait 6 minutes. Green light on Protectoglo unit lights up indicating purge period is over.

13. Press ignition "Start" pushbutton on side of control box and hold in until white light on Protectoglo unit lights up. Red and green lights should go out. Pilot lights up indicated by 0-7 reading on micro amp meter.

14. Adjust manual valve in air line to burner until pressure is below 1-1/2 o.s.i.

15. Reset the two North American safety valves in the main gas line. Handle on both valves must be in UP position prior to opening either valve.

16. Adjust manual valve in air line to burner until pressure is between 15 and 22 o.s.i. It must be above 15 o.s.i.

17. Adjust TRCA-629.12 to temperature at outlet of coil and transfer instrument to "Auto". This is for low fire start-up.

    Use care to make this change, since you can cause shutdown of the furnace.

18. Shut steam valve to coil in the surge tank. Vent coil line to atmosphere.

19. The furnace has been dried out and is ready for use.

20. Observe the furnace temperature at the coil outlet. Do not exceed 50°C. increase for first two hours. Set TRCA-629.12 in automatic and raise the temperature 50°C. per hour until you reach 280°C.

    Open the manual air valve slowly to raise the temperature.

    Place TRCA-629.12 in "Auto" position and put set point at 280°C. System will circulate until needed.

    Check stack temperature and do not exceed 400°C. on the multipoint temperature recorder.



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C. III. 3.2 A. 21. The therminol will continue to circulate from surge tank to heater and back to surge tank until the pumps for the other two systems are turned on. (Items 150 (existing users) and 158 (CEA 2080 users)).

22. To put the therminol through these two systems, fill the lines one at a time. Open each branch valve at feed and discharge to drive out air.

B. Start-Up Following Temporary Shutdown

Assume circulating pump is running (FIA-159-1) and the pilot light is burning.

1. Check to be sure Therminol is in the surge tank (Item 149).

2. Check temperature in surge tank (Item 149), TI-149-2. It should be 100°C.

   Turn on steam to tank coil if necessary.

3. Adjust set point TRCA-629.12 at 126° - 150°C. and controller in "Auto" position.

4. White light on the Honeywell Protectoglo unit will be on indicating the pilot is on.

5. Adjust manual valve in air line to burner until pressure is below 1-1/2 o.s.i.

6. Reset the two North American safety valves in the main gas line.

7. Adjust manual valve in air line to burner until pressure is between 20-22 o.s.i.

8. Adjust TRCA-629.12 to temperature at outlet of coil and transfer instrument to "Auto". Gradually raise the set point to 280°C.

9. Start circulating pumps to both areas (existing old system and 2080 system). Fill lines one at a time, opening discharge and feed line at each feeder.



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C. III. 3.3 Routine Operations

When the Therminol heater system is operating normally, the following conditions will exist in the process.

A. FIA-159-1 will indicate 415 GPM.

B. PI-159 pump discharge pressure 44 psig.

C. PI-150 (existing users) pump discharge pressure 43 psig.

D. PI-158 (CEA 2080 users) pump discharge pressure 44 psig.

E. PI-629.16 heater coil outlet pressure 5-10 psig .

F. TRCA-629.12 heater coil outlet temperature set at 280°C.

G. Honeywell coil outlet temperature indicator at 280°C. Shutdown alarm set at 325°C.

H. TI-149-2 surge tank temperature is around 250°C.

I. Air blower reduced discharge pressure - above 15 o.s.i. less than 22 o.s.i.

J. Main natural gas pressure 40 psig.

K. Natural gas reduced pressure 3-5 o.s.i.

L. Natural gas feed to burner atmospheric pressure (0 o.s.i.).

3.4 Safety Features

A. Honeywell Protectoglo unit has the following safety features:

1. Ignition period 10 second delay between actuation periods for warp switch to cool.

2. Blower reduced air pressure must be above 15 o.s.i. and less than 22 o.s.i.

3. Heater coil high temperature outlet shutdown set at 325°C. (617°F.).

4. Main natural gas low pressure shutdown set at 20 psig, and at 10 psig.

5. Natural gas high reduced pressure shutdown set at 5.0 psig.

6. Circulating pump low flow rate shutdown set at 200 GPM.

7. Air blower start-up sets up automatic 6 minute timed purge before next step of start-up can proceed.



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C. III. 3.4 A. 8. Minimum 15 o.s.i. air pressure is necessary at the main burner for the purge period.

9. A low air pressure ignition for lighting main burner is necessary. Set for air pressure to be below 1-1/2 o.s.i. to main burner.

10. Pilot flame must be burning to start up unit, indicated by 0-7 microamperes on current meter. Meter gives an alternating off-on reading.

B. Check surge tank, Item 149, to be sure therminol level is adequate. There should be 24 inches in the bottom sight glass during normal operation.

3.5 Shutdown

A. Temporary Shutdown

Main gas burner off with pilot light on and circulating pump running.

1. Adjust TRCA-629.12 set point to zero (instrument in "Auto"), or

2. If instrument is in "Manual", adjust controller for output pressure to zero, or

3. Close the 6" manual valve in the main air line to the furnace burner. In case it is necessary to cool the furnace quickly, leave the air valve open.

4. Normally, the circulating pump is left on to cool the heater coil and prevent overheating.

5. Close one or both of the North American safety valves in the gas line to the main burner.

B. Complete Shutdown

Main gas burner pilot light and circulating pump off.

1. Push ignition "Stop" button on side of field control panel.

2. Push "Stop" button for air blower.

3. Close manual valve in the main air line.

4. Close manual valves in main gas supply line.



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C. III. 3.5 B. 5. Allow circulating pump to continue pumping until furnace coil outlet has cooled to 150°C. then shut off the circulating pump.

6. Check surge tank level (Item 149) to be sure the tank does not overflow.

7. If a temperature of 100°C. is to be maintained in the surge tank, it may be necessary to open the valve in the steam line to the tank coil.

8. Set points on TRCA-629.12, heater coil outlet, and the Honeywell Protectoglo unit set point can be left in position when shut off.

9. Shut off circuit No. 5 behind the still panel if the shutdown is to be an extended one.

C. Emergency Shutdown

In case it becomes necessary to shut down fast, the following methods can normally be used.

1. From the Field

a. Push ignition "Stop" button on side of field control panel to shut off pilot and main burner.

b. Turn temperature shutdown set point on Honeywell Protectoglo unit below the furnace coil outlet temperature.

c. Close manual valve in air blower discharge line or stop the air blower.

d. Push "Stop" button for the circulating pump located near the surge tank (Item 149) beside the pump (Item 159).

Main and pilot gas burner will be shut off, while air is being blown through the furnace.

Item d. is the least preferred of the above methods. Normally, the circulating pump will continue to be operated.



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C. III. 3.5 C. 2. At the Still Panel

a. Turn off circuit No. 5 behind still panel.

3. At Motor Control Center

a. Shut off circulating pump circuit breaker. This method is least preferred.

b. Shut off blower circuit breaker.

D. Emergency Shutdown with Alarm

Pilot and main gas burner off. Circulating pump still on.

1. High coil outlet temperature - above 325°C.(617°F.)
2. Low natural gas supply pressure - below 20 psig or below 10 psig
3. Low blower outlet pressure - below 1 psig
4. High reduced natural gas pressure- above 5 psig
5. Low coil flow - below 200 GPM
6. Failure of circuit 5 behind still panel.
7. Failure of "on-off" switch at side of field control panel or blowing 115 volt fuse in panel.

3.6 Control Loops, Interlocks, and Alarms

A. Control Loops

There are three major loops in this system.

1. Circulating Pump Flow Indication - FIA-159-1

Low circulation rate (below 200 GPM) will shut off natural gas to the furnace and sound an alarm horn.

2. Therminol Heater Outlet Coil Temperature Control - TRCA-629.12

Function of this loop is to maintain a constant temperature of 280°C. at the furnace coil outlet. This is accomplished by measurement of the temperature with a thermocouple and controlling the heat input to the furnace with a control valve in the main combustion air line. A low temperature alarm at 220°C. and a high temperature alarm at 325°C. will be actuated at too low or too high a temperature.



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C. III. 3.6 A. 3. Therminol Heater Furnace Control - 629A

The function of this loop is to provide a source of heat for the Therminol circulating system. This is obtained with a North American burner and air blower which is used to heat the Therminol circulating through a direct fired coil. Control of this heating system is obtained by TRCA-629.12. There are four safety features in the furnace controls to shut the system down.

a. High coil outlet temperature - above 325°C.

b. Low natural gas supply pressure-below 20 psig or -below 10 psig

c. Low blower outlet pressure -below 1 psig

d. High reduced natural gas pressure-above 5 psig

B. Interlocks

Interlocks in this system are as follows. Each, except Items 1.a. and b., have alarms.

1. Start-Up of Furnace

a. Actuation of pilot ignition lever on Honeywell Protectoglo unit has a 10 second delay before second try can be made.

b. Ignition "Start" button at the Protectoglo unit has a 6 minute purge delay after the air blower has been started before the furnace will light up.

c. During purge period a minimum of 15 o.s.i. air pressure is necessary prior to completion of purge.

d. To light the main burner the air discharge pressure to the main burner must be below 1-1/2 o.s.i. for low fire start-up.

2. Automatic Furnace Shutdown with Alarms (Pilot and Main Gas Burner Off)

a. High coil outlet temperature - above 325°C. (617°F.)

b. Low natural gas supply pressure - below 20 psig or below 10 psig



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C. III. 3.6 B. 2. c. Low blower outlet pressure - below 1 psig

d. High reduced natural gas pressure - above 5 psig

e. Low coil flow - below 200 GPM

f. Failure of circuit No. 5 behind still panel.

g. Failure of switch at side of field control panel or blowing 115 volt fuse in panel.

C. Alarms

1. All shutdown items under Interlocks B.2. above.

2. Therminol heater coil outlet low temperature below 220°C.

3. Therminol heater coil outlet high temperature above 325°C.

3.7 Abnormal Conditions

A. Unusual high or low temperature readings can occur if the thermocouple extension wire for the Honeywell Protectoglo unit and TRCA-629.12 are mixed up. See note, Section IV-C., below.

IV. COMMENTS ON PROCESS

A. It is very important to be sure the coil in the surge tank (Item 149) is covered when the system is in operation. This assures the circulating pump has a positive suction and prevents surging in the heater coil. Surges in flow can cause coil hot spots and shorten the coil life.

B. FIA-159-1 flow indicator will shut the system down if the flow is less than 200 GPM.

C. At TRCA-629.12, be sure the iron constantan thermocouple extension lead wire (type J) is used to transmit to the control room and the instrument. The conduit run also contains a type K extension lead wire which is chromel alumel. If the type J wire is used, the indicator will read correctly. If the type K wire is used by mistake, the therminol will overheat by about 100°C. The high temperature switch should shut the furnace down at 325°C.



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C. IV. D. The Therminol furnace is rated at 8,000,000 Btu/hour heat input. This corresponds to 22 o.s.i. air pressure at the air inlet of the burner. The manual valve in the air line should be set for 22 o.s.i. when the automatic valve is wide open. This will assure the heat input will not exceed the design rate if the automatic valve should open wide.

E. Care must be taken not to fill the surge tank (Item 149) too full during normal operation. This can cause the tank to run over when the circulating pump is stopped. Normal level will be about 24 inches in the sight glass. The level in the tank will vary, dependent on the operating temperature of the system and the Therminol usage.

F. The control valve formally controlled by FIC-159-1 must be kept closed at all times. This is accomplished by setting the red arrow at zero flow. If this valve is open the hot Therminol does not go through the branch lines to return to the surge tank, since the large supply and return lines are connected at this point.

G. To get natural gas to the main burner the North Americal safety valves must be reset. Prior to opening the valves the handle of each valve must be in the UP position. This sets the safety shutdown pressure switches.

H. Use care when opening the inner door to the field control panel at the furnace. The high temperature shutdown instrument pointer is free floating and can go above the shutdown pointer. The door must be opened slowly.

I. Gas to the venturi mixing chamber for the pilot light on the furnace should be at atmospheric pressure. Air pressure will be the blower discharge pressure (22 o.s.i.). The pilot light will not burn unless this pressure ratio is maintained to give the proper gas-air mixture.

J. In case of a power failure at the field panel for the Therminol heater the reset button on the high temperature shutdown instrument must be pushed to restart the system. There is no apparent indication that this button has been pushed. The red no flame light will not light up and furnace can not be started.



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APPENDIX I

Item 149, Main Therminol Surge Tank

90" OD X 134" Long
*Dished Heads*

| Depth (In.) | Contents (Gal.) | Depth (In.) | Contents (Gal.) |
|---|---|---|---|
| 0 | 0 | 46 | 2148.3 |
| 1 | 7.4 | 47 | 2210.0 |
| 2 | 21.7 | 48 | 2271.7 |
| 3 | 39.4 | 49 | 2332.3 |
| 4 | 60.4 | 50 | 2392.8 |
| 5 | 84.1 | 51 | 2452.1 |
| 6 | 111.1 | 52 | 2512.3 |
| 7 | 139.7 | 53 | 2572.3 |
| 8 | 170.7 | 54 | 2631.0 |
| 9 | 203.1 | 55 | 2689.5 |
| 10 | 248.1 | 56 | 2747.8 |
| 11 | 273.9 | 57 | 2805.7 |
| 12 | 312.0 | 58 | 2862.3 |
| 13 | 348.0 | 59 | 2918.5 |
| 14 | 385.1 | 60 | 2975.4 |
| 15 | 433.3 | 61 | 2030.8 |
| 16 | 472.5 | 62 | 2085.7 |
| 17 | 512.7 | 63 | 3141.2 |
| 18 | 568.6 | 64 | 3195.1 |
| 19 | 610.8 | 65 | 3248.5 |
| 20 | 652.4 | 66 | 3300.3 |
| 21 | 712.0 | 67 | 3340.5 |
| 22 | 763.3 | 68 | 3397.9 |
| 23 | 815.2 | 69 | 3445.5 |
| 24 | 865.7 | 70 | 3494.7 |
| 25 | 922.9 | 71 | 3530.9 |
| 26 | 970.7 | 72 | 3592.3 |
| 27 | 1024.8 | 73 | 3637.8 |
| 28 | 1079.6 | 74 | 3682.3 |
| 29 | 1135.9 | 75 | 3724.8 |
| 30 | 1191.4 | 76 | 3765.2 |
| 31 | 1248.5 | 77 | 3804.5 |
| 32 | 1306.0 | 78 | 3843.5 |
| 33 | 1363.9 | 79 | 3880.3 |
| 34 | 1422.0 | 80 | 3915.6 |
| 35 | 1480.5 | 81 | 3948.4 |
| 36 | 1541.0 | 82 | 3979.7 |
| 37 | 1600.1 | 83 | 4010.1 |
| 38 | 1659.2 | 84 | 4036.6 |
| 39 | 1719.5 | 85 | 4059.9 |
| 40 | 1709.9 | 86 | 4081.7 |
| 41 | 1840.5 | 87 | 4100.7 |
| 42 | 1901.2 | 88 | 4115.1 |
| 43 | 1962.9 | 89 | 4125.6 |
| 44 | 2024.7 | | |
| 45 | 2086.5 | | |



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STANDARD OPERATING INSTRUCTIONS
FOR
SOLID AROCLOR 5460

PROCESS FUNCTION OUTLINE

## III. C. I. NO. 2 WEIGH TANK, NO. 10 & 11 CHLORINATORS, AND NO. 5 BLOW TANK

### 1.1 Scope

This covers the charging, start-up, shutdown, normal operation, and emergency situations involving the No. 2 Weigh (charge) Tank, No. 10 & 11 Chlorinators, and the No. 5 Blow Tank for production of 5460 Solid Aroclor. To avoid confusion, the instructions for the chlorinators will be written for No. 10 with the corresponding item number, controller number, etc., for No. 11 appearing in parenthesis.

### 1.2 Description of Process

Crude 5460 (5060 Aroclor) is produced by the batch chlorination of a weighed quantity of Santowax R in a vertical reaction vessel with Ferric Chloride as a catalyst. Chlorine gas is added at the bottom of the vessel.

By-product HCl gas vented at the top of the chlorinator is recovered in the Muriatic Acid Department. The 5060 produced in batch chlorination is transferred to a blowing tank when the chlorination is completed. Chlorine gas is fed to the chlorinator from tank cars.

## II. PROCESS DIAGRAM

Attached.

## III. DESCRIPTION OF PROCESS

### 3.1 Start-Up

#### A. Charge Therminol Cooling System for the No. 10 (11) Chlorinator

Both chlorinator cooling systems use the same surge tank (Item 114). Therminol 1242 can be charged directly to the surge tank by the following procedure:

1. Align valves in line from storage tank No. 5 to surge tank (Item 114). Care must be taken to ensure that all valves to the other surge tanks are closed. They are also filled from this storage tank line.

2. Check level gauge at surge tank and start the storage tank pump.



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C. III. 3.1 A. 3. Observe the level gauge at surge tank and shut off pump when you have 700 Gals. or 3-1/2 ft. in the sight glass. Once circulation is established Therminol should be added to bring the sight glass level to 12" (approximately 150 gallons more).

4. Close valves in line from storage tank to surge tank.

B. Charge Therminol Cooling System for No. 10 (11) Chlorinator

Charge Therminol (1248 Aroclor) into the surge tank (Item 114) by the following procedure:

1. Use temporarily relocated Pyranol pump to charge the tank.

2. Position 55 gal. drum next to the pump. Remove drum bung and vent cap.

3. Connect flexible hose to pump suction and the stainless steel pipe to be placed in the drum.

4. Position discharge line from the pump into the surge tank (item 114).

5. Open valve on pump suction. Insert pipe into the drum and start pump.

6. Adjust the suction valve on the pump until flow is steady.

7. Continue to fill the tank until 16 drums or 850 gallons are in the surge tank.

C. Start-Up Therminol Cooling System for No. 10 (11) Chlorinator

1. Set valves in the system to flow through the No. 10 (11) chlorinator heat exchanger (Item 106 (119)) and through the tube side of the therminol cooler (Item 116 (123)).

2. Close drain valve on the suction of the circulating pump (Item 115 (122)).

3. Close valves to put Therminol from the furnace system on the No. 10 (11) Aroclor chlorinator heat exchanger (Item 106 (119). Tag lines closed.

4. Open steam valve to coil on the surge tank (Item 114). Both chlorinator cooling systems use the same surge tank (Item 114). There is no temperature controller on this tank. The steam valve should be set to bring the temperature in this tank to 45°C. Once in operation, the valve can be closed. It will be reopened upon shutdown of both chlorinators or if required to maintain an adequate temperature.



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C. III. 3.1 C. 5. Check level in the surge tank (Item 114). Should have an adequate level in the tank.

6. Set TRCA-106-1 (119-1) in "Auto" with set point at 190°C. Low temperature alarm set at 120°C. - high temperature alarm set at 275°C.

7. Set FICA-115-1 (122-1) in "Auto" with set point at 300 GPM. Low flow alarm should sound at 250 GPM.

8. When the material in the surge tank is at 45°C., start the circulating pump (Item 115 (122).

9. Check flow through the Therminol cooling system by observing the following items:

a. Pump discharge pressure should be 45 psig on the local gauge.

b. Flow through Therminol system should be 300 GPM. Check FICA-115-1 (122-1).

c. Check action of control valve to the No. 10 (11) Aroclor heat exchanger. See TRCA-106-1 (119-1). Valve should be closed.

10. Set TICA-116-1 (123-1) on the Therminol cooler to 70°C. Low temperature alarm is set at 50°C. - high temperature alarm is set at 90°C.

11. Check the following temperature points in the Therminol cooling system:

a. Pump discharge temperature, No. 10 (11) chlorinator heat exchanger outlet temperature, and the outlet temperature of the water-cooled heat exchanger for the therminol system (See TRCA-116-1 (123-1)).

12. If there are no problems with the system, let it continue to circulate until needed.

D. Initial Equipment Check for Start-Up

Open valves on steam lines to the Santowax supply to the weigh tank (Item 101). Open valves in the steam lines to the coil on the weigh tank.

1. Set temperature controller on the No. 2 weigh tank, TIC-101-1, at 150°C. The controller has no provision for manual operation.



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C. III. 3.1 D. 2. Check Therminol cooling system.

a. Therminol cooler controller TICA-116-1 (123-1) is set in "Auto." with a set point at 70°C.

b. Flow controller FICA-115-1 (122-1) in "Auto." with the set point at 300 GPM.

c. Pump pressure 45 psig.

3. The No. 5 blow tank temperature controller TIC-125-1 should be in "Auto." with the set point at 240°C.

4. Make sure the main Aroclor therminol heater system is in operation and is circulating at 250°C. This system provides the heat for high temperature line tracing and for the No. 5 blow tank coil.

5. Open therminol feeder lines to heat the following equipment:

a. Transfer lines from weigh tank (Item 101) to the transfer pump and to No. 10 (11) chlorinator (Item 104 (117).

b. Circulating line on No. 10 (11) chlorinator.

c. Sample line on No. 10 (11) chlorinator.

d. Transfer line at No. 10 (11) chlorinator to the No. 5 blow tank (Item 125).

e. Plate coils on No. 5 blow tank (Item 125).

f. Transfer line from No. 5 blow tank to the pump (Item 126).

Observe temperature to be sure the therminol system stays at 250°C., or returns to this temperature after the various feed lines have been started up.

6. Open steam valve on mist eliminator (Item 107 (120)) tracing.

7. Open water valve to S&K jet (Item 127) - 20 psig water pressure. This unit stays in continuous operation.



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C. III. 3.1 D. 8. Start the air blower (Item 124). Open the valve at the No. 5 blow tank two turns.

9. Check the suction on the No. 5 blow tank (Item 125) to be sure it is adequate for operation.

10. Open the manual valves in the water system to the Aroclor cooler (Item 116 (123)).

E. Charge and Operating Temperatures for Crude 5460 Solid Aroclor

The charge and operating temperatures for the chlorinators are shown in Table I.

F. Charge No. 2 Weigh Tank (Charge Tank)

1. Charge 11,200 lbs. of Santowax R in the following manner:

a. Set the valves to receive the charge from the Santowax Department. Santowax R is obtained from the Santowax storage tank.

b. Open the manual valve in the Santowax R line.

c. Depress the pushbutton near the scale to open the automatic valve. This will put the annunciator window light out which is marked "Charge Complete Terphenyl Feed Tank".

d. Start the pump to charge the weigh tank. Santowax R is now entering the weigh tank.

e. When the measured weight reaches the set point, the automatic Santowax R control valve will close and annunciator window marked "Charge Complete Terphenyl Feed Tank" will be actuated.

f. If the charge valve does not close at 11,200 lbs. another switch will attempt to close it at 15,000 lbs. and also sound an alarm.

g. Close the manual valve in the Santowax R line. Turn off pump.

h. Open the automatic valve and allow the line to drain, then reclose the automatic valve.

i. Obtain a Santowax R sample before adding catalyst.

j. Open wing nut lid on top of the weigh tank (Item 101) and add 5 pounds of Ferric Chlorine. Close the lid after adding the Ferric Chloride.



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TABLE I

| BATCH CHLORINATOR OPERATING CONDITIONS - 5060 AROCLOR | |
|---|---|
| Chlorinator Charge:(Lbs.) | |
| Santowax R | 11,200 |
| Approximate Pounds 100% Chlorine Required to Produce Batch: | 30,500 |
| Totalizer Chlorine Settings | |
| Lbs. $Cl_2$ @ 80% | 24,400 |
| Chlorinator Temperature: | |
| Beginning | 190°C. |
| Ending | 250°C. |
| Softening Point | 105 - 115°C |
| Weight of Crude Batch - Lbs.: | 24,200 |
| Gallons | 2,000 |

NOTE: ADD 15 POUNDS OF FERRIC CHLORIDE TO EACH BATCH CHLORINATOR CHARGE.



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C. III. 3.1 F. 1. k. Start the agitator in the weigh tank. Allow agitation to take place for a minimum of one hour. Stop the agitator just before material in the weigh tank is to be charged to the chlorinator.

l. The material is now ready for the next chlorinator charge when needed.

G. Charge No. 10 (11) Chlorinator and Start Chlorination

1. Programmed Chlorinator Operation

a. Close manual chlorine valves at distributors on No. 10 (11) chlorinator.

b. Close vent valve on chlorinator.

c. Open HCl valve to off-gas condenser and on the Muriatic Acid area.

d. Set the chlorine flow controller FRC-104-1 (117-1) in "Manual-Cascade". The controller set point is automatically altered in three steps - 1,500 lbs/hr. for first hour; 2,000 lbs/hr. for the second hour; and 3,000 lbs/hr. for each of nine subsequent hours. The last set point on the flow controller will stay on until the programmer is jogged back to step 0.

e. Set the temperature controller TRCA 106-1 (119-1) in "Manual-Cascade" with the manual set point at zero. The last set point on the temperature controller will stay on until the programmer is jogged back to step 0. The cascade set points are as follows:

| | |
|---|---|
| 1st Hour | 190°C |
| 2nd Hour | 200 |
| 3rd Hour | 210 |
| 4th Hour | 220 |
| 5th Hour | 230 |
| 6 - 7th Hour | 240 |
| 8 - 9th Hour | 250 |
| 10 - 11th Hour | 250 |

f. Check the following control instruments:

(1) #2 weigh tank temperature - TIC-101-1 set at 150°C.

(2) Therminol cooling temperature - TICA-116-1 (123-1) set at 70°C.

(3) Therminol cooling flow - FICA-115-1 (122-1) at 300 GPM, controller in "Auto".

(4) No. 5 blow tank temperature - TIC-125-1 set at 240°C.



TOWOLDMON0048293

C. III. 3.1 C. 1. g. Set valves to transfer charge from #2 weigh tank to the No. 10 (11) chlorinator. Special care must be taken to close the charge valve to the other chlorinator, since it is possible to pump to the wrong one. Be sure transfer line to blow tank is closed off.

h. Start transfer pump (Item 103). The pump discharge valve and the valve at the bottom of the weigh tank have been left open. This is to allow for the thermal expansion of the 150°C Santowax R remaining in the transfer line that is being heated to 250°C by the hot therminol. In this way the pump's seal and the valve's packing are protected from a build up in pressure.

i. As pump-out proceeds and weight falls to 100#, a switch actuates to close down the pump (Item 103). An alarm sounds and the pump "Run Light" will go out.

j. The transfer pump (Item 103) cannot be started if the charge valve is open and vice versa.

k. Close the charge valve on top of the chlorinator. Set valves to circulate the No. 10 (11) chlorinator batch through the heat exchanger (Item 106 (119)) and back to the chlorinator. Once again check line to blow tank.

l. Start the circulating pump (Item 105 (118)) when about one-third of the batch is transferred.

m. After circulation has been established the chlorination is started by pressing the start button on programmer XC1-CP1 (XC1-CP2). This injects both a flow and temperature set point into the respective controllers. Change the temperature controller TRCA-106-1 (119-1) from manual to automatic. The chlorine flow is started in Manual. Set the instrument output pressure at 6 psig then open the manual valves on the distributor. Manually raise the chlorine flow rate until it matches the yellow arrow of the programmer set point. Then change the controller FRC-104-1 (117-1) from manual to automatic. The batch chlorine flow and temperature will now be controlled according to the preset program. Now a flow integrator with two dials is used to read out 80% and total pounds of chlorine. When integrated flow equals the preset 80% mark, one dial stops counting, an alarm bell rings and "Chlorinator #10 (11) 80% Chlorination" lights up. The second dial continues indicating total flow until chlorine flow is shut off.



TOWOLDMON0048294

C. III. 3.1 G. 1. n. Chlorine header pressure control PIC-500-07 will control the pressure to 20-25 psig. A low pressure alarm is set at 15 psig - high pressure alarm at 35 psig.

o. After four hours, take a sample of the Aroclor and check for softening poiat. Samples are taken off the circulating line. This sample is a check to be sure a short charge was not transferred into the chlorinator. The next sample after that will be taken when the 80% alarm bell rings.

p. Check the following items during operation:

(1) Circulation temperature on TRCA-106-1 (119-1).

(2) Chlorine flow on FRC-104-1 (117-1).

(3) Therminol cooling system flow through FICA-115-1 (122-1) - 300 GPM.

(4) Therminol temperature on TICA-116-1 (123-1) - 70°C.

(5) Chlorinator body temperature on the multipoint #1 (7).

q. High chlorinator temperature or failure of the circulating pump will sound an alarm. This high chlorinator body temperature alarm set at 275°C. is in addition to the high alarm of TRCA-106-1 (119-1).

r. The alarm bell will ring when 80% of the chlorine has been fed to the chlorinator. Immediately take a sample at the circulation line to determine the point which the chlorination has reached and the additional chlorine to add.

s. Continue the chlorination until complete. It may be necessary to run the softening point more often during the last one or two hours of the chlorination. A density measurement system DRC-104-4 (117-4) is installed to determine the correlation between density and final softening point. This might in the future eliminate the time consuming softening point determination. For the present it will just record the density.

t. Upon completion of the chlorination (softening point 105-112°C.), shut off the manual chlorine feed valves on the distributors, circulate for 10 min., take a final sample and pump to the No. 5 blow tank.



TOWOLDMON0048295

C. III. 3.1 G. 1. u. As previously stated the final set points will remain on the controllers until the programmer is advanced to Step 0. If there is any delay in transferring, TRCA-106-1 (119-1) may remain in "Automatic-Cascade" as long as Step 0 does not appear on the programmer. At Step 0 the temperature controller must be put in manual with a set point of zero; otherwise, cooling will start and will continue until the circulation cooler is plugged.

2. Manual Operation

Complete manual operation is possible but is not recommended because the function of the programmer is to relieve the operator of the duty of keeping time and manually dialing in set points. The operation is very similar to the automatic programmed operation except for the following:

a. Place the chlorine flow controller FRC-104-1 (117-1) in "Automatic-Set". Then place the arrow at 1,500 lbs/hr. After one hour move it to 2,000 lbs/hr. and then one hour later to 3,000 lbs/hr. The controller can also be placed in "Manual" and the control valve positioned manually. The integrator digit counters will continue to totalize and will sound at the 80% point.

b. Place the circulating temperature controller TIC-106-1 (119-1) in "Automatic-Set" and increase the set point in a number of steps which will simulate the programmer action. If the process is to be operated in "Manual" then this can also be done by manually positioning the control valve and observing the temperature on the controller.

c. Samples should be taken more often towards the end to ensure against over chlorination.

H. Transfer to No. 5 Blow Tank and Air Blow

1. Set transfer lines to pump to the No. 5 blow tank (Item 125). Be sure Therminol heat is on jacketed lines and that the temperature controller TIC-125-1 is set at 240°C.

The chlorinator is still vented to the off-gas storage tank.



TOWOLDMON0048296

C. III. 3.1 H. 2. Check the level indication instrument, LIA-125-2.1 to be sure there is enough room to transfer into the blow tank (Item 125). The tank is sized to hold two chlorinator batches. There is a high level alarm - LIA-125-2.

3. Change final valve in the transfer line and allow material to pump from the No. 10 (11) chlorinator to the No. 5 blow tank. Observe transfer and note level increase in the No. 5 blow tank by LIA-125-2.1. Make sure the complete batch has been transferred. At the completion of the transfer, close the valve in the circulating system and shut off the circulating pump (Item 105 (118)) on the No. 10 (11) chlorinator.

4. The chlorinator is now ready to charge back for the next chlorination.

5. Record transfer information on the chlorinator data sheet and in the log book.

3.2 Routine Operations

During normal operations of the #2 weigh tank, No. 10 (11) chlorinator, and No. 5 blow tank system, the following conditions will exist in the process.

A. Main Therminol Heater

1. Flow through the main therminol heater system will be indicated on FIC-628.1, 415 GPM normal.

2. TRCA-629.12 controls the temperature of the main therminol heating system. Set point normally at 280°C. Low temperature alarm set at 220°C. - high temperature alarm set at 325°C.

B. No. 2 Weigh Tank

1. Assuming a batch is charged into the weigh tank ready for the chlorinator, the following conditions will exist in the control room. The annunciator panel will indicate "charge complete terphenyl feed tank".

2. The control valve in the Santowax R charge line will be closed.

3. TIC-101-1 will be controlling the temperature in the weigh tank at 150°C.

4. Temperature on the Multipoint Indicator will indicate 150°C.



TOWOLDMON0048297

C. III. 3.2 B. 5. The agitator will be running to keep the Ferric Chloride in suspension.

6. The transfer pump will be shut off.

C. No. 10 (11) Chlorinator

1. Chlorine flow will be indicated on FRC-104-1 (117-1). If in "cascade-auto" control, the Taylor Timer will be controlling the flow by program system.

2. Temperature will be controlled by TRCA-106-1 (119-1). With the system in "cascade-auto", the temperature will be controlled by a preset program. Initial starting temperature set point of 190°C., completion temperature 250°C.

3. No. 10 (11) chlorinator circulating pump will be in operation.

4. The Therminol chlorinator cooling system should have the following checks:

a. Flow will be indicated by FICA-115-1 (122-1). Normal set point 300 GPM. Low flow alarm set at 250 GPM.

b. Temperature in the circulating system is indicated by TIC-116-1 (123-1). Normal indication is 70°C. Low temperature alarm set at 50°C. - high temperature alarm set at 90°C.

c. Surge tank Therminol level (Item 114) is 12 inches in the sight glass.

d. The Therminol cooling system pump discharge pressure should be 45 psig.

5. Temperature of the No. 10 (11) chlorinator can also be observed on the Multipoint temperature recorder point 1(7). There should be no more than a 10°C temp. spread between the body temp. and the circulating temperature.

D. No. 5 Blow Tank

1. Temperature will be indicated by TIC-125-1. Normal set point 240°C.

2. Level in the No. 5 blow tank will be indicated by LIA-125-2.1.

3. Water valve should be open to the S&K jet providing suction on the No. 5 blow tank - pressure 20 psig.

4. The air blower (Item 124) should be operating with a discharge pressure of 8-10 psig.



TOWOLDMON0048298

C. III. 3.2 E. Data Sheets

A Solid Aroclor system data sheet is available for the #2 weigh tank, No. 10 (11) chlorinator, and the #5 blow tank. Filling out this sheet is a normal portion of the operator's duties during the shift.

3.3 Safety Features

A. The weigh tank (Item 101) has an interlock system which will not allow starting the transfer pump (Item 103) when Santowax R is being charged into the weigh tank. This interlock is to assure that an overcharge of Santowax cannot be made to the No. 10 (11) chlorinator. A high weigh alarm set at 15,000 pounds will sound for an overcharge.

B. A high temperature alarm is set at 275°C. on the body of No. 10 (11) chlorinator (Item 104 (117)). A low temperature alarm is provided at 120°C. to prevent production of unstable Aroclors.

C. The main therminol heating circulation system has several safety features which can be found in the PFO for this heater system.

D. Check the level in the therminol cooling system surge tank (Item 114) to be sure the therminol level is 12 inches in the sight glass.

E. The valves in the main therminol heating system used to put heat on the No. 10 (11) chlorinator heat exchanger (Item 106 (119)) will normally be tagged out since this heat exchanger is used for cooling. The Therminol heating system is available only for cases of unplugging the heat exchanger.

F. When the chlorine and temperature programmed control system is in operation, the preset program should not be disturbed since this can cause excessive chlorine flow or temperature problems to result.

G. Normally, when the programmed flow control system is in operation, a sample of the material being chlorinated will be taken after four hours of operation. This sample is taken to assure a short charge has not been made to the No. 10 (11) chlorinator. The sample should be checked for softening point. If this sample indicates a normal batch, the next sample would be taken when the 80% bell rings as preset by the chlorine flow totalizer. This sample is to assure a batch is not over-chlorinated and does not set up in the chlorinator preventing its transfer to the #5 blow tank.



TOWOLDMON0048299

C. III. 3.4 Shutdown

Operations of the No. 2 weigh tank, the No. 10 (11) chlorinator, and the No. 5 blow tank can occur which will cause temporary or prolonged shutdowns. The following detailed information concerns individual shutdowns of each of the above items. If the entire system is to be shut down, the various sections can be combined to achieve this objective. Dependent on the reason for the shutdown, it may be necessary to isolate the system from the main therminol heating system to make the system safe. This must be considered, depending on the situation.

A. No. 3 Weigh Tank (Item 101)

1. Temporary Shutdown

a. Close the manual valves in the Santowax supply line to the weigh tank.

b. Close automatic valve in Santowax line to weigh tank.

c. Leave TIC-101-1 in "Auto" with set point at 150°C.

d. Leave therminol heat on the transfer lines to the No. 10 (11) chlorinator.

e. The agitator and pump will normally be shut down unless in use.

2. Prolonged Shutdown

a. Close the manual valve in the Santowax supply lines to the weigh tank.

b. Close automatic valve in Santowax line to weigh tank.

c. Close the valve at the bottom of the weight tank if necessary.

d. Leave the discharge valve on transfer pump open.

e. Move the weigh tank temperature control TIC-101-1 set point to 0°C. Close the manual valve in the steam supply line.



TOWOLDMON0048300

C. III. 3.4 A. 2. f. The agitator and transfer pump will be shut off.

g. Close the valves in the main therminol heating system lines for the weigh tank transfer lines. Close valves in steam supply to Biphenyl lines.

h. The tank may or may not be empty, dependent on the work to be done or the cause for shutdown. Under normal conditions the tank will be empty.

i. Note shutdown information on data sheet.

j. Drain the weigh tank if necessary for repair work.

k. Leave the system in this condition until needed.

B. No. 10 (11) Chlorinator (Item 104 (117))

Operations can occur which will require a chlorinator to be cut back or temporarily shut down. Some of these items are failure of chlorine feed, or a tank car emptying. Normally, if a partial reduction in the chlorine feed occurs, the batch liquid chlorinators will be shut off and the No. 10 (11) chlorinator will continue to be operated.

1. Temporary Shutdown

a. The circulating pump (Item 105 (118) will normally be left in operation.

b. Close the chlorine valves at the distributor on the No. 10 (11) chlorinator.

c. Check the chlorine header pressure and chlorine feed to the other chlorinators. Pressure should be 20-25 psig.

d. Check to see that liquid chlorine is being fed to the vaporizer and that steam is on the vaporizer. Steam pressure should be 15 psig. Discharge pressure on the vaporizer should be 70-100 psig. Chlorine header pressure normally 20-25 psig.

e. Shutdowns should be minimized. If the cause of the cut back can easily be remedied, start the chlorinator back immediately.

f. Leave the therminol cooling system circulating.



TOWOLDMON0048301

C. III. 3.4 B. 1. g. Ensure the cooling therminol does not flow through the circulation cooler. As long as the programmer is in a step other than 0, it is taken care of automatically. If the programmer is in Step 0 then TRCA-106-1 (119-1) should be placed in manual with the set point at zero.

h. Leave the main therminol heating system circulating on the jacketed lines.

i. Notify your chief operator or department supervision immediately in case of a problem.

2. Prolonged Shutdown

a. Normally, when a chlorinator will be left down for a period longer than a few hours, the chlorination will be completed and the batch pumped out prior to shutdown. If Maintenance personnel are to work on the chlorinator, it may be necessary to vent the vessel and purge the chlorine lines and the chlorinator tank with $CO_2$.

NOTE: In case of a complete shutdown for maintenance work, the chlorine valves on the main header to the chlorinator, and the transfer lines into the vessel, will be tagged. The circulating pump circuit breaker box switch will also be tagged out.

b. Empty chlorinator by pumping it out. Then shut off the circulating pump. Drain the chlorinator and pump suction line.

c. Close chlorine valves at distributor on No. 10 (11) chlorinator.

d. Check chlorine header pressure as in Item 1.c. above.

e. Close the HCl vent valve on the chlorinator to the off-gas storage tank.

f. Notify your chief operator or department supervision the vessel is shut down.



TOWOLDMON0048302

C. III. 3.4 B. 2. g. Shut down the therminol cooling system by:

(1) Shutting off circulating pump (Item 115 (122)).

(2) Leave FICA 115-1 (122-1) in "Auto" with set point at 300 GPM.

(3) TICA-116-1 (123-1) will be in "Auto" with the set point at 70°C.

(4) Turn on the steam to the surge tank (Item 114). This will keep the system ready for use.

(5) In case the therminol cooling system must be worked on, it may be necessary to drain the system. If this should occur:

(a) Shut off the steam to the surge tank.

(b) Shut off water to the cooler (Item 116 (123)), if necessary.

(c) Tag out the circulating pump (Item 115 (122)) circuit breaker; and

(d) Tag out the therminol heating valves to the No. 10 (11) chlorinator heat exchanger system.

h. Note shutdown information on the data sheet.

C. No. 5 Blow Tank (Item 125)

1. Temporary Shutdown

a. Close the valve at the bottom of the No. 5 blow tank (Item 125).

b. Vent pump discharge line into the blow tank.

c. Transfer pump will be shut off.

d. Leave TIC-125-1 set point at 240°C. Leave in "Auto".

e. The air blower will continue to run.

f. Water will remain on the S&K jet (Item 127), 20 psig.

g. The system will be left in this condition until need to start back up.



TOWOLDMON0048303

C. III. 3.4 C. 2. Prolonged Shutdown

a. Normally if this vessel is to be shut down for any length of time, the material in the tank will be emptied.

b. Close the valve at the bottom of the blow tank.

c. Shut off the transfer pump (Item 126).

d. Adjust TIC-125-1 controller to 0°C. Close the manual valve in the therminol heating system to the coils on the No. 5 blow tank and tag out valves.

e. Shut off the air blower (Item 124).

f. Shut off water to the S&K jet (Item 127).

g. Leave the system in this condition until necessary to start back up.

D. Emergency Shutdown

Normally, an emergency shutdown does not occur concerning the weigh tank (Item 101) or the No. 5 blow tank (Item 125). However, emergencies can occur which make it necessary to shut down the No. 10 (11) chlorinator as fast as possible. The following methods can be used.

1. From the Field

a. Close the manual chlorine valves to the distributor, or the manual valve from the chlorine header feeding the No. 10 (11) chlorinator.

b. Shut valve in HCl pipe line to the Muriatic Acid Dept. if necessary.

c. Stop circulating pump (Item 105 (118)) if necessary.

d. Dependent on the emergency situation which has occurred, continue to shut this system down systematically by normal procedure.

2. At the Panel

a. Stop chlorine feed to the No. 10 (11) chlorinator. This will be done as follows, dependent on operation:



TOWOLDMON0048304

C. III. 3.4 D. 2. a. (1) Manual Operation

Controller FRC-104-1 (117-1) in "Manual". Adjust chlorine flow controller set point to zero.

Immediately shut off manual valves feeding this chlorinator in the field.

(2) Programmed Operation

Move chlorine controller FRC-104-1 (117-1) from "automatic" to "Manual" and adjust set point on chlorine feed controller to zero. Proceed as in Item (1) above.

b. Shut valve in HCl pipe line to the Muriatic Acid Department if necessary.

c. Stop the circulating pump (Item 105 (118) if necessary.

d. Continue shutdown of this unit as is necessary to handle the emergency which has occurred.

3. Emergency Shutdown Therminol Cooling System for No. 10 (11) Chlorinator

a. Stop therminol cooling system circulating pump.

b. Close manual valves as necessary in the system.

c. The pump can be shut off in Item a. above at the pump itself or at the motor control center circuit breaker.

3.5 Control Loops, Interlocks, and Alarms

A. Control Loops

There are nine (9) major control loops in this system.

1. No. 2 Weigh Tank Scale Loop - 101

The function of this loop is to allow setting the scale by the adjustable set point for Santowax R charges. When the material reaches the desired weight, it automatically closes the control valve in the feed line to the weigh tank and rings an alarm bell indicating "charge complete terphenyl feed tank". During charging of the weigh tank, the transfer pump (Item 103) cannot be started. In case the weigh tank is overcharged, an alarm horn will sound at 15,000 lbs. and will again attempt to close the charging valve.



TOWOLDMON0048305

C. III. 3.5 A. 1. As pump-out proceeds and weight falls to 100 lbs., the pump (Item 103) is shut down. An alarm sounds and "terphenyl feed pump shutdown" is indicated. The pump running light will also go out.

2. Weigh Tank Temperature Control - TIC-101-1

The function of this loop is to maintain a constant temperature of 150°C. in the weigh tank. This is accomplished by measurement of the temperature and controlling the heat input by throttling a control valve in the steam line to the coil in the weigh tank.

3. No. 9 Chlorinator Chlorine Flow Control - FRC-104-1 (117-1)

The function of this loop is to control the chlorine flow to the No. 10 (11) chlorinator to regulate the chlorination rate. This is accomplished by measurement of 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, automatically, or by a preset programmed chlorine feed control.

a. Manual Control

The chlorine flow controller FRC-104-1 (117-1) is positioned in "Manual". The instrument pressure is regulated to give the desired chlorine flow to the No. 10 (11) chlorinator.

b. Automatic Flow Control

The No. 10 (11) chlorinator chlorine flow controller FRC-104-1 (117-1) is positioned in "Auto-Set". The chlorine feed desired is set on the controller which will maintain this chlorine feed by adjusting the control valve as required.

c. Programmed Flow Control

The chlorine flow controller has the set points in "Auto-Cascade". The first chlorine integrator set point is adjusted on a digit counter for the desired chlorine alarm level. When the desired quantity of chlorine has entered the chlorinator, an alarm bell will ring and an annunciator light will flash indicating "No. 10 (11) chlorinator, 80% chlorination". A second digit counter will continue to totalize the flow. The integrator readout (X2) is total pounds of chlorine. The totalizer settings can be used with the automatic flow control above if the controller is not in "cascade". When the controller is in "Auto-cascade", the predetermined program will change the



TOWOLDMON0048306

C. III. 3.5 A. 3. c. chlorine flow rate to the No. 10 (11) chlorinator. The chlorine flow program is set by turning the knob on each flow profile set point. This program, once set up, should not be disturbed without consulting supervision. It is: 1,500 #/hr. for one hour; 2,000 #/hr. for one hour; and 3,000 #/hr. for the remaining time.

4. No. 10 (11) Chlorinator Temperature Control - TRCA-106-1 (119-1)

The function of this loop is to provide temperature control of the chlorination batch in the No. 10 (11) chlorinator. This is accomplished by measurement of the temperature in the crude Aroclor circulating line at the heat exchanger and controlling the therminol cooling system to the shell of this heat exchanger (Item 106 (119). The temperature controls can be operated manually, automatically, or by a predetermined program temperature profile. The temperature system has a low temperature alarm at 120°C. - a high temperature alarm at 275°C. Range of the instrument is 0-300°C.

a. Manual Control

The temperature controller TRCA-106-1 (119-1) will be in "manual". Circulating of the therminol cooling system across the No. 10 (11) chlorinator heat exchanger can be controlled manually by adjusting the control valve with TRCA-106-1 (119-1). Adjust until the desired temperature is acquired.

b. Automatic Control

The temperature controller TRCA-106-1 (119-1) is in "Auto-Set". The controller set point is adjusted to the desired temperature. It will automatically adjust the control valve to maintain the temperature.

c. Programmed Temperature Control

The temperature controller is placed in "auto-cascade". The chlorination temperature time profile is adjusted to the desired temperature by turning the knob on each temperature profile set point. A predetermined program is set up on the Taylor Timer. After start of the program, the Timer will automatically advance through the temperature profile as set up by the program. These set points will be directed by the programmer only if TRCA-106-1 (119-1) is in "auto-cascade". This program, once set up, should not be disturbed without consulting supervision.



TOWOLDMON0048307

C. III. 3.5 A. 5. Chlorine Header Pressure Control - PIC-500.07

The function of this loop is to maintain the chlorine header pressure to the Aroclor chlorinators within a range of 20-25 psig. This is accomplished by measuring the chlorine header pressure and throttling a control valve in the discharge from the chlorine vaporizer to maintain the chlorine header pressure within ± 1 psig of the set point. A low pressure alarm is set at 15 psig and a high pressure alarm at 35 psig.

6. Therminol Cooling System Flow Control-FICA-115-1 (122-1)

The function of this loop is to maintain a constant flow of 300 GPM in the Therminol cooling system. This is accomplished by measurement of flow with an orifice flow meter and adjusting a control valve to by-pass the No. 10 (11) chlorinator heat exchanger (Item 106 (119). Flow through the No. 10 (11) heat exchanger is regulated by the temperature control TRCA-106-1 (119-1). As the chlorinator heat exchanger needs more cooling fluid the control valve reduces the by-pass quantity. Normal operation of the system is with the controller in "Auto" and the set point at 300 GPM. A low flow alarm will sound at 250 GPM.

7. Therminol Cooling System Temperature Control - TICA-116-1 (123-1)

The function of this loop is to control the temperature of the cooling therminol system at 70°C. This is accomplished by measurement of the discharge temperature from the therminol water cooler (Item 116 (123) and automatically throttling the water flow on the shell side of the cooler. The low temperature alarm on this system is set at 50°C. - the high temperature alarm is set at 90°C. Experience has shown that a temperature controller is not needed on the surge tank (Item 114).

8. No. 5 Blow Tank Temperature Control - TIC-541.01

The function of this loop is to maintain a constant temperature of 240°C. in the No. 5 blow tank. This is accomplished by measuring the temperature in the blow tank and throttling the control valve in the Therminol heating system to the coils in the No. 5 blow tank. There are no alarms in this system.



TOWOLDMON0048308

C. III. 3.5 A. 9. No. 2 Blow Tank Level Indication - LIA-125-2.1

This loop measures the level of crude Aroclor in the No. 5 blow tank. This is accomplished by use of a bubbler differential pressure level indication instrument. A 0-100% dial indicates the tank level.

B. Interlocks

There is one interlock in this system.

1. Weigh Tank System

The Santowax transfer pump (Item 103) cannot be started while Santowax R is being filled into the weigh tank. This interlock is energized when the control valve in the feed line is open. Conversely the charge valve cannot be opened if the pump is running.

C. Alarms

The following alarms exist through this system.

1. Weigh Tank (Item 101)

a. When the measured or preset weight approaches the set point on the scales, an alarm bell will sound indicating "charge complete terphenyl feed tank".

b. A high weight alarm will sound if the weigh tank is filled above 15,000 lbs. Immediate action should be taken to stop the filling by stopping the charge pump and/or closing the manual valve.

c. An alarm will sound upon completion of pump-out. The pump is shut off automatically.

2. No. 10 (11) Chlorinator System (Item 106 (117))

a. Chlorine Flow Alarm

(1) When the chlorine totalizer is being used, an alarm bell will ring when the batch is 80% chlorinated.

b. Temperature Alarms

Abnormal temperature alarms are set on the cooler for a low circulation temperature of 120°C. and a high temperature of 275°C. In addition to the high-low temperature alarm of the circulation, high-low alarms will sound at 275°C. and 120°C. for the chlorinator body temperature.



TOWOLDMON0048309

C. III. 3.5 C. 2. c. Chlorine Header Pressure Alarm

The chlorine header pressure will sound an alarm at a low pressure of 15 psig and a high pressure of 35 psig. This will actuate an annunciator on the chlorinator panel indicating "High-Low Chlorine Header Pressure."

d. Low Flow Alarm

A low flow alarm will sound for the Therminol cooling system if the flow falls below 250 GPM.

e. Abnormal exit temperatures on the therminol cooling system from the cooler (Item 116 (123)) will sound an alarm. The low temperature alarm is set at 50°C. and the high temperature alarm at 90°C.

f. An alarm will sound upon circulation pump shutdown (Item 105 (118)).

C. IV. COMMENTS ON PROCESS

A. Special flexible piping joints have been made to the weigh tank (Item 101) since this tank is placed on scales. These flexible piping joints should be carefully inspected to be sure there are no leaks since the material contained in them is extremely hot. During weighting of the raw material charge, the operator should be careful to eliminate problems with excessive movement of the scale.

B. Steam is provided on the incoming transfer lines and the coil to the weigh tank. From the bottom piping on the weigh tank, all the transfer lines and coils in process vessels have therminol heat up to the No. 5 still. Then steam is used in the transfer lines to the flaker hold tank.

C. The transfer pump (Item 103) for the weigh tank has steam on the casing of the pump.

D. The therminol heating system has been provided for this Solid Aroclor facility to eliminate use of gas torches on vessels and pipe lines.

E. Care must be taken not to fill the therminol cooling system surge tank (Item 114) too full during normal operation. This can cause the tank to run over when the circulating pump is stopped.

F. The programmer has been set up to hold the last temperature and chlorine flow set points for a total chlorination cycle time of 20 hrs. This is to prevent the chlorine flow from automatically being shut off at the end of a batch before the manual distributor valves can be closed. It also allows for the chlorination cycle to be increased from the designed 11 hrs. without changing the programmer itself.



TOWOLDMON0048310

## APPENDIX I

### SOLID AROCLORS PROGRAMMED CHLORINATION

### TEMPERATURE & CHLORINE FLOW PROFILE

1. CHLORINE FLOW - FLOW RECORDER CONTROLLER (FRC-104-1 (117-1)

| Time | Aroclor 5060 |
|---|---|
| 1st hour @ | 1,500 Lbs/hr. |
| 2nd Hour @ | 2,000 Lbs/hr. |
| 3rd & subsequent hours to end of batch @ | 3,000 Lbs/hr. |

2. TEMPERATURE CONTROL - TEMPERATURE RECORDER CONTROLLER (TRCA-106-1 (119-1)

| Time | Aroclor 5060 |
|---|---|
| 1st hour @ | 190 |
| 2nd hour @ | 200 |
| 3rd hour @ | 210 |
| 4th hour @ | 220 |
| 5th hour @ | 230 |
| 6 - 7th hour @ | 240 |
| 8 - 9th hour @ | 250 |
| 10 -11th hour @ | 250 |

Total Batch Time - Approximate hours - 10 - 12



TOWOLDMON0048311

## APPENDIX II

### METHOD OF RUNNING SOFTENING POINTS

1. Obtain representative sample of material from sample line at discharge of circulating pump. Catch the sample in can lid or Pyrex beaker.

2. Heat ring and sample.

3. Place ring on can lid or metal plate and fill with sample until material stands slightly higher than edge of ring. Fill the ring from the large diameter side.

4. Cool the ring and lid from bottom of the side until sample sets up, being careful not to get any water on top of the sample.

5. Finish cooling by running water on top of the sample after it sets up.

6. Remove filled ring from lid and trim off any material that is on the outside.

7. Make slight indentation on top of the sample in the center of the ring with a heated wire to hold the ball in place.

8. Fill beaker with water or glycerin.

   a. Use water when expected softening point is under 80°C.

   b. Use glycerin when expected softening point is over 80°C.

9. Place the ring in the sample holder, place ball on sample, and put holder in the beaker.

10. Adjust the thermometer in the holder so that the tip of bulb protrudes 1/4" through the hole in the crossbar that holds sample.

11. Place the beaker on a stand with screen under it and set burner under the stand.

12. Light burner and adjust to give a temperature rise as shown on the thermometer of 5°C. per minute.

13. Bring temperature up 5°C. per minute until ball falls through the sample.

14. Record temperature at time ball falls to lower crossbar as the softening point.



TOWOLDMON0048312

## APPENDIX III

ITEM 114: THERMINOL SURGE TANK
5'-0" OD X 5'-3" HIGH - DISHED ENDS

| Level | Gallons | Level | Gallons | Level | Gallons |
|---|---|---|---|---|---|
| 0" | 78 (Dish) | 2'-5" | 433 | 4'-10" | 788 |
| 1 | 90 | -6 | 445 | -11" | 800 |
| 2 | 102 | -7 | 457 | 5'- 0" | 813 |
| 3 | 114 | -8 | 470 | - 1" | 825 |
| 4 | 127 | -9 | 482 | - 2" | 837 |
| 5 | 139 | -10 | 494 | - 3" | 849 |
| 6 | 151 | -11 | 506 | | |
| 7 | 163 | 3'- 0" | 519 | | |
| 8 | 176 | - 1 | 531 | | |
| 9 | 188 | - 2 | 543 | | |
| 10 | 200 | - 3 | 555 | | |
| 11 | 212 | - 4 | 568 | | |
| 1'- 0" | 225 | - 5 | 580 | | |
| - 1 | 237 | - 6 | 592 | | |
| - 2 | 249 | - 7 | 604 | | |
| - 3 | 261 | - 8 | 617 | | |
| - 4 | 274 | - 9 | 629 | | |
| - 5 | 286 | -10 | 641 | | |
| - 6 | 298 | -11 | 653 | | |
| - 7 | 310 | 4'- 0" | 666 | | |
| - 8 | 323 | - 1 | 678 | | |
| - 9 | 335 | - 2 | 690 | | |
| - 10 | 347 | - 3 | 702 | | |
| - 11 | 359 | - 4 | 715 | | |
| 2'- 0" | 372 | - 5 | 727 | | |
| - 1 | 384 | - 6 | 739 | | |
| - 2 | 396 | - 7 | 751 | | |
| - 3 | 408 | - 8 | 764 | | |
| - 4 | 421 | - 9 | 776 | | |



TOWOLDMON0048313

ITEM 125: BLOWING TANK
10'-0" OD X 10'-0" HIGH
DISHED HEADS

| % Scale | Gallons | Innage(") | | % Scale | Gallons | Innage(") |
|---|---|---|---|---|---|---|
| 0 | 611 (dish) | 0 | (16.3") | 52 | 3,644 | 62.4" |
| 2 | 728 | 2.4 | | 54 | 3,760 | 64.8 |
| 4 | 844 | 4.8 | | 56 | 3,877 | 67.2 |
| 6 | 961 | 7.2 | | 58 | 3,994 | 69.6 |
| 8 | 1,078 | 9.6 | | 60 | 4,110 | 72.0 |
| 10 | 1,194 | 12.0 | | 62 | 4,227 | 74.4 |
| 12 | 1,311 | 14.4 | | 64 | 4,343 | 76.8 |
| 14 | 1,427 | 16.8 | | 66 | 4,460 | 79.2 |
| 16 | 1,544 | 19.2 | | 68 | 4,577 | 81.6 |
| 18 | 1,661 | 21.6 | | 70 | 4,693 | 84.0 |
| 20 | 1,777 | 24.0 | | 72 | 4,810 | 86.4 |
| 22 | 1,894 | 26.4 | | 74 | 4,927 | 88.8 |
| 24 | 2,011 | 28.8 | | 76 | 5,043 | 91.2 |
| 26 | 2,127 | 31.2 | | 78 | 5,160 | 93.6 |
| 28 | 2,244 | 33.6 | | 80 | 5,277 | 96.0 |
| 30 | 2,361 | 36.0 | | 82 | 5,393 | 98.4 |
| 32 | 2,477 | 38.4 | | 84 | 5,511 | 100.8 |
| 34 | 2,594 | 40.8 | | 86 | 5,627 | 103.2 |
| 36 | 2,711 | 43.2 | | 88 | 5,743 | 105.6 |
| 38 | 2,827 | 45.6 | | *90 | 5,860 | 108.0 |
| 40 | 2,944 | 48.0 | | 92 | 5,976 | 110.4 |
| 42 | 3,060 | 50.4 | | 94 | 6,093 | 112.8 |
| 44 | 3,177 | 52.8 | | 96 | 6,210 | 115.2 |
| 46 | 3,294 | 55.2 | | 98 | 6,326 | 117.6 |
| 48 | 3,410 | 57.6 | | 100 | 6,443 | 120.0 |
| 50 | 3,527 | 60.0 | | | | |

Sp.Gr.: 1.5
Inst. Range: 0-180" $H_2O$
Inst. Scale: 0-100% Linear

*Alarm Point %

0284060

TOWOLDMON0048314

STANDARD OPERATING INSTRUCTIONS
FOR
SOLID AROCLOR 5460

PROCESS FUNCTION OUTLINE

III. C. I. NO. 5 STILL SYSTEM

1.1 Scope

This covers the charging, start-up, shutdown, normal operation, and emergency situations involving the No. 5 Aroclor Still System.

1.2 Description of Process

Aerated crude Aroclor from a blowing tank is fed to the still tank. Hydrated lime is added to the crude Aroclor.

Vacuum is applied to the still and the Aroclor is circulated through the furnace coil and heated to the vaporization temperature. Vapors pass up an open column through a cyclone separator to the condenser. Distilled Aroclor is collected in a receiver. Quality of the distilled solid Aroclors is analyzed by the Lab, and if in specification, it is transferred to the flaker hold tank for flaking or drumming into suitable containers.

Still residue or bottoms from two distillations (four chlorinator batches) are drawn into containers and sold as Montars, or it is discarded in trash drums.

II. PROCESS DIAGRAM

Attached.

III. OPERATION OF PROCESS

3.1 Start-Up

A. Initial Start-Up

1. Therminol Cooling System for No. 5 Still Condenser

a. Charge system with Therminol FR-2 (Aroclor 1248):

(1) Use temporarily relocated Pyranol pump to charge Therminol surge tank (Item 139).

(2) Position 55 gallon drum next to the pump. Remove drum bung and vent cap.

(3) Connect flexible hose to pump suction and the stainless steel pipe to be inserted into the drum.



TOWOLDMON0048315

C. III. 3.1 A. 1. a. (4) Position discharge line from the pump into the tank.

(5) Open valve on pump suction; insert pipe into drum and start pump.

(6) Adjust the suction valve on the pump until the flow is steady.

(7) Continue to fill the surge tank until six drums or approximately 325 gallons total are in the surge tank (Item 139).

b. Therminol 1242 can be charged directly to the surge tank (Item 139) by the following procedure:

(1) Align valves in line from storage tank to surge tank (Item 139). Care must be taken to ensure that all valves to the other surge tanks are closed. They are also filled from this storage tank line.

(2) Check level gauge at surge tank.

(3) Start storage tank pump.

(4) Observe this level gauge at the surge tank and shut off pump when you have 275 gallons or 32 inches in the sight glass. Once circulation is established add therminol to bring the sight glass level to 12".

(5) Close valves in line from storage tank to surge tank.

2. Still and Furnace Start-Up

a. Charge to the No. 5 Still

Under normal conditions, crude Aroclor is charged to the No. 5 still with the charge measured by the level indication (LIA-125-2) on the No. 5 blow tank. The blow tank (Item 125) holds two chlorinator batches of 2,160 gals/batch. Two chlorinator batches are charged to the No. 5 still to make up one still batch.

b. Prepare No. 5 Blow Tank (Item 125) for transfer of charge:

(1) Check to be sure the steam heating system is on the transfer pump (Item 126) and the therminol on the charging lines. Material to be pumped must be hot. Cold lines can also cause plug-ups and failure to transfer material.



TOWOLDMON0048316

C. III. 3.1 A. 2. b. (2) Check temperature of material in blowing tank to be sure it is hot enough to transfer - above 200°C. See TIC-125-1.

(3) Check with the chlorinator operator to be sure crude Aroclor has been air-blown for one hour.

c. Prepare still to receive charge:

(1) Close valve at the bottom line under the still (Item 129).

(2) Set valves from the No. 5 blow tank to the No. 5 still. Be sure the therminol heating system is on all transfer lines.

(3) Close the main valve in the vacuum line to the still just above the receiver. Start steam to the vacuum jets. Put steam on stage 4, stage 3, stage 2, and stage 1, in that order. Stage 1 is the closest to the receiver. Adjust water to the after condensers on the last three stages. The jet on the No. 5 still should pull down to 2-3 mm Hg absolute on the receiver (Item 132). The steam to the jet on the No.5 still should have a minimum of 90 psig supply pressure - operate at 110 psig. Normally, this unit will stay in continuous operation.

(4) Open vent valve on the still receiver.

d. Start up the Therminol Cooling System for the No. 5 Still Condenser (Item 131):

(1) Set TICA-141-1 at 60°C.

(2) The set points for the therminol high and low temperature alarms are at 70°C and 30°C.respectively.

(3) Set the valves in the therminol cooling system for the No. 5 still condenser (Item 131) to allow circulation from the surge tank through the condenser and back into the surge tank. Therminol only goes through the tower water cooler on demand. When needed, the small stream of 60°F therminol is mixed with the hot circulating therminol to maintain the desired 145°C.

(4) Open the steam heating valve to the surge tank (Item 139). Wait until the temperature of the therminol cooling system is 70°C., then start the circulating pump (Item 140).



TOWOLDMON0048317

C. III. 3.1 A. 2. d. (5) Check the level in the surge tank (Item 139). There should be 12 inches in the sight glass.

(6) Set the temperature controller TRC-131-1 for the therminol going to the condenser at 145°C.

(7) Check the following items on the therminol cooling system circulation:

(a) Therminol cooling system circulating pump (Item 140) discharge pressure should be 45 psig. Flow rate should be 200 GPM.

(b) TICA-131-1 (circulating therminol temperature) should be set at 145°C.

(c) TIC-141-1 (cooled therm. from therm. cooler) should be set at 60°C.

e. Charging the No. 5 Still and Start-up:

(1) Set valves in transfer line from No. 5 blow tank to the still.

(2) Start the blowing tank pump (Item 126) and transfer a full charge into the still tank. This is done by observing the before and after level in the blow tank (Item 125).

(3) Stop the No. 5 blow tank transfer pump when the charge is complete as noted on the No. 5 blow tank level gauge.

(4) Close the valve on the transfer line located on top of the blow tank.

(5) Set valves in the No. 5 still circulating line through the heater coil (Item 128) and back into the still tank. These valves stay in the correct position during normal operation.

(6) Start up preheat of the No. 5 still furnace (Item 128). (See the following page)

(7) Start the circulating pump (Item 134) after the furnace stack temperature has reached 200°C.



TOWOLDMON0048318

C. III. 3.1 A. 2. e. (8) Add hydrated lime through the chute provided for this purpose on the No. 5 still. Add 400 pounds (8 bags) of lime for each still batch.

(9) Swing the chute away and button down the wing nuts.

f. Furnace Start-Up for the First Time:

(1) Preliminary Procedure

(a) Open manual valves in the natural gas line to the furnace main and pilot gas lines.

(b) Open damper on the furnace stack.

(c) Turn on circuit No. 9 at the still panel and the breaker switch on the outside of the field control box to "ON". The "RED" light at the Honeywell Protectoglo unit will light up.

(d) Put fuel gas flow controller FRCA-128-1 in manual with output at 1 psig.

(e) Set high temperature switch at 425°C. (800°F).

(f) At this stage the "RED" light on the "Protectoglo Relay" is on. The heater shutdown alarm is sounding and must be acknowledged.

(2) Start-Up Procedure

(a) Move red safety switch inside the "Protectoglo" unit in the field control box to the right to reset. You must wait 10 seconds before the switch can be reset in case it has to be redone.

(b) At end of purge period (there is no air blower and hence no purge but purge timer introduces a time delay and natural convection will cause an upward draught) the green "pre-purge complete" light will light.

(c) Carry out a "sniff" test through the small side door of the furnace. If the test shows dangerous, stop and correct the cause of trouble before lighting the burner. When the heater is cold, there is no natural draft to carry away gas or fumes. After the unit gets hot, there will always be a natural draft provided the flue damper is open. If satisfactory, proceed.



TOWOLDMON0048319

C. III. 3.1 A. 2. f. (2) (d) Depress the ignition start button inside the field control box to actuate the pilot flame. Hold the button depressed for no more than 10 seconds. If all is well, the "white" light on the Protectoglo unit will come on and the "green" and "red" lights will go out. When this occurs, pull your finger away. The pilot is now properly lit. Pilot flame is detected by "purple peeper" and a steady audible clicking of checking relay will be heard.

(e) Manually open the two reset safety valves in the main gas line prior to the flow valve. The heater is now ready for operation. These safety valves will not stay open if the signal to the gas flow control valve is above 3 psig.

(f) The main burner will not yet be lit because the fuel gas flow control valve FV-128-1 is closed. See f.(1)(d) previous page.

(g) The still furnace coil can be preheated by using the pushbutton on the still control panel. This will allow by-passing the furnace no flow interlock to start gas into the furnace without starting the still pump.

It is desirable to fire the furnace for the purpose of either drying out the brickwork or to temper the coils before circulation begins when the unit is cold. Preheating is necessary to prevent plugging. For this reason, a tempering button is installed on the burner control panel which is mounted in the field. This button energizes a relay for ten (10) minutes only. It may be necessary to use this temper button several times.

(h) When preheating is required the tempering button is pushed and with the gas flow controller FRCA-128-1 in "manual", slowly open the control valve and monitor stack temperature when the main burner has lit. Observe the temperature at point #8 on the multipoint recorder. Do not exceed 200°C. but this temperature should be maintained until circulation is established. If preheating is not necessary, skip this step.



TOWOLDMON0048320

C. III. 3.1 A. 2. f. (2) (i) Start up the solid still circulating pump (Item 134). The circulating flow meter FIA-128-2 will now indicate a flow around 290 GPM. Flow below 125 GPM will cause the main burner to be shut off.

(j) Leave the gas flow controller, FRCA-128-1 on manual. If there was no preheat the gas flow will be a zero. Gradually increase the set point to 3,000 SCFH. Press the "acknowledge" button on main control panel. Alarm "Still #5 Fuel Gas Low Flow" should go out. If the stack outlet temperature is higher than 550°C. the set point should be lowered. Switch the controller to automatic operation.

Observe the coil outlet temperature on the multipoint temperature recorder. The distillation or "boiling" is considered to be started when the vapor temperature makes a sudden increase. Observe point #14 on the digital indicator for this indication. After the initial heat up to around 290°C. the fuel gas must be cut back to 2,300 SCFH to maintain vacuum around 12-15 mm Hg in the still.

(k) Check the following items in the system to be sure operations are normal.

1) Natural gas flow to the furnace on FRCA-128-1.

2) No. 5 still circulating pump flow FIA-128-2.

3) Therminol cooling system temperature on TRCA 131-1.

4) Check the coil temperature differential on the inlet and outlet of the furnace (Item 128). There should be an 8°C. spread.

g. Start-Up of Furnace after Temporary Shutdown:

(1) Prior to start-up, the still coil can be preheated before starting the circulating pump, if necessary. See Section f.(2)(g).

(2) Adjust natural gas flow controller in "manual" to a set point of 1 psig output pressure. This is FRCA-128-1.



TOWOLDMON0048321

C. III. 3.1 A. 2. g. (3) Start up the solid still circulating pump (Item 134). The Aroclor circulating flow meter FIA-128-2 should now indicate a flow in excess of 290 GPM. Shutdown will occur at a flow below 125 GPM.

(4) Check that the vacuum is 1 mm Hg on the line above the catch tank (Item 135). Open the main valve in the vacuum line from the jets to the receiver. Vacuum at the still receiver should be approximately 2-3 mm Hg. The vacuum on the still will be 12-15 mm Hg. during operation.

(5) Gradually raise the set point of the natural gas flow controller FRCA-128-1 to 3,000 SCFH for the initial heat up. (See (j) previous page)

3. Operation of the Still During Distillation

a. Check the multipoint temperature recording instrument for the temperature rise across the coil in the heater furnace points #8 and #9. In case this temperature chart is not indicating correctly, check for plugged lines or instrument problems. Check to be sure the pump flow is being measured correctly. If necessary, shut off the pump while at a low temperature to be sure the system is operating. Have the electrician check the temperature instruments if you do not get a rise.

b. A spread of 8°C. between the coil inlet and outlet is normal. A 12°C. temperature spread is the maximum difference allowable.

c. Be sure the steam heating system is off the vacuum line to the jets during operation.

d. Check the therminol cooling system on the No. 5 still condenser (Item 131) to be sure the condenser does not plug up. If plugging begins to occur, raise the temperature in the therminol cooling circulation system. Use TRC -131-1 to accomplish this. There is no alarm on this controller, so it must be watched closely.

e. Vacuum problems on the stills are usually due to flashing of product over plugging vacuum lines, leaks in the still system, leaks at pump packing, or therminol flow problems on the condenser, water adjustment on the jets, changes in the steam pressure to the jets, or problems in the nozzles for the jet. Flashing can be stopped by lowering the temperature of the therminol cooling system for the No. 5 still condenser. Vacuum trouble must be traced systematically from the jet to the receiver and then to the still. To accomplish this, manometer pressure indicators have been placed in the system as follows:



TOWOLDMON0048322

C. III. 3.1 A. 3. e. (1) On top of the trap in front of the jet (Item 135).

(2) On the cyclone separator off-gas line (Item 130).

(3) On the still (Item 129).

(4) On the receiver (Item 132).

f. The still receiver temperature indicating controller TIC-132-1 is set at 150°C.

g. A level indication gauge has been installed in the still receiver (Item 132) to allow indication of the level of material being distilled over. The level instrument is LI-132-2.1. This level indication can be used to help determine when the distillation is near completion. Normally the receiver gauge will be indicating 80-90% at the end.

h. As the distillation nears completion, the vacuum will start to come down lower and the flow through the coil will start to drop. If the flow drops below 125 GPM, an alarm will sound and the main gas burner to the furnace will shut off. Normally the flow will not drop below 240 GPM.

i. The distillation temperature should normally be carried no higher than 370°C. on the coil outlet. At this point the batch is checked for color and softening point. Be sure the receiver has been circulating for at least 30 minutes before a sample is taken. If it is in specification, cut the fuel gas flow to zero, transfer the receiver to the day tank (Item 810), and prepare to charge the still again. For the second run, the fuel gas should be cut back to 1400-1500 SCFH to maintain the circulating Montar 5 around 360°C. This is to prevent it from cooling down before they are drawn. Be careful to shut off the furnace before the coil is sucked.

j. Close the main valve in the vacuum line on top of the receiver (Item 132). This is to isolate the jet from the still system and eliminate plugging of the jet.

k. Vent the furnace coil and allow it to suck dry after the second run.

l. Coil inlet and outlet temperature must be watched closely at the end of the distillation. Still bottoms are very viscous; therefore, if the circulating pump is in poor condition, or the distillation is carried too far, circulation may stop and the coil will become plugged or be burned.



TOWOLDMON0048323

C. III. 3.1 A. 3. 1. Heat from the furnace actually burns the Aroclor to carbon when overheated. If the coil outlet temperature jumps suddenly and the inlet temperature stays the same or falls, circulation is nearly stopped. In this case, shut off the furnace gas supply and suck the coil. If the coil cannot be sucked, it is plugged and will have to be replaced.

m. Batch data sheets are filled out during each distillation. Information includes the still lot number, materials being distilled, start time, finish time, the temperature spread on the still coils, the vacuum, the end time for the distillation, etc.

n. The distillation operating conditions are show in Table II.

4. Pump Out Still Receiver

a. Transfer material from the still receiver (Item 132) to the day hold tank (Item 810) or the flaker hold tank (Item 811).

b. Observe level of material in the still receiver by use of LI-132-2.1.

c. Check to be sure the heating system is on the jackets of the transfer lines.

d. Set valves in the line to transfer to the desired hold tank.

e. When material is to be transferred, start the transfer pump (Item 133) under the receiver. Allow material to pump until the receiver is empty.

f. Close the valves and stop the transfer pump when the receiver is empty. This can be observed by checking level gauge LI-132-2.1.

5. Operation for Drawing Bottoms into Drums:

a. Check to be sure that Therminol heat is on the draw-out line.

b. Place necessary drum near draw-out station approximately 30-35 drums.

c. Set valves in line to draw-out station.



TOWOLDMON0048324

TABLE II

| DISTILLATION OPERATING CONDITIONS-SOLID 5460 AROCLOR | |
|---|---|
| Approximate Temperature at which 5460 Aroclor starts distilling @ 10 mm Vacuum. At Still: | |
| Coil Inlet | 280°C |
| Coil Outlet | 290°C |
| Approximate Finishing Temperature: | |
| Still Pot | 360°C |
| Coil Inlet | 360°C |
| Coil Outlet | 370°C |
| Finishing Softening Point | 98-105°C |



TOWOLDMON0048325

C. III. 3.1 A. 5. d. Check to be sure the exhaust fan is running.

e. Obtain assistance to draw bottoms.

NOTE: Fumes from this operation are toxic. If the exhaust fan should stop, discontinue drawing out and notify the Chief Operator.

The material to be drawn into drums is hot. Have the person filling the drums to put on face shield and gloves.

f. Place drum under valve at draw-out station. Open valve under still. Close draw-out valve.

g. If the bottoms being drawn out are for shipment, open the valve at draw-out station and allow approximately 25 to 30 gallons of material to flow through the line into the drum to flush out the line.

h. If the bottoms being drawn out are not for shipment, flush out of line is not necessary.

i. Continue drawing out until the still is empty. Fill drums to within 6" - 8" of top and place cover on drum. As the drums are filled move them on conveyor to east platform.

j. Close the valve under the still. Leave the valve at draw-out station open.

k. Allow drums to set on conveyor and labor will palletize the drums. Drums to be discarded will be transferred to the dump by plant stake truck.



TOWOLDMON0048326

C. III. 3.1 B. Start-Up Following Temporary Shutdown

This start-up phase would normally be a situation where a previous distillation is complete and the still has been shut down for charging with a new batch.

1. Prepare No. 5 Blow Tank for Transfer Charge

   a. Check to be sure that the therminol heating system is on the transfer lines from the blow tank to the still pot.

   b. Check the temperature of the material in the blow tank. It should be at least 200°C.

   c. Check with the chlorinator operator to be sure that the crude Aroclor has been air-blown one hour.

   d. The No. 5 still vacuum system should be operating with the valve just above the No. 5 still receiver closed. Water should be on the condensers and steam on the jet stages. Vacuum on the trap (Item 135) in the vacuum pipe line should be indicating 1-3 mm Hg.

2. The No. 5 still receiver temperature controller TIC-132-1 should have the set point at 150°C.

3. The therminol cooling system should be circulating through the No. 5 still condenser and back to the surge tank. The temperature controller TRC-131-1 should be in "auto" with the set point at 145°C. Tower water should be on the therminol water cooled heat exchanger.

4. The natural gas flow controller FRCA-128-1 will be in "manual" with the set point below 2.5 psig output pressure.

5. The pilot flame for the No. 5 still furnace (Item 128) will be on as indicated by the Honeywell Protectoglo unit in the field panel. The "white" light on the Protectoglo unit will be on.

6. Set valves in the transfer line from the No. 5 blow tank to the No. 5 still.

7. Open the vent valve on the No. 5 receiver.

8. Start the No. 5 blow tank transfer pump and charge the No. 5 still. Observe level indication gauge in the No. 5 blow tank to measure the still charge.



TOWOLDMON0048327

C. III. 3.1 B. 9. The solid still circulating pump will already be circulating.

10. Stop the No. 5 blow tank transfer pump as soon as the blow tank is empty. Close the valve on the transfer line.

11. Add 400 lbs. of lime to the still charge.

12. Close the vent valve on the No. 5 receiver. Open the vacuum valve on the No. 5 still receiver and start the vacuum on the system.

13. Gradually raise the set point of the natural gas flow controller FRCA-128-1 to 3,000 SCFH. Watch the temperature rise across the furnace coil inlet and outlet as the temperature is raised. Normally, an 8°C. spread will be obtained across the furnace coil.

14. During normal operation of the still system, the following items will be observed.

a. Temperature spread across the still furnace.

b. Flow of the Aroclor through the furnace coil. See FIA-128-2.

c. Level indication in the No. 5 still receiver. See LI-132-2.1.

d. Natural gas flow control to the No. 5 still furnace. See FRCA-128-1.

e. Temperature control on the No. 5 still condenser therminol circulating system. See TRC-131-1.

f. Temperature control in the No. 5 still receiver. See TIC-132-1.

15. At the end of the distillation the batch is checked for color and softening point.



TOWOLDMON0048328

C. III. 3.1 B. 16. Shut off the natural gas when the distillation is finished, and bottoms are ready to be drawn. Clear the coil by doing the following:

a. Close the vacuum valve on top of the No. 5 still receiver in the line to the jet.

b. Vent the still heater coil and suck the coil dry.

17. Set lines to transfer material to the desired hold tank. Set the valves in the transfer line and start transfer pump to the hold tank. When the No. 5 still receiver is empty, stop the circulating pump and close the valves in the transfer lines.

3.2 Routine Operations

When the No. 5 still system is operating normally, the following conditions will exist in the process:

A. No. 5 still pressure will be around 12-15 mm Hg.

B. No. 5 still circulatin pump flow indicated on FIA-128-2 with flow above 125 GPM.

C. No. 5 still condenser temperature control TRC-131-1 set at 145°C.

D. Natural gas feed to the still furnace controller FRCA-128-1 set to give desired coil outlet temperature (about 2300 scfh).

E. Furnace high temperature alarm instrument set at 425°C.

F. Therminol cooling system temperature controller TICA-141-1 set at 60°C.

G. No. 5 still receiver temperature control TIC-132-1 set at 150°C.

H. No. 5 still receiver level indication gauge LI-132-2.1 will indicate level.

I. Main natural gas pressure 40 psig.

J. Natural gas reduced pressure 4 psig.



TOWOLDMON0048329

C. III. 3.3 Safety Features

A. The Honeywell Protectoglo unit has the following safety features for the No. 5 still furnace (Item 128):

1. Ignition period 10 second delay between actuation periods for the warp switch to cool.

2. Heater coil high temperature outlet shutdown set at 425°C.

3. Natural gas high reduced pressure shutdown set at 25 psig.

4. Circulating pump low flow rate shutdown and alarm set at 125 GPM.

5. Pilot flame must be burning to start up the unit. This is indicated by 4 microamperes on the field control panel.

3.4 Shutdown

A. Temporary Shutdown

Main gas burner is off with the pilot light on. The No. 5 still circulating pump running and the vacuum system on.

1. Adjust FRCA-128-1. Set point to 0. Instrument in "manual".

2. The vacuum may be cut off by closing the manual valve above the No. 5 still receiver. The still would then be vented and shut down systematically, if necessary.

B. Complete Shutdown

Main gas burner and pilot light shut off. Still circulating pump off. The vacuum shut down and the Therminol cooling system shut off.

1. Push ignition stop button inside the field control panel for the furnace control system. Hold it until the red lamp comes on.



TOWOLDMON0048330

C. III. 3.4 B. 2. After the furnace has cooled slightly, push the stop button for the No. 5 still circulating pump (Item 134).

3. Close manual valve above the No. 5 still receiver in the vacuum line.

4. Shut off steam to the vacuum jet by closing main valve in the steam supply line.

5. Close valve in the water line to the condensers on the No. 5 still jet.

6. Stop the Therminol cooling system circulating pump (Item 140). An alarm will sound.

7. Check the surge tank level to be sure the tank does not overflow after this pump is shut off.

8. Adjust TRC-131-1, and TIC-132-2 controller set point to 0.

9. Turn off the tower cooling water to the Therminol cooler (Item 141).

3.5 Control Loops, Interlocks, and Alarms

A. Control Loops

There are nine (9) major control loops in this system.

1. No. 5 Still Circulating Pump Low Flow Shutdown-FIA-128-2

The function of this loop is to measure the flow through the furnace heater coil on the No. 5 still. This is accomplished by measurement with a Ramapo Mark 5 Flow Meter that indicates the flow to a panel. Normal flow will be 290 GPM. A low flow alarm shutdown for the furnace (Item 128) main gas system will be actuated if the flow drops below 125 GPM. Complete shutdown of fuel gas to the main burner occurs.

2. Heater Fuel Gas Flow Control - FRCA-128-1

The function of this loop is to control the gas input to the No. 5 still furnace. This is accomplished by measurement of the natural gas through an orifice flow meter and throttling the control valve in the reduced gas line until the desired setting is obtained.



TOWOLDMON0048331

C. III. 3.5 A. 3. No. 5 Still Furnace Controls - Item 128

The function of this control system is to control the natural gas feed pressure to the still furnace and assure a pilot light is always burning when natural gas is being fed to the furnace. This is accomplished with a Minneapolis-Honeywell Protectoglo pilot light control mechanism. There are six safety features in the furnace controls to shut the system down:

a. High furnace coil outlet temperature will shut down the furnace above 425°C.

b. Low reduced natural gas pressure 2-1/2 psig.

c. High reduced natural gas pressure 25 psig.

d. Failure of circuit No. 9 at the rear of the still panelboard, or electrical failure.

e. Failure of any component in the Honeywell pilot flame mechanism.

f. Low circulating of crude Aroclor flow below 125 GPM.

When any one of the six conditions occurs an alarm sounds in the main control room indicating furnace shutdown. If the shutdown is caused by a. or f. separate alarms also sound. If neither of these alarms sound then the cause of shutdown must be eliminated between b., c., d., or e.

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

The function of this loop is to control the temperature in the No. 5 still receiver to 150°C. This is accomplished by measuring the temperature in the receiver and throttling a control valve on the 200# steam inlet line to the heating coil.

5. No. 5 Still Receiver Level Indication - LI-132-2.1

The function of this loop is to indicate the level of distilled product in the No. 5 still receiver. This is accomplished by a float level instrument which indicates the Aroclor level in the control room and in the field.

6. No. 5 Still Condensate Temperature - TRC-131-1

The function of this loop is to control the temperature of the cooling therminol going into the No. 5 still condenser. It does this by mixing therminol cooled to 60°C. in the tower water cooler (Item 141) with the hot circulating therminol to maintain a temperature of 145°C.



TOWOLDMON0048332

C. III. 3.5 A. 7. Therminol Cooling System Flow Control - FICA-140-1

The function of this loop is to maintain a constant flow of 200 GPM. through the still condenser. This is accomplished by measurement of flow with an orifice flow meter and adjusting a control valve. When TRC-131-1 calls for cooled therminol to maintain 145°C. in the circulating system, FICA-140-1 closed down in proportion to maintain a 200 GPM total flow. Normal operation of the system is with the controller in "Auto" and the set point at 200 GPM. A low flow alarm will sound at 160 GPM.

8. Therminol Cooling System Temperature Control-TICA-141-1

The function of this loop is to control the temperature of the therminol going through the cooler at 60°C. This therminol is needed by TRC-131-1 to maintain 145°C in the condenser during distillation. This is accomplished by measurement of the discharge temperature from the therminol water cooler (Item 141) and automatically throttling the water flow on the shell side of the cooler. The low temperature alarm on this system is set at 30°C. The tower water valve TV-141-1 has a stop to ensure water is always flowing through the cooler thus preventing boiling. The high temperature alarm is set at 70°C. There is no temperature controller on the surge tank (Item 139).

9. Still No. 5 Level System - LS-129-3 & 4

The function of this loop is to only give visual and audible indication of low level. High level will shut down the blow tank pump (Item 126). These will prevent over charging the still pot and alert operators that batch distillation has continued to a point that endangers the N.P.S.H. requirements of the still circulating pump. The level switches are both gamma type radiation detectors. The high level actuates when radiation is decreased and the low level when radiation increases sufficiently.

B. Interlocks

Interlocks in this system are as follows:

1. Start-Up of No. 5 Still Furnace (Item 128)

a. Actuation of the pilot ignition lever on the Honeywell Protectoglo unit has a 10 second delay before a second try can be made.

b. Before the ignition "start" button at the Protectoglo unit is pushed the red safety switch is moved to reset. It has a 3 minute purge delay. This is to allow for natural convection to purge the furnace before it lights up.



TOWOLDMON0048333

C. III. 3.5 B. 1. c. The two safety valves in the main fuel gas line will not stay on unless the signal to the gas control valve is below 3 psig.

d. Complete shutdown of fuel gas to the main burner occurs if the circulating flow through the furnace drops below 125 GPM.

e. As stated in "A" Section (Control Loops), the furnace will shut down from six safety features. See Section "A".

2. Automatic No. 5 Still Furnace Shutdown with Alarms (Pilot and Main Gas Burner Off)

a. High furnace coil outlet temperature above 425°C.

b. Low reduced natural gas pressure 2-1/2 psig.

c. High reduced natural gas pressure 25 psig.

d. Low coil flow below 125 GPM. (Pilot light stays on)

e. Failure of circuit No. 9 at the rear of the still panel.

f. Failure of the switch inside the field control panel, or blowing the 115 volt fuse in the panel.

C. Alarms

1. All shutdown items under "Interlocks" (B.2. above) have alarms.

2. No. 5 still circulating pump low flow alarm below 125 GPM.

3. Therminol cooling system TICA-141-1 has a low temperature alarm at 30°C. and a high temperature alarm at 70°C.

4. There is a high-low temperature alarm on the No. 5 still pot that is detected by the multipoint recorder. It is set at 430°C. for the high alarm and at 200°C. for the low alarm.

IV. COMMENTS ON THE PROCESS

A. It is very important to be sure there is adequate fluid in the Therminol cooling system surge tank (Item 139). This assures the circulating pump has a positive suction. This will allow more uniform control of the temperature in the Therminol cooling system.



TOWOLDMON0048334

C. IV. B. Care must be taken not to fill the surge tank (Item 139) too full during normal operation. This can cause the tank to run over when the circulating pump is stopped.

C. After the first two or three still batches have been run so the natural gas heat input rate is known, adjust the linkage on the reduced gas pressure control valve so a 3-15 psig instrument signal will fully stroke the valve. Make the adjustment so that only 10-15% above the maximum needed gas pressure can be obtained. This will reduce charring of the coils in the still furnace (Item 128).

D. During distillation of Solid Aroclors, vacuum problems occur in the pipe line to the jet system and plugging of the jet nozzles occur due to flashing and normal vapor pressure carry-over. The vacuum line from the No. 5 still receiver (Item 132) has steam heat on the tracers of the pipe line up to the suction line on the jet (Item 136). The trap tank (Item 135) in the vacuum line has steam heat on the coils in the tank. It is very important that the steam heating system be cut off the tracer lines and the coils in the trap tank during normal operation. If these lines are kept hot during normal operation, it will cause carry-over into the jet nozzles and cause more rapid plugging than in the past. When using the steam heating system to clean out the lines or drain the trap tank, the jet should be isolated from the No. 5 still system. This can be done by either shutting the steam off to the jets or closing the block valve in the pipe line at the suction of the jet.

E. The still pot No. 5 level system LS-129-3 & 4 requires special attention. There is a lock that maintains a safety shutter on the radiation source holder which must be unlocked to operate. The law requires the source holder will be periodically wipe tested by an approved representative to ensure that leakage of the radioactive source has occurred.



TOWOLDMON0048335

Aroclor -
PFO

## APPENDIX

ITEM 111 and 139: Therminol Surge Tank
3'-6" OD X 4'-3" High
Dished Ends

| Level | Gallons | Level | Gallons |
|---|---|---|---|
| 0" | 24 (Dish) | 2'-6" | 204 |
| 1" | 30 | 2'-7" | 210 |
| 2" | 36 | 2'-8" | 216 |
| 3" | 42 | 2'-9" | 222 |
| 4" | 48 | 2'-10" | 228 |
| 5" | 54 | 2'-11" | 234 |
| 6" | 60 | 3'-0" | 240 |
| 7" | 66 | 3'-1" | 246 |
| 8" | 72 | 3'-2" | 252 |
| 9" | 78 | 3'-3" | 258 |
| 10" | 84 | 3'-4" | 264 |
| 11" | 90 | 3'-5" | 270 |
| 1'-0" | 96 | 3'-6" | 276 |
| 1'-1" | 102 | 3'-7" | 282 |
| 1'-2" | 108 | 3'-8" | 288 |
| 1'-3" | 114 | 3'-9" | 294 |
| 1'-4" | 120 | 3'-10" | 300 |
| 1'-5" | 126 | 3'-11" | 306 |
| 1'-6" | 132 | 4'-0" | 312 |
| 1'-7" | 138 | 4'-1" | 318 |
| 1'-8" | 144 | 4'-2" | 324 |
| 1'-9" | 150 | 4'-3" | 330 |
| 1'-10" | 156 | | |
| 1'-11" | 162 | | |
| 2'-0" | 168 | | |
| 2'-1" | 174 | | |
| 2'-2" | 180 | | |
| 2'-3" | 186 | | |
| 2'-4" | 192 | | |
| 2'-5" | 198 | | |



TOWOLDMON0048336

APPENDIX

ITEM 132: No. 5 STILL BATCH RECEIVER
8'-0" OD x 10'-0" HIGH - DISHED HEADS

| % Scale | Gallons | Innage(") | % Scale | Gallons | Innage(") |
|---|---|---|---|---|---|
| 0 | 310 | 0 (13") | | | |
| 1 | 347 | 1.2 | 51 | 2,212 | 61.2 |
| 2 | 385 | 2.4 | 52 | 2,250 | 62.4 |
| 3 | 422 | 3.6 | 53 | 2,287 | 63.6 |
| 4 | 459 | 4.8 | 54 | 2,325 | 64.8 |
| 5 | 496 | 6.0 | 55 | 2,362 | 66.0 |
| 6 | 534 | 7.2 | 56 | 2,399 | 67.2 |
| 7 | 571 | 8.4 | 57 | 2,435 | 68.4 |
| 8 | 608 | 9.6 | 58 | 2,472 | 69.6 |
| 9 | 646 | 10.8 | 59 | 2,510 | 70.8 |
| 10 | 683 | 12.0" (1 ft.) | 60 | 2,547 | 72.0 (6 ft.) |
| 11 | 720 | 13.2 | 61 | 2,584 | 73.2 |
| 12 | 757 | 14.4 | 62 | 2,522 | 74.4 |
| 13 | 795 | 15.6 | 63 | 2,660 | 75.6 |
| 14 | 832 | 16.8 | 64 | 2,698 | 76.8 |
| 15 | 869 | 18.0 | 65 | 2,732 | 78.0 |
| 16 | 907 | 19.2 | 66 | 2,770 | 79.2 |
| 17 | 943 | 20.4 | 67 | 2,808 | 80.4 |
| 18 | 981 | 21.6 | 68 | 2,847 | 81.6 |
| 19 | 1,018 | 22.8 | 69 | 2,883 | 82.8 |
| 20 | 1,056 | 24.0 (2 ft.) | 70 | 2,920 | 84.0 (7 ft.) |
| 21 | 1,093 | 25.2 | 71 | 2,957 | 85.2 |
| 22 | 1,131 | 26.4 | 72 | 2,995 | 86.4 |
| 23 | 1,168 | 27.6 | 73 | 3,031 | 87.6 |
| 24 | 1,205 | 28.8 | 74 | 3,070 | 88.8 |
| 25 | 1,243 | 30.0 | 75 | 3,108 | 90.0 |
| 26 | 1,280 | 31.2 | 76 | 3,145 | 91.2 |
| 27 | 1,317 | 32.4 | 77 | 3,182 | 92.4 |
| 28 | 1,354 | 33.6 | 78 | 3,218 | 93.6 |
| 29 | 1,391 | 34.8 | 79 | 3,256 | 94.8 |
| 30 | 1,428 | 36.0 (3 ft.) | 80 | 3,292 | 96.0 (8 ft.) |
| 31 | 1,466 | 37.2 | 81 | 3,330 | 97.2 |
| 32 | 1,503 | 38.4 | 82 | 3,368 | 98.4 |
| 33 | 1,540 | 39.6 | 83 | 3,405 | 99.6 |
| 34 | 1,578 | 40.8 | 84 | 3,442 | 100.8 |
| 35 | 1,615 | 42.0 | 85 | 3,480 | 102.0 |
| 36 | 1,652 | 43.2 | 86 | 3,517 | 103.2 |
| 37 | 1,689 | 44.4 | 87 | 3,553 | 104.4 |
| 38 | 1,727 | 45.6 | 88 | 3,590 | 105.6 |
| 39 | 1,763 | 46.8 | 89 | 3,628 | 106.8 |
| 40 | 1,801 | 48.0 (4 ft.) | 90 | 3,667 | 108.0 (9 ft.) |
| 41 | 1,838 | 49.2 | 91 | 3,702 | 109.2 |
| 42 | 1,877 | 50.4 | 92 | 3,740 | 110.4 |
| 43 | 1,913 | 51.6 | 93 | 3,777 | 111.6 |
| 44 | 1,950 | 52.8 | 94 | 3,815 | 112.8 |
| 45 | 1,988 | 54.0 | 95 | 3,853 | 114.0 |
| 46 | 2,027 | 55.2 | 96 | 3,890 | 115.2 |
| 47 | 2,062 | 56.4 | 97 | 3,928 | 116.4 |
| 48 | 2,100 | 57.6 | 98 | 3,964 | 117.6 |
| 49 | 2,137 | 58.8 | 99 | 4,000 | 118.8 |
| 50 | 2,173 | 60.0 (5 ft.) | 100 | 4,040 | 120.0 (10 ft.) |

Aroclor 5460
Sp.Gr.: 1.5 @ 150°C
Temperature: 150°C

Inst. Range: 0-10 ft.
Inst. Scale: 0-100% Linear

0284083

TOWOLDMON0048337

AROCLOR 5460

ITEM 810

| % Scale | Gal. | Inch. | % Scale | Gal. | Inch. | % Scale | Gal. | Inch. |
|---|---|---|---|---|---|---|---|---|
| 0 | 480 | 9 | 35 | 1889 | 49 | 70 | 3298 | 90 |
| 1 | 520 | 10 | 36 | 1929 | 50 | 71 | 3338 | 91 |
| 2 | 561 | 11 | 37 | 1969 | 52 | 72 | 3378 | 92 |
| 3 | 601 | 12 | 38 | 2010 | 53 | 73 | 3418 | 93 |
| 4 | 641 | 14 | 39 | 2050 | 54 | 74 | 3459 | 94 |
| 5 | 681 | 15 | 40 | 2090 | 55 | 75 | 3499 | 95 |
| 6 | 722 | 16 | 41 | 2130 | 56 | 76 | 3539 | 96 |
| 7 | 762 | 17 | 42 | 2171 | 57 | 77 | 3579 | 98 |
| 8 | 802 | 18 | 43 | 2211 | 58 | 78 | 3620 | 99 |
| 9 | 842 | 19 | 44 | 2251 | 60 | 79 | 3660 | 100 |
| 10 | 883 | 21 | 45 | 2291 | 61 | 80 | 3700 | 101 |
| 11 | 923 | 22 | 46 | 2332 | 62 | 81 | 3740 | 102 |
| 12 | 963 | 23 | 47 | 2372 | 63 | 82 | 3781 | 103 |
| 13 | 1003 | 24 | 48 | 2412 | 64 | 83 | 3821 | 104 |
| 14 | 1044 | 25 | 49 | 2452 | 65 | 84 | 3861 | 106 |
| 15 | 1084 | 26 | 50 | 2493 | 67 | 85 | 3901 | 107 |
| 16 | 1124 | 27 | 51 | 2533 | 68 | 86 | 3942 | 108 |
| 17 | 1164 | 29 | 52 | 2573 | 69 | 87 | 3982 | 109 |
| 18 | 1205 | 30 | 53 | 2613 | 70 | 88 | 4022 | 110 |
| 19 | 1245 | 31 | 54 | 2654 | 71 | 89 | 4062 | 111 |
| 20 | 1285 | 32 | 55 | 2694 | 72 | 90 | 4103 | 113 |
| 21 | 1325 | 33 | 56 | 2734 | 73 | 91 | 4143 | 114 |
| 22 | 1366 | 34 | 57 | 2774 | 75 | 92 | 4183 | 115 |
| 23 | 1406 | 35 | 58 | 2815 | 76 | 93 | 4223 | 116 |
| 24 | 1446 | 37 | 59 | 2855 | 77 | 94 | 4264 | 117 |
| 25 | 1486 | 38 | 60 | 2895 | 78 | 95 | 4304 | 118 |
| 26 | 1527 | 39 | 61 | 2935 | 79 | 96 | 4344 | 119 |
| 27 | 1567 | 40 | 62 | 2976 | 80 | 97 | 4384 | 121 |
| 28 | 1607 | 41 | 63 | 3016 | 81 | 98 | 4425 | 122 |
| 29 | 1647 | 42 | 64 | 3056 | 83 | 99 | 4465 | 123 |
| 30 | 1688 | 44 | 65 | 3096 | 84 | 100 | 4505 | 124 |
| 31 | 1728 | 45 | 66 | 3137 | 85 | | | |
| 32 | 1768 | 46 | 67 | 3177 | 86 | | | |
| 33 | 1808 | 47 | 68 | 3217 | 87 | | | |
| 34 | 1849 | 48 | 69 | 3257 | 88 | | | |

Range - 0-172" W.C.

Sp.Gr. 1.49
For 5460 @ 240°C

0284084

TOWOLDMON0048338

SOLID AROCLOR FLAKER FEED TANK

ITEM 811

| Inches | Gallons | Inches | Gallons | Inches | Gallons |
|---|---|---|---|---|---|
| 1 | 8 | 36 | 1715 | 71 | 4138 |
| 2 | 23 | 37 | 1783 | 72 | 4196 |
| 3 | 40 | 38 | 1853 | 73 | 4260 |
| 4 | 64 | 39 | 1928 | 74 | 4323 |
| 5 | 90 | 40 | 1994 | 75 | 4385 |
| 6 | 119 | 41 | 2060 | 76 | 4444 |
| 7 | 152 | 42 | 2128 | 77 | 4502 |
| 8 | 187 | 43 | 2198 | 78 | 4563 |
| 9 | 223 | 44 | 2266 | 79 | 4620 |
| 10 | 262 | 45 | 2342 | 80 | 4678 |
| 11 | 302 | 46 | 2408 | 81 | 4734 |
| 12 | 345 | 47 | 2478 | 82 | 4789 |
| 13 | 389 | 48 | 2545 | 83 | 4841 |
| 14 | 433 | 49 | 2621 | 84 | 4894 |
| 15 | 480 | 50 | 2695 | 85 | 4945 |
| 16 | 528 | 51 | 2762 | 86 | 4995 |
| 17 | 578 | 52 | 2829 | 87 | 5043 |
| 18 | 629 | 53 | 2903 | 88 | 5090 |
| 19 | 682 | 54 | 2979 | 89 | 5134 |
| 20 | 735 | 55 | 3046 | 90 | 5178 |
| 21 | 790 | 56 | 3116 | 91 | 5221 |
| 22 | 846 | 57 | 3182 | 92 | 5261 |
| 23 | 904 | 58 | 3258 | 93 | 5300 |
| 24 | 961 | 59 | 3326 | | |
| 25 | 1022 | 60 | 3396 | | |
| 26 | 1080 | 61 | 3464 | | |
| 27 | 1139 | 62 | 3530 | | |
| 28 | 1201 | 63 | 3596 | | |
| 29 | 1264 | 64 | 3671 | | |
| 30 | 1328 | 65 | 3741 | | |
| 31 | 1386 | 66 | 3809 | | |
| 32 | 1454 | 67 | 3874 | | |
| 33 | 1521 | 68 | 3938 | | |
| 34 | 1586 | 69 | 4003 | | |
| 35 | 1650 | 70 | 4070 | | |

Sp. Gr. 1.49

For 5460 @ 240°C

0284085

TOWOLDMON0048339

STANDARD OPERATING INSTRUCTIONS
FOR
SOLID AROCLOR 5460

PROCESS FUNCTION OUTLINE

## III. C. I. SOLID HCl OFF-GAS CLEAN-UP

### 1.1 Scope

This covers the start-up, shutdown, and normal operation of the HCl Off-Gas Clean-Up System involving No. 10 (11) Chlorinator.

### 1.2 Description of Process

HCl gas produced on the No. 10 (11) chlorinator system passes through an off-gas condenser which cools the gas to knock out the Santowax and Aroclor vapors. The gas then flows through a catch tank, combines with the gas from the Liquid system and flows to the Muriatic Acid absorber.

A Therminol (1242 Aroclor) cooling system is circulated through the tube side of the off-gas condenser to cool the HCl gases. Material collected in the catch tank is returned to the weigh tank for other chlorinator charges.

## II. PROCESS DIAGRAM

Attached.

## III. OPERATION OF PROCESS

### 3.1 Charge Therminol Cooling System Surge Tank (Item 111)

A. Therminol 1242 can be charged directly to the surge tank by the following procedure:

1. Align valves in line from storage tank to surge tank. Care must be taken to ensure that all valves to the other surge tanks are closed. They are also filled from this storage tank line.

2. Check level gauge at surge tank.

3. Start storage tank pump.

4. Observe the level gauge at surge tank and shut off pump when you have 275 gals. or 32 inches in the level gauge.

5. Close valves in line from storage tank to surge tank.



TOWOLDMON0048340

C. III. 3.1 B. Charge System with Therminol FR-2 (Aroclor 1248)

1. Use temporary relocated Pyranol pump to charge surge tank (Item 139).

2. Position 55 gal. drum next to the pump. Remove drum bung and vent cap.

3. Connect flexible hose to pump suction and the stainless steel pipe to be inserted into the drum.

4. Position discharge line from pump into the tank.

5. Open valve on pump suction; insert pipe into drum and start pump.

6. Adjust suction valve on pump until flow is steady.

7. Continue to fill the surge tank until five (5) drums or approximately 275 gallons total are in the surge tank (Item 111).

3.2 Start-Up

1. Set the panel mounted therminol temperature controller TIC-111-1 in automatic with the set point at 120°C.

2. Set the off-gas storage tank (Item 109) locally mounted temperature indicating controller, TIC 109-1, in automatic with the set point at 120°C.

3. Set valves to allow circulation of the therminol system from the therminol surge tank (Item 111) to the circulating pump (Item 112), through the tube side of the off-gas condenser (Item 108), through the air therminol cooler (Item 113), and back to the therminol surge tank.

4. Open manual valves to allow circulation of steam heat through the jacket on the off-gas storage tank (Item 109).

5. Check to be sure the valve on bottom of the off-gas storage tank is closed.

6. Set manual valves to allow HCl gas to flow through the off-gas condenser (Item 108) through the off-gas storage tank (Item 109) and to the Muriatic Acid absorber.



TOWOLDMON0048341

C. III. 3.2 7. This system should now be in automatic control. Checking of the pressure across the condenser will indicate plugging if if should occur.

8. Material accumulated in the off-gas storage tank will be recycled through the chlorinator system for reuse. A locally mounted gauge indicates the tank level.

3.3 Shutdown

1. It is necessary to shut down the No. 10 (11) chlorinator if work is to be done on the condenser (Item 108) or the off-gas storage tank (Item 109).

2. Close manual valve from the chlorinator and on the exit line after the storage tank.

3. The therminol heat system on the tube side of the off-gas condenser can be shut down by stopping the circulating pump (Item 112).

4. The system is now shut down and can be worked on if necessary.

3.4 Instruments

1. Therminol Circulating System Temperature Control-TIC-111-1

The temperature in the therminol circulating system for the off-gas condenser in the clean-up system is controlled by sensing the temperature in the surge tank and controlling the louvers on the air cooled therminol cooler and the control valve on the line to the coil in the surge tank. At 3 psig, the louvers are open giving maximum cooling; at 9 psig, the louvers are closed and the second positioner (which has been inoperative up to 9 psig) applies a 3 psig signal to the steam control valve on the coils causing it to open. At 15 psig., input into this positioner will cause a 15 psig signal to the valve to open it fully. The instrument will be in automatic with the set point at 120°C.

2. Off-Gas Storage Tank Temperature Controller - TIC-109-1

The temperature in the off-gas storage tank (Item 109) is controlled by sensing the temperature of the material in the tank and throttling the control valve on the input line on the tank's jacket. The controller is in automatic with the set point at 120°C.



TOWOLDMON0048342

C. III. 3.4 3. Solids Knock-Out Tank Level Indicator - LI-109-2

The off-gas storage tank has a sight feed bubbler system sensed by a D/P cell and is transmitted to a gauge graduated 0-100%. The signal is directly proportional to tank level. it is field mounted.

IV. COMMENTS

1. Plugging of the off-gas condenser in the clean-up system can occur. To unplug the off-gas condenser the temperature of the therminol system will be elevated as required. It will probably require a temperature of 160 - 170°C.

2. Even with the louvers shut the steam coil does not transfer enough heat to the Therminol to overcome the cooling effect of the fan in cold weather. During winter months it will be necessary to operate with the fan off and only turning it on as needed to keep the off-gas condenser temperature below 130°C.



TOWOLDMON0048343

ITEM 109: OFF-GAS SURGE TANK
6'-6" OD X 7'-9" HIGH
DISHED HEADS

| % Scale | Gallons | Innage (") | % Scale | Gallons | Innage(") |
|---|---|---|---|---|---|
| 0 | 170(Dish) | 0 (14") | 52 | 1,140 | 48.5" |
| 2 | 208 | 1.9 | 54 | 1,176 | 50.3 |
| 4 | 246 | 3.8 | 56 | 1,214 | 52.2 |
| 6 | 282 | 5.6 | 58 | 1,252 | 54.1 |
| 8 | 320 | 7.5 | 60 | 1,290 | 56.0 |
| 10 | 356 | 9.3 | 62 | 1,326 | 57.8 |
| 12 | 394 | 11.2 | 64 | 1,364 | 59.7 |
| 14 | 432 | 13.1 | 66 | 1,400 | 61.5 |
| 16 | 470 | 15.0 | 68 | 1,438 | 63.4 |
| 18 | 506 | 16.8 | 70 | 1,474 | 65.2 |
| 20 | 544 | 18.7 | 72 | 1,512 | 67.1 |
| 22 | 580 | 20.5 | 74 | 1,550 | 69.0 |
| 24 | 618 | 22.4 | 76 | 1,586 | 70.8 |
| 26 | 654 | 24.2 | 78 | 1,624 | 72.7 |
| 28 | 692 | 26.1 | 80 | 1,662 | 74.6 |
| 30 | 730 | 28.0 | 82 | 1,698 | 76.4 |
| 32 | 766 | 29.8 | 84 | 1,736 | 78.3 |
| 34 | 804 | 31.7 | 86 | 1,774 | 80.2 |
| 36 | 842 | 33.6 | 88 | 1,810 | 82.0 |
| 38 | 878 | 35.4 | 90 | 1,848 | 83.9 |
| 40 | 916 | 37.3 | 92 | 1,886 | 85.8 |
| 42 | 954 | 39.2 | 94 | 1,924 | 87.7 |
| 44 | 990 | 41.0 | 96 | 1,960 | 89.5 |
| 46 | 1,028 | 42.9 | 98 | 1,996 | 91.3 |
| 48 | 1,066 | 44.8 | 100 | 2,034 | 93.2 |
| 50 | 1,102 | 46.6 | | | |

Sp.Gr.: 1.2
Inst. Range: 0-112" $H_2O$
Inst. Scale: 0-100% Linear



TOWOLDMON0048344

Aroclor -
PFO

## APPENDIX

ITEM 111 and 139: Therminol Surge Tank
3'-6" OD X 4'-3" High
Dished Ends

| Level | Gallons | Level | Gallons |
|---|---|---|---|
| 0" | 24 (Dish) | 2'-6" | 204 |
| 1" | 30 | 2'-7" | 210 |
| 2" | 36 | 2'-8" | 216 |
| 3" | 42 | 2'-9" | 222 |
| 4" | 48 | 2'-10" | 228 |
| 5" | 54 | 2'-11" | 234 |
| 6" | 60 | 3'-0" | 240 |
| 7" | 66 | 3'-1" | 246 |
| 8" | 72 | 3'-2" | 252 |
| 9" | 78 | 3'-3" | 258 |
| 10" | 84 | 3'-4" | 264 |
| 11" | 90 | 3'-5" | 270 |
| 1'-0" | 96 | 3'-6" | 276 |
| 1'-1" | 102 | 3'-7" | 282 |
| 1'-2" | 108 | 3'-8" | 288 |
| 1'-3" | 114 | 3'-9" | 294 |
| 1'-4" | 120 | 3'-10" | 300 |
| 1'-5" | 126 | 3'-11" | 306 |
| 1'-6" | 132 | 4'-0" | 312 |
| 1'-7" | 138 | 4'-1" | 318 |
| 1'-8" | 144 | 4'-2" | 324 |
| 1'-9" | 150 | 4'-3" | 330 |
| 1'-10" | 156 | | |
| 1'-11" | 162 | | |
| 2'-0" | 168 | | |
| 2'-1" | 174 | | |
| 2'-2" | 180 | | |
| 2'-3" | 186 | | |
| 2'-4" | 192 | | |
| 2'-5" | 198 | | |



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